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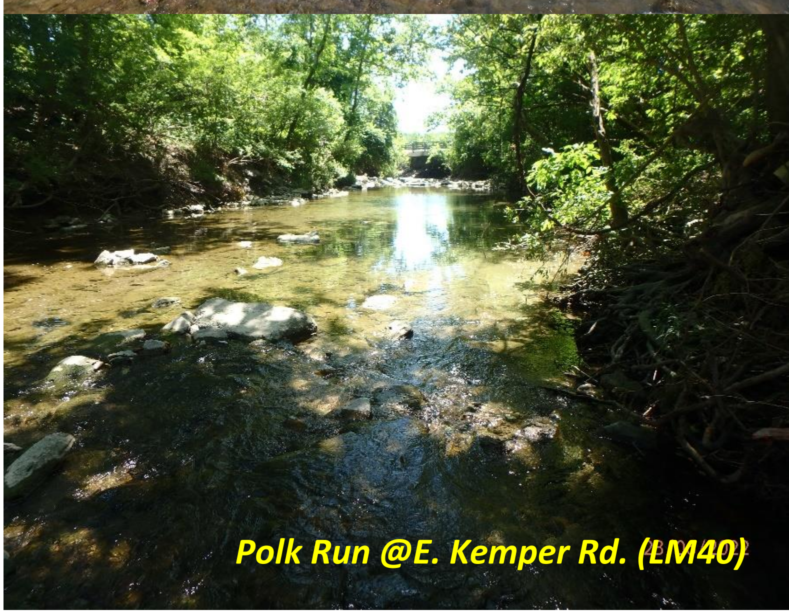
Biological and Water Quality Study of the Lower Little Miami River and Selected Tributaries 2022


Little Miami River dst. U.S. Rt. 22 (LM01)


Sycamore Creek @Loveland Rd. (LM50)


Polk Run @E. Kemper Rd. (LM40)

Duck Creek @Steel Place (LM73)

Peter A. Precario, Executive Director
James Lane, Board President

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Biological and Water Quality Study of the Little Miami River and Selected Tributaries 2022

Greater Cincinnati MSD Service Area

Hamilton County, Ohio

Technical Report MBI/2023-6-12

June 30, 2023

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Glossary of Terms

Ambient Monitoring — Sampling and evaluation of receiving waters not necessarily associated with episodic perturbations.

Aquatic Assemblage — An association of interacting populations of organisms in a given waterbody, for example, the fish assemblage or the benthic macroinvertebrate assemblage.

Aquatic Community — An association of interacting assemblages in a given waterbody, the biotic component of an ecosystem.

Aquatic Life Use (ALU) — A beneficial use designation in which the waterbody provides suitable habitat for survival and reproduction of desirable fish, shellfish, and other aquatic organisms; classifications specified in State water quality standards relating to the level of protection afforded to the resident biological community by the custodial State agency.

Assemblage — Refers to all of the various species of a particular taxonomic grouping (e.g., fish, macroinvertebrates, algae, submergent aquatic plants, etc.) that exist in a particular habitat. Operationally this term is useful for defining biological assessment methods and their attendant assessment mechanisms, i.e., indices of biotic integrity (IBI), O/E models, or fuzzy set models.

Attainment Status — The state of condition of a waterbody as measured by chemical, physical, and biological indicators. Full attainment is the point at which measured indicators signify that a water quality standard has been met and it signifies that the designated use is both attained and protected. Non-attainment is when the designated use is not attained based on one or more of these indicators being below the required condition or state for that measure or parameter.

Attribute — A measurable part or process of a biological system.

Beneficial Uses — Desirable uses that acceptable water quality should support. Examples are drinking water supply, primary contact recreation (such as swimming), and aquatic life support.

Benthic Macroinvertebrates Animals without backbones, living in or on the substrates, of a size large enough to be seen by the unaided eye, and which can be retained by a U.S. Standard No. 30 sieve (0.595 mm openings). Also referred to as benthos, infauna, or macrobenthos.

Best Management Practice An engineered structure or management activity, or combination of these that eliminates or reduces an adverse environmental effect of a pollutant, pollution, or stressor effect.

Biological Assessment An evaluation of the biological condition of a waterbody using surveys of the structure and function of a community of resident biota; also known as bioassessment. It also includes the interdisciplinary process of determining condition and relating that condition to chemical, physical, and biological factors that are measured along with the biological sampling.

Biological Criteria (Biocriteria) Scientific meaning: quantified values representing the biological condition of a waterbody as measured by structure and function of the aquatic communities typically at reference condition; also known as biocriteria.

Regulatory meaning: narrative descriptions or numerical values of the structure and function of aquatic communities in a waterbody necessary to protect a designated aquatic life use, implemented in, or through state water quality standards.

Biological Condition Gradient A scientific model that describes the biological responses within an aquatic ecosystem to the increasing effects of stressors.

Biological Diversity Refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different taxa and their relative frequencies. For biological diversity, these taxa are organized at many levels, ranging from complete ecosystems to the biochemical structures that are the molecular basis of heredity. Thus, the term encompasses different

	ecosystems, species, and genes; also known as biodiversity.
Biological Indicator	An organism, species, assemblage, or community characteristic of a particular habitat, or indicative of a particular set of environmental conditions; also known as a bioindicator.
Biological Integrity	The ability of an aquatic ecosystem to support and maintain a balanced, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats within a region (after Karr and Dudley 1981).
Biological Monitoring	The use of a biological entity (taxon, species, assemblage) as a detector and its response as a measure of response to determine environmental conditions. Ambient biological surveys and toxicity tests are common biological monitoring methods; also known as biomonitoring.
Biological Survey	The collection, processing, and analysis of a representative portion of the resident aquatic community to determine its structural and/or functional characteristics and hence its condition using standardized methods.
Clean Water Act (CWA)	An act passed by the U.S. Congress to control water pollution (formally referred to as the Federal Water Pollution Control Act of 1972). Public Law 92-500, as amended. 33 U.S.C. 1251 et seq.; referred to herein as the CWA.
CWA Section 303(d)	This section of the Act requires States, territories, and authorized Tribes to develop lists of impaired waters for which applicable water quality standards are not being met, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters. States, territories, and authorized Tribes are to submit their list of waters on April 1 in every even-numbered year.

CWA Section 305(b)	Biennial reporting required by the Act to describe the quality of the Nation's surface waters, to serve as an evaluation of progress made in maintaining and restoring water quality, and describe the extent of remaining problems.
Criteria	Limits on a particular pollutant or condition of a waterbody presumed to support or protect the designated use or uses of a waterbody. Criteria may be narrative or numeric and are commonly expressed as a chemical concentration, a physical parameter, or a biological assemblage endpoint.
DELT Anomalies	The percentage of Deformities, Erosions (e.g., fins, barbels), Lesions and Tumors on fish assemblages (DELT). An important fish assemblage attribute that is a commonly employed metric in fish IBIs.
Designated Uses	Those uses specified in state water quality standards for each waterbody or segment whether or not they are being attained.
Disturbance	Any activity of natural or human causes that alters the natural state of the environment and its attributes and which can occur at or across many spatial and temporal scales.
Ecological integrity	The summation of chemical, physical, and biological integrity capable of supporting and maintaining a balanced, integrated adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats in the region.
Ecoregion	A relatively homogeneous geographical area defined by a similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables; ecoregions are portioned at increasing levels of spatial detail from level I to level IV.
Existing Use	A use that was actually attained in a waterbody on or after November 28, 1975, whether or not they are included in the state water quality standards (November 28, 1975 is the date on which U.S. EPA

	promulgated its first water quality standards regulation in 40CFR Part 131). Existing uses must be maintained and cannot be removed.
Index of Biotic Integrity (IBI)	An integrative expression of site condition across multiple metrics comprised of attributes of a biological assemblage. It refers to the index developed by Karr (1981) and explained by Karr et al. (1986). It has been used to express the condition of fish, macroinvertebrate, algal, and terrestrial assemblages throughout the U.S. and in each of five major continents.
MIwb	The Modified Index of Well-Being (MIwb) is based on fish assemblage measures including numbers, biomass, and two diversity indices (Shannon Index) based on numbers and biomass. The numbers and biomass metrics exclude highly tolerant species. It reflects the overall productivity and diversity of the fish assemblage and it frequently responds before the IBI to improvements in water quality and habitat.
Metric	A calculated term or enumeration representing an attribute of a biological assemblage, usually a structural aspect, that changes in a predictable manner with an increased effect of human disturbance.
Monitoring and Assessment	The entire process of collecting data from the aquatic environment using standardized methods and protocols, managing that data, analyzing that data to make assessments in support of multiple program objectives, and disseminating the assessments to stakeholders and the public.
Multimetric Index	An index that combines assemblage attributes, or metrics, into a single index value. Each metric is tested and calibrated to a scale and transformed into a unitless score prior to being aggregated into a multimetric index. Both the index and metrics are useful in assessing and diagnosing ecological condition.
Narrative Biocriteria	Written statements describing the narrative attributes of the structure and function of aquatic communities

	in a waterbody necessary to protect a designated aquatic life use.
Natural Condition	This includes the multiplicity of factors that determine the physical, chemical, or biological conditions that would exist in a waterbody in the absence of measurable impacts from human activity or influence.
Numeric Biocriteria	Specific quantitative and numeric measures of the structure and function of aquatic communities in a waterbody necessary to protect a designated aquatic life use.
Qualitative Habitat Evaluation Index	A qualitative habitat evaluation assessment tool that is applied to streams and rivers in Ohio and which is used to identify habitat variables that are important to attainment of the Ohio biological criteria.
Reference Condition	The condition that approximates natural, unimpacted, or best attainable conditions (biological, chemical, physical, etc.) for a waterbody. Reference condition is best determined by collecting measurements at a number of sites in a similar waterbody class or region under minimally or least disturbed conditions (by human activity), if they exist. Since undisturbed or minimally disturbed conditions may be difficult or impossible to find in some states, least disturbed conditions, combined with historical information, models or other methods may be used to approximate reference condition as long as the departure from natural or ideal is comprehended. Reference condition is used as a benchmark to establish numeric biocriteria.
Reference Site	A site selected to represent an approximation of reference condition and by comparison to other sites being assessed. For the purpose of assessing the ecological condition of other sites, a reference site is a specific locality on a waterbody that is minimally or least disturbed and is representative of the expected ecological condition of other localities on the same waterbody or nearby waterbodies.

Regional Reference Condition	A description of the chemical, physical, or biological condition based on an aggregation of data from reference sites that are representative of a waterbody type in an ecoregion, subregion, bioregion, or major drainage unit.
Stressors	Physical, chemical, and biological factors that can adversely affect aquatic organisms. The effect of stressors is apparent in the biological responses.
Use Attainability Analysis (UAA)	A structured scientific assessment of the physical, chemical, biological or economic factors affecting attainment of the uses of waterbodies.
Use Classes	A broad capture of a designated use for general purposes such as recreation, water supply, and aquatic life.
Use Subclasses	A subcategorization of use classes into discrete and meaningful descriptions. For aquatic life this would include a hierarchy of warmwater and cold water uses and additional stratification provided by different levels of warmwater uses and further stratification by waterbody types.
TALU Based Approach	This approach includes tiered aquatic life uses (TALU) based on numeric biological criteria and implementation via an adequate monitoring and assessment program that includes biological, chemical, and physical measures, parameters, indicators and a process for stressor identification.
Tiered Aquatic Life Uses (TALUs)	As defined: The structure of designated aquatic life uses that incorporates a hierarchy of use subclasses and stratification by natural divisions that pertain to geographical and waterbody class strata. TALUs are based on representative ecological attributes and these should be reflected in the narrative description of each TALU tier and be embodied in the measurements that extend to expressions of that narrative through numeric biocriteria and by extension to chemical and physical indictors and criteria.

	As used: TALUs are assigned to water bodies based on the protection and restoration of ecological potential. This means that the assignment of a TALU tier to a specific waterbody is done with regard to reasonable restoration or protection expectations and attainability. Hence knowledge of the current condition of a waterbody and an accompanying and adequate assessment of stressors affecting that waterbody are needed to make these assignments.
Total Maximum Daily Load (TMDL)	The maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. Alternatively, a TMDL is an allocation of a water pollutant deemed acceptable to attain the designated use assigned to the receiving water.
Water Quality Standards (WQS)	A law or regulation that consists of the designated use or uses of a waterbody, the narrative or numerical water quality criteria (including biocriteria) that are necessary to protect the use or uses of that particular waterbody, and an antidegradation policy.
Water Quality Management	A collection of management programs relevant to a water resource protection that includes problem identification, the need for and placement of best management practices, pollution abatement actions, and measuring the effectiveness of management actions.

List of Acronyms

ALU	Aquatic Life Use
BCG	Biological Condition Gradient
CWA	Clean Water Act
DELT	Deformities, Erosions, Lesions, and Tumors
EWH	Exceptional Warmwater Habitat
EPT	Ephemeroptera, Plecoptera, Trichoptera
IBI	Index of Biotic Integrity for fish assemblages
ICI	Invertebrate Community Index
LRW	Limited Resource Water
M&A	Monitoring and Assessment
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PHWH	Primary Headwater Habitat
QHEI	Qualitative Habitat Evaluation Index
SNAP	Stream Nutrient Assessment Procedure
TALU	Tiered Aquatic Life Use
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
WLA	Waste Load Allocation
WQS	Water Quality Standards
WWH	Warmwater Habitat
WWTP	Wastewater Treatment Plant

FOREWORD

What is a Biological and Water Quality Survey?

A biological and water quality survey, or "biosurvey", is an interdisciplinary monitoring effort coordinated on a specific waterbody or watershed scale. This may involve a relatively simple setting focusing on one or two small streams, one or two principal stressors, and a handful of sampling sites or a much more complex effort including entire drainage basins, multiple and overlapping stressors, and tens of sites. The latter is the case with this study in that Little Miami represents a watershed of 1,170 square miles in drainage area with a mix of overlapping stressors and sources in a highly urbanized and legacy industrial landscape. The 2022 assessment is a follow-up to previous surveys of the Lower Little Miami River and Selected Tributaries performed by MBI in 2012, 2013 (partial survey), and 2017 (MBI 2013, 2018) and Ohio EPA in 1983, 1993, 1998, and 2007 (Ohio EPA 1995, 2000, 2009).

Scope of the 2022 Lower Little Miami River and Selected Tributaries Biological and Water Quality Assessment

The scope of the MSDGC 2022 Lower Little Miami River and Selected Tributaries biological and water quality assessment was the same as in 2017 (MBI 2018) which included the mainstem and all or parts of four tributary subwatersheds. This compares to the full watershed scope of the 2012 survey (MBI 2013) that included the lower mainstem, the lower East Fork mainstem, and all the tributary subwatersheds. In addition to supporting the instream monitoring requirement of the MSDGC Combined Sewer Overflow (CSO) National Pollutant Discharge Elimination System (NPDES) permit (1PX00022*ED) the overall objectives remained the same:

1. Assess the attainability of the existing aquatic life use designations codified in the Ohio Water Quality Standards (WQS) and make recommendations for any changes as revealed by the survey data and analysis;
2. Determine the extent to which biological assemblages are impaired (using Ohio EPA methods and criteria);
3. Determine the extent of recreational use impairments using *E. coli* as the sole indicator and criteria in the Ohio WQS;
4. Determine the categorical stressors and sources that are associated with those impairments; and,
5. Add to the broader databases for the Little Miami River study area to track and understand changes over time that occur as the result of MSDGC abatement actions or other factors.

The data presented herein were processed, evaluated, and synthesized as a biological and water quality assessment of aquatic life and recreational use support status. The assessment of the mainstem is directly comparable to those accomplished previously in 1983, 1989, 1993, 1998, and 2007 by Ohio EPA and 2012, 2013, and 2017 by MBI, such that trends in status can be examined, and causes and sources of impairment can be confirmed, appended, or removed.

This study includes an assessment of chemical and physical stressors related to biological assemblages. It is not the purpose of this study to identify specific remedial actions on a site specific or subwatershed basis. However, the data produced by this study contributes to the maintenance and use of the Integrated Prioritization System (IPS; MBI 2015) that was developed to determine and prioritize remedial projects for the MSDGC service area and adjoining watersheds.

EXECUTIVE SUMMARY

Scope and Purpose

In 2010 MSDGC and MBI developed a four-year rotational watershed assessment approach that is documented in the *Watershed Monitoring and Bioassessment Plan for the MSD Greater Cincinnati Service Area, Hamilton County, Ohio; Technical Report MBI/5-11-3* (MBI 2011). Initiated in 2011, it has provided biological and water quality monitoring data that has assisted MSDGC and area stakeholders in better understanding current water quality, trends through time, and considerations for capital planning and implementation of Project Groundwork to further improve water quality. The 2022 bioassessment of the Little Miami River study area is the third survey in series of baseline and follow-up surveys that are conducted primarily in support of the instream monitoring requirement of the CSO NPDES permit. The sampling and analysis in 2022 was performed by Level 3 Qualified Data Collectors and under a Project Study Plan (PSP) approved by Ohio EPA under the specifications of the Ohio Credible Data Law and Regulations.

An intensive pollution survey design that employs a high density of sampling sites and biological, chemical, and physical indicators and parameters was followed. The principal objectives of biological assessments are to assess current conditions, verify existing aquatic life and recreational use designations, assign uses to unlisted streams and stream segments, make recommendations for any changes to use designations, report attainment status following the Ohio WQS and Ohio EPA practices, and determine associated causes and sources of impairment. The determination of associated causes and sources of impairments to aquatic life and recreational uses followed practices similar to that employed by Ohio EPA. As such, these determinations are mostly categorical, but can include the identification of specific pollutants. The results of this study will be incorporated in an ongoing assessment of stressors and their root causes and sources throughout the MSDGC service area via the Integrated Prioritization System (IPS; MBI 2015). The IPS includes more detailed analyses of regional patterns in stressors by relating them to the chemical, physical, and biological data generated by the surveys to land use data available in GIS coverages.

Highlighted Findings

Aquatic Life Use Attainability

The key indicator of overall condition in terms of aquatic life is the status of the attainment of aquatic life use designations based on attainment of the Ohio biological criteria. The status of use attainment is portrayed as full, partial, or non-attainment at each site. The 2022 assessment of the Little Miami River mainstem, the Duck Creek watershed, and parts of Sycamore Creek provided an opportunity to update use attainment status and to gauge the effectiveness of prior and ongoing attempts to improve water quality and overall conditions by comparing the results to prior assessments. The 2012, 2013 (fish/habitat only), and 2017 surveys by MBI and the 1983, 1993, 1998, and 2007 surveys by Ohio EPA provide the most consistent basis for comparisons in terms of spatial coverage and between indicators and parameters for the 2022 survey results.

Of the 41 sites that were assessed in the 2022 Little Miami River bioassessment, 13 sites were evaluated against the Exceptional Warmwater Habitat (EWH) use, 18 sites were evaluated against the Warmwater Habitat (WWH) use, six (6) sites against the Limited Resource Waters (LRW) use, and four (4) for the Primary Headwater Habitat (PHWH) classification consisting of one (1) PHW3A, two (2) PHW2, and one (1) PHW1 (Table 1). Recommendations for aquatic life use changes were originally made as part of the larger in scope 2012 bioassessment (MBI 2013) and again by the 2017 bioassessment (MBI 2018). All except one of the recommendations were eventually adopted into the Ohio WQS. These confirmed and recommended uses were used to gauge attainment status in 2017 and again in 2022.

The lower reach of the East Fork of Duck Creek was recommended for the WWH use in lieu of the designated LRW use in 2017 (MBI 2018). This recommendation was not accepted by Ohio EPA for the most recent WQS revisions for the Little Miami River basin. The 2022 results show that the potential for WWH still exists at the lowermost two sites, LM 84 (RM 2.20) and LM 85 (RM 1.30), based on QHEI scores of 62.5 and 65.0, respectively. The biological results revealed impairment with fair macroinvertebrate narratives and IBI scores of 22 (poor) and 28 (fair) with causes including very poor and poor urban land use and urban pollutant impacts. The biological performance, while impaired for WWH, was well above that expected for a LRW designated stream. The basis of the recommendation was on habitat despite the presence of urban impacts. This is consistent with how WWH designations have been recommended by MBI since 2011 and subsequently adopted by Ohio EPA throughout the MSDGC Service Area.

Trajectories in Key Indicators

Developing an understanding of the temporal trajectory of the different indicators and parameters that are provided by a spatially adequate monitoring design is important feedback to MSDGC, Ohio EPA, and stakeholders in the Little Miami River study area. The study area has a complex mosaic of watershed level and site-specific impacts. The complexity of which makes being able to understand and then develop management responses to impairments challenging. The documentation of incremental improvements as opposed to a singular focus on the full restoration of impairments allows program effectiveness to receive credit short of achieving full restoration. Furthermore, failing to recognize if waters are improving and on a positive trajectory can lead to erroneous conclusions about the attainability of Clean Water Act (CWA) goals and the viability of restoration efforts. Simply put, a selective focus on individual or selected pollutants is insufficient in a complex setting like the Little Miami River study area. It is for these reasons that being able to detect, measure, and express incremental improvements in key biological indicators is vital. Showing incremental progress not only provides confirmation that restoration efforts are working, but it also provides important feedback for those programs which, because of uncertainties about their control, must be adaptive in order to make progress. As such, the type of monitoring and assessment that was employed in this survey was designed to provide results that could be used to demonstrate the degree and direction of incremental change.

Table 1. *Summary of current and recommended (yellow shaded) aquatic life uses (AQLU) based on use attainability analyses from the 2012 and 2017 Little Miami River biological and water quality assessments by site sampled in 2022. Other color shading distinguishes the mainstem and three tributary subwatersheds in the 2022 survey.*

Site ID	Basin-Stream Code		River_Stream Name	Drain. Area (mi.^{2})	RM	Current AQL Use[1]	Year Verified	Verified By	Recom-mended AQL Use[2]	Location Description
LM01	11	001	Little Miami River	1140	27.90	EWH	1983	OEPA	EWH	Dst. U.S. Rt. 22/St. Rt. 3 - L. Miami State Park
LM02	11	001	Little Miami River (RF06)	1145	24.10	EWH	1983	OEPA	EWH	Ust. O'Bannon Cr.
LM03	11	001	Little Miami River	1150	22.30	EWH	1983	OEPA	EWH	Ust. Polk Run WWTP
LM05	11	001	Little Miami River	1160	21.50	EWH	1983	OEPA	EWH	Hopewell Rd. (Bridge Street)
LM07	11	001	Little Miami River	1187	18.50	EWH	1983	OEPA	EWH	Camargo Rd.
LM08	11	001	Little Miami River	1190	17.70	EWH	1983	OEPA	EWH	Canoe access dst. St. Rt. 126
LM09	11	001	Little Miami River	1203	13.10	EWH	1983	OEPA	EWH	Wooster Pike - Milford
LM11	11	001	Little Miami River	1707	10.90	EWH	1983	OEPA	EWH	Intersection of Mt. Carmel & Round Bottom Rd.
LM12	11	001	Little Miami River	1710	8.10	EWH	1983	OEPA	EWH	Newtown Rd.
LM13	11	001	Little Miami River	1720	6.83	EWH	1983	OEPA	EWH	R.R. Trestle/Mariemont
LM15	11	001	Little Miami River	1740	4.10	EWH	1983	OEPA	EWH	Ust. Duck Creek
LM16A	11	001	Little Miami River	1752	3.70	EWH	1983	OEPA	EWH	Dst. Duck Creek/Ust. Beechmont Ave.
LM16	11	001	Little Miami River	1752	3.50	EWH	1983	OEPA	EWH	Beechmont Ave. dst. Duck Cr., ust. Clough Cr.
LM17	11	001	Little Miami River	1754	1.60	WWH	1983	OEPA	WWH	Kellog Ave.
LM50	11	007	Sycamore Creek	12.5	1.10	WWH	1983	OEPA	WWH	Loveland Rd.
LM51	11	007	Sycamore Creek	24.0	0.50	WWH	1983	OEPA	WWH	Dst. N. Fork
LM52	11	007	Sycamore Creek	24.0	0.10	WWH	1983	OEPA	WWH	Dst. Sycamore Cr. WWTP
LM54	11	086	U.T. @1.82 to U.T. Sycamore Cr. @1.12	1.58	0.40	PHW2	2012	MBI	PHW3A	Behind house on Pepperell Rd.
LM55	11	049	Un. Trib to Sycamore Cr. @1.12	4.22	1.20	WWH	2012	MBI	WWH	Upstream Blome Rd bridge
LM56	11	049	Un. Trib to Sycamore Cr. @1.12	5.61	0.20	WWH	2012	MBI	WWH	Nearest 8174 Loveland Maderia Dr
LM40	11	009	Polk Run	10.80	0.30	WWH	1983	OEPA	WWH	East Kemper Rd.
LM71	11	004	Duck Creek	0.29	6.10	LRW	2012	MBI	LRW	Norwood/Harris Ave
LM72	11	004	Duck Creek	1.80	5.14	LRW	2012	MBI	LRW	Duck Creek Road
LM73	11	004	Duck Creek	1.91	4.58	LRW	2012	MBI	LRW	Steel Place
LM74	11	004	Duck Creek	9.56	3.90	LRW	2007	OEPA	LRW	Dst. E. Fork Duck Creek
LM75	11	004	Duck Creek	10.20	3.40	LRW	2007	OEPA	LRW	Erie Avenue
LM76	11	004	Duck Creek	11.60	2.80	WWH	2007	OEPA	WWH	Red Bank Rd. and Fair Ln.
LM77	11	004	Duck Creek	14.40	2.00	WWH	2007	OEPA	WWH	Wooster Rd.
LM79	11	004	Duck Creek	14.70	0.90	WWH	2007	OEPA	WWH	Ust. Wooster Rd.
LM80	11	075	Un. Trib. to Duck Cr. @4.80	1.40	5.00	LRW	2012	MBI	LRW	Kennedy Avenue
LM83	11	075	Un. Trib. to Duck Cr.k @4.80	1.20	0.80	PHW2	2012	MBI	PHW2	Behind Home Depot
LM82	11	077	Un. Trib. to L. Duck Cr. @4.42	1.40	0.20	PHW3	2012	MBI	PHW3A	At baseball field
LM81	11	004	East Fork Duck Creek	0.29	2.30	LRW	2007	OEPA	PHW1	End of Tamworth Dr.
LM84	11	051	East Fork Duck Creek	2.20	0.70	LRW	2007	OEPA	WWH	Behind John P. Parker School
LM85	11	051	East Fork Duck Creek	1.30	2.00	LRW	2007	OEPA	WWH	Stewart Ave.
LM86	11	076	Little Duck Creek	0.22	2.40	WWH	2012	MBI	WWH	Camargo Road
LM87	11	076	Little Duck Creek	0.50	1.90	WWH	2012	MBI	WWH	Plainville Road
LM90	11	076	Little Duck Creek	0.55	1.00	WWH	2012	MBI	WWH	Settle Street
LM92	11	076	Little Duck Creek	1.68	0.49	WWH	2012	MBI	WWH	Wooster Rd. @Red Bank
LM95	11	002	Clough Creek	2.10	3.20	WWH	2007	OEPA	WWH	Clough Pike and Bridges Rd.
LM98	11	002	Clough Creek	7.97	0.40	WWH	2007	OEPA	WWH	St. Rt. 125

Footnotes: [1] Current AQL use listed in OAC 3745-1-18 (November 2022 version); [2] Verified or recommended AQL use based on 2022 results.

The results of the bioassessment using the primary indices that comprise the Ohio biocriteria were used to quantify the degree to which overall aquatic life conditions have improved through time up to and including the 2017 survey. The Area of Degradation (ADV) and Area of Attainment (AAV) methodology (Yoder et al. 2005) was used to illustrate the degree of change between the Ohio EPA surveys of 1983, 1993, 1998, and 2007 and the 2012, 2013, and 2017 MBI surveys of the mainstem of Little Miami. The ADV/AAV term is an expression of the degree to which one of the biological index values is either above or below the applicable biocriterion and the distance of the mainstem over which it occurs. As such it is a quantification of the

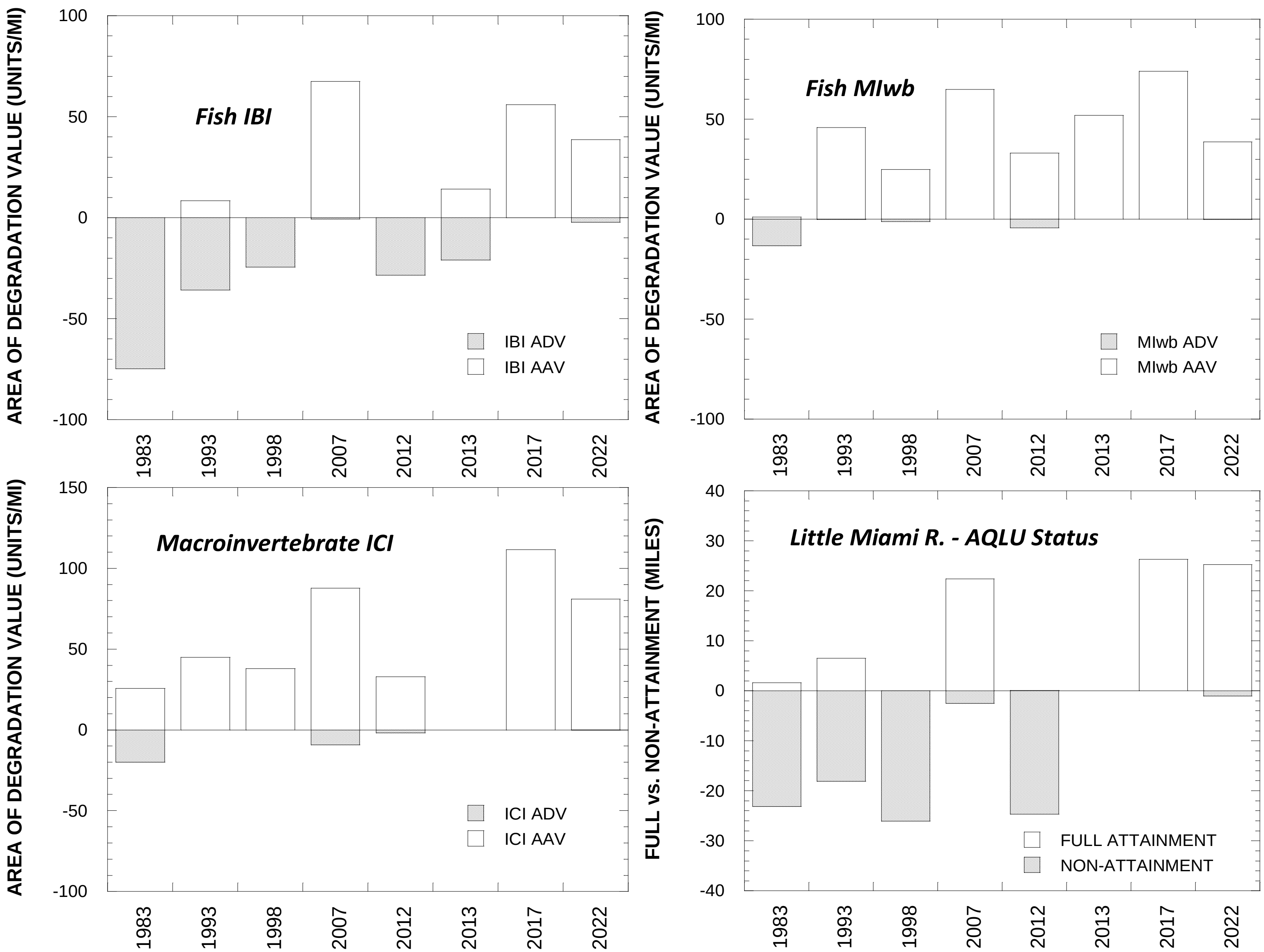


Figure 1*. Area of Degradation (ADV) and Area of Attainment (AAV) values for the IBI (upper left), MIwb (upper right), and ICI (lower right) in the Little Miami River mainstem between 1983 and 2022. The miles of full and non-attainment are depicted in the lower right panel (AQLU – Aquatic Life Use Attainment).*

"quantity" of biological attainment and impairment. When normalized to a standard distance (e.g., per mile) it can be an effective indicator of the degree of change taking place over time.

Little Miami River Mainstem
ADV/AAV results for the fish Index of Biotic Integrity (IBI), the Modified Index of Well-Being (MIwb), and the macroinvertebrate Invertebrate Community Index (ICI) were available from the series of Ohio EPA surveys in 1983, 1993, 1998, and 2007 and the 2012, 2013 (fish only), 2017 and 2022 MSDGC surveys of the lower Little Miami River mainstem. When this was assessed after the initial 2012 MSDGC survey (MBI 2013), a substantial decline was observed between the zenith of recovery documented by Ohio EPA in 2007 and the 2012 results especially for the fish IBI (Figure 1). Ohio EPA (2010) had credited the near complete recovery in 2007 from the impaired conditions in 1998 to improved WWTP treatment and phosphorus removal at selected WWTPs along the mainstem. The 2012 results showed a return to the impaired conditions of 1998 which prompted follow-up sampling in 2013 by Ohio EPA and MSDGC. The decline was the most severe in the fish IBI which was also evident in reduced AAVs for the fish MIwb and the ICI in 2012. Follow-up sampling for fish in 2013 showed a reduction in the degree of impairment, but recovery remained incomplete. The 2013 MSDGC sampling was extended upstream into Warren County to upstream from the confluence with Caesar Creek at RM 51.2 and included 24 sites downstream through the 2012 study area. IBI scores exceeded full attainment of the EWH IBI biocriterion with scores >52 downstream to RM 36.0 upstream from Lebanon. Between RM 36.0 to RM 17.7 at Miamiville, most scores declined marginally, either just meeting the EWH biocriterion of 48 or in non-significant departure. Scores declined to 40 or less at the remaining seven sites downstream from RM 12.7 at Milford. While inconclusive about a specific cause of the decline observed in 2012, the 2013 follow-up results better delineated the reaches of decline and impairment. The 2017 results demonstrated a near complete return to the full attainment of EWH in the reach of the mainstem downstream from RM 27.9 to the WWH reach at Beechmont Ave. (RM 3.0). The AAV for the fish IBI was just shy of the 2007 value and for the fish MIwb and macroinvertebrate ICI were slightly higher than in 2007. The 2022 results were essentially the same as in 2017, but with slightly lower AAVs which reflected more sites in non-significant departure of the fish IBI EWH biocriterion especially. The MIwb and ICI were likewise slightly lower in 2022 compared to 2017. The non and partial attainment of EWH and new site LM16A and the downstream most EWH site at LM16 showed impairment of EWH for the first time since 1998.

Duck Creek
Sufficient data was available from 2012, 2017, and 2022 to conduct a trend evaluation for the Duck Creek mainstem using the ADV/AAV methodology (Figure 2). Insufficient sites were sampled by Ohio EPA in 1983, 1994, or 2007 to include in this analysis, but an examination of those scant results indicates that conditions were likely the same or worse than in 2012. Both the fish IBI and macroinvertebrate ICI results demonstrated reduced ADVs and increased AAVs between 2012, 2017, and 2022 with the largest improvement in the macroinvertebrates. Aquatic life use status between 2012 and 2022 improved only slightly gaining perhaps one mile of full attainment and this considering the Limited Resource Waters (LRW) designation of the

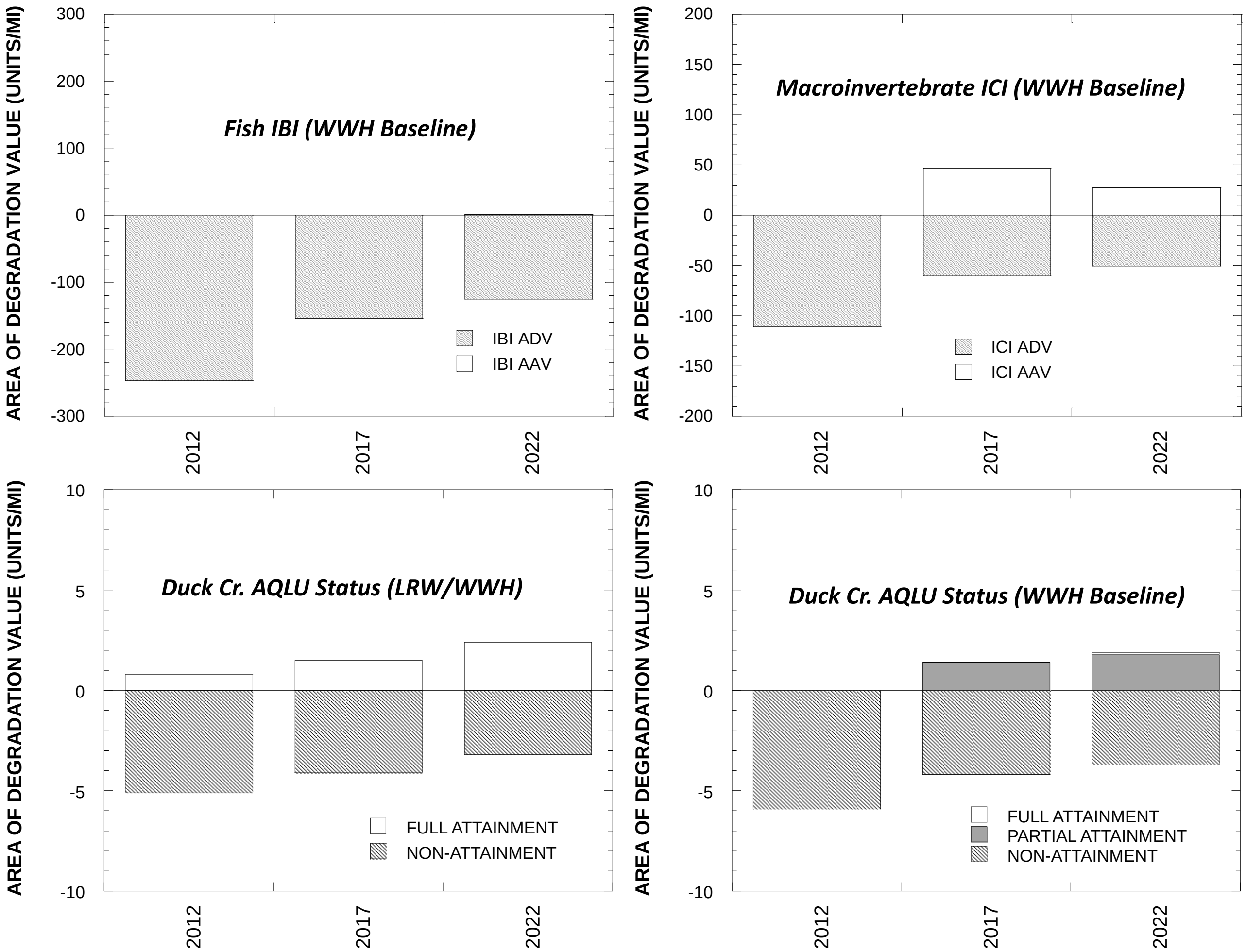


***Figure 2**. Area of Degradation (ADV) and Area of Attainment (AAV) values for the IBI (upper left), ICI (upper right) in the Duck Creek mainstem between 2012, 2017, and 2022. The miles of full and non-attainment are depicted for the current LRW and WWH use designations (lower left) and against a WWH baseline (lower right).*

upper two-thirds of Duck Creek. As such the improved ADV/AAVs for the fish IBI and macroinvertebrate ICI show an incremental improvement not revealed by the attainment status. The fish assemblage is the limiting factor in the use attainment results and an indication that the highly modified habitat of Duck Creek is a major limiting factor in Duck Creek along with multiple water quality impacts. The positive improvement in the macroinvertebrate assemblage between 2012 and 2017 was more likely associated with a lessening of chemical impacts, but this improvement trajectory leveled off in 2022 as well.

Aquatic Life Use Attainment Status

The aquatic life use attainment status for 2022 is depicted in Table 2 and Figures 1 and 2. Table 2 also lists causes of impairment and threats to fully attaining sites. The determination of causes and sources of aquatic life use impairment was accomplished by associating the occurrence of sampling results that exceeded various chemical and physical thresholds that are known to adversely affect aquatic organisms. These distinctions may include multiple or specific types of effects and mechanisms. Some are parameter specific (e.g., low dissolved oxygen) since the data are collected at that level. Yet others are at the categorical level (e.g., nutrient enrichment, toxicity) that can include multiple parameters. In addition, certain stressors can be proxies for a wider range of specific causes or can mask causes that eventually emerge with changing conditions. Sources are also necessarily categorical and some are broader in their inclusion of specific activities than others. The causes and sources that are listed along with the biological impairments appear in the determination of aquatic life use attainment status (Table 2) and are summarized as weighted causes for impaired sites in the 2022 survey area. A summary description of attainment status and causes of impairment and threats to full attainment for each of the Little Miami River mainstem, Duck Creek, Sycamore Creek, and Clough Creek subwatersheds follows:

Little Miami River Mainstem – Overall Results

- The 2022 results showed full attainment of the Exceptional Warmwater Habitat (EWH) use at 11 of the 13 sites in the EWH designated reach.
- The 2022 results were similar to 2017 which was then a marked improvement over the near complete non-attainment of EWH that was observed in 2012 and nearly equivalent to or in excess of the 2007 results obtained by Ohio EPA. Of the nine (9) sites that fully attained EWH, seven (7) had one or two of the biocriteria indices in the non-significant departure range, six (6) for the IBI and two each for the MIwb and ICI. This compares to only three (3) such instances in 2017, each of which were for the IBI only. This also resulted in lower AAV/mile values for all three indices in 2022 compared to 2017 and 2007 that signifies a noticeable weakening of the EWH attainment in 2022.
- IPS derived threats to full EWH attainment included high urban land use in the catchment and buffer at all mainstem sites (48.6%) followed by organic and nutrient enrichment stressors (29.7%), urban related parameters (10.8%), low D.O. (8.1%), and toxic impacts (2.7%; Figure 4). Of the latter, zinc and lead levels also served as indicators of urban runoff and while low, pose a potential threat to the exceptional biota. Macrohabitat related threats were zero.
- The Ohio EPA large rivers nutrient effects assessment indicated no imminent issues or threats from nutrient enrichment as all sites evaluated were in the acceptable category. However, given the predominance of treated wastewater flows in proportion to low flow thresholds this poses a threat especially under any increases in such flows.
- There are no recommendations for any revisions to the existing aquatic life use designations for the Lower Little Miami River mainstem.
- A new site, LM16A downstream from Duck Creek, and two long term sites LM16 (RM 3.50) downstream from Beechmont Ave. and LM17 (RM 1.70) in the Ohio River influenced lower reach, were impaired as follows:
    - The status at LM16A was non-attainment of EWH with all three biological indices failing to meet the EWH biocriteria.
    - The status at LM16 was partial attainment due to only the IBI failing to meet the EWH biocriterion.

***Table 2**. Aquatic life use attainment status at 41 sites in the Lower Little Miami River mainstem, the Duck Creek subwatershed, and other partial subwatersheds in Hamilton Co. in 2022. Site IDs, river miles, drainage area, designated/recommended aquatic life use, fish and macroinvertebrate index scores, QHEI, weighted causes of impairment for impaired sites (very poor – red; poor – orange, fair – yellow), and threats to attaining sites (light blue)are listed for each site. The Ohio biological criteria and acronyms/abbreviations used in the table are in the footnotes.*

Site ID	River Mile Fish/Macros	Drain-age Area (sq. mi.)	Aquatic Life Use	IBI	MIwb	ICI	Aq. Life Status	QHEI	Very Poor	Poor	Fair
									Little Miami River (EWH Aquatic Life Use –Existing)		
LM01	27.90/27.80	1070	EWH	50	10.3	42^{ns}	Full	89.5	H. Urb (Cat); H. Urb (Buff); Chloride; TDS; Nitrate; Cond; Lead;		
LM02	24.10/23.90	1090	EWH	52	10.9	50	Full	91.0	TDS; H. Urb (Cat); H. Urb (Buff); Nitrate; Cond; Lead;		
LM03	22.30/22.20	1150	EWH	47^{ns}	9.5^{ns}	52	Full	84.5	H. Urb (Cat); H. Urb (Buff); Nitrate; Lead;		
LM05	21.50/20.90	1160	EWH	47^{ns}	10.3	52	Full	89.5	H. Urb (Cat); H. Urb (Buff); Nitrate; Lead;		
LM07	18.50/18.50	1190	EWH	51	10.3	48	Full	89.5	H. Urb (Cat); H. Urb (Buff); Nitrate; Lead;		
LM08	17.70/16.90	1190	EWH	52	10.2	50	Full	85.5	H. Urb (Cat); H. Urb (Buff); Nitrate; Chloride; Lead;		
LM09	13.10/13.10	1200	EWH	48	10.0	52	Full	87.8	H. Urb (Cat); H. Urb (Buff); BOD; Nitrate; Lead;		
LM11	10.90/10.90	1710	EWH	44^{ns}	9.8	42^{ns}	Full	85.0	H. Urb (Cat); H. Urb (Buff); Nitrate; Lead;		
LM12	8.10/8.00	1710	EWH	44^{ns}	9.3^{ns}	56	Full	89.3	H. Urb (Cat); H. Urb (Buff); Nitrate; Lead;		
LM13	6.83/7.30	1720	EWH	46^{ns}	9.8	54	Full	87.0	H. Urb (Cat); H. Urb (Buff); Nitrate; Lead;		
LM15	4.10/4.10	1730	EWH	44^{ns}	10.1	58	Full	87.5	H. Urb (Cat); H. Urb (Buff); BOD; Nitrate; Lead;		
LM16A	3.70/3.70	1740	EWH	30*	8.8*	40*	Non	65.0	H. Urb (Cat); H. Urb (Buff); Mod. Attr.		Channel; BOD; Org., Enrich; Lead;
LM16	3.50/3.50	1750	EWH	41*	9.2^{ns}	42^{ns}	Partial	84.0	H. Urb (Cat); H. Urb (Buff);		Lead;
									Little Miami River (WWH Aquatic Life Use – Existing)		
LM17	1.60/1.40	1760	WWH	36^{ns}	7.8*		Partial	62.0	H. Urb (Cat);		Channel; Lead(18.2)
									Sycamore Creek (WWH Aquatic Life Use - Existing)		
LM50	1.10/1.00	12.5	WWH	24*	NA	46	Non	70.0	H. Urb (Cat); H. Urb (Buff);	Chloride; BOD; TDS; TAmm;	TKN; Cond; Lead; High Mod. Attr.
LM51	0.50/0.24	22.8	WWH	49	7.7^{ns}	48	Full	61.5	H. Urb (Cat); H. Urb (Buff); Chloride; Channel; TDS; Cond;		
LM52	0.10/0.10	23.3	WWH	47	7.8^{ns}	38	Full	68.0	Chloride; pH; Nitrate; H. Urb (Cat); H. Urb (Buff); TDS; Cond; TKN; Lead;		
									Unnamed Tributary at RM 1.82 Unnamed Tributary to Sycamore Cr. at RM 1.12 (PHW3A Existing Use)		
LM54	2.40/2.40	1.58	PHW3	12	NA		PHW3A		QHEI; Substr; Channel; H. Urb (Cat); Org. Enrich		
									Unnamed Tributary to Sycamore Cr. at RM 1.12 (WWH Aquatic Life Use - Existing)		
LM55	1.20/1.00	5.32	WWH	26*	NA	G	Non	60.8	Chloride; TDS; H. Urb (Cat);	Cond;	Attr.
LM56	0.20/0.20	5.61	WWH	28*	NA	36	Partial	63.0	QHEI; Substr; Channel; H. Urb (Cat);	Chloride;	Org. Enrich
									Polk Run (WWH Aquatic Life Use - Existing)		
LM40	0.30/0.30	9.97	WWH	52	NA	50	Full	63.0	Chloride; H. Urb (Cat); H. Urb (Buff); TDS; Zinc(25.0); Channel; Cond;		

Biological Criteria – Interior Plateau Ecoregion					AQLU	Status	Narrative
Index	**EWH**	**WWH**	**MWH**	**LRW**	EWH	Full	>75
IBI – Boat	48	38	26	16.0	EWH	Partial	60-74
IBI – Wading	50	40	28	18.0	EWH	Non	46-59
IBI - HW	50	40	28	18.0	WWH	Full	30-45
MIwb - Boat	9.6	8.7	6.4	5.0	WWH	Partial	<30
MIwb – Wading	9.4	8.1	5.9	4.5	WWH	Non	
ICI	46	30	14	8.0	WWH	Non	
ICI Narrative	E	G	F	P	LRW	Full	

Glossary of Acronyms and Abbreviations					
Acronym	**Description**	**Acronym**	**Description**	**Acronym**	**Description**
H. Urb (Cat)	Urban land use in HUC12 catchment	Substr	Substrate condition from QHEI	TDS	Total dissolved solids
Dev-WS	Developed land HUC12	NPS	Nonpoint source	Conduct	Specific conductance
H. Urb. (Buff)	Urban land use in the 30 meter buffer	Mod. Attr.	Modified QHEI Attributes	TKN	Total Kjeldahl nitrogen
Imperv-30C	Imprevious surface 30 m buffer clipped	PAH	Polycyclic aromatic hydrocarbons	TP	Total phosphorus
Imperv-500	Impervious surface 500 meter buffer	WC Metals	Metals concentration in water column	BOD	Biochemical oxygen demand
QHEI	Qualitative Habitat Evaluation Index (QHEI)	D.O.	Dissolved oxygen	Max.	Maximum
Chan	Channel condition from QHEI	SSC	Suspended Sediment Concentration	Org. Enrich.	Organic Enrichment

Table 2. continued.

Site ID	River Mile Fish/Macros	Drain-age Area (sq. mi.)	Aquatic Life Use	IBI	MIwb	ICI	Aq. Life Status	QHEI	Very Poor	Poor	Fair
Duck Creek (LRW Aquatic Life Use – Existing)											
LM71	6.10/6.00	2.24	LRW	12*	NA	VP*	Non	26.0	Substr; H. Urb (Cat);	QHEI; Chloride;	Channel;
LM72	5.14/4.60	5.05	LRW	24	NA	P	Full	54.5	H. Urb (Cat); H. Urb (Buff); Chloride; TDS; QHEI; Channel; Cond; Org. Enrich		
LM73	4.58/4.40	5.84	LRW	12*	NA	F	Non	16.0	QHEI; Substr; H. Urb (Cat); H. Urb (Buff);	Chloride; TDS;	Channel; Cond; Lead;
LM74	3.90/3.90	9.59	LRW	28	NA	F	Full	63.0	H. Urb (Cat); H. Urb (Buff); Chloride; Channel; TDS; Cond; Lead;		
LM75	3.40/3.30	11.5	LRW	12*	NA	F	Non	15.0	QHEI; Substr; Chloride; TDS; H. Urb (Cat); H. Urb (Buff)	Cond; Lead	Channel;
LM76	2.80/2.90	11.7	LRW	24	NA	26	Full	66.0	Chloride; TDS; H. Urb (Cat); H. Urb (Buff); BOD; Cond; Channel; Lead;		
Duck Creek (WWH Aquatic Life Use – Existing)											
LM77	2.00/1.80	14.3	WWH	36^{ns}	NA	32	Full	67.0	Chloride; TDS; H. Urb (Cat); H. Urb (Buff); Cond; Channel; Lead;		
LM79	0.50/0.90	14.6	WWH	26*	NA	38	Non	68.8	H. Urb (Cat); H. Urb (Buff);	Chloride; TDS;	Cond; Lead;
Unnamed Tributary to Duck Creek at RM 4.8 (PHW2 Existing Use)											
LM83	0.00/0.80	1.20	PHW2	12	NA		PHW2		QHEI; Substr; Channel; H. Urb (Cat); H. Urb (Buff);		
LM80	0.10/0.20	1.42	PHW2	12	NA	P	PHW2	34.5	Chloride; BOD; TDS; pH; Cond; H. Urb (Cat); H. Urb (Buff); QHEI; Substr; Channel; TKN; Org. Enrich; Lead;		
East Fork Duck Creek (LRW Aquatic Life Use - Existing)											
LM81	2.30/2.30	0.29	PHW1		NA		PHW1	Dry - no samples			
East Fork Duck Creek (WWH Aquatic Life Use - Recommended)											
LM85	2.00/1.50	1.31	WWH	22*	NA	F	Non	62.5	TDS; H. Urb (Cat); H. Urb (Buff);	Chloride; Cond;	Mod. Atttr.
LM84	0.50/0.60	1.99	WWH	28*	NA	F	Non	65.0	Chloride; TDS; Cond; H. Urb (Cat); H. Urb (Buff);		Channel; Org. Enrich; Lead;
Little Duck Creek (WWH Existing Use)											
LM86	2.40/2.70	0.22	WWH	32*	NA	MG	Partial	56.5	H. Urb (Cat);	Chloride; TDS;	Mod. Attr.
LM87	1.90/2.60	0.45	WWH	32*	NA	G	Partial	61.0	H. Urb (Cat);	Chloride; TDS; Mod. Attr.	Channel; Cond; Org Enrich
LM90	1.00/2.30	0.55	WWH	32*	NA	G	Partial	61.0	H. Urb (Cat); H. Urb (Buff);	Chloride; TDS; Cond;	Channel; Org Enrich
LM92	0.49/0.49	1.68	WWH	12*	NA		Non	66.5	H. Urb (Cat); H. Urb (Buff);	TDS; Lead;	Chloride; Cond;
Unnamed Tributary to Little Duck Creek at RM 4.42 (PHW3A Existing Use)											
LM82	0.20/0.10	0.59	PHW3A	28	NA		PHW3A	50.5	H. Urb (Cat); TDS; QHEI; Channel; TKN; Chloride; Cond; Lead;		
Clough Creek (WWH Aquatic Life Use – Existing)											
LM95	3.20/3.20	1.95	WWH	30*	NA	MG	Partial	59.0	Chloride; pH; H. Urb (Cat); H. Urb (Buff);	TDS;	QHEI; Channel; Cond; Lead
LM98	0.60/0.40	7.81	WWH	38^{ns}	NA	G	Full	59.5	H. Urb (Cat); H. Urb (Buff); Chloride; TDS;QHEI; Channel; Cond; Org. Enrich		

Biological Criteria – Interior Plateau Ecoregion					AQLU	Status	Narrative
Index	**EWH**	**WWH**	**MWH**	**LRW**	EWH	Full	>75
IBI – Boat	48	38	26	16.0	EWH	Partial	60-74
IBI – Wading	50	40	28	18.0	EWH	Non	46-59
IBI - HW	50	40	28	18.0	WWH	Full	30-45
MIwb - Boat	9.6	8.7	6.4	5.0	WWH	Partial	<30
MIwb – Wading	9.4	8.1	5.9	4.5	WWH	Non	
ICI	46	30	14	8.0	WWH	Non	
ICI Narrative	E	G	F	P	LRW	Full	

Glossary of Acronyms and Abbreviations

Acronym	Description	Acronym	Description	Acronym	Description
H. Urb (Cat)	Urban land use in HUC12 catchment	Substr	Substrate condition from QHEI	TDS	Total dissolved solids
Dev-WS	Developed land HUC12	NPS	Nonpoint source	Conduct	Specific conductance
H. Urb. (Buff)	Urban land use in the 30 meter buffer	Mod. Attr.	Modified QHEI Attributes	TKN	Total Kjeldahl nitrogen
Imperv-30C	Imprevious surface 30 m buffer clipped	PAH	Polycyclic aromatic hydrocarbons	TP	Total phosphorus
Imperv-500	Impervious surface 500 meter buffer	WC Metals	Metals concentration in water column	BOD	Biochemical oxygen demand
QHEI	Qualitative Habitat Evaluation Index (QHEI)	D.O.	Dissolved oxygen	Max.	Maximum
Chan	Channel condition from QHEI	SSC	Suspended Sediment Concentration	Org. Enrich.	Organic Enrichment

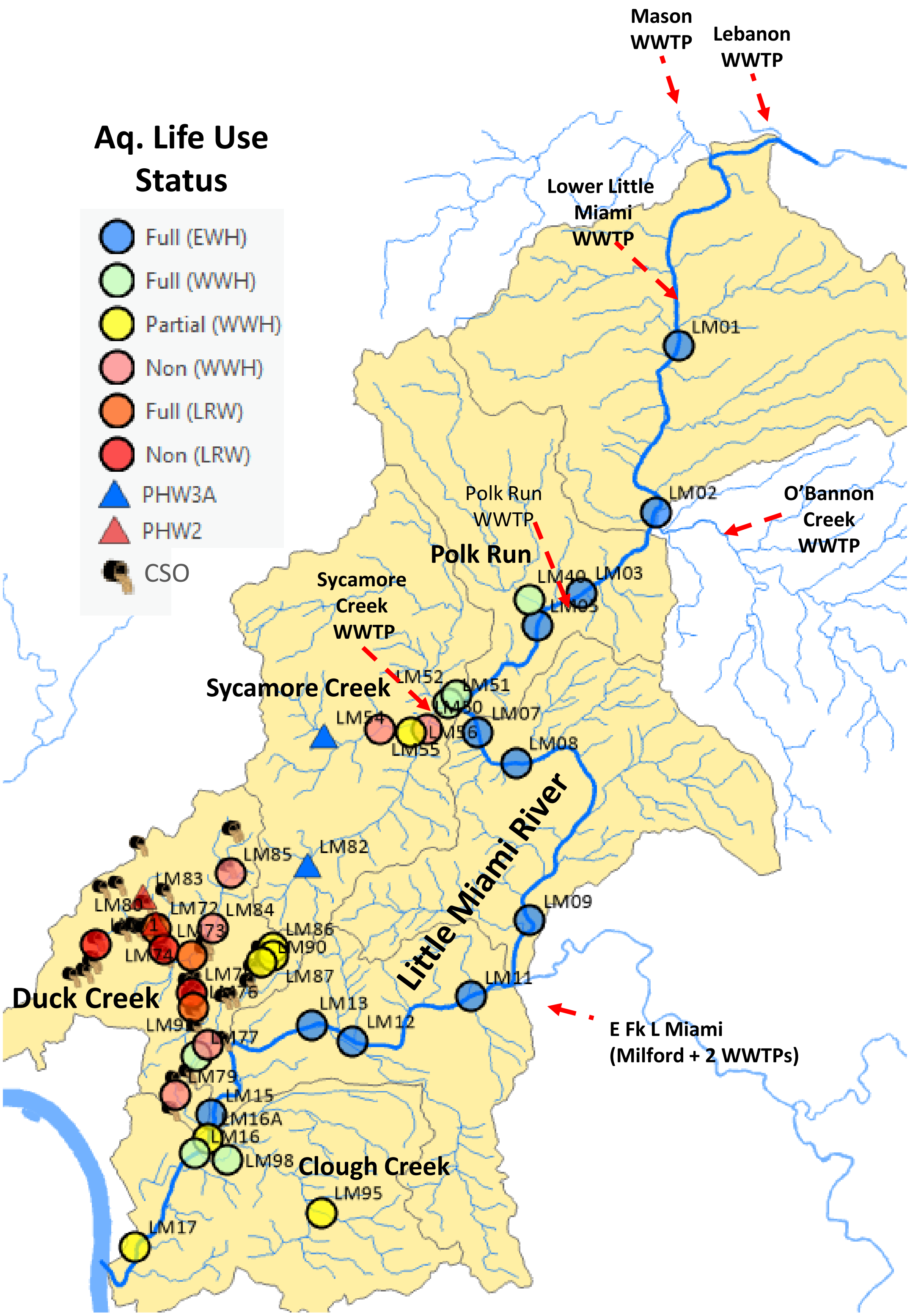


Figure 3. *Aquatic life use attainment status in the Little Miami River study area during 2022 (blue circles – full attainment of EWH; green circles – full attainment of WWH; yellow – partial attainment; red – non-attainment; grey outfall symbols – CSO locations). Site descriptions and site codes appear in Table 6. Sites evaluated as PHWH sites appear as triangles with their classification results (blue – PHW Class 3AI; orange – PHWH Class 2; yellow – PHW Class 1).*

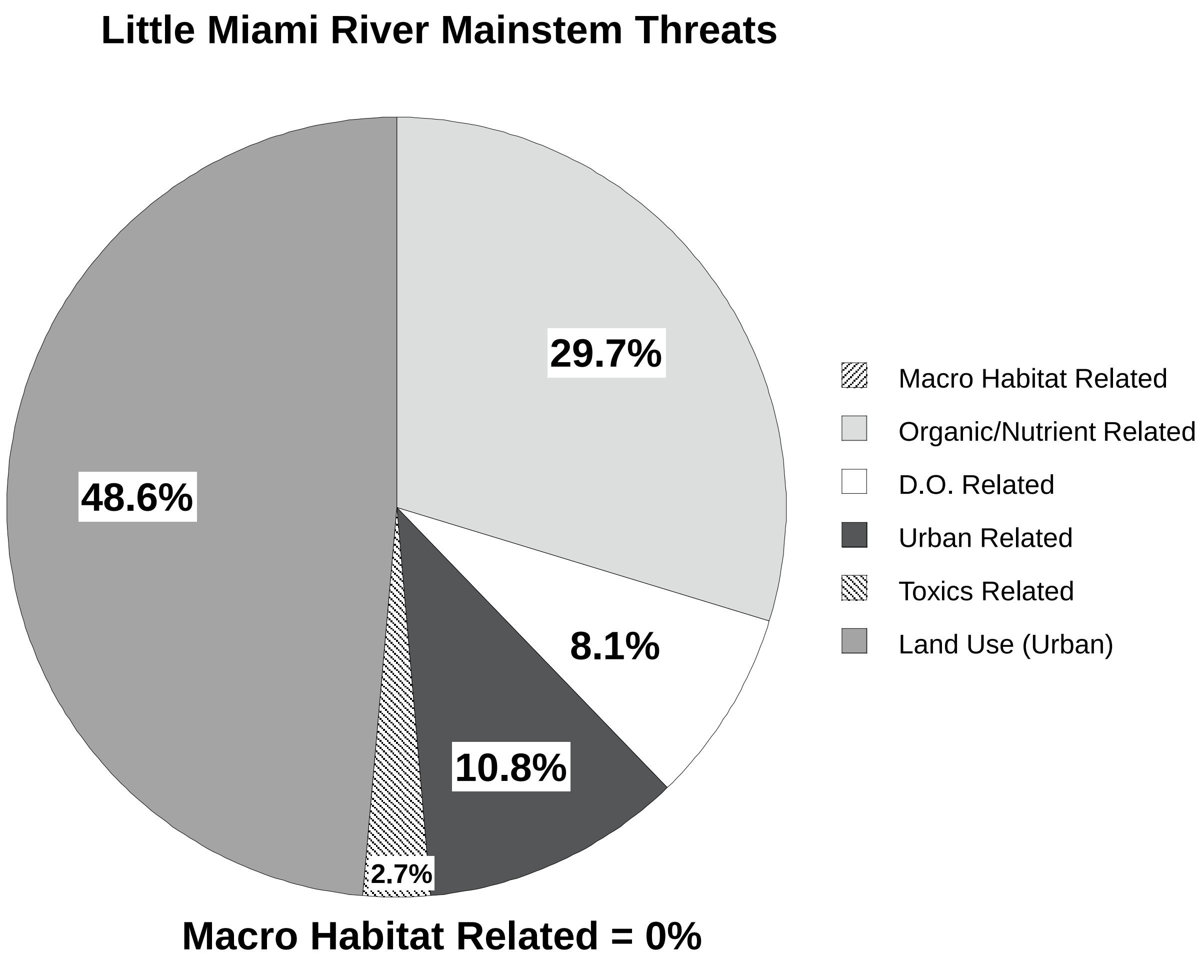


***Figure 4**. Categorical threats to full EWH attainment in the Little Miami River mainstem as derived from the SW Ohio IPS threat and susceptibility thresholds for land use, chemical, and habitat stressors in 2022.*

- The status at LM17 was in partial attainment of WWH due to the MIwb failing to meet the WWH biocriterion.

<u>Little Miami River – Site 16A</u>

- The cause of the non-attainment at LM16A was related to its close proximity to Duck Creek as evidenced by the sharp decline in all three biological indices related to the nearest upstream site at LM15 that was in full EWH attainment. Duck Creek receives discharges from numerous CSOs and urban stormwater. In addition, the severely modified habitat in the middle and upper subwatershed reduces the assimilative capacity allowing it to function as a conduit for CSO and urban related pollutants. The most striking evidence of serious organic enrichment is the *E. coli* mean of 1,100 cfu/mL and a maximum of 241,960 cfu/mL measured at LM16A compared to a lower mean of 129 cfu/100 mL and maximum of 1,414 cfu/100 mL at closest upstream site LM15 (RM 4.10).
- The 2022 IBI and MIwb were considerably lower than values obtained by MBI at this same location in 2019 that was sampled as part of another project. The IBI score declined from

an average of 41 in 2019 to 30 in 2022 and the MIwb declined from 10.1 to 8.9, respectively. The total number of individuals and number of fish species also declined.

- DELT anomalies on fish at LM16A were elevated at 2.6% in August and 6.0% in September 2022, an increase over values of 0 and 0.6% in 2019, thus reflecting an increased sublethal stress response that is likely related to the comparatively low D.O. values that exceeded the EWH criteria in 2022 combined with low level toxicity. The declining results in these indicators between August and September reflects a longer-term response as opposed to an episodic, short term event.

  The macroinvertebrate assemblage likewise reflected an impact similar to the fish assemblage with an ICI score of 40 at LM16A compared to an ICI score of 58 at LM15. The %Mayflies metric was dramatically reduced to 4.8% at LM16A compared to 23.8% at LM15, a response that is typical of low D.O., organic enrichment, and urban related impacts.

<u>Little Miami River – Site 16</u>

- The partial attainment at LM16 was likely the result of the temporal impacts from the coffer dam constructed for the Beechmont bicycle path addition to the Beechmont Ave. bridge in 2021-22. There was a decline between 2019 and 2022 in the number of species and individuals that resulted in a decline in the average IBI from 46 (meets EWH) to 41 (fails EWH) and a decline in the MIwb from 9.8 to 9.2. The coffer dam was in place during the first fish pass in 2022, but was removed before the second pass. There was an increase in the number of darters from the first to second pass with only Greenside Darter collected during the first sampling event, while Variegate, Greenside, Rainbow, Banded, and Fantail Darter were all collected post-cofferdam removal that allowed the riffle at this site to reform. Stonecat Madtom and Gravel Chub also reappeared in the post dam removal sample.

<u>Little Miami River – Site 17</u>

- The single site in the lower three-mile long WWH designated reach at LM17 (RM 1.60) was in partial attainment of WWH due to the failure of the MIwb to meet the WWH biocriterion. This site is impounded by the Ohio River which effectively modifies the habitat, but it is also subject to impacts from urban runoff.

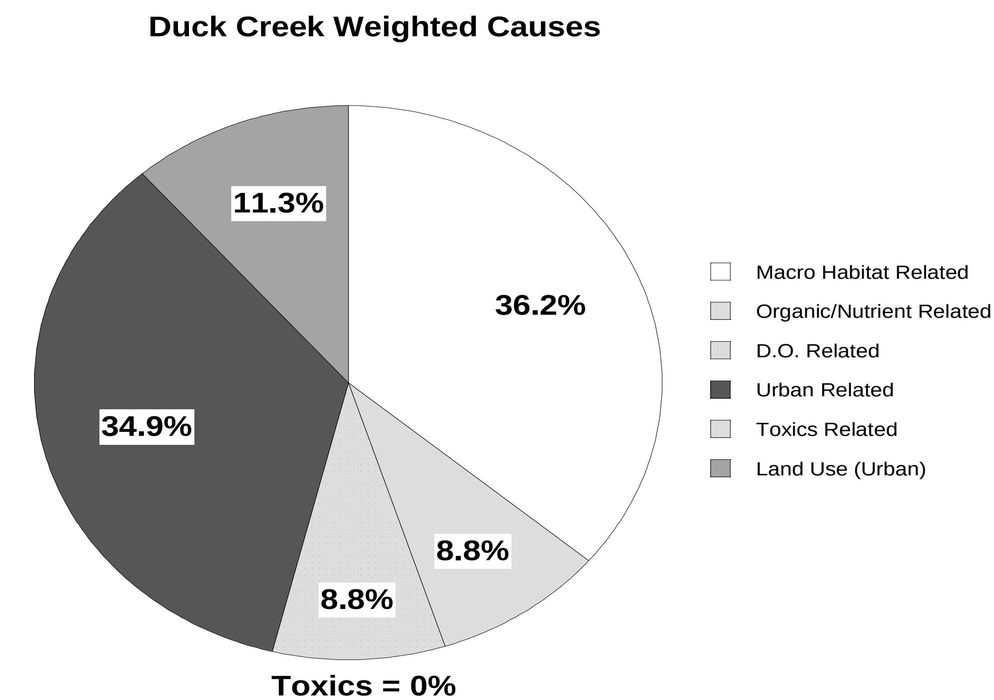
Duck Creek Subwatershed

- The status of aquatic life use attainment had improved slightly between 2012 and 2017 with a gain of approximately one mile in full attainment in the existing Limited Resource Waters designated segment (LRW; upstream Red Bank Rd., RM 2.4). Another incremental gain was observed in 2022 with a gain of 0.9 miles in full attainment.
- No appreciable change was observed in the WWH segment downstream to the Little Miami River between 2012 and 2017, but full attainment was observed in 2022 at LM77 (RM 2.00). The downstream most site was in non-attainment due to the poor performance of the IBI, but only slightly below the partial attainment in 2017.
- Of the eight (8) sites assessed in the mainstem in 2022, three (3) were in full attainment of LRW, three (3) in non-attainment of LRW, one (1) in non-attainment of WWH (poor fish assemblage limited), and one (1) in full attainment of WWH.

- Improvements in the fish IBI and macroinvertebrate ICI (or narrative equivalents) occurred in the Duck Creek mainstem between 2012 and 2017 and again between 2017 and 2022, but with some leveling off of the trajectory of improvement in 2022. These differences were evident in reduced ADVs and increased AAVs demonstrating a detectable and incremental improvement in conditions for aquatic life. At some point the extent to which improvements can continue to occur will be limited by the severely altered habitat in the LRW reach even though two sites had QHEI values consistent with WWH attainability.
- The fish assemblage was the more limited of the two biological assemblages and an indication that the controlling factors remain those directly and indirectly associated with the highly modified habitat.
- Of the 10 sites located in Duck Creek tributaries none were in full attainment of WWH (a decline from 2017); three (3) were in partial attainment of WWH (fish assemblage limited), three (3) sites in were non-attainment of WWH (two showed incremental improvements since 2012), one (1) LRW site was evaluated as PHW1, two (2) sites were classified as Primary Headwater Habitat Class 2, and one (1) site was classified as Primary Headwater Habitat Class 3A (equivalent to WWH). The result at the upstream most site in the headwaters of the East Fork is a return to the PHWH Class 1 in 2012, a decline from PHW2 in 2017.
- The primary causes associated with the partial and non-attainment included high urban land use in the HUC12 catchment (7 sites), organic enrichment (4 sites), chlorides (7 sites), and TDS (6 sites). Weighted causes in the Duck Creek subwatershed (Figure 5) were predominated by macrohabitat related causes (36.2%) and urban related causes (34.9%) that included urban pollutants such as chlorides and TDS. The remainder included urban land use (11.1%), organic enrichment and nutrients (8.9%), and D.O. related effects (8.9%). The were no toxic effect related causes.
- Nutrient effects were evaluated using the Ohio EPA Stream Nutrient Assessment Procedure (SNAP) at sites with continuous D.O. data. Out of 10 sites that had sufficient data to make a SNAP determination Duck Creek had three (3) sites that attained LRW that were threatened by nutrients and two (2) sites that were impaired for LRW with nutrients as a likely cause. Five (5) sites were impaired for WWH, but with causes other than nutrients that included altered habitat and urban related causes.
- One use change recommendation is to designate the lower reach of the East Fork of Duck Creek as WWH in lieu of the existing LRW. This is a repeat recommendation from 2017. One (1) site was classified as PHW3A which is an improvement from 2017, but Ohio EPA is not currently acting on any PHW recommendations.

Sycamore Creek/Polk Run/Clough Creek Partial Subwatersheds

- Of the nine (9) sites assessed in the Sycamore Creek, Polk Run, and Clough Creek subwatersheds in 2022, four (4) were in full attainment of WWH (an improvement since 2012), two (2) in were in partial attainment of WWH (fish assemblage limited), two (2) sites were in non-attainment, and one (1) site was classified as a PHWH Class 3A (an improvement over the PWH2 in 2017). The single site in lower Polk Run had exceptional IBI and ICI scores making it the highest quality tributary sampled in 2022. The principal



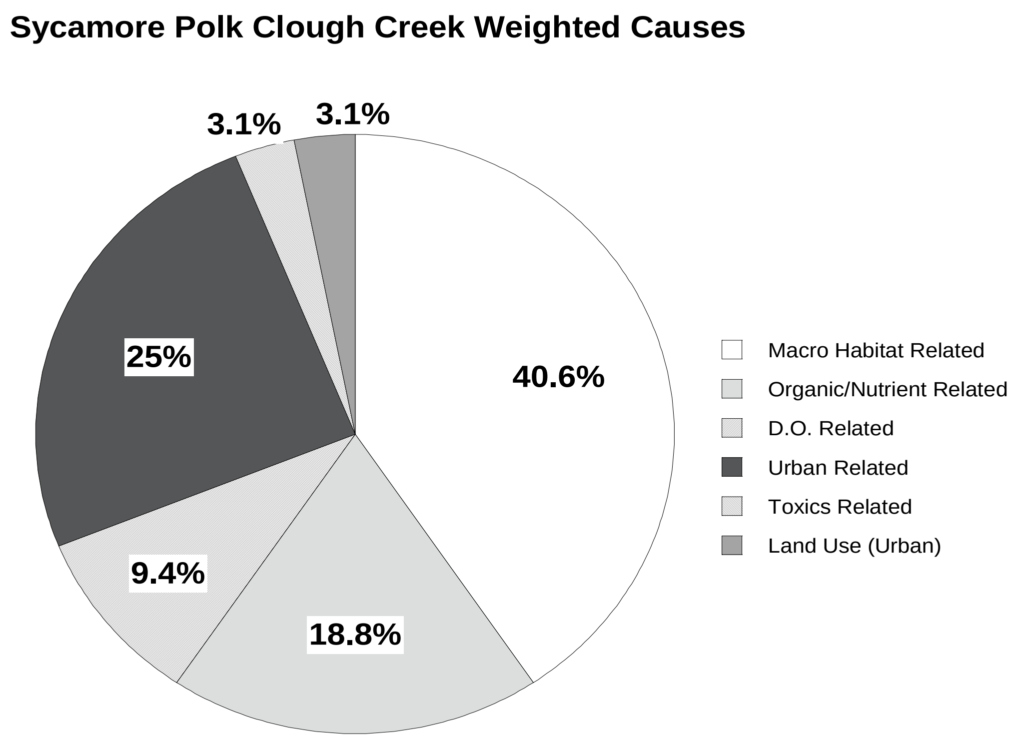


***Figure 5**. Weighted categorical causes of aquatic life use impairment in the Duck Creek subwatershed and the Sycamore Creek, Polk Run, and Clough Creek partial subwatersheds in 2022.*

causes associated with the partial and non-attainment status included urban land use in the HUC12 catchment and buffer, chlorides, TDS, and organic enrichment. Weighted causes in these partial subwatersheds (Figure 4) were predominated by macrohabitat related causes (40.6%), urban related causes (25.0%) that included urban pollutants such as chlorides and TDS, and organic enrichment and nutrients (18.8%). The remainder included D.O. related (9.4%), urban land uses (3.1%) , and toxic effects (3.1%).

- Nutrient effects were evaluated using the Ohio EPA SNAP at sites with continuous D.O. data. Out of six (6) sites that had sufficient data for a SNAP determination only two sites, Polk Run (LM 40; RM 0.40) and Clough Creek (LM98; RM 0.60) attained WWH with no threat from nutrient enrichment. Two (2) sites in Sycamore Creek (LM 51 and LM52) attained WWH, but were threatened by nutrient enrichment. These were downstream from another site in Sycamore Creek (LM50; RM 1.10) that was non-attaining for WWH with nutrients as a likely cause.
- Weighted causes in the partial subwatersheds combined included macrohabitat related causes (40.6%), urban related pollutants (25.0%), organic and nutrient enrichment related causes (18.8%), low D.O. (9.4%), urban land use (3.1%), and toxic related causes (3.1%; Figure 5)
- There are no recommendations for any revisions to the existing aquatic life use designations for the Sycamore Creek/Polk Run/Clough Creek Subwatersheds. While one site classified as PHW3A which is an improvement from 2017, Ohio EPA is not currently acting on any PHWH recommendations.

Recreational Use Status

Impairment of the Primary Contact Recreation (PCR) recreational use in the 2022 Little Miami study area was judged by the *Escherichia coli (E. coli)* bacterial criteria in the Ohio WQS (OAC 3745-1-07; Table 7-13). *E. coli* bacteria are normally present in the feces and intestinal tracts of humans and other warm-blooded animals typically comprising 97 percent of the fecal coliform bacteria in humans (Dufour 1977). There is currently no practical way to quantitatively differentiate between human and animal sources of coliform bacteria in surface waters, although methodologies for this type of analysis have been developed including recent research supported by MSDGC. *E. coli* enters surface waters via direct discharges of human and animal wastes, and in runoff from land surfaces where wastes have been deposited. Pathogenic (disease-causing) organisms are typically present in the environment in such small amounts that it is impractical to directly monitor each one. Fecal indicator bacteria by themselves, including *E. coli,* are usually not pathogenic. However, some strains of *E. coli* can be pathogenic, capable of causing serious illness. Although not necessarily agents of disease, fecal indicator bacteria such as *E. coli* may signal the *potential* presence of pathogenic organisms that enter the environment via the same pathways. When *E. coli* are present in extremely high numbers (i.e., >10,000 cfu/100 mL) in a water sample, it invariably means the water has received a dose of fecal matter from one or more sources including untreated sewage.

The Ohio WQS for recreational uses were revised in early 2016 to reflect a more rigid adherence to equalizing all forms of human contact with surface waters as ensuing the same level of risk. This replaced the former framework that was stratified to account for the degree of contact with three levels of the PCR use as PCR-A, PCR-B, and PCR-C. Those subcategories are now merged into a single use. This action also obviated the recommendations made in the 2011-14 watershed assessments for the redesignation of certain streams to one of the three former subcategories. The application of the Secondary Contact Recreational (SCR) use was also changed to a more restrictive interpretation of the potential for human contact with surface waters. Existing SCR designations made prior to 2011 remain, but could potentially be reviewed and revised to PCR by Ohio EPA at any time. Any new SCR recommendations would need to document that there is virtually no human contact that is possible due to physical restrictions that preclude humans from accessing surface water. As a result, the evaluation of the recreational uses in the 2022 Little Miami River study area were done in accordance with the existing designations of PCR and SCR and with the 2016 criteria as applicable.

Rivers and streams in the 2022 study area are designated as PCR and/or SCR in the Ohio WQS (OAC 3745-1- 30). Water bodies with a designated recreation use of PCR *". . . are suitable for one or more full-body contact recreation activities such as, but not limited to, wading, swimming, boating, water skiing, canoeing, kayaking, and scuba diving"* (OAC 3745-1-07(B)(4)(b)). Secondary Contact includes waters that *". . . result in minimal exposure potential to water borne pathogens because the waters are rarely used for water based recreation such as, but not limited to, wading; situated in remote, sparsely populated areas; have restricted access points; and have insufficient depth to provide full body immersion, thereby greatly limiting the potential for water based recreation activities."* The *E. coli* criterion that applies to PCR is expressed as a 90-day geometric mean of ≤126 colony forming units (cfu)/100 ml with a Statistical Threshold Value (STV) of 410 cfu/100 ml. The criterion that applies to SCR streams is ≤1,030 cfu/100 ml for both the 90-day geometric mean and the STV (Table 3). Per Ohio EPA practice, the seasonal geometric mean can be evaluated by the arithmetic mean of two or more samples and is used as the basis for determining the attainment status of the PCR use in this assessment. Maximum values are used to assess against the STV criterion.

Table 3. *E. coli criteria for Ohio streams and rivers (OAC 3745-1-07).*

	***E. coli* Counts (cfu/100 ml)**	
Recreation Use	Seasonal Geometric Mean	Statistical Threshold Value[1]
PCR	126	410
SCR	1,030	1,030

[1]These criteria shall not be exceeded in more than 10 percent of the samples taken during any 90-day period.

Widespread impairment of the PCR and SCR based on *E. coli* results persisted in the Little Miami River mainstem and the Duck Creek and Sycamore Creek/Polk Run/Clough Creek partial subwatersheds in 2022. However, direct comparisons of changes in attainment status between 2012 and 2017 and 2022 are complicated by changes to the recreation uses and criteria in early 2016. Recreational use attainment for each of the 38 sites sampled for *E. coli* in 2022 appears in Table 4 and on Figure 6. A narrative summary of the major portions of the 2022 study area follows:

Little Miami River Mainstem

- In 2017, only four of 13 sites were impaired for the PCR use, and these were insignificant exceedances of the STV – all geometric means were below that criterion. This was a significant improvement over the 2012 results when 14 of 16 sites were impaired for the

***Table 4**. Status of recreational use attainment in the 2022 Little Miami River study area as attaining or impaired based on the E. coli geometric mean and statistical threshold criteria at 38 sites assessed in 2022. PCR – Primary Contact Use; SCR – Secondary Contact Use.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Samples	Recreation Use	Minimum	Mean	Maximum
Little Miami River							
LM01	27.90	1069.0	6	PCR	75	209	727
LM02	24.10	1085.0	6	PCR	47	156	548
LM03	22.30	1148.0	6	PCR	55	186	866
LM05	21.50	1160.0	6	PCR	36	128	613
LM07	18.50	1187.0	6	PCR	47	164	1120
LM08	17.70	1190.0	6	PCR	34	121	727
LM09	13.10	1203.0	6	PCR	31	229	4140
LM11	10.90	1707.0	6	PCR	74	175	1730
LM12	8.10	1710.0	6	PCR	39	151	2420
LM13	6.83	1720.0	6	PCR	73	174	2420
LM15	4.10	1730.0	6	PCR	20	129	1414
LM16a	3.70	1752.0	6	PCR	214	1011	241960
LM16	3.50	1752.0	6	PCR	28	140	1414
LM17	1.60	1754.0	6	PCR	38	229	2420
Sycamore Creek (LMR RM 19.2)							
LM50	1.10	14.7	4	PCR	51	376	7440
LM51	0.50	24.0	4	PCR	119	296	649
LM52	0.10	24.0	4	PCR	23	68	172
Unnamed Tributary to Sycamore Creek at RM 1.12							
LM55	1.20	5.3	2	PCR	67	106	167
LM56	0.20	5.6	2	PCR	67	71	75
Polk Run (LMR RM 21.55)							
LM40	0.30	10.8	4	PCR	248	338	411
Duck Creek (LMR RM 3.87)							
LM71	6.10	2.2	4	SCR	1	2	7
LM72	5.14	5.1	4	SCR	411	2461	61310
LM73	4.58	5.8	4	SCR	411	1372	4710
LM74	3.90	9.6	4	SCR	411	488	687
LM75	3.40	7.3	4	SCR	186	383	649
LM76	2.80	11.8	4	PCR	365	454	579
LM77	2.00	14.3	4	PCR	126	401	770
LM79	0.50	14.6	4	PCR	82	204	411
Unnamed Tributary to Duck Creek at RM 4.8							
LM80	0.10	1.4	4	PCR	770	6592	68670
(green)	Meets Primary Contact Recreation (PCR) geometric mean criterion of 126 cfu/mL.						
(yellow)	exccedance of Primary Contact Recreation (PCR) geometric mean criterion of 126 cfu/mL.						
(orange)	exccedance of PCR Statistical Maximum Value (STN) criterion of 410 cfu/mL.						
(red)	exccedance of Secondary Contact Recreation (SCR) maximum criterion of 1030 cfu/mL.						

***Table 4**. continued.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Samples	Recreation Use	Minimum	Mean	Maximum
East Fork Duck Creek							
LM85	2.00	1.3	4	PCR	548	778	1414
LM84	0.50	2.4	4	PCR	260	495	770
Little Duck Creek							
LM86	2.40	0.5	2	PCR	548	669	816
LM87	1.90	0.5	2	PCR	228	306	411
LM90	1.00	1.1	2	PCR	144	178	219
LM92	0.49	1.7	1	PCR	248	248	248
Unnamed Tributarty to Little Duck Creek at 4.42							
LM82	0.20	0.3	3	PCR	105	194	345
Clough Creek (LMR RM 2.9)							
LM95	3.20	2.1	2	PCR	57	63	69
LM98	0.60	7.8	2	PCR	122	138	155
(green)	Meets Primary Contact Recreation (PCR) geometric mean criterion of 126 cfu/mL.						
(yellow)	exccedance of Primary Contact Recreation (PCR) geometric mean criterion of 126 cfu/mL.						
(orange)	exccedance of PCR Statistical Maximum Value (STN) criterion of 410 cfu/mL.						
(red)	exccedance of Secondary Contact Recreation (SCR) maximum criterion of 1030 cfu/mL.						

- PCR-A subcategory. These would translate to exceedances of both the geometric mean and STV values under the revised PCR criteria. In 2022 all 14 mainstem sites were impaired for the PCR use and while most were only modest exceedances of the PCR Geometric Mean, some of the STV were well above the PCR criterion (Table 4). STVs ranged from 1,120 cfu/100 mL to 2,420 cfu/100 mL at and downstream from LM07 (RM 18.50) which is downstream from Sycamore Creek. The highest value measured at any site was 214,960 cfu/100 mL that occurred at LM16A immediately downstream from Duck Creek on September 12, 2022. The mean at this same site was 1,011 cfu/100 mL and it had the highest minimum value of 214 cfu/100 mL.

Duck Creek Subwatershed

- Of the 16 sites assessed in the Duck Creek subwatershed, five (5) were evaluated against the SCR criterion and the remainder against the PCR criteria. In the mainstem two sites (LM72 and 73) had maximum values that exceeded the STV with one site at 61,310 cfu/100 mL. The two PCR designated sites were impaired for the Geometric Mean and STV. The upstream most site (LM 71) had extremely low *E. coli* values with a mean of 2 cfu/100 mL and a maximum of 7 cfu/100 mL.
- All of the tributary sites exceeded the Geometric Mean and all except two sites in lower Little Duck Creek (LM 90 and LM92) exceeded the STV. The Unnamed Tributary at RM 4.8 (LM80) had a maximum value of 68,670 cfu/100 mL.

Sycamore Creek/Polk Run/Clough Creek Partial Subwatersheds

- Of the six (6) sites assessed in the Sycamore Creek subwatershed in 2017, three (3)

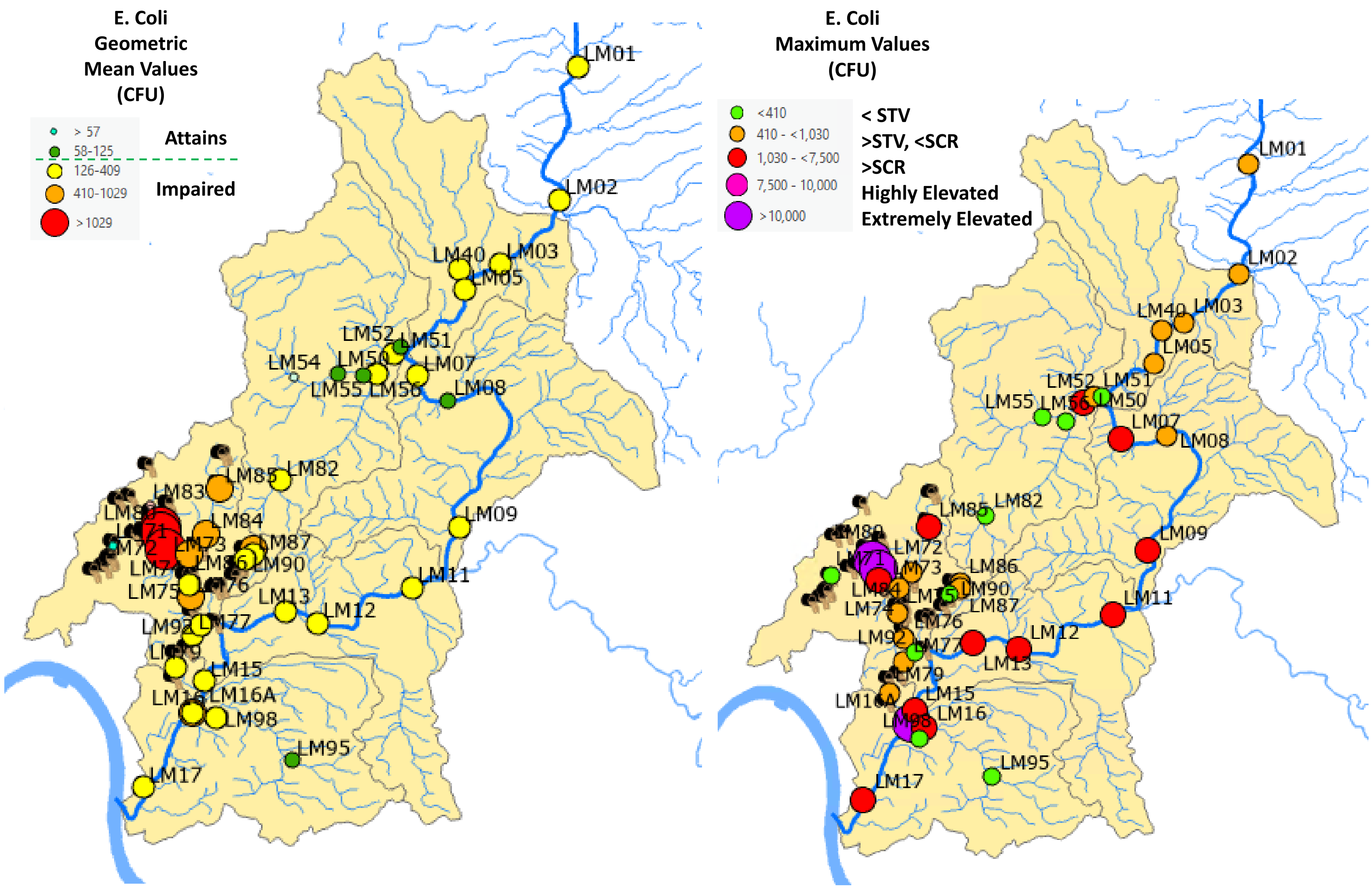


Figure 6. *Maps of recreational use attainment status for the Primary Contact Recreational and Secondary Contact uses in the 2022 Little Miami River study area expressed as degrees of attainment (blue or green) or non-attainment (orange or red) based on mean (left) and maximum (right) E. coli values. MSDGC CSO locations appear as outfall symbols.*

attained the SCR use criteria and three (3) PCR sites were impaired. The three latter sites had maximum *E. coli* values of >2,420 cfu/100 ml which contributed to the impaired status. In 2022, eight (8) sites were assessed and four (4) moderately exceeded the Geometric Mean. Only a single site exceeded the STV, LM50 in upper Sycamore Creek had a value of 7,440 cfu/100 mL. LM52 in Sycamore Creek and LM95 in Clough Creek fully attained PCR recreational use.

Recommendations

Designated Use Attainment Status

An original objective of the MSDGC service area watershed bioassessment plan was to evaluate existing aquatic life and recreational use designations and to recommend new uses for undesignated/unverified streams and changes to existing uses as necessary based on the series of 2011-14 baseline and 2016-2018 follow-up watershed assessments. Ohio EPA had last reviewed the aquatic life and recreational designations in the Little Miami River study area in 2007 (Ohio EPA 2010). Now, Ohio EPA has either adopted or is in the process of adopting the use designation recommendations from the 2012 and 2017 MSDGC surveys[1]. As such, that objective has been largely satisfied, but a rejected recommendation from 2017 is repeated herein for the East Fork of Duck Creek based on the 2022 results.

The MSDGC instream monitoring scope shifted to a more focused approach in 2016-18 and 2021-23 to document status, trends, and potential causes/sources of impairments related to pollution control efforts by Project Groundwork and related wet weather improvement efforts by MSD. A continued focus on documenting status and trends will inform decisions on Project Groundwork and document wet weather improvements primarily on the major mainstem rivers and streams and some of their tributaries. The methodology can identify and track causes and sources of impairment allowing informed decisions about the allocation of capital improvement resources by MSD. The 2017 Little Miami River and Selected Tributaries assessment represented the first follow-up survey five years after the 2012 Little Miami Basin baseline survey and it revealed some positive trends; some of which are related to MSDGC CSO abatement efforts in the Duck Creek subwatershed. Further incremental improvements were observed in 2022. However, there are no detailed analyses about which CSOs (or clusters of CSOs that have been eliminated or otherwise abated) to which the instream improvements can be quantitatively related. This should be addressed in the forthcoming work planned for the Southwest Ohio IPS (MBI 2015) by adding a more focused assessment that relates CSO/SSO abatements to instream changes both positive or negative. It should also include a more detailed analysis of the source of the impairment of the EWH use observed at LM16A, which is a new site that was first sampled in support of the pre-construction assessment for the Beechmont Ave. bicycle bridge in 2019. Given that this site fully attained EWH in 2019, the 2022 results indicate a localized, but significant impact that emanates from Duck Creek.

[1] The 2012 and 2017 MSDGC bioassessments are found at: http://www.msdgc.org/initiatives/water_quality/index.html.

BIOLOGICAL AND WATER QUALITY STUDY OF THE LITTLE MIAMI RIVER AND SELECTED TRIBUTARIES 2022

Introduction

The 2022 Little Miami River and Tributaries biological and water quality assessment covered more than 40 CSOs and SSOs, nine (9) municipal WWTPs, and numerous minor discharges providing the basis for documenting incremental changes against the previous 39 years of standardized monitoring of the Little Miami mainstem and major tributaries by Ohio EPA and MSDGC. The spatial and temporal sampling design and the biological, chemical, and physical indicators and parameters that were collected at each sampling site are described in the *Watershed Monitoring and Bioassessment Plan for the MSD Greater Cincinnati Service Area, Hamilton County, Ohio; Technical Report MBI/5-11-3* (MBI 2011). Biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment are supported by chemical and physical measures and ancillary information about pollution sources and other stressors for the overall biological assessment. The assessment employed a targeted-intensive pollution survey design which documents changes in a longitudinal manner as the effects of multiple pollution sources accumulate in a downstream direction.

MSDGC intends to use the results and analysis of the monitoring and bioassessment program to accomplish the following:

1. Determine the status of service area rivers and streams in quantitative terms, i.e., not only if the waterbody is impaired but the spatial extent and severity of the impairment;

2. Determine the proximate stressors that contribute to the observed impairments for the purpose of targeting management actions to those stressors;

3. Evaluate the appropriateness of existing aquatic life and recreational use designations and make recommendations for any changes to those designations; and,

4. Continue the development of the Integrated Prioritization System (IPS) for a variety of purposes. Among its many uses, the IPS will assist MSDGC in making decisions about how to prioritize and design pollution abatement projects and measure their effectiveness.

To meet these objectives all data was generated by methods and implementation in conformance with the provisions of the Ohio Credible Data Law (ORC 6111.51). Under the regulations that govern the Credible Data program at Ohio EPA, data collection and analyses must be collected and performed under the direction of Level 3 Qualified Data Collectors (OAC 3745-4). MSDGC has used the data to evaluate the attainability of aquatic life and recreational uses and determine the status of service area rivers and streams since 2011. As such, the sampling and analysis of the biological and physical condition conducted herein conforms to these provisions by the development and submittal of annual Level 3 Project Study Plans (PSP).

MSDGC Watershed Bioassessment Scope and Purpose

The MSDGC watershed bioassessment project domain consists of eleven subwatersheds, three mainstem rivers, and the Ohio River mainstem within Hamilton County and parts of adjoining counties. These watersheds are impacted by a variety of stressors including municipal and industrial point source discharges of wastewater, habitat modifications in the form of modified stream channels, run-of-river low head dams, riparian encroachment, and channelization, and nonpoint source runoff from widely differing degrees of landscape modifications from rural to suburban to intensive urban development. The urban stressor gradient is the strongest in Lower and Middle Mill Creek lessening somewhat across the Little Miami and Great Miami River subwatersheds. In the 2022 survey area, combined sewer overflows (CSOs) are the most numerous in Duck Creek and some have subsumed historical streams. Major wastewater treatment plants discharge to the Little Miami River mainstem and lower Sycamore Creek.

2022 Little Miami River and Tributaries Assessment Scope and Purpose

The 2022 Little Miami assessment included the lower mainstem of Little Miami R., the Duck Creek subwatershed, portions of the Sycamore Creek subwatershed, Polk Run, and Clough Creek within the scope of the MSDGC service area watershed monitoring plan (MBI 2011). In addition to the baseline purposes of the MSDGC monitoring plan, specific assessment issues in the 2017 Little Miami River study area include a high density of CSO and SSO outfalls in Duck Creek, the EWH status of the lower Little Miami, and other pollution sources including direct discharges and runoff from industrial operations, urban stormwater, and permitted municipal point sources.

Cincinnati has the fifth highest volume of CSOs in the U.S. (MSDGC 2011a). As a result, water quality has been significantly impacted in the Little Miami subwatershed. MSDGC is working to remediate these issues under a Consent Decree with the U.S. Dept. of Justice and U.S. EPA to reduce CSO volume by two billion gallons by 2019. To resolve the public health and water quality issues, MSDGC has implemented Project Groundwork under a Consent Decree with the U.S. Dept. of Justice and U.S. EPA, a multi-year and multi-billion dollar initiative that includes hundreds of sewer improvements and stormwater control projects (MSDGC 2011b). To date, MSDGC has reduced CSO discharges by 6 billion gallons, from 14 billion gallons at the start of Project Groundwork to 8 billion gallons at present with CSO mitigation efforts continuing. The role of the watershed monitoring program is to support these initiatives by providing current information about baseline conditions, provide feedback about the effectiveness of new and past remediation efforts via trend assessment, and to assure that restoration resources are targeted to the actions and places that have the greatest return on investment. As such the 2022 Little Miami River bioassessment is a continuation of that process. The 2022 Little Miami River biological and water quality assessment also fulfills the MSDGC NPDES CSO permit reporting requirements.

METHODS

Monitoring Design

An intensive pollution survey design that employs a high density of sampling sites and biological, chemical, and physical indicators and parameters was followed in 2022. The principal objectives of the biological assessment are to report aquatic life and recreational use attainment status, following the Ohio WQS and Ohio EPA practices, and determine associated causes and sources of impairment. To accomplish this sites were positioned upstream and downstream from major discharges, sources of potential releases and contamination, and major physical modifications to provide a "pollution profile" along the Little Miami River mainstem and within the Duck and Sycamore Creek watersheds. The result was a design that included chemical, physical, and biological sampling at a total of 41 sites in the 2022 study area. Each site was assigned a unique site code as depicted in Figure 7 and Appendix Table E-1.

Biological and Water Quality Surveys

A biological and water quality survey, or "biosurvey", is an interdisciplinary monitoring effort coordinated on a water body specific or watershed scale. Biological, chemical, and physical monitoring and assessment techniques are employed in biosurveys to meet three major objectives:

1. Determine the extent to which use designations assigned in the state Water Quality Standards (WQS) or equivalent policies or procedures are either attained or not attained;
2. Determine if use designations and/or goals set for or assigned to a given water body are appropriate and attainable; and,
3. Determine if any changes in key ambient biological, chemical, or physical indicators have taken place over time, particularly before and after the implementation of point source pollution controls or best management practices.

Measuring Incremental Changes

Incremental change is defined here to represent a measurable and technically defensible, change in the condition of a water body within which it has been measured. Most commonly this is termed "incremental improvement" in which the condition of a water body that does not yet fully meet all applicable water quality standards (WQS) can be tracked as to the direction of any changes. The general principles of incremental change are defined as follows (after Yoder and Rankin 2008):

- ***measurement of incremental change*** can be accomplished in different ways, provided the measurement method is scientifically sound, appropriately used, and sufficiently sensitive enough to generate data from which signal can be discerned from noise;

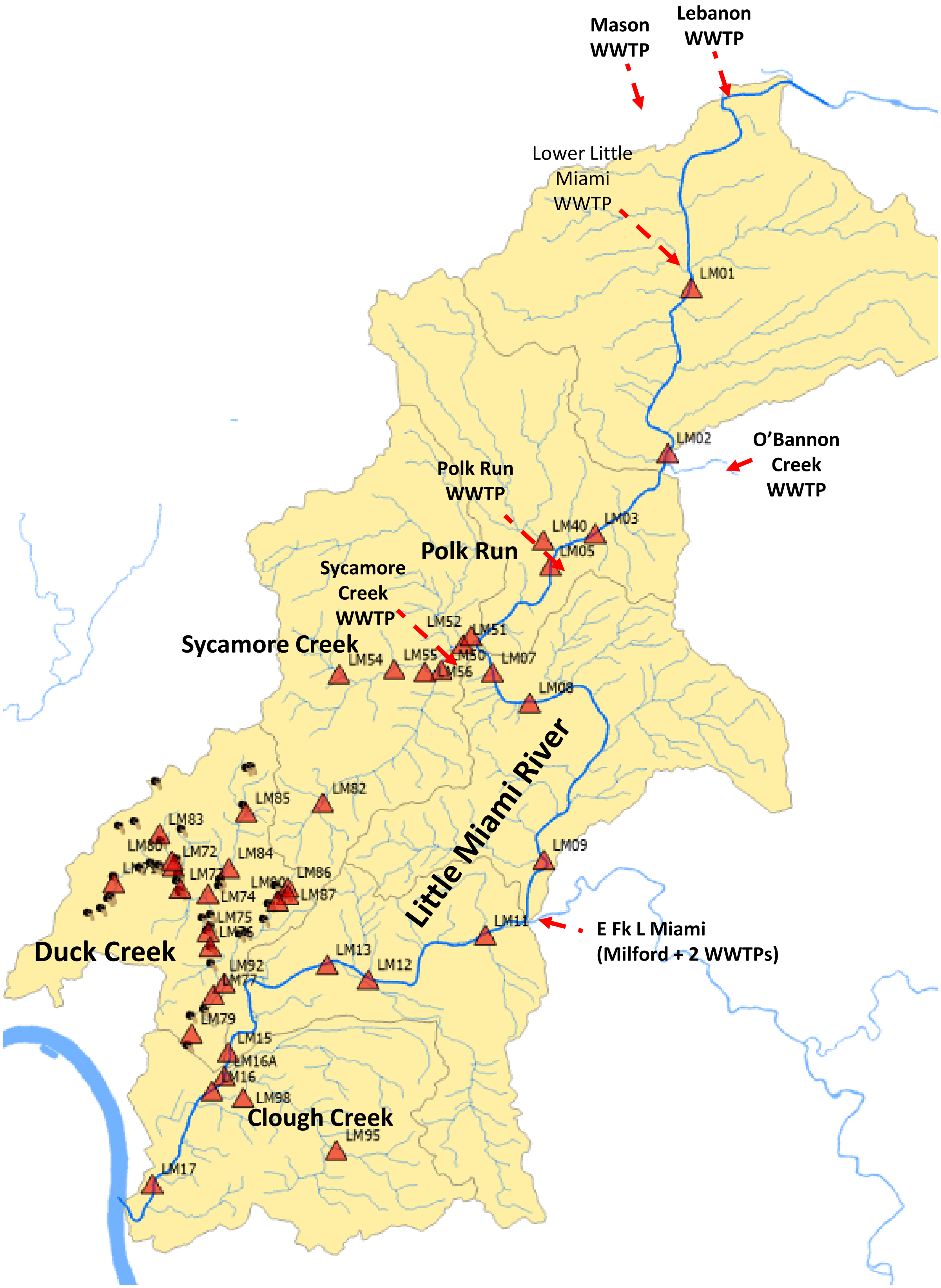


Figure 7. *The 2022 Little Miami River study area showing sampling locations by site code (see Table 6) and the occurrence of CSO locations in Duck and Sycamore Creeks and WWTP discharges to the Little Miami River mainstem.*

- ***measurable parameters and indicators*** of incremental change include biological, chemical, and physical properties or attributes of an aquatic ecosystem that can be used to reliably indicate a change in condition; and,
- ***a positive change in condition*** means a measurable improvement that is related to a reduction in a specific pollutant load, a reduction in the number of impairment causes, a reduction in an accepted non-pollutant measure of degradation, or an increase in an accepted measure of waterbody condition relevant to designated use support.

This was accomplished for this study by comparing the results of prior, comparable assessments. In this case there has been a series of bioassessments beginning in 1983 by Ohio EPA which serves as the baseline against which subsequent results were compared to assess incremental changes in key parameters and indicators. Subsequent to 1983, sufficient data was available from 1993 (Ohio EPA 1995), 1998 (Ohio EPA 2000), 2007 (Ohio EPA 2009), 2012 (MBI 2013), 2013 (MBI partial assessment only), 2017 (MBI 2018), and 2022 (MBI, this study) to inform the trend analyses.

Biological Methods

All biological sampling methods are defined by the applicable protocols published by the Ohio EPA (1987a,b; 1989a,b; 2015 a). These meet the specifications of the Ohio WQS and are used to assess aquatic life and recreational use designations, to determine the extent and severity of impairments, and to document incremental changes that result from pollution abatement actions.

Fish Assemblage Methods

Methods for the collection of fish at wadeable sites was performed using a tow-barge or long-line pulsed D.C. electrofishing equipment based on a T&J 1736 DCV electrofishing unit described by Ohio EPA (1989a). A Wisconsin DNR battery powered backpack electrofishing unit was used as an alternative to the long line in the smallest streams and in accordance with the restrictions described by Ohio EPA (1989a). A three-person crew carried out the sampling protocol for each type of wading equipment. Sampling effort was indexed to lineal distance and ranged from 150- 200 meters in length. Non-wadeable mainstem sites were sampled with a raft-mounted pulsed D.C. electrofishing device. A Smith-Root 5.0 GPP unit was mounted on a 15.5’ Wing raft with an electrode array in keeping with Ohio EPA (1989a) electrofishing design specifications. Sampling effort for this method was 500 meters and was conducted during a June 16-October 15 seasonal index period once or twice at all sites. Variably high flows in September and October precluded a second pass at several mainstem sites. A more detailed summary of the key aspects of each method appears in the *Watershed Monitoring and Bioassessment Plan for the MSD Greater Cincinnati Service Area, Hamilton County, Ohio; Technical Report MBI/5-11-3* (MBI 2011).

Macroinvertebrate Assemblage Methods

Macroinvertebrates were sampled using modified Hester-Dendy artificial substrate samplers (quantitative sample) and a qualitative dip net/hand pick method in accordance with Ohio EPA macroinvertebrate assessment procedures (Ohio EPA 1989a, 2015a). The artificial substrates were exposed for a colonization period of six weeks between July 12 and September 14 and placed to ensure adequate stream flow over the substrates, but in general samplers should be set where flow is 0.3 feet/second over the plates. A qualitative sample using a triangular frame dip net and hand picking was collected at the time of substrate retrieval. All samples were initially preserved in a 10% solution of formaldehyde. Substrates were then transferred to the laboratory, disassembled, sieved (standard no. 30 and 40), and transferred to 70% ethyl alcohol. Laboratory sample processing of both the quantitative and qualitative samples included an initial scan and pre-pick for large and rare taxa followed by subsampling procedures in accordance with Ohio EPA (1989a, 2015a). Identifications were performed to the lowest taxonomic resolution possible for the commonly encountered orders and families, which is genus/species for most organisms. From these results, the density of macroinvertebrates per square foot is determined as well as a taxonomic richness and an Invertebrate Community Index (ICI; Ohio EPA 1987b; DeShon 1995) score for the quantitative samples and a narrative assessment for the standalone qualitative samples. A more detailed summary of the key aspects of the methods appears in the *Watershed Monitoring and Bioassessment Plan for the MSD Greater Cincinnati Service Area, Hamilton County, Ohio; Technical Report MBI/5-11-3* (MBI 2011).

Primary Headwater Habitat (PHWH) Methods

PHWH methods were simultaneously applied to all sites draining <2.5 mi.^{2} to allow for a data driven determination of the existing use designation. Stream sites that were completely dry during any of the sampling visits were evaluated with the HHEI at a minimum. Methods for the collection of macroinvertebrates and salamanders at PHWH candidate sites followed the qualitative macroinvertebrate collection techniques used by the Ohio EPA for all stream types (Ohio EPA 1989a, 2015a) and in accordance with the most recent PHWH manual (Ohio EPA 2020). Salamander collections were made in two 30 feet subsections of the 200 feet stream reach assessed for a PHWH evaluation. Each subsection was chosen where an optimal number and size of cobble type microhabitat substrates are present. A minimum of 30 minutes was spent searching for salamanders. At least five larvae and two juvenile-adults of each species type were preserved. Adult and juvenile salamanders were placed into plastic bags with moist leaf litter. The larva were transported in stream water and placed in a cooler and returned to the lab for preparation of voucher specimens and verifications.

Area of Degradation and Attainment Values

The ADV (Yoder and Rankin 1995; Yoder et al. 2005) was originally developed to quantify the extent and severity of departures from biocriterion within a defined river reach. For reaches that exceed a biocriterion it is expressed as an Area of Attainment Value (AAV) that quantifies the extent to which minimum attainment criteria are surpassed. The ADV/AAV correspond to the area of the polygon formed by the longitudinal profile of IBI scores and the straight line boundary formed by a criterion, the ADV below and the AAV above. The computational formula (after Yoder et al. 2005) is:

$$ADV/AAV = \sum [(aIBIa + aIBIb) - (pIBIa + pIBIb)] * (RMa - RMb), \text{ for } a = 1 \text{ to } n, \text{ where;}$$

aIBIa = actual IBI at river mile a,
aIBIb = actual IBI at river mile b,
pIBIa = IBI biocriterion at river mile a,
pIBIb = IBI biocriterion at river mile b,
RMa = upstream most river mile,
RMb = downstream most river mile, and
n = number of samples.

The average of two contiguous sampling sites is assumed to integrate biological assemblage status for the distance between the points. The intensive pollution survey design typically positions sites in close enough proximity to sources of stress and along probable zones of impact and recovery so that meaningful changes are adequately captured. We have observed biological assemblages as portrayed by their respective indices to change predictably in proximity to major sources and types of pollution in numerous instances (Ohio EPA1987a; Yoder and Rankin 1995; Yoder and Smith 1999; Yoder et al. 2005). Thus, the longitudinal connection of contiguous sampling points produces a reasonably accurate portrayal of the extent and severity of impairment in a specified river reach as reflected by the indices (Yoder and Rankin 1995). The total ADV/AAV for a specified river segment is normalized to ADV/AAV units/mile for making comparisons between years and rivers. The ADV is calculated as a negative (below the biocriterion) expression; the AAV is calculated as a positive (above the biocriterion) expression. Each depicts the extent and degree of impairment (ADV) and attainment (AAV) of a biological criterion, which provides a more quantitative depiction of quality than do pass/fail descriptions. It also allows the visualization of incremental changes in condition that may not alter the pass/fail status, but are nonetheless meaningful in terms of incremental change over space and time. In these analyses, the Exceptional Warmwater Habitat (WWH) biocriterion for the fish and macroinvertebrate indices were used as the threshold for calculating the ADV and AAV for the Little Miami mainstem. The WWH biocriterion was used for Duck Creek as it represents the minimum goal required by the Clean Water Act (CWA) for the protection and propagation of aquatic life, thus it was used as a standard benchmark for the ADV/AAV analysis.

Habitat Assessment

Physical habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995; Ohio EPA 2006). Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrates, amount and quality of instream cover, channel morphology, extent and quality of riparian vegetation, pool, run, and riffle development and quality, and gradient are some of the metrics used to determine the QHEI score which generally ranges from 20 to less than 100. The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of segments around the state have indicated that values greater than 60 are generally conducive to the existence of warmwater faunas whereas scores less than 45 generally cannot support a warmwater assemblage consistent with baseline Clean Water Act goal expectations (e.g., the WWH in the Ohio WQS).

Physical habitat was simultaneously evaluated at sites draining <2.5 mi.^{2} using the Headwater Habitat Evaluation Index (HHEI) developed by Ohio EPA (2013). The HHEI scores various attributes of the physical habitat that have been found to be statistically important determinants of biological community structure in primary headwater streams. Statistical analysis of a large number of physical habitat measurements showed that three QHEI habitat variables (channel substrate composition, bank full width, and maximum pool depth) are sufficient in distinguishing the physical habitat of primary headwater streams using the HHEI. The characterization of the channel substrate includes a visual assessment of a 200 feet stream reach using a reasonably detailed evaluation of both the dominant types of substrate and the total number of substrate types. Bank full width is a morphological characteristic of streams that is determined by the energy dynamics related to flow and has been found to be a strong discriminator of the three classes of primary headwater streams in Ohio. The bank full width is the average of 3-4 separate bank full measurements along the stream reach. The maximum pool depth within the stream reach is important since it is a key indicator of whether the stream can support a WWH fish assemblage. Streams with pools less than 20 cm in depth during the low flow periods of the year are less likely to have WWH fish assemblages and thus more likely to have viable populations of lungless salamanders, which replace fish as the key vertebrate indicator in primary headwater streams.

Stream Nutrient Assessment Procedure (SNAP)

A SNAP assessment includes an evaluation of the status of the applicable biological criteria (IBI, ICI), the 24-hour diel D.O. swing, and the concentration of benthic chlorophyll a to determine the nutrient enrichment status of a site. The SNAP matrix yields one of the following findings:

1. Attaining aquatic life use and not threatened;
2. Attaining aquatic life use, but aquatic life use may be threatened;
3. Impaired aquatic life use, but from cause(s) other than nutrients;
4. Impaired aquatic life use, nutrient enrichment is a likely cause; or
5. Impaired aquatic life use, nutrient enrichment is a material cause.

The overall result is determined by a combined analysis of all indicators, but full attainment of aquatic life supersedes exceedances of nutrient thresholds for N and P alone. The SNAP matrix and flow chart used to determine impairment or threat by nutrients appears in Appendix F.

Chemical/Physical Methods

Chemical/physical assessment for the MSDGC service area includes the collection and analysis of water samples for chemical/physical and bacterial analysis and sediment samples for determining sediment chemical quality. Methods for the collection of water column chemical/physical and bacterial samples followed the procedures of Ohio EPA (2019a) and MSDGC (2011c). Sediment chemical sampling followed that described by Ohio EPA (2019b). All laboratory analysis was performed and/or overseen by MSDGC.

Water Column Chemical Quality

Water column chemical quality was determined by the collection and analysis of grab water samples, instantaneous measurements recorded with a water quality meter, and continuous measurements recorded at 3-4 day intervals in the mainstem and larger tributary sites.

Grab Sampling

Grab samples of water were collected with a stainless steel bucket from a location as close to the center point of the stream channel as possible by MBI sampling crews. Samples were collected from the upper 12-24" of the surface and then transferred to sample containers in accordance with MSDGC procedures (MSDGC 2011c) and delivered to MSDGC Mill Creek Lab for analysis. Sampling was conducted between mid-June and mid-October and under "normal" summer-fall low flows – highly elevated flows following precipitation events were avoided and sampling was delayed until flows subsided to "normal" levels. The frequency of sampling ranged from six times per season at most sites to two times per season at the smallest headwater sites. Water samples were collected provided there was sufficient water depth to collect a sample without disturbing the substrates. Instantaneous values for temperature (°C), conductivity (µS/cm2), pH (S.U.), and dissolved oxygen (D.O.; mg/l) were recorded with a YSI Model 664 meter at the time of grab sample collection.

Continuous Recordings

Continuous readings of temperature (°C), conductivity (µS/cm), pH (S.U.), and dissolved oxygen (D.O.; mg/L) were recorded with a YSI 6920 V2 Sonde ("Datasonde") instrument at mainstem and major tributary locations. The Datasondes were deployed in an accessible part of the stream channel in a PVC enclosure that ensured no contact with the stream bottom or other solid objects. The Datasondes were positioned vertically where depth allowed by driving steel fence posts into the bottom and positioning the PVC enclosure in an upright position. Where the depth was too shallow the PVC enclosure was secured in a horizontal position in an area of the stream channel with continuous flow. All Datasondes were secured against theft or vandalism as much as possible. Datasondes were deployed for a 3-4 day continuous interval during periods of maximum summer temperatures and normal summer flows. Readings were taken at 15 minute intervals. At the time of retrieval data was downloaded to a YSI Model 650 Instrument with high memory capacity and then transferred to a PC for storage and later analysis.

Sediment Chemical Quality
Fine grain sediment samples were collected in the upper 4 inches of bottom material at each sampling location using decontaminated stainless steel spoons and excavated using nitrile gloves. Decontamination of sediment sampling equipment followed the procedures outlined in the Ohio EPA sediment sampling guidance manual (Ohio EPA 2019c).

Sediment grab samples were homogenized in stainless steel pans (material for VOC analysis was not homogenized), transferred into glass jars with Teflon® lined lids, placed on ice (to maintain 4^{o}C) in a cooler, and delivered to MSDGC Mill Creek Lab. Sediment data is reported on a dry weight basis. Sediment samples were analyzed for total analyte list inorganics (metals), nutrients, volatile organic compounds, semivolatile organic compounds, PCBs, total petroleum hydrocarbons, and cyanide.

Determining Use Attainment Status

Use attainment status is a term which describes the degree to which environmental parameters or indicators are either above or below criteria specified by the Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1). For the 2022 Little Miami River and Tributaries assessment two use designations were evaluated, aquatic life and recreation in and on the water by humans. Hence the process herein is referred to as the determination of aquatic life and recreational status for each sampling site. This process is applied to data collected by ambient assessments and applies to rivers and streams outside of point source discharge mixing zones.

Aquatic Life
Aquatic life use attainment status is determined by the Ohio EPA biological criteria (OAC 3745-1-07; Table 7-1). Numerical biological criteria are based on multimetric biological indices which include the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIwb), which indicate the response of the fish assemblage, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate assemblage. The IBI and ICI are multimetric indices patterned after an original IBI described by Karr (1981) and Fausch *et al.* (1984) and subsequently modified by Ohio EPA (1987b) for application to Ohio rivers and streams. The ICI was developed by Ohio EPA (1987b) and is further described by DeShon (1995). The MIwb is a measure of fish community abundance and diversity using numbers and weight information and is a modification of the original Index of Well-Being originally applied to fish community information (Gammon 1976; Gammon *et al.* 1981). Numerical biocriteria are stratified by ecoregion, use designation, and stream or river size. Three attainment status results are possible at each sampling location - full, partial, or non-attainment. Full attainment means that all of the indices meet the applicable biocriteria. Partial attainment means that one or more of the indices fails to meet the applicable biocriteria. Non-attainment means that none of the indices meet the applicable biocriteria or one of the organism groups reflects poor or very poor quality. An aquatic life use attainment table (see Table 2) is constructed based on the sampling results and is arranged from upstream to downstream and includes the sampling locations indicated by river mile, the applicable biological indices, the use attainment status

(*i.e.,* full, partial, or non), the Qualitative Habitat Evaluation Index (QHEI), and causes of non or partial attainment or threats to full attainment at each sampling location. The use attainment table is further organized by Ohio EPA Waterbody Assessment Unit so that the results can be used by Ohio EPA for assessment purposes.

Recreation

Water quality criteria for determining attainment of recreational uses are established in the Ohio Water Quality Standards (OAC 3745-1-07; Table 7-13) based upon the quantities of bacterial indicators *(Escherichia coli)* present in the water column. *Escherichia coli (E. coli)* bacteria are microscopic organisms that are normally present in the feces and intestinal tracts of humans and other warm-blooded animals. *E. coli* typically comprises approximately 97 percent of the organisms found in the fecal coliform bacteria of human feces (Dufour 1977). There is currently no simple way to differentiate between human and animal sources of coliform bacteria in surface waters, although methodologies for this type of analysis are being developed including recent research supported by MSDGC. These microorganisms can enter water bodies where there is a direct discharge of human and animal wastes, or may enter water bodies along with runoff from soils where wastes have been deposited. Pathogenic (disease-causing) organisms are typically present in the environment in such small amounts that it is impractical to directly monitor each type of pathogen. Fecal indicator bacteria by themselves, including *E. coli,* are usually not pathogenic. However, some strains of *E. coli* can be pathogenic, capable of causing serious illness. Although not necessarily agents of disease, fecal indicator bacteria such as *E. coli* may signal the potential presence of pathogenic organisms that enter the environment via the same pathways. When *E. coli* are present in extremely high numbers in a water sample, it invariably means the water has received fecal matter from one or more sources.

The Ohio WQS for recreational uses were revised in early 2016 to reflect a more rigid adherence to any form of contact with surface waters as ensuing the same level of risk. This replaced the former framework that was stratified to account for the degree of bodily contact with three subcategories of the Primary Contact Recreational (PCR) use as PCR-A, PCR-B, and PCR-C. Those subcategories were essentially merged into a single use category. This action also obviated the recommendations made in the 2011-14 watershed assessments for assignment certain streams to one of the three former subcategories. The application of the Secondary Contact Recreational (SCR) use was also changed to a more restrictive interpretation of the potential for human contact with surface waters. Existing SCR designations remain, but could potentially be reviewed and revised to PCR by Ohio EPA. Any new SCR recommendations would need to document that there is no human contact possible due to physical restrictions to access a surface water. As a result the evaluation of the recreational uses in the 2022 Little Miami study were done in accordance with the existing designations of PCR and SCR where the latter remains applicable.

Streams in the Little Miami watershed are designated as primary contact recreation (PCR) and/or secondary contact recreation (SCR) use in the Ohio WQS (OAC 3745-1- 30). Water bodies with a designated recreation use of PCR *". . . are suitable for one or more full-body* *contact recreation activities such as, but not limited to, wading, swimming, boating, water skiing, canoeing, kayaking, and scuba diving"* (OAC 3745-1- 07(B)(4)(b)). Secondary Contact includes waters that *". . . result in minimal exposure potential to water borne pathogens because the waters are: rarely used for water based recreation such as, but not limited to, wading; situated in remote, sparsely populated areas; have restricted access points; and have insufficient depth to provide full body immersion, thereby greatly limiting the potential for water based recreation activities."*

The *E. coli* criterion that applies to PCR is expressed as a 90-day geometric mean of ≤126 colony forming units (cfu)/100 ml with a Statistical Threshold Value of 410 cfu/100 ml[2]. The criterion that applies to SCR streams is ≤1,030 cfu/100 ml for both the 90 day geometric mean and the STV. The geometric mean can be assessed using an arithmetic mean of two or more samples and the STV is assessed by the maximum value. Both are used as the basis for determining the attainment status of the PCR use.

Determining Use Attainability

Use designation reviews and recommendations for revisions, when necessary, were a major product of the series of 2011-14 watershed assessments conducted throughout the MSDGC service area. Since the 2022 Little Miami River and Tributaries survey is a reassessment of a portion of the larger 2012 study area we did not expect to have many use change recommendations. The details of the 2011-14 use recommendations are available in each watershed assessment report[3]. Given the status of the 2011-14 data as Level 3 credible data it is eligible to be used by Ohio EPA to revise aquatic life use designations. All of the use recommendations made for the Warmwater Habitat suite of uses were either adopted or are in the process of being adopted by Ohio EPA into the Ohio WQS. None of the recreational use recommendations were accepted because of the subsequent revision to the recreational uses and criteria and how these are assigned to individual stream segments. None of the Primary Headwater Habitat (PHWH) use recommendations were adopted because Ohio EPA has not yet adopted PHWH as a distinct use tier. For the interim, MSDGC is assuming such streams will receive protections equivalent to WWH.

Determining Causal Associations

Using the results, conclusions, and recommendations of this report requires an understanding of the methodology used to determine biological status (i.e., unimpaired or impaired, narrative ratings of quality) and assigning associated causes and sources of impairment utilizing the accompanying chemical/physical data and source information (e.g., point source loadings, land use). The identification of impairment in rivers and streams is straightforward - the numerical biological indices are the principal arbiter of aquatic life use attainment and impairment following the guidelines of Ohio EPA (1987). The rationale for using the biological results in the

[2] These criteria shall not be exceeded in more than ten per cent of the samples taken during any ninety-day period.
[3] http://www.msdgc.org/initiatives/water_quality/index.html

role as the principal arbiter within a weight of evidence framework has been extensively discussed elsewhere (Karr *et al.* 1986; Karr 1991; Ohio EPA 1987a,b; Yoder 1991; Yoder 1995).

Describing the causes and sources associated with observed biological impairments relies on an interpretation of multiple lines of evidence including the water chemistry data, sediment chemistry data, habitat data, effluent data, land use data, and biological response signatures (Yoder and Rankin 1995; Yoder and DeShon 2003). Thus the assignment of associated causes and sources of biological impairment in this report represents the association of impairments (based on response indicators) with stressor and exposure indicators using linkages to the bioassessment data based on previous experiences within the strata of analogous situations and impacts. For example, exceedances of established chemical thresholds such as chronic and acute water quality criteria or sediment effect thresholds are grounds for listing such categories of parameters to include individual pollutants provided that they co-occur with a biological impairment. Biological effect thresholds in the recently completed *Integrated Prioritization System (IPS) Documentation and Atlas of Biological Stressor Relationships for Southwest Ohio* (Technical Report MBI/2015-12-15, MBI 2015) were also used to support causal assignments. These were used either as primary or supplemental screenings for the interpretation of biological impairments consistent with the WQS for the application of biological criteria in Ohio[4].

Hierarchy of Water Indicators

A carefully conceived ambient monitoring approach, using cost-effective indicators comprised of ecological, chemical, and toxicological measures, can ensure that all pollution sources are judged objectively on the basis of environmental results. A tiered approach that links the results of administrative actions with true environmental measures was employed in our analyses and within the limitations of the data that is currently available for certain sources. This integrated approach is outlined in Figure 8 and includes a hierarchical continuum from administrative to true environmental indicators. The six "levels" of indicators include:

1. Actions taken by regulatory agencies (permitting, enforcement, grants);
2. Responses by the regulated community (treatment works, pollution prevention);
3. Changes in discharged quantities (pollutant loadings);
4. Changes in ambient conditions (water quality, habitat);
5. Changes in uptake and/or assimilation (tissue contamination, biomarkers, assimilative capacity); and, changes in health, ecology, or other effects (ecological condition, pathogens).

In this process the results of administrative activities (levels 1 and 2) can be linked to efforts to improve water quality (levels 3, 4, and 5) which should translate into the environmental "results" (level 6). An example is the aggregate effect of billions of dollars spent on water pollution control since the early 1970s that have been determined with quantifiable measures of environmental condition (Yoder et al. 2005). Superimposed on this hierarchy is the concept

[4] OAC 3745-1-07(A)(6)(a) for full attainment and (A)(6)(b) for non-attainment.

Completing the Cycle of WQ Management: Assessing and Guiding Management Actions with Integrated Environmental Assessment

Indicator Levels

1: Management actions

2: Response to management

Administrative Indicators *[permits, plans, grants, enforcement, abatements]*

3: Stressor abatement

Stressor Indicators *[pollutant loadings, land use practices]*

4: Ambient conditions

5: Assimilation and uptake

Exposure Indicators *[pollutant levels, habitat quality, ecosystem process, fate & transport]*

6: Biological response

Response Indicators *[biological metrics, multimetric indices]*

Ecological "Health" Endpoint

Figure 8*. Hierarchy of administrative and environmental indicators which can be used for water quality management activities such as monitoring and assessment, reporting, and the evaluation of overall program effectiveness. This is patterned after a model developed by U.S. EPA (1995a,b) and further enhanced by Karr and Yoder (2004).*

of stressor, exposure, and response indicators. *Stressor* indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications. *Exposure* indicators are those which measure the effects of stressors and can include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent. *Response* indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices which comprise the Ohio EPA biological endpoints. Other response indicators can include target bacterial levels that serve as surrogates for the recreational uses. These indicators represent assemblages, *i.e.,* rare, threatened, endangered, special status, and declining species or the essential technical elements for watershed-based management approaches. The key, however, is to use the different indicators *within* the roles which are most appropriate for each (Yoder and Rankin 1998).

STUDY AREA DESCRIPTION

Geographic Setting

The Little Miami River basin lies within the Interior Plateau Ecoregion of southwest Ohio and is bounded by the Great Miami River basin to the northwest, Mill Creek to the west and southwest, the Scioto River basin to the north and east, Whiteoak Creek to the southeast, and the Ohio River and direct tributary watersheds to the south. The Little Miami River mainstem flows southward for 111 miles from the headwaters in Clark County through Greene, Warren, and Clermont Counties to its confluence with the Ohio River in Hamilton County draining 1757 mi2. The study area is located in the Eastern Corn Belt Plains and Interior Plateau ecoregions (see Figure 5). Along its course the stream has an average gradient of 6.35 feet per mile (ODNR 1960). Major tributaries within the 2012 and 2017 Little Miami River study area include O’Bannon Creek, Polk Run, Sycamore Creek, Dry Creek, Duck Creek, Clough Creek, and the East Fork of the Little Miami River. These tributaries enter the Little Miami River mainstem from the hillsides that characterize the watershed. The upper portion of Little Miami River mainstem located in Warren County is mostly rural, but increased suburban development has occurred over the past 3 decades. The lower portion of Little Miami River is more urban and some tributary subwatersheds are almost completely developed.

Subecoregion Characteristics

The 2022 Little Miami River study area lies within two Level III ecoregions, the Interior Plateau (IP) and the Eastern Corn Belt Plains (ECBP; Omernik 1987). Subsequent delineations of Level IV subregions provide more detail for the four components of ecoregions - surficial geology, soils, potential natural vegetation, and land use (Woods et al. 1995). The lower Little Miami River study area and much of the East Fork of the Little Miami River lie entirely within the Northern Bluegrass subregion (71d) of the Interior Plateau. The remainder of the study area lies within the Pre-Wisconsinan Drift Plains subregion (55d) of the Eastern Corn Belt Plains ecoregion. The southernmost portion of the study area overlies the Wisconsinan Drift Plains subregion (55d) and the northern portions and the East Fork of the Little Miami River lie within the Loamy High-lime Till Plains subregion (55b) of the ECBP ecoregion. The characteristics of each subregion appear in Table 5.

Description of Pollution Sources and Other Stressors

Pollution sources and general stressors are numerous in the Little Miami River watersheds subwatersheds. These sources include permitted discharges of municipal and industrial process wastewater, discharges from combined and sanitary sewer overflows (CSO and SSO), runoff and releases from industrial facilities, urban runoff and its associated chemical pollution and hydrological alterations, and direct and indirect habitat alterations. These are described in the following discussions and many are included in Table 6.

Point Sources

There are 24 point source discharges in the lower Little Miami River that hold NPDES permits

***Table 5**. Level IV subregions of the Little Miami River watersheds watershed and their key attributes (from Woods et al. 1995).*

Level IV Subregion	Physiography	Geology	Soils	Potential Natural Vegetation	Land Use/Land Cover
Loamy, High Lime Till Plains (55b)	Glaciated; level to rolling glacial till plain with low gradient streams; also end moraines and glacial outwash landforms.	Loamy, high lime, late-Wisconsinan glacial till and also glacial outwash and scattered loess overlie Paleozoic carbonates and shale.	Alfisols (Hapludalfs, Epiaqualfs, Endoaqualfs), Mollisols (Argiaquolls, Endoaquolls, Argiudolls), Entisols (Fluvaquents)	Mostly beech forest; also, oak-sugar maple forest, elm-ash swamp forest on poorly-drained valley bottoms and ground moraines.	Extensive corn, soybean, and livestock farming; also scattered beech-maple, pin oak-swamp, white oak woodlands. Urban-industrial activity in municipal areas.
Pre-Wisconsinan Drift Plains (55d)	Glaciated. Dissected glacial till plain with low to medium gradient streams.	Deeply leached, acidic pre-Wisconsinan clay-loam glacial till and thin loess overlie Paleozoic carbonates.	Alfisols (Fragiudalfs, Hapludalfs, Fragiaqualfs, Glossaqualfs), Entisols (Fluvaquents)	Mostly beech forest, elm-ash swamp forest; also oak-sugar maple forest.	Soybean, livestock, corn, general, and tobacco farming; where poorly-drained or rugged, pin oak-swamp, white oak flatwoods, and beech-maple woodlands.
Northern Bluegrass (71d)	Unglaciated and glaciated; dissected plains and hills with medium gradient, gravel bottom streams. Steep slopes, high relief near Ohio River.	Discontinuous loess and leached pre-Wisconsinan glacial till deposits. Ordovician limestone and shale.	Alfisols (Hapludalfs, Fragiudalfs), Mollisols (Hapludolls)	Mixed meso-phytic forest, mixed oak forest, oak-sugar maple forest; along Ohio River, bottomland hardwoods.	Mosaic of forest, agriculture, and urban-industrial activity near Cincinnati and elsewhere along Ohio River. Wooded where steep

(Table 6). Of these, 11 are considered to be major discharges and all are municipal wastewater treatment plants. A total of 54.4 MGD of capacity is shared by the seven WWTPs that directly impact the Lower Little Miami River mainstem. Another 17.4 MGD of capacity is shared by three WWTPs on the lower East Fork of the Little Miami River. All of these WWTPs operate at what may be termed “advanced treatment” levels for oxygen demanding substances and ammonia removal, which is typical for WWTPs with permits based on meeting the Ohio WQS. Following the 1998 bioassessment of the Little Miami River in which Ohio EPA found significant impairment of the fish assemblages in particular, upgrades to WWTPs followed and some of these included phosphorus removal, mostly in the upper one-half of the mainstem. The results

Table 6. *Major pollution sources in and adjacent to the 2022 Little Miami River study area.*

Receiving Stream	Drainage Area (mi^2)	River Mile	Confluence River Mile	2022 Site Code/RM	Facility Name or Discharge Number/Description	Major (M) Minor (m)	NPDES Permit No.
Little Miami	1036	32.10		LM01/27.9 LM02/24.1	Lebanon WWTP	M	1PC00003
Little Miami	1036	31.95			Mason WWTP	M	1PC00004
Little Miami	1057	30.70			Deerfield-Hamilton WTP	m	1IY00162
Little Miami	1069	28.14			Lower Little Miami WWTP	M	1PK00018
O'Bannon Creek	59.1	2.57	24.00	LM03/22.3	O'Bannon Creek Regional WWTP	M	1PK00017
Polk Run	10.2	0.10	21.55	LM05/21.5	Polk Run WWTP	M	1PK00019
Little Miami	1160	21.00			Arrowhead Park WWTP	m	1PH00014
Sycamore Creek	12.5	1.10	19.20	LM50/1.1; LM51/0.5	SSO 1008, 579	M	1PX00022
Sycamore Creek	20.9	0.26		LM52/0.10; LM07/18.5	Sycamore Creek WWTP	M	1PK00005
U.T. Sycamore Cr. @RM	5.32	1.20	1.12	LM55/1.20; LM56/0.2	SSO 705, 647	M	1PX00022
Little Miami	1186	18.80		LM08/17.7	Lake Remington MHP	m	1PV00101
Little Miami	1190	16.80			MGS Water Sub District	m	1IX00030
Little Miami	1194	16.10			Wards Corner Regional WWTP	m	1PK00021
Little Miami	1200	14.20			Villiage of Indian Hill WWTP	m	1IX00050
Little Miami	1203	13.30		LM09/13.1	Milford Waterworks	m	1IW00110
East Fork Little Miami	360	20.50	11.28	LM11/10.9	US DOA William H Harsha Lake	m	1PN00000
East Fork Little Miami	364	13.50			City of Batavia WWTP	m	1PB00001
East Fork Little Miami	373	12.60			Clermont Co. Middle East Fork Regional WWTP	M	1PK00010
East Fork Little Miami	490	4.90			Clermont Co. Lower East Fork Regional WWTP	M	1PK00009
East Fork Little Miami	490	4.90			U.S. EPA Experimental Stream Facility	m	1IN00116
East Fork Little Miami	498	1.60			Milford WWTP	M	1PC00005
Little Miami	1711	10.00		LM12/8.10	Evans Landscaping Inc	m	1IN00298
Little Miami	1730	5.90			Cincinnati Steel Treating Co.	m	1IN00237
Little Miami	1730	5.90			Keebler and Co.	m	1IH00022
Little Miami	1735	4.45		LM15/4.10	CSO 656	M	1PX00022

***Table 6**. continued.*

Receiving Stream	Drainage Area (mi^2)	River Mile	Confluence River Mile	2022 Site Code/RM	Facility Name or Discharge Number/Description	Major (M) Minor (m)	NPDES Permit No.
Duck Creek	2.24	6.10	3.87	LM71/6.1	CSO 170, 500, 501	M	1PX00022
Duck Creek	5.05	5.14		LM72/5.14	CSOs: 043, 054, 135, 170, 187, 214, 500, 501, 549,	M	1PX00022
Duck Creek	5.84	4.58		LM73/4.58	CSOs: 043, 061, 188	M	1PX00022
Duck Creek	10.0	3.98		LM74/3.9	CSOs: 064, 066, 068, 188, 205, 554, 555, 556	M	1PX00022
Duck Creek	11.5	3.38		LM75/3.4	CSOs: 080, 084, 0.83, 136, 199, 205	M	1PX00022
Duck Creek	11.7	2.40		LM77/2.00	CSOs: 083, 084, 085, 086, 199, 503, via L. Duck Creek	M	1PX00022
U.T Duck Cr. @RM 4.8	1.2	0.80	4.80	LM83/0.8	CSO 554, 555, 556	M	1PX00022
East Fork Duck Creek	1.31	2.00	4.60	LM85/2.0	CSO 554, 555, 556	M	1PX00022
Little Duck Creek	1.71	2.40	1.95	LM86/2.40	SSO 1014, 1057	M	1PX00022
Little Duck Creek	0.45	1.90		LM87/1.90	CSO 071	M	1PX00022
Little Duck Creek	0.8	1.70			CSOs: 069, 071, 072, 074, 075, 076	M	1PX00022
Little Duck Creek	1.1	1.15		LM90/1.00	CSOs: 069, 071, 072, 078, 079	M	1PX00022
Little Miami	1740	3.70		LM16A/3.70	CSOs: 085, 086, ~~470, 471~~, 476, Duck Creek	M	1PX00022
Little Miami	1750	3.50		LM16/3.5	CSOs: 085, 086, ~~470, 471~~, 476, Duck Creek	M	1PX00022
Clough Creek	6.01	2.50	2.90	LM98/0.60	CSO 182, 476; SSO 588, 589	M	1PX00022
Little Miami	1757	0.80		LM17/1.6	GCWW Richard Miller WTP	m	1IV00040

quote the 2010 Ohio EPA report:

> *". . . the overall turnaround of the Little Miami River's biotic integrity can be attributed to improved treatment and operations at several Wastewater Treatment Plants (WWTPs) in the watershed. Many facilities that were previously operating at or over capacity since the last survey in 1998 were upgraded, while others began actively removing phosphorus from treated effluent. These improvements, in turn, allowed for the rebound of the fish community, which has historically borne the brunt of impacts from nutrient over-enrichment in the river."*

The MSDGC survey of 2012 showed a decline specifically with the mainstem fish assemblage similar to 1998 levels of impairment. Follow-up surveys by MBI in 2013 showed partial improvements in this status and that the impairment emanated upstream from Hamilton Co. The 2017 survey showed a recovery that was a virtual return to 2007 full attainment conditions. The 2022 results essentially confirmed the improvement observed in 2017.

Wet Weather Sources

Wet weather sources merit description since they are prominent in the Duck Creek subbasin and some of the other Lower Little Miami River tributary subwatersheds (Table 6). The two major sources of wet weather related pollution in the 2022 study area emanate from untreated sources (CSOs, SSOs, and urban stormwater). The CSOs and SSOs occur because the volume of sanitary wastewater and stormwater entering the MSDGC sewer system during precipitation events (i.e., during "wet weather") exceeds the capacity of the collection system. There are two types of pipes that carry wastewater in Hamilton County, "combined sewers" and "sanitary sewers." Combined sewers collect and transport both sewage and stormwater, while sanitary sewers collect and transport only sewage. Wastewater discharges that are released to the environment from sanitary sewer systems before they reach a treatment plant are known as "sanitary sewer overflows," or SSOs. The term SSO can also refer to a sanitary sewer overflow structure or outfall. Discharges that are comprised of sanitary sewage and storm water are known as "combined sewer overflows," or CSOs. Approximately one-third of the sewers in the MSDGC service area are combined and the remainder are sanitary sewers (MSDGC 2006). CSOs and SSOs in the Little Miami study area are listed in Table 6 along with the CSO permit number and classified as a major discharge.

In the MSDGC collection system, the primary cause of SSOs is a lack of system capacity, blockages, and ineffective maintenance. This happens when the sewer system receives increased flows as a result of "infiltration and inflow," or I/I, which is the entry of "clean" rain water into the sewer system through leaks in the system caused by deteriorating pipes and tree roots growing into the sewers ("infiltration"), as well as through roof drains, manhole covers and yard drains ("inflow"), thus exacerbating the lack of hydraulic capacity. As a result, during periods of rainfall or snowmelt, wastewater is frequently discharged from overflow structures into area rivers and streams. The MSDGC system has approximately 80 such overflow points, which discharge wastewater when the pipes become too full. These SSO structures were constructed many years ago, consistent with the then-acceptable approach for addressing overloaded sanitary sewer systems. In contrast, a combined sewer system is designed to transport both sewage and storm water. These systems are largely an “artifact” of an earlier way of building sewers and have not been newly constructed in the United States for decades. Combined sewers are generally not designed to be big enough to carry wastewater plus all of the rainfall from the area’s larger storms. Thus, combined sewers are designed to discharge from combined sewer overflow points, or “CSOs.” MSDGC has approximately 200 CSO discharge points in its collection system (MSDGC 2006). To remedy SSOs and CSOs, the County and City signed Consent Decrees in 2002 and 2003 with U.S. EPA, Ohio EPA, and ORSANCO that establish a judicially enforceable framework for ensuring that MSDGC develops and implements sophisticated, long-term plans for remedying the overflows resulting from the aging sewer system. The decrees also require MSDGC to implement millions of dollars of interim measures to ameliorate these problems while developing and implementing the long-term remedial measures.

RESULTS – CHEMICAL PHYSICAL WATER QUALITY

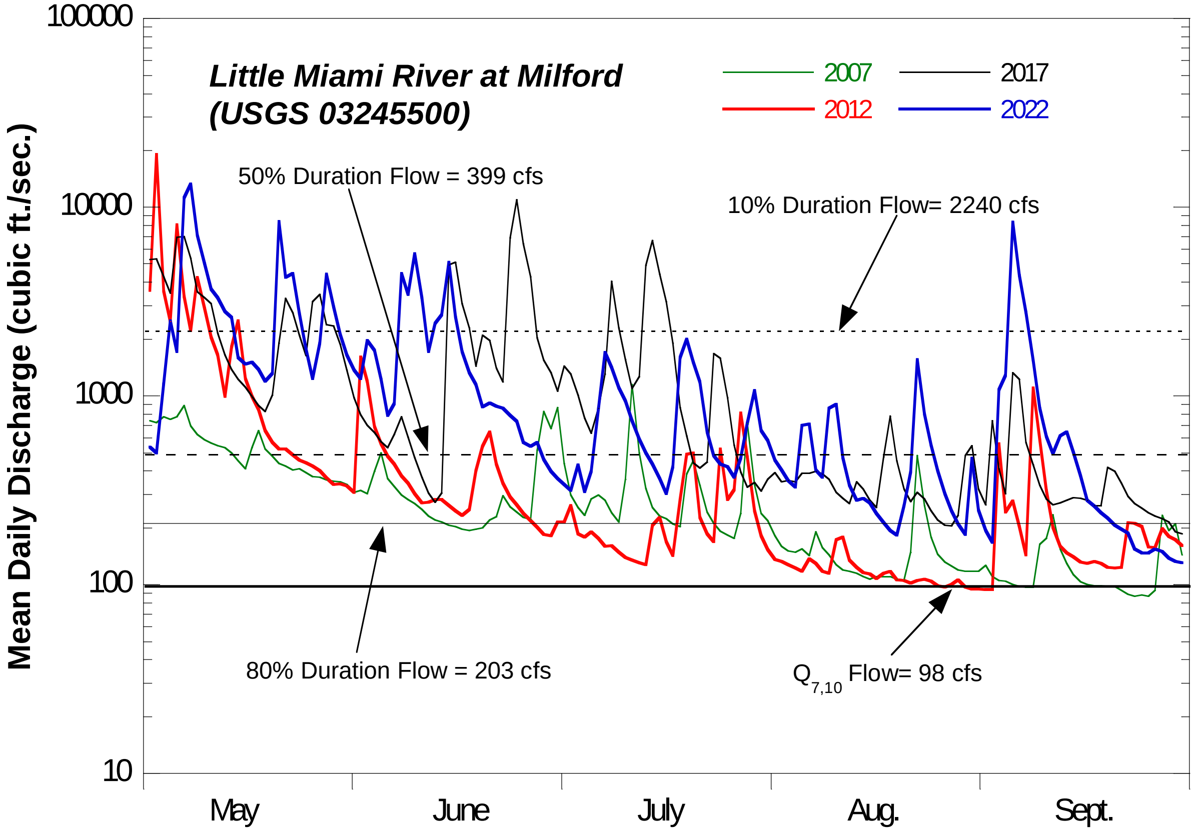
Chemical/physical water quality in the 2022 Little Miami study area was characterized by grab sample data collected from the water column two to six times at each site during base flows and within a June 16-October 15 seasonal index period. Continuous measurements were made with Datasondes over 3-4 consecutive day periods at selected mainstem and tributary sites in late July and early August. Sediment chemistry was determined from samples collected at all mainstem and selected tributaries in mid-October. The results were evaluated by assessing exceedances of criteria in the Ohio WQS, exceedances of regionally derived biological effect thresholds (MBI 2015) for parameters that lack formal criteria in the WQS, and by exceedances of consensus based probable and threshold effect levels for sediment chemistry (Persaud et al. 1993; MacDonald et al. 2000). The chemical/physical results also serve as indicators of exposure and stress and in support of using the biological data for assessing the attainment of aquatic life uses and assigning associated causes and sources for impairments. Bacteria data were collected by grab samples at all sites and used primarily to determine the status of recreational uses in accordance with the Ohio WQS. Recently revised Ohio EPA protocols for determining attainment of the applicable designated recreational uses were followed.

Flow Regime

The flow regime in the Little Miami mainstem during the period May 1 – October 31 is depicted in Figure 8 for the years 2007, 2012, 2017, and 2022 based on the gauge operated by the U.S. Geological Survey at Milford (RM 10.0) as a seasonal hydrograph and a frequency plot. These are the most recent years with bioassessment data in the Little Miami River mainstem and each represents a slightly different periodicity of both high and low flows. The consistently lowest flows occurred in 2007 and 2012 with multiple daily values at or less than the $Q_{7,10}$ critical low flow and nearly one-half below the 80% duration flow for the May 1-October 31 period. The flows in each year were well below what are referred to herein as normal summer-fall flows that are approximated by the range between statistical median (50th percentile) and 80th percentile flows. All sampling was confined to normal seasonal flows avoiding high flow events and sampling was not resumed until normal base flows returned. The difference between 2007 and 2012 was more frequent spates of elevated flows in 2012 above the median and some above the 10th percentile (Figure 8 box plot). Flows in 2017 and again in 2022 were consistently at or above the 80th percentile flows and within the normal range less than one-half the time. Sampling for fish was delayed on more than one occasion to avoid high flows and allow them to return to normal. Peak flows generally occurred in May-June following significant precipitation events, but were evident as low level events in June, July, and August and a larger event in September 2022. Each year had flows that were well above the 10th percentile flow as evidenced by the number of outliers in the frequency plots for 2017 and 2022.

Water Column Chemistry

Water quality was assessed by grab samples collected during the summer-fall index period. Parameter groupings included field, demand, ionic strength, nutrients, heavy metals, and



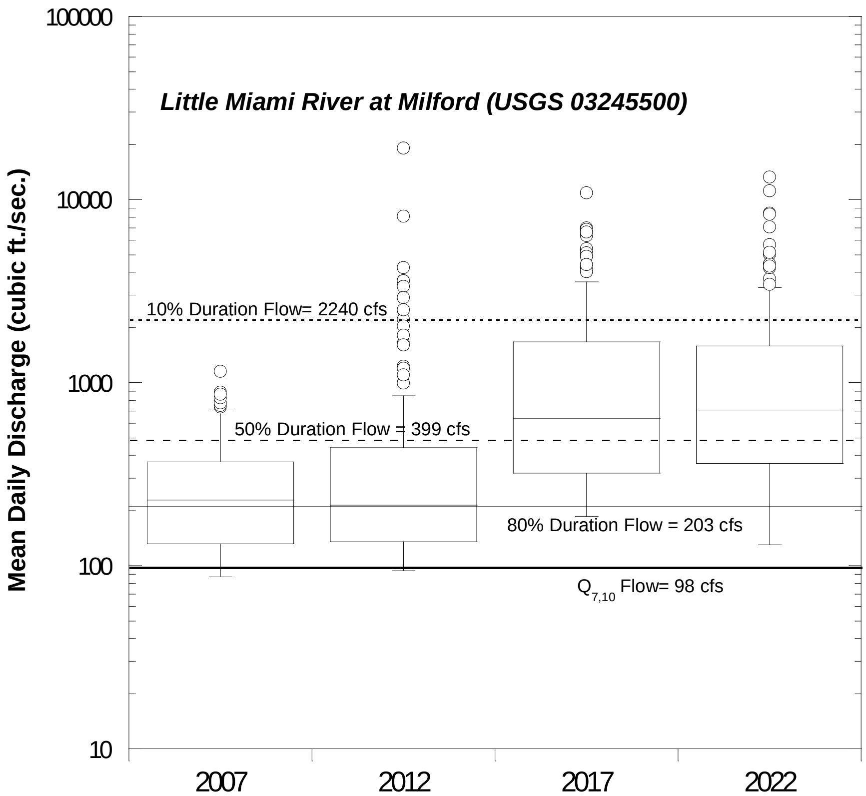


***Figure 9**. Flow measured at the USGS gauge at Milford (RM) during May 1-October 31 depicted as a hydrograph in 2007, 2012, 2017, and 2022 (upper) and a frequency box plot for each year (lower). The median, 80th%, 10th%, and $Q_{7,10}$ flows are indicated on each hydrograph.*

organic compounds. Continuous measurements over 3-4 consecutive day periods were made at all mainstem sites (excepting the downstream most sites influenced by the Ohio River) for D.O. (mg/l), pH (S.U.), conductivity (µS/cm), and temperature (°C) using YSI Datasonde continuous recorders during August 1-4 and August 8-11, 2022.

Water Quality Criteria Exceedances

Assessing exceedances of water quality criteria was done for parameters that have formal criteria codified in the Ohio WQS. For the 2022 Little Miami River survey this included criteria for the protection of aquatic life and for recreational uses.

Aquatic Life Criteria Exceedances

Measured exceedances of aquatic life water quality criteria in the Ohio WQS were limited mostly to continuous and grab D.O. and scattered exceedances for temperature, pH, copper, and lead (Table 7). D.O. exceedances occurred in continuous data samples at two sites in the Little Miami River mainstem. A minor exceedance of the EWH 5.0 mg/L minimum occurred at LM01 (RM 27.90). More serious exceedances occurred at LM16A (RM 3.70) of both the 6.0 mg/L average and the 5.0 mg/L minimum over the four-day deployment. D.O. exceedances in the Duck Creek subwatershed included an exceedance of the 2.0 mg/L LRW minimum at LM73 (RM 4.58) and four exceedances of the WWH minimum of 4.0 mg/L at LM80 (RM 0.10), LM 85 (RM 2.00), LM92 (RM 0.49), and LM82 (RM 0.20). Four exceedances of the WWH minimum of 4.0 mg/L were recorded in grab samples, two in Sycamore Creek (LM50 and LM51) and the Unnamed Tributary at RM 1.12 (LM55 and LM56). A single exceedance of the chronic criterion for ammonia-N occurred in the upper Sycamore Creek site at LM50. Modest temperature criteria exceedances of the applicable maximum criterion of 29.4°C occurred in the mainstem at LM05 (RM 21.50) and in Clough Creek at LM98 (RM 0.60). The exceedances corresponded almost equally across attaining and non-attaining (one partial attainment) sites, but were more serious or severe departures at the non-attaining sites and what amounted to insignificant exceedances at the attaining sites. The exceedances in 2022 were only slightly more frequent than in 2017 and involved mostly exceedances of D.O. criteria in the tributaries, but were much less frequent than those observed in 2012 that included more numerous D.O. exceedances in the mainstem and more frequent exceedances of urban pollutants such as lead, copper, and ammonia-N.

Exceedances of Biological Effect Thresholds

Biological effect thresholds were employed for parameters that do and do not have formal criteria codified in the Ohio WQS to determine the risks of any exceedances to the attainment of aquatic life uses. The thresholds developed as part of the *Integrated Prioritization System (IPS) Documentation and Atlas of Biological Stressor Relationships for Southwest Ohio* (Technical Report MBI/2015-12-15, MBI 2015) were used to assess conventional, ionic strength, heavy metals, and nutrient parameters. These "IPS thresholds" were used in lieu of the Ohio EPA (1999) *Appendices to Association Between Nutrients and the Aquatic Biota of Ohio River and Streams* the thresholds from which were employed in a similar fashion in the 2011-14

***Table 7**. Exceedances of Ohio water quality criteria recorded by grab and continuous sampling in the Lower Little Miami River study area in 2022 with aquatic life attainment status shown for comparative purposes.*

Site ID	River Mile Fish/Macros	Drainage Area (mi.^{2})	Aquatic Life Use	Attainment Status	Parameters (Values) Exceeding Ohio Aquatic Life Criteria
Little Miami River (EWH Aquatic Life Use –Existing)					
LM01	27.90/27.80	1070	EWH	Full	Grab D.O. (min. 4.51 mg/L); Sonde D.O. (min. 4.53 mg/L)
LM02	24.10/23.90	1090	EWH	Full	
LM03	22.30/22.20	1150	EWH	Full	
LM05	21.50/20.90	1160	EWH	Full	Max. Temperature (29.8°C)
LM07	18.50/18.50	1190	EWH	Full	
LM08	17.70/16.90	1190	EWH	Full	
LM09	13.10/13.10	1200	EWH	Full	
LM11	10.90/10.90	1710	EWH	Full	
LM12	8.10/8.00	1710	EWH	Full	
LM13	6.83/7.30	1720	EWH	Full	Copper (36 µg/L)
LM15	4.10/4.10	1730	EWH	Full	
LM16A	3.70/3.70	1740	EWH	Non	Grab D.O. (min. 3.00 mg/L), Sonde D.O. (min. 3.12 mg/L, avg. 4.3 mg/L)
LM16	3.50/3.50	1750	EWH	Partial	
Little Miami River (WWH Aquatic Life Use –Existing)					
LM17	1.60/1.40	1760	WWH	Partial	Lead (25.2 µg/L)
Sycamore Creek (WWH Aquatic Life Use - Existing)					
LM50	1.10/1.00	12.5	WWH	Non	Grab D.O. (min. 4.30 mg/L), NH_3-N (3.4 mg/L)
LM51	0.50/0.24	22.8	WWH	Full	Grab D.O. (avg. 4.70 mg/L)
LM52	0.10/0.10	23.3	WWH	Full	
Unnamed Tributary (1.82) to Tributary to Sycamore Creek (1.1) (PHW3A Existing Use)					
LM54	0.00/0.40	1.6	PHW3A	PHW3A	
Unnamed Tributary to Sycamore Cr. at RM 1.12 (WWH Aquatic Life Use - Existing)					
LM55	1.20/1.00	5.32	WWH	Non	Grab D.O. (min. 2.90 mg/L)
LM56	0.20/0.20	5.61	WWH	Partial	Grab D.O. (min. 3.30 mg/L)
Polk Run (WWH Aquatic Life Use - Existing)					
LM40	0.30/0.30	9.97	WWH	Full	
Duck Creek (LRW Aquatic Life Use – Existing)					
LM71	6.10/6.00	2.24	LRW	Non	
LM72	5.14/4.60	5.05	LRW	Full	pH (max. 9.1 S.U.)
LM73	4.58/4.40	5.84	LRW	Non	Grab D.O. (min.1.00 mg/L); Sonde D.O. (min. 0.92)
LM74	3.90/0.15	9.59	LRW	Full	
LM75	3.40/3.30	11.5	LRW	Non	
LM76	2.80/2.90	11.7	LRW	Full	

***Table 7**. continued.*

Site ID	River Mile Fish/Macros	Drainage Area (sq. mi.)	Aquatic Life Use	Attainment Status	Parameters (Values) Exceeding Ohio Aquatic Life Criteria
Duck Creek (WWH Aquatic Life Use – Existing)					
LM77	2.00/1.80	14.3	WWH	Full	
LM79	0.50/0.90	14.6	WWH	Non	
Unnamed Tributary to Duck Creek at RM 4.8 (PHW2 Existing Use)					
LM83	0.00/0.80	1.2	PHW2	PHW2	
LM80	0.10/0.20	1.42	PHW2	PHW2	Grab D.O. (min. 0.70 mg/L)
East Fork Duck Creek (WWH Aquatic Life Use - Recommended)					
LM85	2.00/1.50	1.31	WWH	Non	Grab D.O. (min. 3.95 mg/L)
LM84	0.50/0.60	1.99	WWH	Non	Copper (35.1 µg/L)
Little Duck Creek (WWH Aquatic Life Use - Existing)					
LM86	2.40/2.70	0.22	WWH	Partial	
LM87	1.90/2.60	0.45	WWH	Partial	
LM90	1.00/2.30	0.55	WWH	Partial	
LM92	0.49/0.49	1.68	WWH	Non	Grab D.O. (min. 3.90 mg/L)
Unnamed Tributary to Little Duck Creek at RM 4.42 (PHW3A Existing Use)					
LM82	0.20/0.10	0.59	PHW3A	PHW3A	Grab D.O. (min. 3.00 mg/L)
Clough Creek (WWH Aquatic Life Use – Existing)					
LM95	3.20/3.20	1.95	WWH	Partial	
LM98	0.60/0.40	7.81	WWH	Full	Max. Temperature (30.0°C)

MSDGC service area watershed assessments. The IPS thresholds are more robust and regionally relevant and are a more robust and regionally relevant analysis of biological stressor thresholds and especially in light of the Ohio EPA (1999) dataset being somewhat sparse in the Interior Plateau ecoregion. The IPS thresholds also offer discrete goals that are directly linked to the codified biological criteria and their application in the determination of aquatic life use attainment and the response to a finding of attainment and findings of non-attainment[5]. The results for selected parameters are compared to the IPS threshold goals that align with the applicable aquatic life use and stream size category and color coded in keeping with the hierarchy of the Ohio tiered aquatic life uses. The results are graphically depicted along the Little Miami River mainstem as median or mean values for the 2022 results with maximum and minimums, as medians or means comparing available results using prior Ohio EPA and MBI results as a historical baseline, and in tabular form for 2022 median or mean values for the mainstem and tributary subwatershed sites. The degree or "severity" of an IPS threshold exceedance was also evaluated against the narrative thresholds of excellent, good, fair, poor, and very poor. The excellent and good thresholds are consistent with the EWH and WWH uses, respectively. This also allowed for a weighted approach to assessing threshold exceedances in the aquatic life use attainment and synthesis tables. These also factored into the calculation of Restorability scores for impaired sites and Susceptibility and Threat scores for attaining sites.

[5] OAC 3745-1-07(A)(6)(a) describe the options for a finding of full attainment and (A)(6)(b) for a finding of non-attainment.

Nutrients at wadeable and headwater sites were assessed using the draft SNAP (Ohio EPA 2015d) which is a “combined criteria” consisting of the fish and macroinvertebrate biological criteria, the diel D.O. flux, benthic chlorophyll α, sestonic chlorophyll α, total nitrate, total phosphorus, and allied parameters such as BOD_5, TKN, and SSC. The Little Miami River mainstem was assessed for nutrient effects using the Ohio Large Rivers approach described by Miltner (2018) that offers assessment thresholds for each of the variables included in a combined nutrients effect assessment for three states of eutrophication – acceptable, enriched, and over-enriched. Lastly, sediment chemical data was assessed using the threshold and probable effect levels of MacDonald et al. (2000), Persuad et al. (1999), and Ohio EPA Sediment Reference Values (SRVs).

Conventional, Demand, and Nutrient Parameters - Little Miami River Mainstem

This category includes D.O., temperature, pH, ammonia-N, total phosphorus, total nitrate, and total Kjeldahl nitrogen all from grab samples collected under normal summer-fall flows. *E. coli* is added here as it can be an effective indicator of organic enrichment from sewage discharges. Benthic and sestonic chlorophyll a values are also included as they were collected in concert with the continuous D.O. data to support the Large River Nutrient and SNAP assessments. The D.O. results were comprised of both grab and short-term continuous data.

Dissolved Oxygen (D.O.)

D.O. values from daytime grab samples revealed only three exceedances of the minimum EWH criterion of 5.0 mg/L in the Little Miami River mainstem (Figure 10). All were minor excursions. No maximum values were recorded that would indicate excessive diel swings resulting from excessive nutrient enrichment and the means were well above the average criterion. No exceedances were observed in 2017. Exceedances of the EWH average and excessively high daytime values were evident in 2012, thus the 2017 and 2022 results were an improvement in the D.O. regime. The comparison of median D.O. values between 1983, 2007, 2012, 2017, and 2022 indicated no substantial changes between years with all except one value in 1983 were well within the range of median values and well above the average EWH criterion (Figure 10).

Short-term (4-5 days) continuous D.O. monitoring conducted in August 2022 at 14 mainstem locations showed D.O. exceedances at a single site, LM16A (RM 3.70) located immediately downstream from Duck Creek (Figure 11). This is a new site that has not been previously assessed. The low minimum of 3.0 mg/L and median of 4.0 mg/L indicate a chronic impact from low D.O. that is well below the water quality criteria for EWH. The lack of an excessively high maximum D.O. indicates this is unrelated to nutrient enrichment and is more likely due to excessive organic enrichment by sewage released via Duck Creek. The impact is localized to a reach of no more than 0.3 miles as evidenced by a return to upstream levels at LM16 (RM 3.5). Otherwise the 2022 results showed no other issue including excessive maximum values associated with nutrient enrichment with the possible exception of LM17 which had a high maximum of nearly 12 mg/L and at the maximum threshold of 12 mg/L that is indicative of excessive nutrient enrichment effects. This site is impounded by the Ohio River hence the

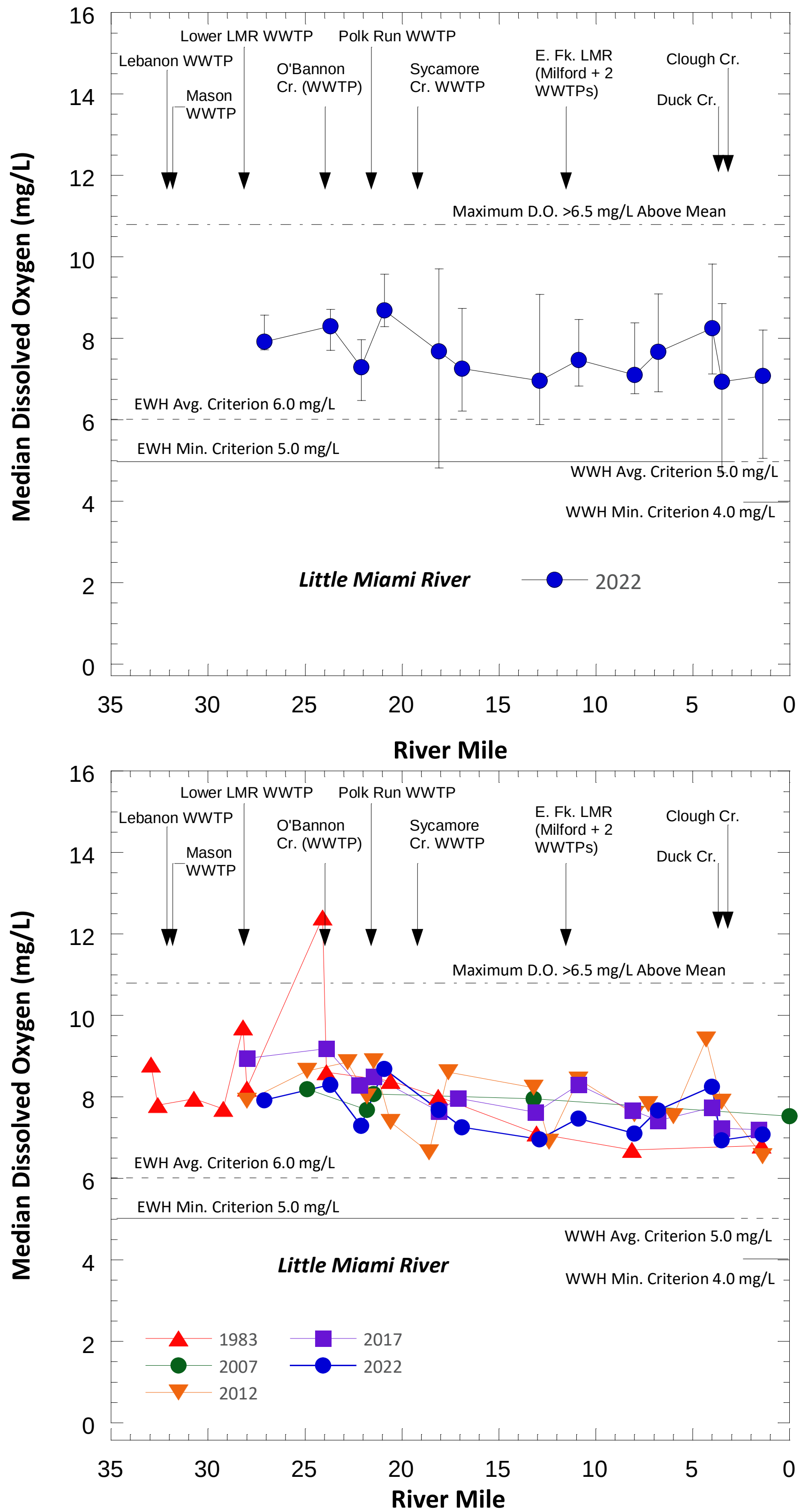


***Figure 10**. Median, maximum, and minimum D.O. values from daytime grab samples in 2022 (upper) and median D.O. values in 1983, 2007, 2012, 2017, and 2022 (lower). The EWH and WWH average and minimum criteria are shown as each applies to the L. Miami R. mainstem. Major discharges and tributaries are indicated across the top.*

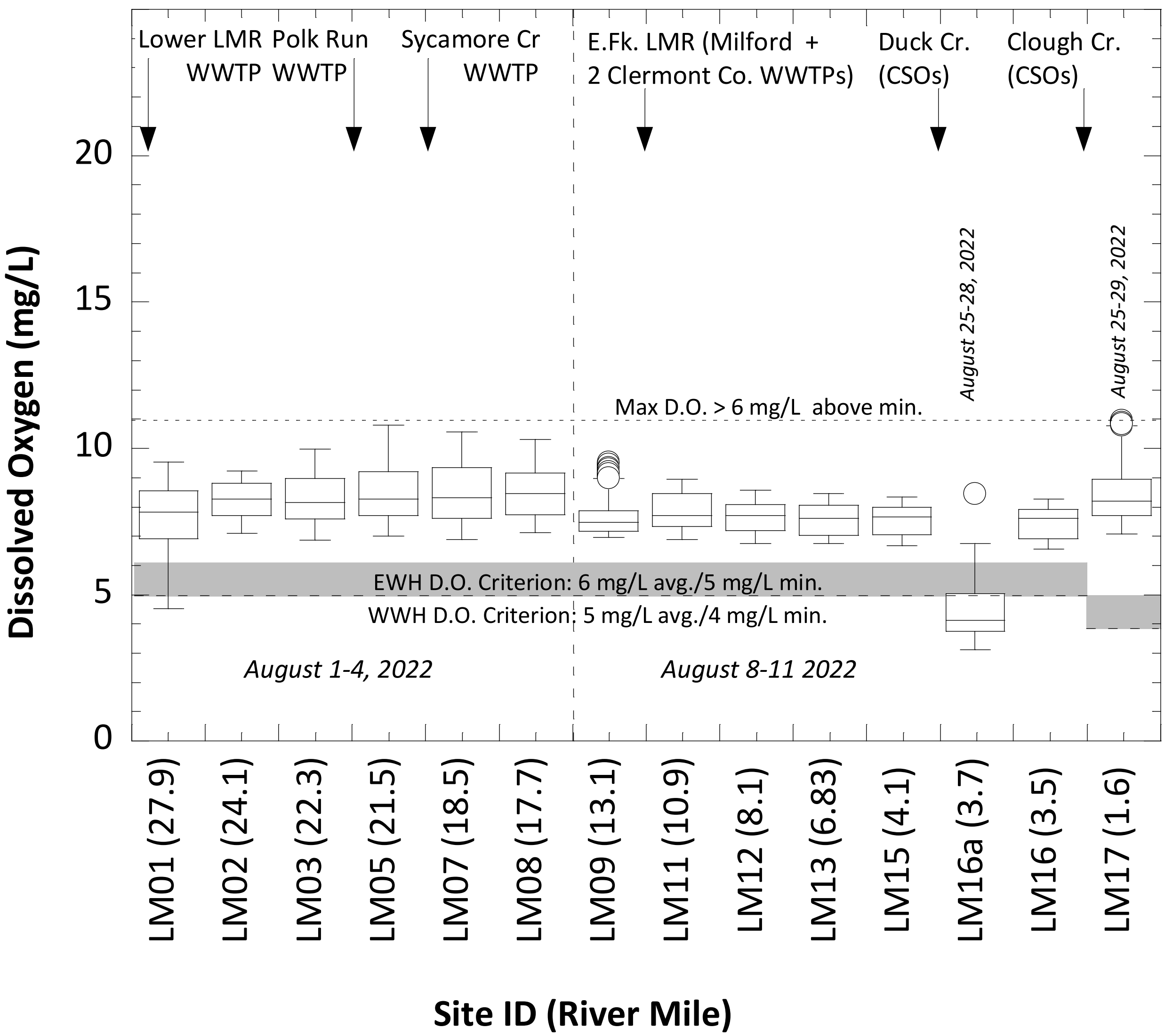


***Figure 11**. Box-and-whisker plots of continuous D.O from Datasonde continuous recorders at 14 sites in the Little Miami River mainstem during August 1-4 and 8-11, 2022. The EWH and WWH daily average and minimum criteria are indicated by gray shaded bars, solid and dashed lines, and the maximum D.O. indicative of excessive diel swings is indicated by a black dashed line. Major discharges and tributaries are indicated across the top.*

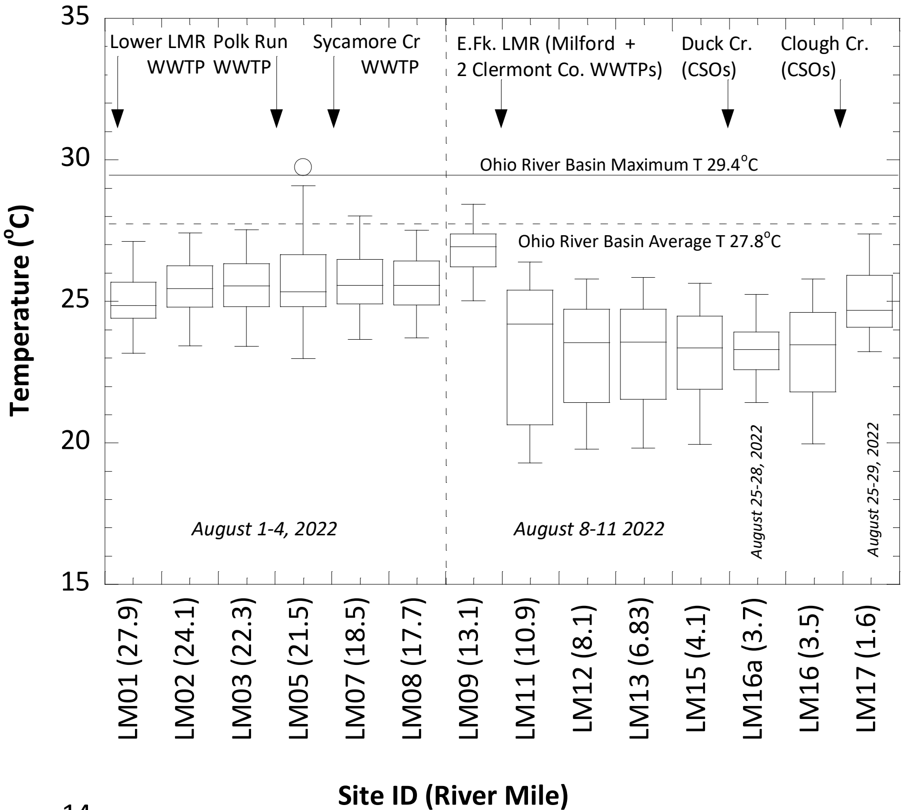
slower flows and longer retention time likely contributed to these values. Maximum D.O. values in 2017 eclipsed the maximum value of 12 mg/L more frequently throughout the lower mainstem, but without any excursions even close the average or minimum EWH D.O. criterion. More frequent continuous monitoring in July and August 2012 revealed even more frequent and higher exceedances of the 12 mg/L threshold and with exceedances of the minimum EWH D.O. criterion at multiple sites. As was shown previously (see Figure 9), flows were much lower in 2012 compared to 2017 and 2022, the latter two of which had similar flow regimes. Also observed in 2012 was temporal variation in the more frequently monitored continuous D.O. data with more frequent high and low values in July than in August 2012. This illustrates an apparent periodicity in spates of D.O. values that show a response to nutrient enrichment and oxygen demand.

Temperature (℃)
Continuous temperature data revealed only a single and slight exceedance of the Ohio River Basin maximum of 29.4C at LM05 (RM 21.50), but with the remaining maximum and means well below the maximum and period average criteria (Figure 12, upper panel). No exceedances of the temperature criteria were observed in 2017 as all values were well below both the average and maximum. In 2012 exceedances of both the average and maximum criteria values occurred downstream from the East Fork confluence persisting downstream to the Ohio River. This was associated with atypical releases from the W.M. Harsha Reservoir and the comparatively low flow conditions in 2012.

pH (S.U.)
pH values were well within the 6.5-9.0 S.U. criteria in 2022 with no excessively wide swings that would be indicative of excessive nutrient enrichment effects on algae (Figure 12, lower panel). The result at LM16A (RM 3.70) immediately downstream from Duck Creek was the lowest in the 2022 study and could have resulted from reduced algal activity due to toxicity from Duck Creek. The effect, if any, was brief as pH values returned to upstream levels at LM16 (RM 3.50). The pH values in 2017 were also well within the 6.5-9.0 criteria and with no excessive diel swings indicative of excessive nutrient enrichment. While not graphed the 2012 results for pH had diel fluctuations that corresponded to those commonly associated with diel D.O. fluctuations. Here again the effect was likely more apparent due to the consistently lower flows in 2012.

Ammonia-N
The median ammonia-N was at or just above the detection limit and well below the excellent IPS threshold for all samples in the mainstem in 2022 (Figure 13; Table 8) a result similar to 2017 and 2012. Maximum values exceeded the excellent threshold at LM05 (RM 21.50) and increasingly so downstream from the East Fork confluence at LM11 (RM 10.90) to the last site at LM17 (RM 1.70). Each of these maximum values was within the good range of the IPS indicating intermittently detectable, but low ammonia-N levels in the lower one half of the study area. Four of the sites had levels that were below detection and median values mostly at 0.03 mg/L (Table 8). Mean values were somewhat higher reflecting the higher maximum values downstream from the East Fork confluence indicating detectable sources of ammonia-N, but at levels below the excellent IPS threshold.

Total Kjeldahl Nitrogen (TKN)
Median TKN values exceeded the EWH IPS threshold in 2022, but were well within the WWH range (Figure 14; Table 8). Maximum values showed considerable variability at the same sites with high maximum ammonia-N with five values just exceeding the fair threshold. The median values in 2022 were comparable to 2017, but were lower than values recorded in 1983, 2007, and 2012, several of which exceeded the fair IPS threshold. This shows a consistent reduction in



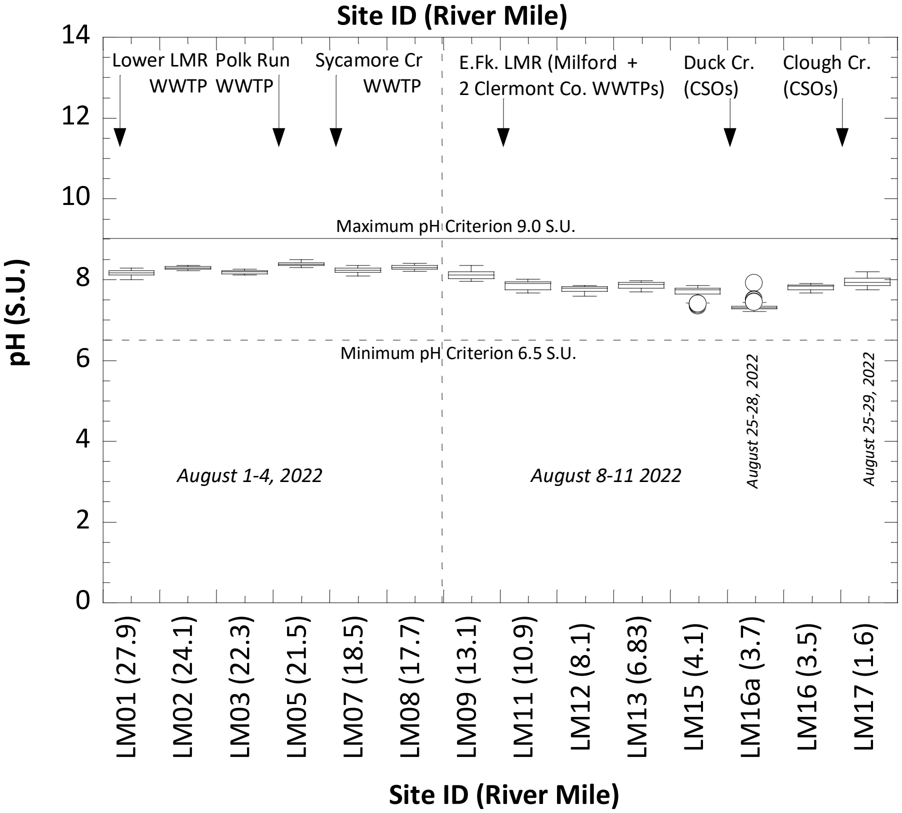


***Figure 12**. Box-and-whisker plots of continuous temperature (C°) and pH (S.U.)from Datasonde continuous recorders at 14 sites in the Little Miami River mainstem during August 1-4 and 8-11, 2022. The period average and maximum temperature criteria are indicated by solid and dashed lines (upper) and the pH criteria by solid and dashed lines (lower). Major discharges and tributaries are indicated across the top.*

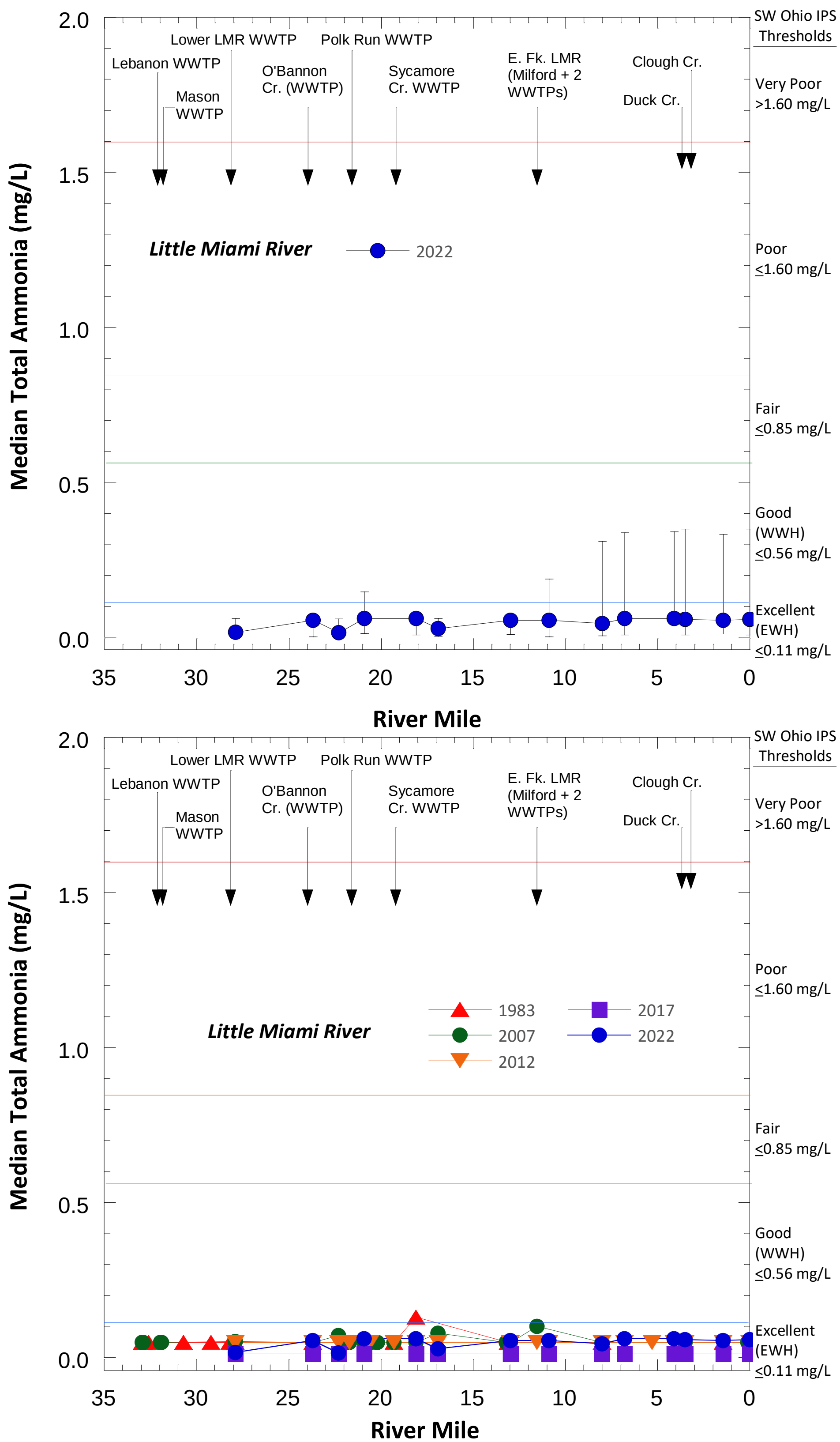
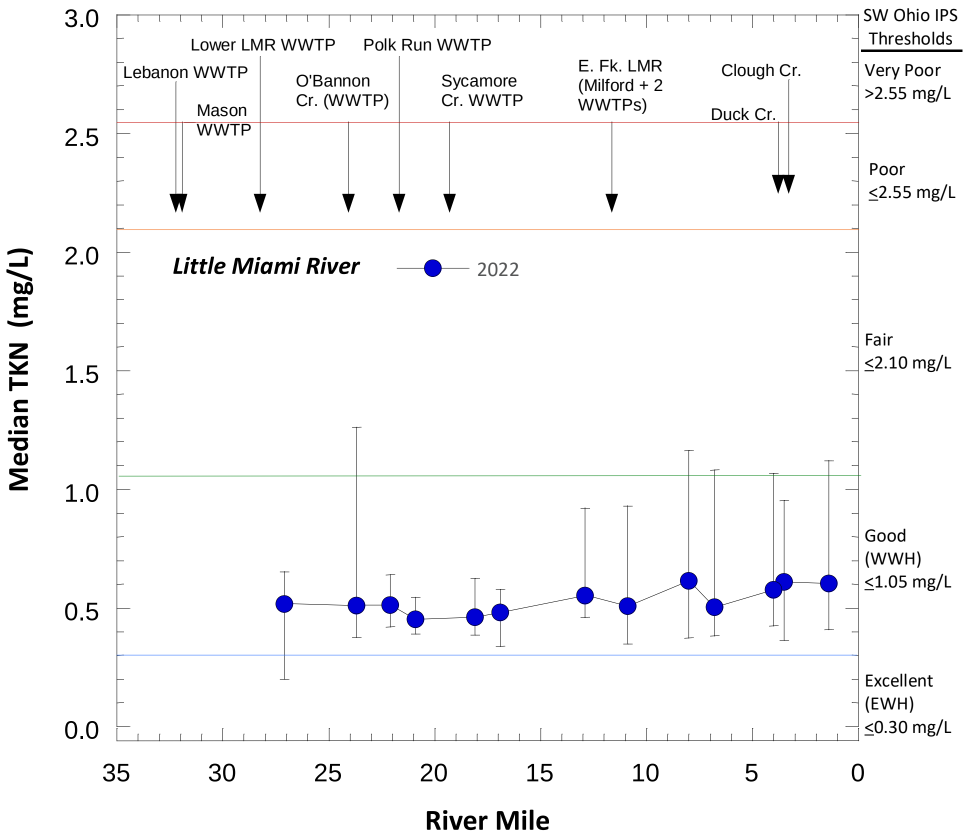


***Figure 13**. Median, maximum, and minimum ammonia-N values in 2022 (upper) and median ammonia-N values in 1983, 2007, 2012, 2017, and 2022 (lower). The IPS thresholds are depicted by the solid colored lines. Major discharges and tributaries are indicated across the top.*



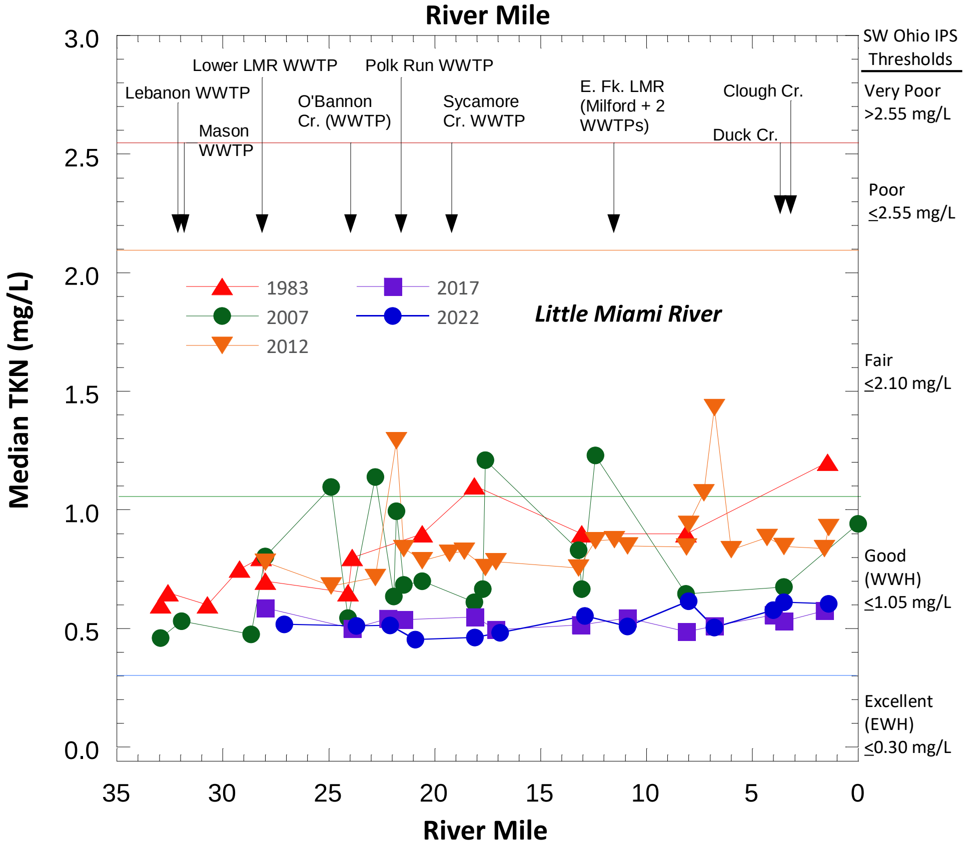


***Figure 14**. Median, maximum, and minimum TKN values in 2022 (upper) and median TKN values in 1983, 2007, 2012, 2017, and 2022 (lower). The IPS thresholds are depicted by the solid colored lines. Major discharges and tributaries are indicated across the top.*

***Table 8**. Ammonia-N and nutrient related parameter median and mean values at 14 sites in the Lower Little Miami River mainstem in 2022. Color shading corresponds to IPS and other thresholds for each parameter listed in the legend below the table.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Total Ammonia (mg/L)		Total Nitrate (mg/L)		TKN (mg/L)		Total Phsphorus (mg/L)		Sestonic Chlorophyll (µg/L)		Benthic Chlorophyll (mg/m^2)
			Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	
Little Miami River													
LM01	27.90	1069.0	BD	BD	2.80	3.00	0.52	0.48	0.21	0.21	2.34	2.78	65.10
LM02	24.10	1085.0	BD	BD	1.92	2.09	0.51	0.65	0.14	0.15	2.94	3.56	53.00
LM03	22.30	1148.0	0.02	0.02	1.98	2.20	0.51	0.52	0.16	0.17	4.01	4.53	74.10
LM05	21.50	1160.0	0.03	0.05	2.05	2.20	0.45	0.46	0.16	0.17	4.54	5.52	71.80
LM07	18.50	1187.0	0.03	0.03	2.08	2.30	0.46	0.49	0.18	0.19	4.54	5.15	59.30
LM08	17.70	1190.0	BD	BD	1.93	2.23	0.48	0.46	0.16	0.17	3.88	5.47	61.00
LM09	13.10	1203.0	BD	BD	1.62	1.86	0.55	0.62	0.16	0.20	3.61	6.30	50.20
LM11	10.90	1707.0	0.03	0.05	1.87	1.90	0.51	0.56	0.24	0.26	4.81	5.94	86.40
LM12	8.10	1710.0	0.03	0.07	1.81	1.83	0.61	0.65	0.23	0.25	4.81	5.84	84.80
LM13	6.83	1720.0	0.03	0.08	1.74	1.77	0.50	0.59	0.22	0.24	5.08	7.09	84.20
LM15	4.10	1730.0	0.03	0.09	1.56	1.68	0.58	0.63	0.24	0.24	6.41	7.65	84.60
LM16a	3.70	1752.0	0.05	0.08	0.52	0.91	0.71	0.64	0.18	0.20	4.81	4.97	84.20
LM16	3.50	1752.0	0.03	0.08	1.65	1.73	0.50	0.59	0.22	0.24	4.81	6.05	82.70
LM17	1.60	1754.0	0.03	0.08	1.52	1.65	0.60	0.66	0.21	0.22	5.01	7.27	127.00
Boatable Narrative Threshold Rankings	**Exceptional**		<0.11		<0.71		<0.30		<0.05				
	Good		<0.56		<1.68		<1.05		<0.21		<30		<182
	Fair		<0.85		<2.17		<2.10		<0.54		30-100		182-320
	Poor		<1.60		<3.68		<2.55		<0.86		>100		>320
	Very Poor		≥1.60		≥3.68		≥2.55		≥0.86				
Source	**IPS**		**IPS**		**IPS**		**IPS**		**IPS**		**OEPA Large River**		**OEPA SNAP**

the values observed in 2017 and 2022 and is a positive indication of decreased loadings of organic nitrogen biomass. All 2017 and 2022 values were well below the WWH IPS thresholds.

Fecal Bacteria (E. coli)
A graph of *E. coli* levels was included to serve as an indicator of excessive organic enrichment in the form of sewage inputs. The 2022 results were highlighted earlier regarding the contact recreation use implications (see Table 3). The recreation use criteria are included along with a level of E. coli that is almost certainly due to human sewage as the primary source in Figure 15. Arguably, values that exceed the SCR criterion of 1030 cfu/100 mL are likely the result of human

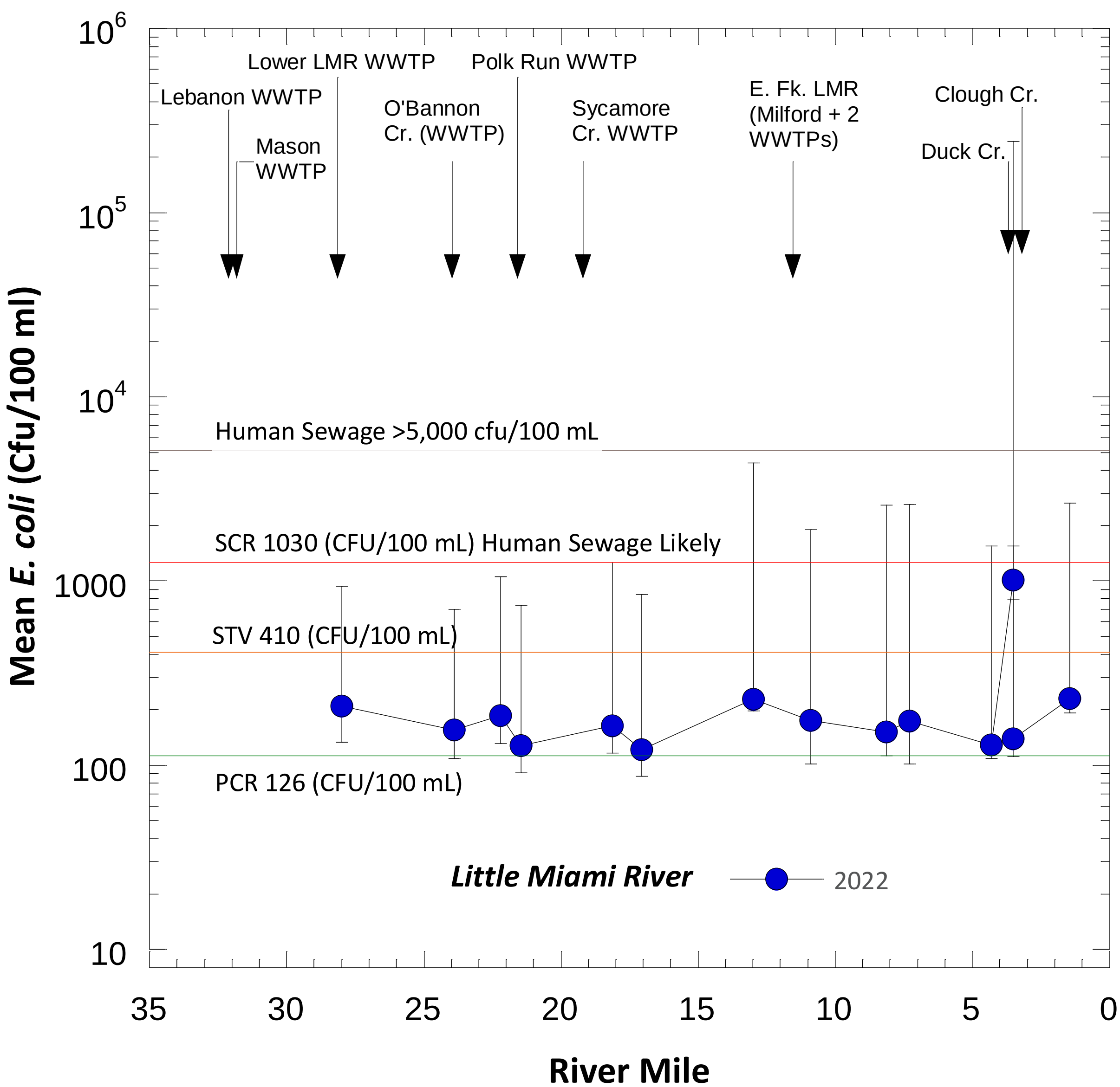


***Figure 15**. Median, maximum, and minimum E. coli values in 2022. The contact recreation criteria are depicted by the solid colored lines with the level associated with human sewage as the primary source added. Major discharges and tributaries are indicated across the top.*

sewage. Using these thresholds there are significant sources of sewage inputs upstream from site LM09 (RM 10.90) and downstream to site LM17 (RM 1.70). The extremely high maximum value of 241,960 cfu/100 mL at LM16A immediately downstream from Duck Creek is certainly indicative of a major sewage release that is albeit highly localized as values returned to upstream levels at LM16 just 0.3 miles downstream.

Total Phosphorus

Total phosphorus median values were at just below or just above the good IPS threshold in 2022 (Figure 16; Table 8). Maximum values increased by 3-4 times relative to values upstream from site LM09 (RM 10.90) and downstream to site LM17 (RM 1.70), which roughly reflected the pattern of maximum *E. coli* and TKN maximum levels. Median values in 2022 were the second lowest among the years 1983, 2007, 2012, and 2017 with 2012 showing very low levels (Figure 16). The 2017 total phosphorus and nitrate reflected consistent exceedances of both the EWH and WWH IPS thresholds (Figure 16; Table 8). Excepting the very low levels in 2012, total P levels have declined since 1983 and 2007 when median values were consistently in the fair range and some values in the poor range.

Total Nitrate-N

Median and maximum total nitrate showed a pattern of general decline from upstream to downstream through the study area most likely reflecting inputs from upstream sources of the nitrification of municipal wastewater (Figure 17; Table 8). The sources of municipal wastewater in the study area had no apparent effect on this pattern. Median values exceeded the fair range at the upstream site (LM01) and declined through the fair range downstream to site LM15 (RM 4.10) and then to the good range at site LM16A (RM 3.70) to LM17 (RM 1.70). The same general upstream to downstream pattern persisted among the median values in 1983, 2007, 2012, and 2017 with the exception of one extremely high value in 2012. The highest values tended to occur in 2007 and the lowest in 2012, with 2022 the second lowest. However, the differences between years were mixed depending on the site. Being wastewater dominated the Lower Little Miami River has higher nitrate levels relative to the IPS thresholds than do the other nutrient related parameters.

Chlorophyll a

Benthic chlorophyll a and sestonic chlorophyll a values were all in their good range in accordance with the Ohio EPA Large Rivers and SNAP methodologies (Table 8). Sestonic chlorophyll a was collected along with other grab samples resulting in enough samples per site to calculate a median and mean value. Both were very low relative to the Ohio EPA large river maximum of 30 µg/L ranging from 2.34 µg/L to 7.27 µg/L and with a general increase in values from upstream to downstream. Benthic chlorophyll a was collected once during the Datasonde deployments and ranged from 53.00 mg/m^2 to 127.00 mg/m^2 also with an increasing pattern from upstream to downstream and well below the 182.00 mg/m^2 SNAP threshold for good values.

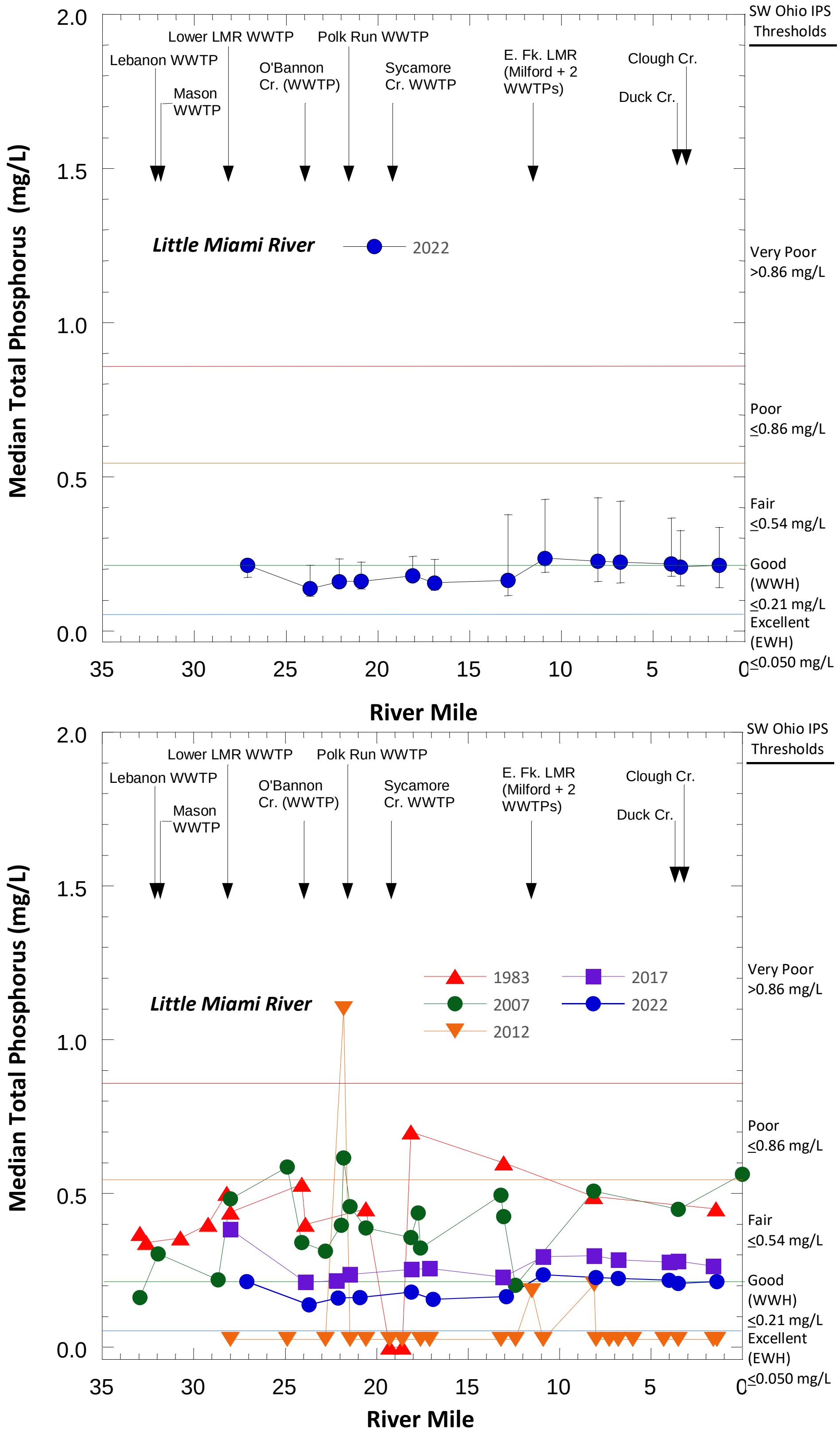


Figure 16. *Median, maximum, and minimum total phosphorus values in 2022 (upper) and median TKN values in 1983, 2007, 2012, 2017, and 2022 (lower). The IPS thresholds are depicted by the solid colored lines. Major discharges and tributaries are indicated across the top.*

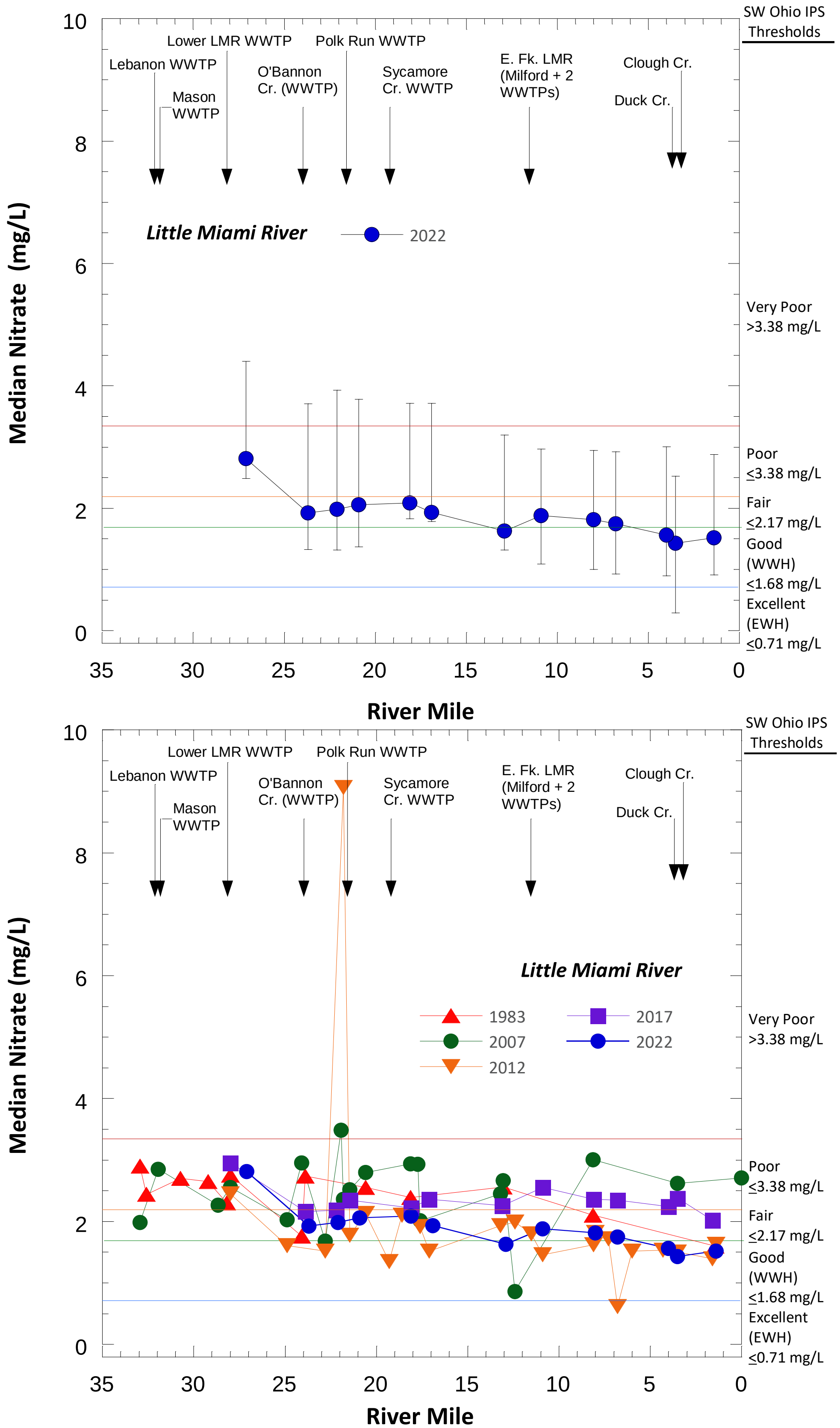


***Figure 17**. Median, maximum, and minimum total nitrate-N values in 2022 (upper) and median TKN values in 1983, 2007, 2012, 2017, and 2022 (lower). The IPS thresholds are depicted by the solid colored lines. Major discharges and tributaries are indicated across the top.*

Nutrient Effects Assessment

The impact of nutrients on aquatic life has been well documented (Allan 2004), but the derivation of modernized nutrient criteria and their form and application are only just now emerging. Because of the widely varying efforts to develop nutrient criteria by the States, conflicting U.S. EPA oversight, and the potential cost of additional nutrient controls it has been a controversial issue (Evans-White et al. 2014). Unlike toxicants, the influence of nutrients on aquatic life is indirect and primarily via their influence on algal photosynthesis and respiration and the resulting increase in the magnitude of diel D.O. swings and by the biochemical oxygen demand exerted by algal photosynthesis, respiration, and decomposition. Nutrients can also affect food sources for macroinvertebrates and fish and the response of aquatic life to elevated nutrients is co-influenced by habitat (e.g., substrate composition, channel morphology), stream flow (e.g., scouring and dilution), temperature, and exposure of the water column to sunlight. Ohio has developed a technical approach to evaluate nutrient effects in large rivers (Miltner 2018) and is in the midst of a process to develop modernized nutrient water quality criteria. At this time an approach for developing nutrient water quality criteria for large rivers was described as part of an Early Stakeholder Outreach process in 2018 (Ohio EPA 2018) to revise (OAC 3745-1-36[6]). However, no formal proposal for revising these criteria has been made at this time.

The Ohio Large Rivers approach described by Miltner (2018) offers assessment thresholds for each of the variables included in a combined nutrients effect assessment (Table 9) for three states of eutrophication – acceptable, enriched, and over-enriched. The enriched and over-enriched states also imply that biological assemblages are "stressed" for enriched and impaired for over-enriched along with the over-enriched state being "aesthetically obvious". For the latter, the Ohio EPA (2018) ESO presentation described visual signs of over-enrichment based on color and clarity with enriched conditions at >100 μg/L sestonic chlorophyll a and nuisance conditions occurring at levels of >165 μg/L. The combined effects of nutrient enrichment were assessed to integrate the preceding descriptions of the concentrations of each of the key nutrient related parameters with measures of algal productivity, habitat, and the numeric biocriteria. A multi-parameter approach using elements of the Ohio large rivers methodology (Miltner 2018), the proposed eutrophication standard box model (Ohio EPA 2018), the Ohio EPA SNAP (2015b) methodology, and the primacy of the biocriteria for determining aquatic life use attainment status (OAC 3745-1-07[C]). These were used in a combined approach to evaluate nutrient effects on the eutrophication status and aquatic life use attainment in the Lower Little Miami River mainstem. Some of the Ohio EPA nutrient thresholds differ from the SW Ohio IPS thresholds.

The results are detailed in a matrix that shows the biocriteria indices, the QHEI score, benthic and sestonic chlorophyll a (as biomass), the maximum and minimum D.O. (based on Datasondes), the width of the highest daily diel D.O. swing, BOD_5, total P, TKN, TSS, nitrate-N, an overall rating of the degree of nutrient enrichment based on the frequency and magnitude of exceedances of thresholds for the aforementioned indicators and parameters with aquatic

[6] OAC 3745-1-36 is not currently listed in the Ohio WQS and will be proposed as a new rule.

***Table 9**. Nutrient assessment thresholds for nutrient and related parameters and indicators developed by Miltner (2018), Ohio EPA (2015b), and Ohio EPA (2018) for assigning eutrophication status to Ohio large rivers as acceptable, enriched, and over-enriched and as used to assess the status of sites in the Lower Little Miami River mainstem in 2022.*

Parameter	Acceptable	Enriched	Over-Enriched	Source
Chlorophyll a (µg/L)[a]	<30	30-100 rapid increase in BOD_5 and 24-h D.O. Range	≥100 BOD5 and TKN always highly elevated	Miltner (2018) Table 6
Chlorophyll a (µg/L)[a]	<30	100 with aesthetic impacts apparent	≥165 with nuisance conditions apparent	Ohio EPA (2018) Slide 2
Chlorophyll a (mg/m^2)[b]	<182	182-320	>320	Ohio EPA SNAP (2015b)
BOD_5 (mg/L)	<2.5	2.5-6.0 range of increasing stress	≥6.0	Miltner (2018) Table 6
TKN (mg/L)	NA	NA	≥0.75	Miltner (2018) Table 6
24-hour D.O. (mg/L)	<7	7-9 rapid increase in BOD_5	≥9	Miltner (2018) Table 6
TSS (mg/L)	NA	>25 screening level under stable hydrograph	NA	Miltner (2018) Table 6
Total P (mg/L)	≤0.130	>0.130	NA	Miltner (2018) Text
Nitrate-N (mg/L)	1.500 "starting point"	NA	NA	Miltner (2018) Text

Footnotes: a - sestonic chlorophyll a as concentration; b - benthic chlorophyll a as biomass.

life use attainment status as the controlling factor (Table 10). Although the longitudinal and temporal trends in the chemical indicators and their relationship to the nutrient enrichment thresholds described by Miltner (2018) has already been thoroughly described individually, the box model matrix allows for as aggregate assessment of the contributing variables along the longitudinal pollution gradients present in the middle Scioto River. The overall degree of nutrient enrichment effects are represented by three narrative ratings of acceptable, enriched, or over enriched contingent on the degree to which each of the parameters and indicators exceeded their respective thresholds in accordance with Miltner (2018) against the attainment status of the applicable aquatic life use designation. Full attainment of the applicable aquatic life use resulted in an acceptable rating in keeping with OAC 3745-1-07(C)(1).

All the 14 mainstem sites evaluated had an acceptable result (Table 10). Eleven of the sites were rated as Acceptable based on full attainment of the EWH use designation and a lack of enrichment responses in the D.O. and chlorophyll a results. Nutrients were elevated, but not enough to counter the full attainment and lack of direct response indications. The related parameters such as BOD5, TKN, and SSC has some elevated levels, but not nearly enough to offset the more direct response indicators. Two sites were impaired for EWH and one for WWH, but for causes other than nutrients thus these were deemed acceptable based on the lack of strong nutrient responses in the D.O. and chlorophyll a indicators. This is a result similar to that

***Table 10**. Results of applying the Ohio Large River nutrient assessment and box model to 14 sites in the 2022 Lower Little Miami River mainstem study area. Thresholds for how each parameter reflects the degree of nutrient enrichment effects and are in Table 9 and at the bottom of the matrix.*

Site ID	River Mile Fish/Macroin-vertebrates	Drainage Area (mi.^{2})	Current Aquatic Life Use[a]	IBI[b]	MIwb[b]	ICI[b]	Aquatic Life Use Status[c]	QHEI	Benthic Chloro-phyll (mg/m^2)	Sestonic Chloro-phyll (mg/L)	BOD_5 (mg/L)	Min. D.O. (mg/L)	Max. D.O. (mg/L)	Max. Daily D.O. Swing	TKN (mg/L)	SSC (mg/L)	TP (mg/L)	Nitrate-N (mg/L)	Overall Nutrient Box Model Status
LM01	27.90/27.90	1070	EWH	50	10.3	42^{ns}	Full	89.5	65.1	2.8	2.5	4.5	9.5	3.5	0.48	15.6	0.21	3.01	Acceptable
LM02	24.10/24.10	1090	EWH	52	10.9	50	Full	91.0	53.0	3.6	2.3	7.1	9.2	1.8	0.65	14.0	0.15	2.10	Acceptable
LM03	22.30/22.30	1150	EWH	47^{ns}	9.5^{ns}	52	Full	84.5	74.1	4.5	2.2	6.9	10.0	2.8	0.52	23.5	0.17	2.20	Acceptable
LM05	21.50/21.50	1160	EWH	47^{ns}	10.3	52	Full	89.5	71.8	5.5	2.3	7.0	10.8	3.8	0.46	13.6	0.17	2.21	Acceptable
LM07	18.50/18.50	1190	EWH	51	10.3	48	Full	89.5	59.3	5.2	2.5	6.9	10.6	3.2	0.49	14.2	0.19	2.31	Acceptable
LM08	17.70/17.70	1190	EWH	52	10.2	50	Full	85.5	61.0	5.5	2.5	7.1	10.3	3.0	0.46	13.3	0.17	2.24	Acceptable
LM09	13.10/13.10	1200	EWH	48	10.0	52	Full	87.8	50.2	6.3	3.0	7.0	9.5	1.9	0.62	12.2	0.20	1.87	Acceptable
LM11	10.90/10.90	1710	EWH	44^{ns}	9.8	42^{ns}	Full	85.0	86.4	5.9	2.5	6.9	9.0	1.1	0.56	22.6	0.26	1.91	Acceptable
LM12	8.10/8.10	1710	EWH	44^{ns}	9.3^{ns}	56	Full	89.3	84.8	5.8	2.5	6.8	8.6	1.1	0.65	11.2	0.25	1.84	Acceptable
LM13	6.83/6.83	1720	EWH	46^{ns}	9.8	54	Full	87.0	84.2	7.1	2.3	6.8	8.5	0.6	0.59	15.5	0.24	1.77	Acceptable
LM15	4.10/4.10	1730	EWH	44^{ns}	10.1	58	Full	87.5	84.6	7.7	2.7	6.7	8.3	0.7	0.63	16.3	0.24	1.69	Acceptable
LM16A	3.70/3.70	1740	EWH	30*	8.8*	40*	Non	65.0	84.2	4.97	3.2	3.1	8.5	5.3	0.64	21.6	0.20	0.91	Acceptable
LM16	3.50/3.50	1750	EWH	41*	9.2^{ns}	42^{ns}	Partial	84.0	82.7	6.1	2.3	6.6	8.3	0.8	0.59	17.5	0.24	1.73	Acceptable
LM17	1.60/1.60	1760	WWH	36^{ns}	7.8*		Partial	62.0	127.0	7.3	2.5	7.1	11.0	3.6	0.66	10.7	0.22	1.66	Acceptable
Narrative Threshold Rankings		Exceptional		48-60	>9.6	≥42	FULL	>75											Acceptable
		Good		38-43	8.0-9.1	32-40	FULL	60-74	<182	<30	<2.5	>4	<12	<7.0	<0.75	<20	≤0.13	<1.56	Acceptable
		Fair		26-37	5.8-7.9	14-30	PART./NON	46-59	182-320	30-100	2.5-5.9	<4	>12	7.0 - 8.9	≥0.75	>20	>0.13	≥1.56	Enriched
		Poor		19-25	4.0-5.7	8-12	NON-Poor	30-45	>320	>100	≥6.0	<2	>15	>9.0	≥0.75				Over Enriched
		Very Poor		12-18	<4.0	0-6	NON-V.Poor	<30											
Source		Ohio EPA		Ohio EPA					SNAP	OEPA	OEPA	OEPA	OEPA	OEPS	OEPA	OEPA	OEPA	OEPA	OEPA

observed in 2017 using a modification of the SNAP assessment. A SNAP assessment was not conducted in 2012 as the methodology had not been developed at that time. An inspection of the 2012 D.O. results indicated a response to nutrient enrichment with extended diel D.O. variations that eclipsed the maximum of 12 mg/L. However nutrient levels were lower than in 2017 and 2022, but partial attainment of EWH was prevalent at most sites in the mainstem with only three of 17 sites attaining EWH. Without a more detailed re-analysis of the 2012 results it is not certain that nutrients would have been the sole or primary cause of the partial attainment.

Urban Parameters - Little Miami River Mainstem

Urban parameters include ionic strength measures such as conductivity, total dissolved solids, and total chlorides plus selected heavy metals such as copper, lead, and zinc. Suspended sediment (SSC) is included as a proxy for totals suspended solids (TSS) which is used frequently as an indicator of urban stormwater even though it is seldom directly related to aquatic life impairments. TKN is also considered an urban parameter as it has been shown to be an indicator of urban nonpoint source runoff. Major sources of organic nitrogen in urban stormwater runoff include organic nitrogen in algae, lawn and garden fertilizers, pet waste, leaking septic tanks, landfills, effluent from sewage treatment plants, and vehicle exhaust (U.S. EPA 2020). Nitrogen from aerial and terrestrial sources accumulates on roads and parking lots until runoff from a precipitation event carries the pollutants into stormwater drains and directly to local waterbodies. All of these parameters are commonly elevated in urban areas and are the result of stormwater runoff, but can also be indicative of other industrial and municipal sources of pollution. In addition to graphical depictions of these parameters the IPS biological effect thresholds (MBI 2015) were used to assess all of the urban parameters similar to the preceding analyses of nutrient and demand parameters (Table 11).

Chlorides

Median total chlorides generally declined through the study area in 2022 with values in the poor range at LM01 (RM 27.90) and a longitudinal pattern similar to nitrate-N and *E. Coli* (Figure 18). With the exception of a mean value that just exceeded the good threshold (Table 11), all median and mean values were in the upper good range with some borderline fair values. Maximum values were at or just into the poor range declining into the fair range in the lower one half of the mainstem (Figure 18). The 2022 median values were consistently the lowest of the 1983, 2007, 2012, and 2017 surveys. Median levels in 2017 were only slightly higher than in 2022 with both being among the highest flow years of the historical surveys. Median values were higher in 2007 and 2012 which had substantially lower flows by comparison (see Figure 8).

Specific Conductance and Total Dissolved Solids (TSS)

Specific conductance was measured by via grab sampling and short-term deployment of Datasondes at all 2022 Little Miami River mainstem sites (Table 11; Figure 19). Grab sample medians and means were all within the good IPS range with the exception of site LM01 (RM

***Table 11**. Urban source related parameter median and mean values at 14 sites in the Lower Little Miami River mainstem in 2022. Color shading corresponds to IPS and other thresholds for each parameter listed in the legend below the table. The corresponding chronic water quality criteria at 300 mg/L hardness for metals parameters are listed with the good IPS thresholds.*

Site ID	River Mile	Aquatic Life Use	Drainage Area (Sq. mi.)	Specific Conductivity (umhos/cm)		Total Dissolved Solids (TDS) (mg/L)		Suspended Sediment Concentration (SSC)		Chloride (mg/L)		Total Kjeldahl Nitrogen (mg/L)		Total Cadmium (µg/L)		Total Copper (µg/L)		Total Lead (µg/L)		Total Zinc (µg/L)	
				Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean
Little Miami River																					
LM01	27.90	EWH	1069.0	810	826	450	445	17.0	15.6	98	97	0.52	0.48	BD	BD	3.15	2.65	25.40	21.03	20.50	20.75
LM02	24.10	EWH	1085.0	694	715	386	593	10.4	14.0	59	62	0.51	0.65	BD	BD	2.75	2.57	24.20	19.83	21.30	18.62
LM03	22.30	EWH	1148.0	691	665	356	355	16.0	23.5	62	62	0.51	0.52	BD	BD	3.05	2.77	26.70	21.39	14.70	14.15
LM05	21.50	EWH	1160.0	710	704	356	363	9.5	13.6	65	63	0.45	0.46	BD	BD	2.85	2.68	22.90	19.98	22.95	21.73
LM07	18.50	EWH	1187.0	710	718	374	385	9.5	14.2	67	68	0.46	0.49	BD	BD	3.30	2.77	25.55	20.68	22.90	23.02
LM08	17.70	EWH	1190.0	700	681	386	391	9.9	13.3	66	70	0.48	0.46	BD	BD	2.95	2.83	27.00	21.73	17.70	17.27
LM09	13.10	EWH	1203.0	698	681	376	379	10.5	12.2	64	67	0.55	0.62	BD	BD	3.50	4.12	26.40	22.28	25.20	27.75
LM11	10.90	EWH	1707.0	664	643	338	353	10.5	22.6	57	61	0.51	0.56	BD	BD	3.50	3.77	24.45	20.76	18.75	18.63
LM12	8.10	EWH	1710.0	673	643	340	341	10.3	11.2	59	60	0.61	0.65	BD	BD	4.00	4.67	22.75	20.04	22.85	24.75
LM13	6.83	EWH	1720.0	673	640	332	341	8.2	15.5	59	59	0.50	0.59	BD	BD	3.20	8.96*	25.25	21.71	22.00	21.35
LM15	4.10	EWH	1730.0	649	638	348	341	9.0	16.3	57	58	0.58	0.63	BD	BD	4.30	4.47	23.75	19.31	20.45	20.15
LM16a	3.70	EWH	1752.0	659	671	340	343	17.5	21.6	60	65	0.71	0.64	BD	BD	3.50	4.53	23.35	19.74	24.40	35.75
LM16	3.50	EWH	1752.0	646	635	326	327	11.5	17.5	58	59	0.50	0.59	BD	BD	3.40	3.28	17.45	17.03	18.70	19.18
LM17	1.60	EWH	1754.0	642	638	342	333	10.5	10.7	59	61	0.60	0.66	BD	BD	3.75	4.52	18.15*	17.29	15.45	15.78
Boatable Sites		Excellent		<580		<302		<43.5		<32.9		<0.30		BD		<5.9		<2.7		<16.4	
		Good		<730		<396		<74.3		<68.4		<1.05		BD/5.8		<8.9/24.0		<17.4/26.0		<39.3/300.0	
		Fair		<805		<442		<132.6		<86.1		<2.10		BD		<10.4		<26.8		<50.8	
		Poor		<992		<559		<156.7		<130.6		<2.55		BD		<14.1		<50.3		<79.4	
		Very Poor		≥992		≥559		≥156.7		≥130.6		≥2.55		BD		≥14.1		≥50.3		≥79.4	

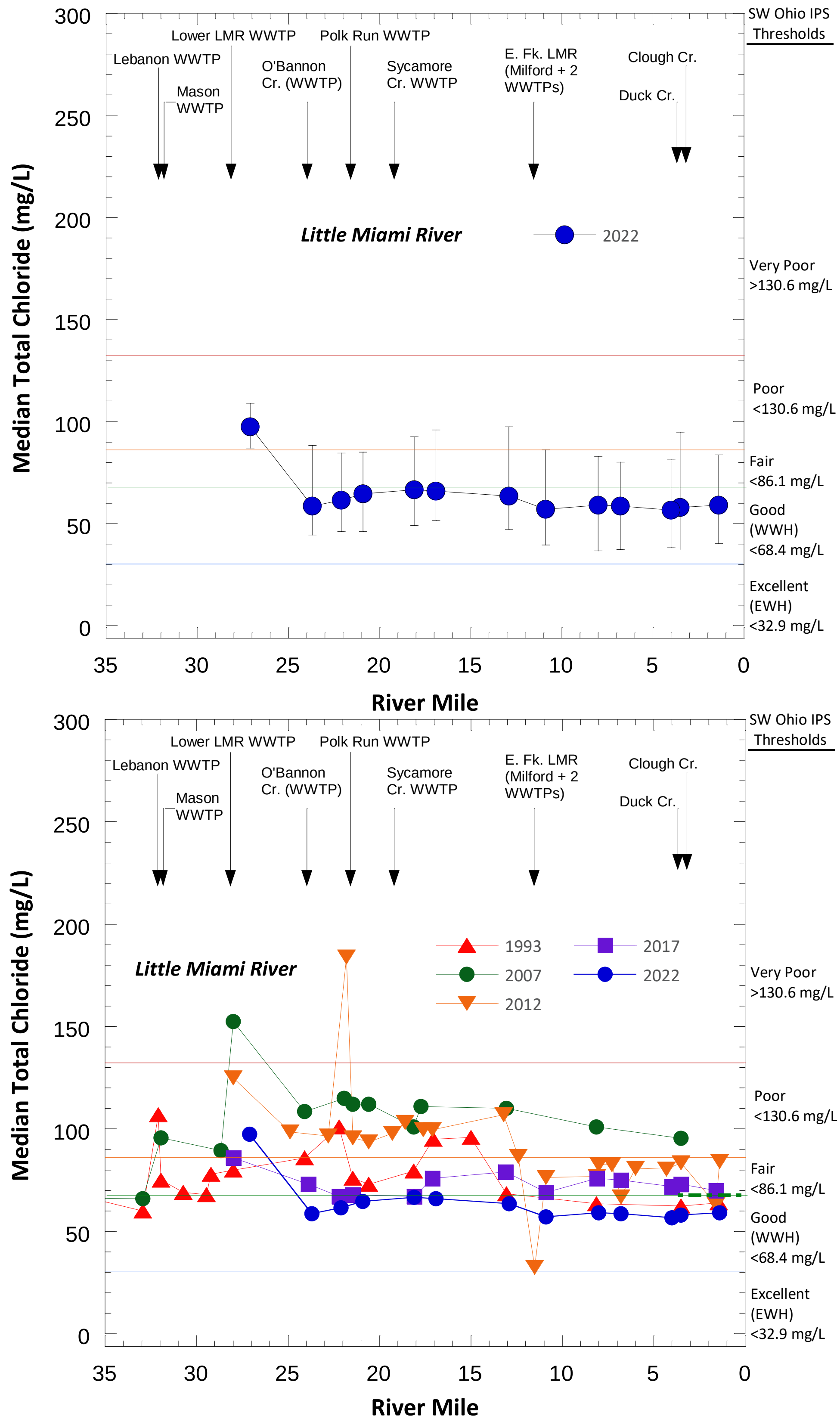


Figure 18. *Median, maximum, and minimum total chloride values in 2022 (upper) and median TKN values in 1983, 2007, 2012, 2017, and 2022 (lower). The IPS thresholds are depicted by the solid colored lines. Major discharges and tributaries are indicated across the top.*

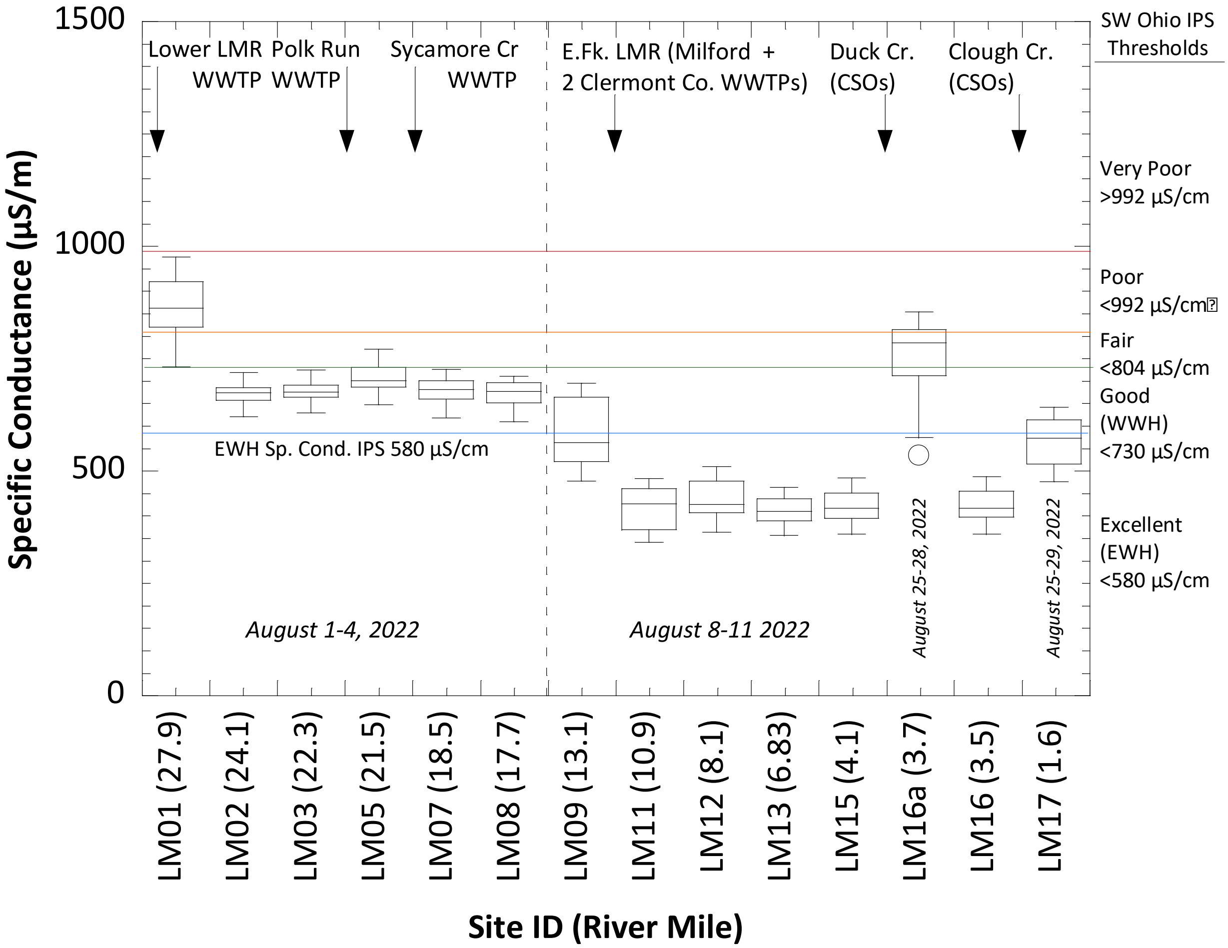


Figure 19. *Box-and-whisker plots of specific conductance from Datasonde continuous recorders at 14 sites in the Little Miami River mainstem during August 1-4, 8-11, and 25-29, 2022. The IPS thresholds are depicted as colored solid lines. Major discharges and tributaries are indicated across the top.*

27.90) that was in the fair range (Table 11). The continuous results from August 2022 showed a somewhat similar longitudinal pattern with poor values at LM01 (RM 27.90) and a generally declining pattern in a general downstream direction with values in the good range between LM02 (RM 24.10) to the East Fork confluence and then declining to the exceptional range at all except two sites, LM16A (RM 3.70) and LM17 (RM 1.70; Figure 19). Maximum and upper quartile (75th percentile) values spiked into the poor range at LM16A with the median in the fair range, reflecting the effect of Duck Creek on this site. Again, as with other parameters that increased at LM16A, values returned to upstream excellent range levels at LM16 (RM 3.50). Values increased at LM17 (RM 1.70) with just less than one half the values into the good range.

This same pattern was perhaps accentuated by TDS median and mean values that were likewise in the good range excepting poor median and mean values at LM01 (RM 27.90) and a very poor mean at LM02 (RM 24.10) in 2022 (Table 11). The longitudinal profile from prior years in 2007 and 2012 showed higher values and increases immediately downstream from point sources, but values between sites were remarkably similar to 2017 and 2022 and not reflective of any specific sources. This is the same conclusion that was reached in 2012 showing that few if any changes have taken place over the past five years since 2017. TDS were likewise in excess of both the excellent and good IPS thresholds in 2017.

Suspended sediment Concentration (SSC)

Median SSC concentrations in 2022 were well within the excellent range (Table 11; Figure 20). A few maximum values were in the good range with one just into the fair range an indication of the variability in this parameter. Median values in 2022 were similar to 2017 and are the lowest among the historical surveys and in the excellent range. The highest values occurred in 2007 followed by 2012, but all except three sites in the good range in 2007, all were within the excellent range (Figure 20). SSC can serve as a proxy for TSS which is a commonly employed indicator parameter for urban stormwater. However, it has consistently exhibited a poor relationship with the condition of the aquatic biota which serves as the arbiter of designated use attainment. A more complex array of parameters as employed herein is needed to better characterize stormwater quality and impacts.

Other Urban Parameters

All of the data were within the good or excellent IPS thresholds for TKN as were the heavy metals total cadmium, total copper, or total zinc in the mainstem in 2022. A single low level exceedance of the copper criteria (36 µg/L) occurred at LM13 although the mean and median values were low (Table 11). Total lead had median and mean values that were consistently in the fair range with a median value in the poor range at LM08 (RM 17.70) which is 0.4 miles downstream from Sycamore Creek, although most values were “estimated” indicating uncertainty about the true value although most values were “estimated” indicating uncertainty about the true value. The IPS thresholds for cadmium, copper, and zinc are lower than the current chronic of Outside Mixing Zone Average (OZMA) chronic water quality criteria for each, but lead is close with the IPS threshold for fair being equivalent to the OMZA at 300 mg/L hardness (Table 11). These results are reflective of modest impacts by urban potential stormwater that largely enters the mainstem via tributaries such as Sycamore Creek and Duck Creek, although there is uncertainty about the measure values.

Sediment Chemistry

Sediment samples were collected from 14 sites in the Little Miami River mainstem in October 2022 and analyzed for heavy metals and organic compounds. The results were screened with the MacDonald et al. (2000) and Persuad et al. (1993) consensus-based levels for potential adverse effects to aquatic life and Ohio Sediment Reference Values (SRVs). MacDonald et al. (2000) described two levels of contamination - a Threshold Effects Concentration (TEC) and a Probable Effects Concentration (PEC). Persaud et al. (1993) described a similar scheme with a Severe Effect Level (SEL) and Low Effect Level (LEL). The TEC or LEL indicates exceedances for sensitive species and taxa while the PEC or SEL indicates effects for most species and taxa. The Ohio SRVs are based on reference sites data and thus reflect background levels. IPS thresholds have not yet been developed for sediment chemicals.

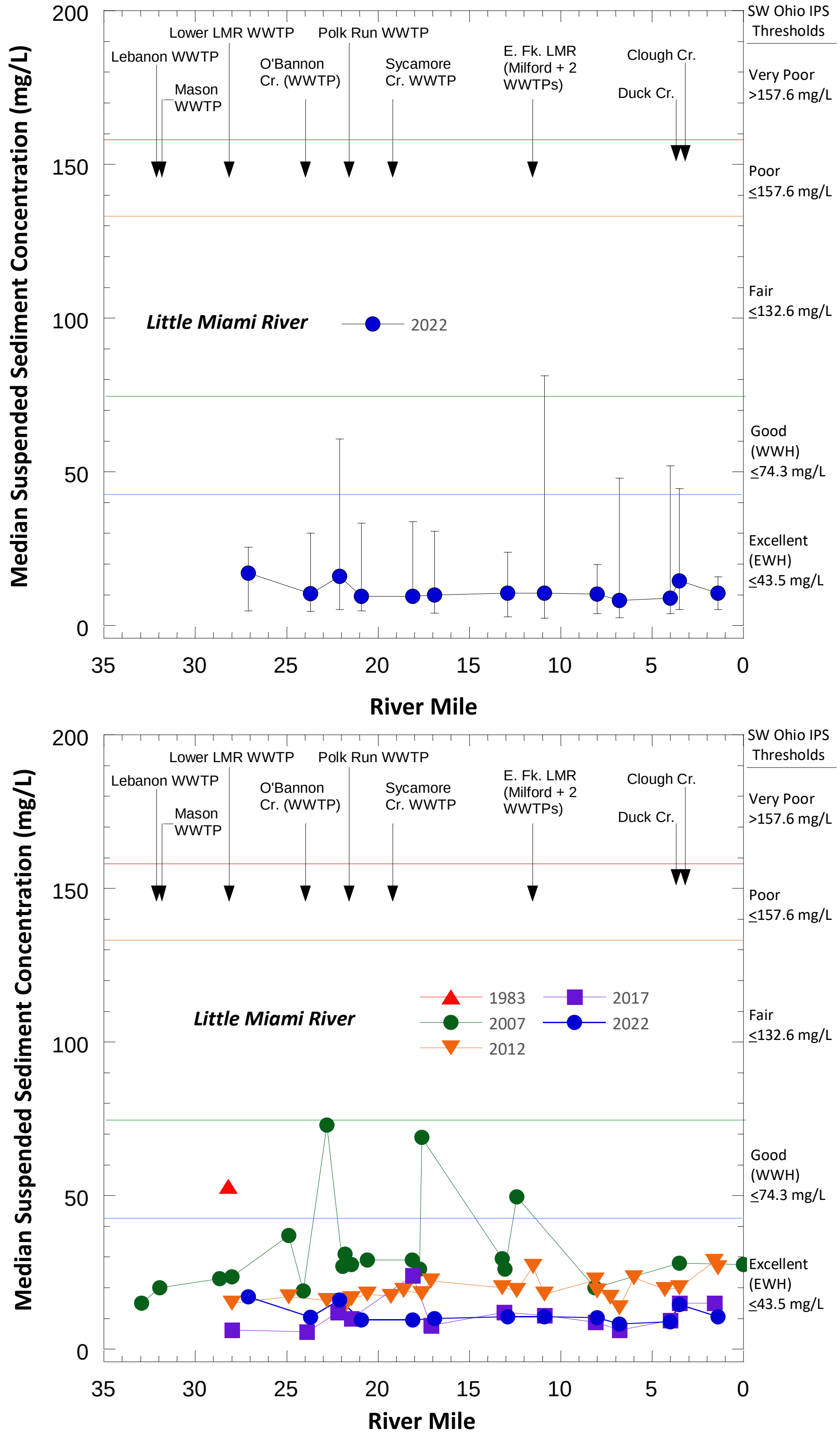


Figure 20. *Median, maximum, and minimum suspended sediment concentration (SSC) values in 2022 (upper) and median TKN values in 1983, 2007, 2012, 2017, and 2022 (lower). The IPS thresholds are depicted by the solid colored lines. Major discharges and tributaries are indicated across the top.*

***Table 12**. Sediment metals concentrations (mg/kg) for parameters with values >detection in the Little Miami River study area in October 2022. Values above the MacDonald et al. (2000) Threshold Effect Concentration (TEL) and Probable Effect Concentration (PEC) thresholds or above Ohio Sediment Reference Values (SRVs) are shaded in accordance with the color-code key at bottom. BD – below detection.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
Little Miami River								
LM01	27.90	1069.0	4.30	BD	BD	12000	BD	BD
LM02	24.10	1085.0	4.20	BD	4.60	-	BD	BD
LM03	22.30	1148.0	2.60	BD	3.40	6200	5.10	13
LM05	21.50	1160.0	1.90	BD	BD	-	BD	BD
LM07	18.50	1187.0	2.40	BD	6.60	-	BD	BD
LM08	17.70	1190.0	1.70	BD	4.70	-	BD	BD
LM09	13.10	1203.0	2.60	BD	5.30	-	BD	BD
LM11	10.90	1707.0	4.10	BD	BD	-	BD	BD
LM12	8.10	1710.0	3.90	0.53	8.90	-	BD	37
LM13	6.83	1720.0	2.20	BD	5.30	-	BD	BD
LM15	4.10	1730.0	3.70	0.61	1.80	-	8.60	16
LM16a	3.70	1752.0	4.90	0.53	3.00	-	8.60	18
LM16	3.50	1752.0	1.60	0.54	2.40	-	7.70	12
LM17	1.60	1754.0	1.70	0.57	3.40	-	8.40	43
Ohio EPA		>SRV	>25.1	>0.8	>33	>51000	>47	>170
MacDonald et al. (2000)		>PEC	>33	>5	>149	--	>128	>459
		>TEC	>9.79	>0.99	>32	--	>23	>121
		≤TEC	<9.79	≤0.99	≤32	<51000	≤23	≤121

Sediment Metals

There were no exceedances of TECs for any sediment metal that was analyzed and detected in the mainstem in 2022 (Table 12). Arsenic was the only metal parameter that was detected at every site while copper was detected at 11 sites. Cadmium, lead, and zinc were below detection at about one-half the sites with detections occurring in the downstream half of the mainstem. While none of the results indicate any threat to aquatic life, the pattern of detection indicates the influence of urban stormwater and other discharges that tends to accumulate in a downstream direction.

Sediment Organics

Organic chemical parameters that were detected in Little Miami River mainstem sediment samples revealed varying exceedances of only the MacDonald (2000) TEC and the Persuad et al. (1993) LEL thresholds in selected instances with a high number of below detection results (Table 13). Eleven (11) polycyclic aromatic hydrocarbon compounds were detected at all of the mainstem sites, but most were below the TEL or LEL thresholds. Benzo(a)anthracene, dibenzo(a,h)anthracene, and pyrene most frequently exceeded the TEC at the majority of

***Table 13**. Sediment PAH and selected organic chemical parameter concentrations (µg/kg) in the Little Miami River mainstem in October 2022. Values above the MacDonald et al. (2000) TEC and PEC and Persaud et al. (1993) SEL and LEL thresholds are shaded in accordance with the color-code key at the bottom of the table. BD – below detection; AD – above detection.*

Site ID	River Mile	Drain-age Area (Sq. mi.)	Acenaphthylene (mg/kg dry)	Anthracene (mg/kg dry)	Benzo(a)anthracene (mg/kg dry)	Benzo(a)pyrene (mg/kg dry)	Benzo(b)fluoranthene (mg/kg dry)	Benzo(g,h,i)perylene (mg/kg dry)	Benzo(k)fluoranthene (mg/kg dry)	Chrysene (mg/kg dry)	Dibenzo(a,h)anthracene (mg/kg dry)	Fluoranthene (mg/kg dry)	Indeno(1,2,3-cd)pyrene (mg/kg dry)	Phenanthrene (mg/kg dry)	Pyrene (mg/kg dry)	n-Octadecane (mg/kg dry)	Fluorene (mg/kg dry)	Naphthalene (mg/kg dry)	Acenaphthene (mg/kg dry)	Carbazole (mg/kg dry)	Bis(2-ethylhexyl)phthalate (mg/kg dry)	Toluene (mg/kg dry)	1,4-Dichlorobenzene (mg/kg dry)	Aroclor 1221 (mg/kg dry)	Aroclor 1254 (mg/kg dry)
Little Miami River																									
LM01	27.90	1069.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BD	BD	BD	BD
LM02	24.10	1085.0	0.04	0.05	0.22	0.29	0.42	0.22	0.14	0.29	0.07	0.60	0.28	0.20	0.46	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM03	22.30	1148.0	BD	BD	0.03	0.04	0.05	0.03	0.03	0.03	BD	0.08	0.03	0.04	0.06	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM05	21.50	1160.0	BD	0.04	0.14	0.20	0.24	0.14	0.11	0.13	0.06	0.33	0.17	0.15	0.25	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM07	18.50	1187.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BD	BD	BD	BD
LM08	17.70	1190.0	BD	BD	0.14	0.18	0.25	0.14	0.09	0.18	0.04	0.38	0.16	0.13	0.29	193.30	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM09	13.10	1203.0	0.05	0.07	0.29	0.40	0.52	0.32	0.22	0.43	0.09	0.79	0.37	0.45	0.64	130.40	0.03	0.40	BD	BD	BD	BD	BD	BD	BD
LM11	10.90	1707.0	BD	0.04	0.15	0.13	0.16	0.09	0.07	0.10	0.06	0.28	0.13	0.14	0.22	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM12	8.10	1710.0	BD	0.03	0.11	0.11	0.14	0.08	0.07	0.08	0.06	0.17	0.10	0.07	0.14	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM13	6.83	1720.0	0.03	0.07	0.28	0.32	0.54	0.26	0.21	0.44	0.07	0.81	0.31	0.24	0.63	BD	BD	0.03	BD	BD	BD	BD	BD	BD	BD
LM15	4.10	1730.0	BD	BD	0.02	0.01	0.02	0.01	BD	0.01	BD	0.03	0.01	0.01	0.02	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM16a	3.70	1752.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BD	BD	BD	BD
LM16	3.50	1752.0	0.05	0.09	0.35	0.37	0.49	0.24	0.16	0.43	0.05	0.87	0.27	0.49	0.76	BD	0.04	0.01	0.02	0.05	BD	BD	BD	BD	BD
LM17	1.60	1754.0	BD	BD	0.10	0.10	0.15	0.07	0.05	0.08	BD	0.20	0.08	0.05	0.16	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
MacDonald et al. (2000) Thresholds		PEC	--	>0.845	>1.050	--	--	--	--	>1.29	--	>2.230	--	>1.170	>1.520	--	>0.536	>0.561	>88.90	--	--	--	--	--	--
		TEC	--	>0.057	>0.108	--	--	--	--	>0.166	>0.033	>0.423	--	>0.204	>0.195	--	>0.077	>0.176	>6.710	--	--	--	--	--	--
Persaud et al. (1993) Thresholds		SEL	>0.088	>370	>1480	>1440	>1340	>320	>1340	>460	>130	>1020	>320	>950	>850	--	>160	>0.391	>88.9	--	--	--	--	--	>340
		LEL	>0.0067	>0.220	>0.320	>0.370	>0.240	>0.170	>0.240	>0.340	>0.060	>0.750	>0.200	>0.560	>0.490	AD	>0.190	>0.034	>6.710	AD	AD	AD	AD	AD	>60
		<LEL/TEC	<0.0067	<0.057	<0.108	<0.370	<0.240	<0.170	<0.240	<0.166	<0.033	<0.423	<0.200	<0.204	<0.195	BD	<0.077	<0.034	<6.710	BD	BD	BD	BD	BD	<60

mainstem sites. Other PAH compounds such as anthracene, chrysene, fluoranthene, phenanthrene, and naphthalene exceeded the TEC at LEL at a handful of sites. The only non-PAH compound detected was the aromatic heterocyclic organic carbazole at a single site in the lower mainstem. PAH compounds are commonly detected in sediment samples at sites impacted by urban runoff. All of the detected PAH compounds are by products of coal tar, gasoline exhaust, and incomplete combustion of coal and oil and several are known carcinogens. Most of these compounds are not manufactured and are more commonly detected in urban rivers and streams with runoff from asphalt pavement and heavy automobile traffic as the primary sources.

Conventional, Demand, and Nutrient Parameters - Tributary Subwatersheds

Results in the tributary subwatersheds are portrayed in tables for all sites where water samples were collected and graphically for the mainstem of Duck Creek. Three sites that were classified as Primary Headwater Habitat were not sampled for water chemistry. The tributary subwatersheds have a wide range of impacts ranging from relatively unimpacted in Polk Run to wastewater and urban runoff in Sycamore Creek, CSOs in Clough Creek, and numerous CSOs and urban stormwater conveyances in Duck Creek. The latter also has a mix of WWH and Limited Resource Water (LRW) designated streams and mainstem reaches, thus parameters with water quality criteria and IPS threshold differences as a result of the differing existing and recommended aquatic life use designations were included in the assessment of the results. Three sites in the Duck Creek subwatershed are classified as Primary Headwater Habitat, one PHW1 (also LRW designated), one PHW2, and one PHW3A. One site in the unnamed tributary at RM 1.82 to the unnamed tributary Sycamore Creek at RM 1.12 (LM54) is classified as a PHW3A. Only one of these sites (LM82) had water chemistry data. The sampling in Duck Creek included a total of 16 sites, eight (8) in the mainstem, four (4) in Little Duck Creek, two (2) in the East Fork Duck Creek, and two sites each in two unnamed tributaries one to Duck Creek at RM 4.8 (LM80) and the other to Little Duck Creek at RM 4.42 (LM82). The sampling in Sycamore Creek, Polk Run, and Clough Creek included eight (8) sites of which five (5) were in the Sycamore Creek subwatershed. Sycamore Creek receives four (4) SSO and one WWTP discharge in proximity to the sampling sites (see Table 8). The two sites in Clough Creek are impacted by two CSOs and two SSOs and Polk Run is affected only by a low level of urban runoff.

Dissolved Oxygen (D.O.)

D.O. was measured with daytime grab samples and continuously over a short term period of four days in August 2022 at three (3) sites in Sycamore Creek, one (1) site in Polk Run, seven (7) sites in the Duck Creek mainstem, one (1) site in the East Fork Duck Creek, and one (1) site in Clough Creek (Figure 21). The results at the two upstream sites in Sycamore Creek showed wide diel variations with minimums well above the average WWH criteria and an indication of excessive nutrient effects. The site downstream from the WWTP had a considerably reduced diel variation a likely response to the “diluting” effect of treated wastewater. Polk Run exhibited a much narrower diel fluctuation an indication of no apparent enrichment effects a result that was mimicked by the Clough Creek results.

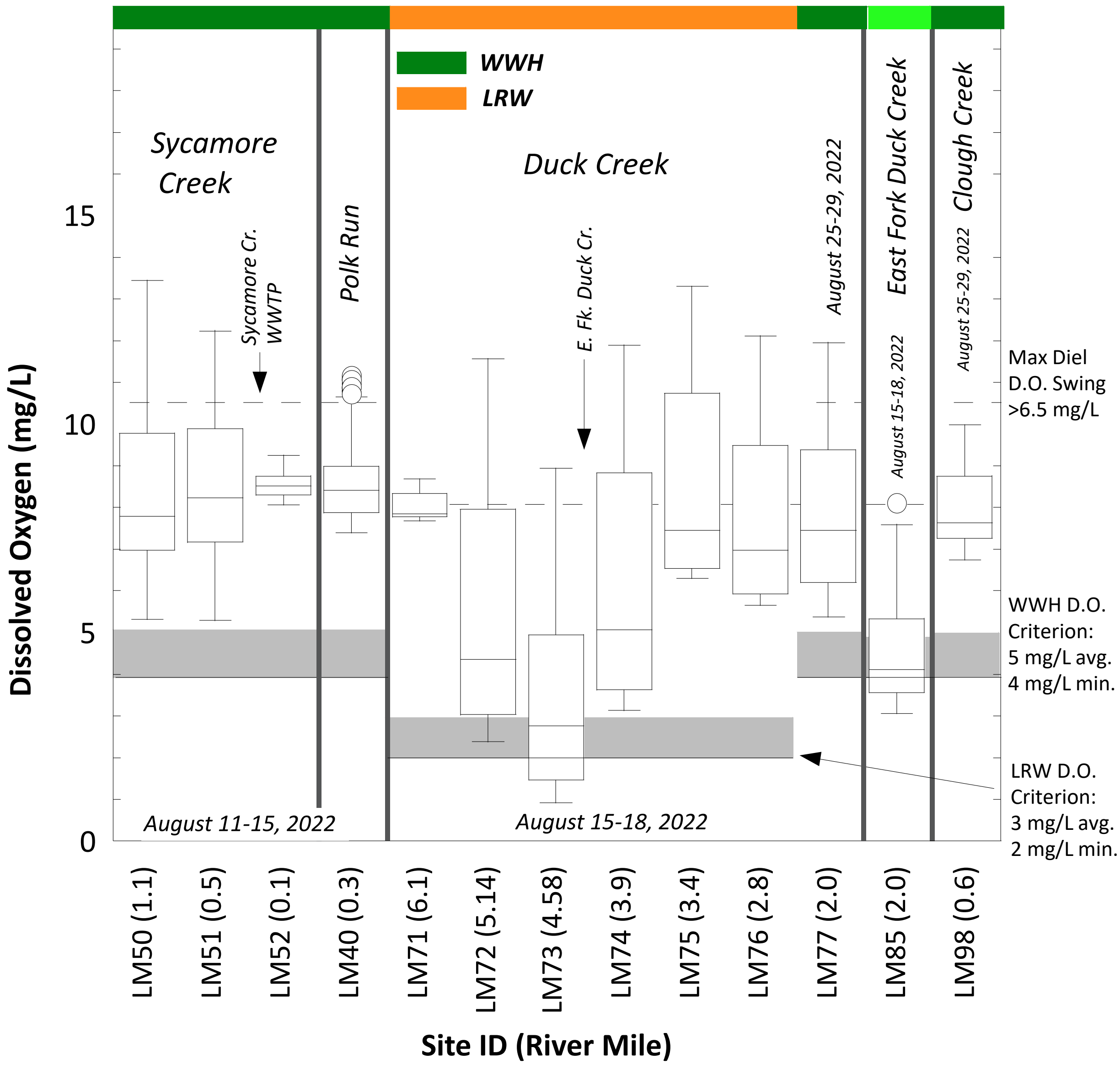


***Figure 21**. Box-and-whisker plots of continuous D.O. from Datasonde continuous recorders at 13 sites in Duck Creek, Sycamore Creek, Polk Run, and Clough Creek during August 11-15, 15-18, and 25-29, 2022. The WWH and LRW daily average and minimum criteria are indicated by gray shaded bars, solid lines, and the maximum D.O. indicative of excessive diel swings is indicated by a black dashed line. The applicable use designation is shown as a colored bar across the top of the graph (green – WWH; light green – WWH recommended; orange – LRW).*

The results in the Duck Creek mainstem varied considerably with all except the upstream most site (LM71) either showing a wide diel swing or low minimum values that exceeded the 2.0 mg/L minimum LRW criterion at LM73 (Figure 21). The East Fork at LM85 exceeded the WWH 4.0 mg/L minimum D.O. criterion which the results were evaluated against given the recommendation to upgrade the use form LRW to WWH. These results show the impacts of numerous CSO discharges, urban runoff, and the modified habitat in the LRW designed reach of the Duck Creek mainstem that has reduced assimilative capacity and accelerated downstream delivery of pollutants.

Temperature (℃)

With the exception of the upstream most site in Duck Creek (LM71), median temperature was generally between 21-23°C (Figure 22). Maximum values were all less than 27.8°C, well below the WWH maximum of 29.4°C and the LRW maximum of 34.0°C. The width of the diel swing on Temperature was higher in smaller streams which are less buffered from solar insolation and nighttime cooling than large streams or those with a wastewater discharge. The results are otherwise unremarkable with no patterns related to land use or wastewater discharges.

pH (S.U.)

Median pH values were generally in the range of 7.8-8.3 S.U. which is only slightly higher than the median of reference sites for headwater streams in the SW Ohio IPS database. One site in Duck Creek (LM72) had a maximum of 9.1 S.U. which is a technical exceedance of the pH water quality criterion (Figure 23). The diel swings were wider than in the mainstem a reflection of the smaller stream size and more influence from urban and CSO/SSO nutrient enrichment.

Ammonia-N

Median and mean total ammonia-N values were generally below or close to the method detection limit at except six (6) sites in the Little Miami River tributaries (Table 14). The only value outside of the excellent or good IPS ranges was a mean value of 0.87 mg/L at the upstream most site (LM50) in Sycamore Creek. This site is impacted by two SSOs. This impact apparently was episodic as evidenced by the comparatively low median of 0.03 mg/L and short lived as the ammonia-N next site (LM51) 0.6 miles downstream was below detection.

Nitrate-N

Mean and median total nitrate-N values were largely within the excellent range of IPS thresholds with eight (8) sites in Duck Creek within the good range (Table 14). Two sites in Sycamore Creek (LM52) downstream from the WWTP had nitrate-N values in the very poor range, a result of the nitrification process to reduce ammonia-N.

Total Kjeldahl Nitrogen (TKN)

Mean and median TKN values were predominantly in the excellent and good ranges at the majority of sites (Table 14). However, values in the fair range were more frequent. The mean in Sycamore Creek at site LM50 (RM 1.10) was in the fair range and disproportionate to the mean indicating an episodic event similar to the ammonia-N result. This site is downstream of two SSOs. The Sycamore Creek site (LM52) downstream from the WWTP also had virtually identical elevated mean and median values in the fair range indicating a more consistent exposure. The other fair range median and mean values were in the unnamed tributary to Duck Creek at RM 4.8 (LM80) and the unnamed tributary to Little Duck Creek at RM 4.8 (LM82) also with similar mean and median values indicating a more consistent exposure. Both sites are impacted by the same three CSOs.

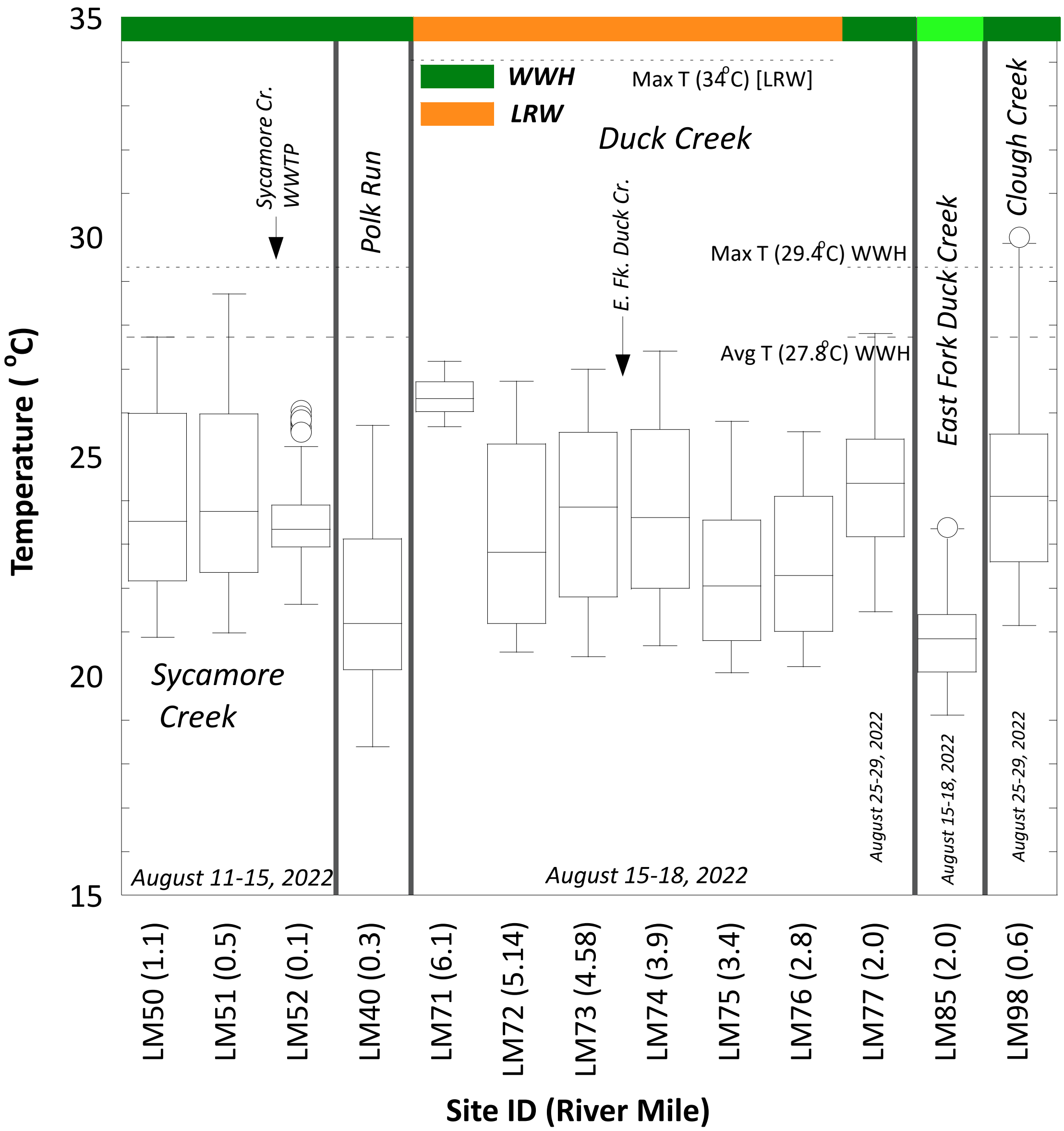


***Figure 22**. Box-and-whisker plots of continuous temperature (°C) from Datasonde continuous recorders at 13 sites in Duck Creek, Sycamore Creek, Polk Run, and Clough Creek during August 11-15, 15-18, and 25-29, 2022. The WWH and LRW daily average and minimum criteria are indicated by dashed and dotted lines. The applicable use designation is shown as a colored bar across the top of the graph (green – WWH; light green – WWH recommended; orange – LRW).*

Fecal Bacteria (E. coli)

A graph of *E. coli* levels in the Duck Creek mainstem was included to serve as an indicator of excessive organic enrichment in the form of sewage inputs from CSOs and SSOs. The 2022 results were highlighted earlier regarding the contact recreation use implications (see Table 3). The recreation use criteria are included along with a level of *E. coli* (5,000 cfu/100 mL) that is almost certainly due to human sewage as the primary source in Figure 24. Values that exceed the SCR criterion of 1,030 cfu/100 mL are also likely the result of human sewage. Using these thresholds there are significant sources of sewage inputs to Duck Creek from CSOs and SSOs in

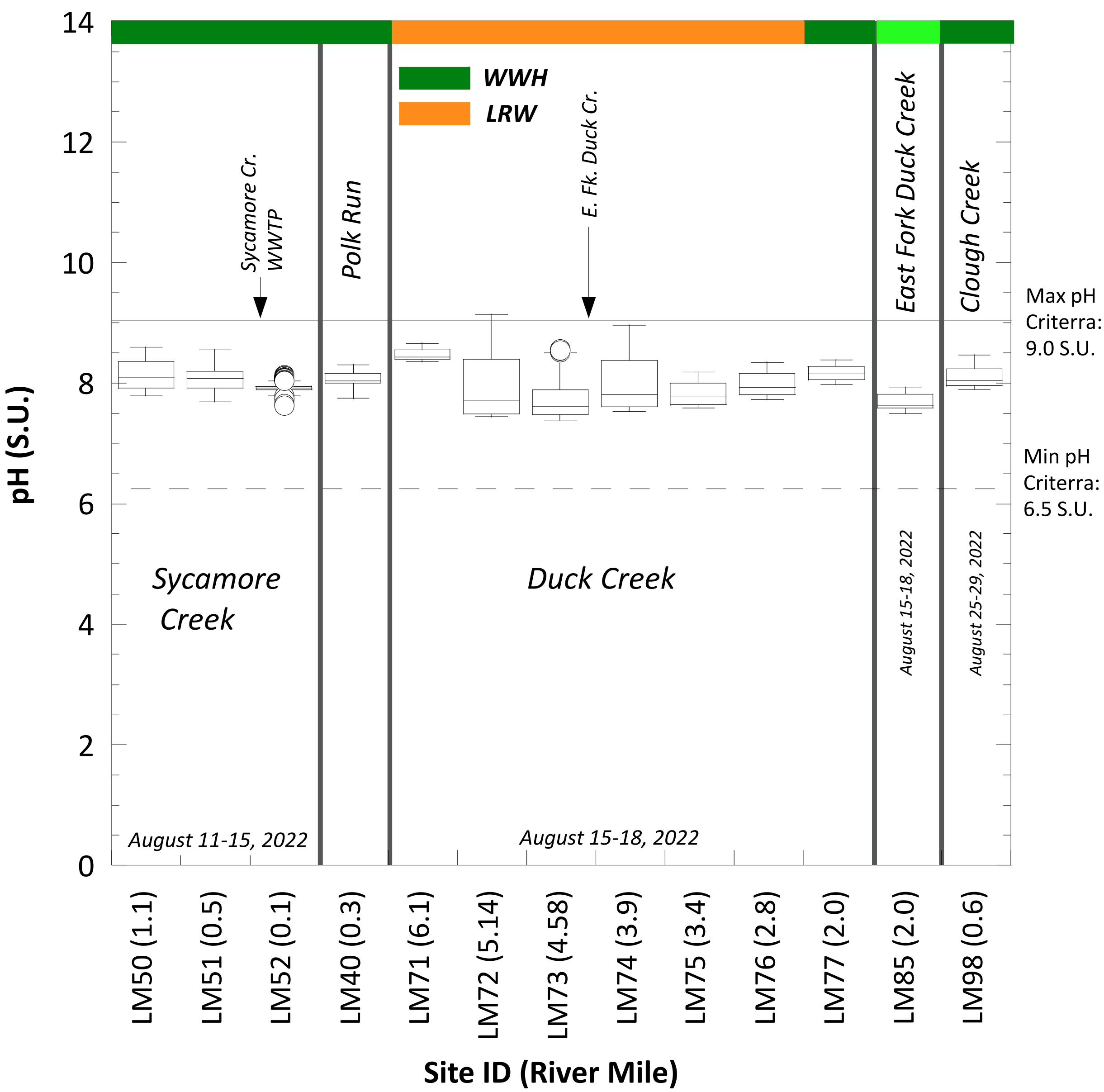


***Figure 23**. Box-and-whisker plots of continuous pH (S.U.) from Datasonde continuous recorders at 13 sites in Duck Creek, Sycamore Creek, Polk Run, and Clough Creek during August 11-15, 15-18, and 25-29, 2022. The range of pH criteria of 6.5-9.0 S.U. is indicated by dashed and solid lines. The applicable use designation is shown as a colored bar across the top of the graph (green – WWH; light green – WWH recommended; orange – LRW).*

the upper one half of the LRW designated reach. Mean values greater than the 1,030 cfu/100 mL Secondary Contact criterion and maximum values of 75,000 cfu/100 mL is certainly indicative of sewage releases into Duck Creek that essentially acts as a "point source" to the Little Miami River mainstem. Based on a comparison of means from 2012, 2017, and 2022 the levels of *E. coli* have been essentially unchanged over that time period with the exception of very low levels at the upstream most site in Duck Creek.

***Table 14**. Ammonia-N and nutrient related parameter median and mean values at 24 Little Miami River tributary sites in 2022. Color shading corresponds to wadeable and headwater site IPS and other thresholds for each parameter listed in the legend at the bottom of the table.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Total Ammonia (mg/L)		Total Nitrate (mg/L)		TKN (mg/L)		Total Phsphorus (mg/L)		Sestonic Chlorophyll (µg/L)		Benthic Chlorophyll (mg/m^2)
			Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	
Sycamore Creek (LMR RM 19.2)													
LM50	1.10	14.7	0.03	0.87	0.37	0.39	0.24	1.27	0.47	0.49	2.64	5.07	72.80
LM51	0.50	24.0	BD	BD	0.15	0.24	0.31	0.30	0.12	0.12	1.34	2.25	92.80
LM52	0.10	24.0	BD	BD	4.88	4.75	0.68	0.67	0.13	0.17	1.00	1.29	151.00
Unnamed Tributary to Sycamore Creek at RM 1.12													
LM55	1.20	5.3	BD	BD	0.14	0.14	0.18	0.18	0.10	0.10	1.00	1.00	-
LM56	0.20	5.6	BD	BD	0.09	0.09	0.22	0.22	0.08	0.08	6.60	6.60	-
Polk Run (LMR RM 21.55)													
LM40	0.30	10.8	BD	BD	0.19	0.21	0.11	0.13	0.08	0.08	1.00	1.00	62.30
Duck Creek (LMR RM 3.87)													
LM71	6.10	2.2	BD	BD	0.78	0.81	BD	BD	0.21	0.21	1.00	1.00	159.00
LM72	5.14	5.1	0.12	0.10	0.72	0.74	0.49	0.49	0.23	0.23	1.30	1.70	78.10
LM73	4.58	5.8	0.08	0.11	0.63	0.62	0.46	0.49	0.23	0.23	1.04	1.17	52.40
LM74	3.90	9.6	0.03	0.05	0.53	0.49	0.35	0.37	0.22	0.21	1.87	1.87	119.00
LM75	3.40	7.3	BD	BD	0.93	0.93	0.28	0.30	0.15	0.15	2.10	3.30	135.00
LM76	2.80	11.8	BD	BD	0.94	0.94	0.32	0.36	0.13	0.13	6.41	8.13	143.00
LM77	2.00	14.3	BD	BD	0.55	0.58	0.36	0.35	0.10	0.11	4.01	4.52	84.30
LM79	0.50	14.6	BD	BD	0.40	0.45	0.29	0.29	0.13	0.13	1.30	1.84	-
Wadeable Narrative Threshold Rankings	**Exceptional**		<0.11		<0.73		<0.50		<0.04				
	Good		<0.53		<1.38		<0.58		<0.17		<30		<182
	Fair		<0.83		<1.70		<1.63		<0.70		30-100		182-320
	Poor		<1.58		<2.50		<2.03		<1.34		>100		>320
	Very Poor		≥1.58		≥2.50		≥2.03		≥1.34				
Headwater Narrative Threshold Rankings	**Exceptional**		<0.09		<0.65		<0.38		<0.03				
	Good		<0.31		<0.96		<0.51		<0.17		<30		<182
	Fair		<0.63		<1.12		<1.70		<1.03		30-100		182-320
	Poor		<1.43		<1.51		<2.15		<2.60		>100		>320
	Very Poor		≥1.43		≥1.51		≥215		≥2.60				
Source	**IPS**		**IPS**		**IPS**		**IPS**		**IPS**		**OEPA SNAP**		**OEPA SNAP**

***Table 14**. continued.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Total Ammonia (mg/L)		Total Nitrate (mg/L)		TKN (mg/L)		Total Phsphorus (mg/L)		Sestonic Chlorophyll (µg/L)		Benthic Chlorophyll (mg/m^2)
			Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	
Unnamed Tributary to Duck Creek at RM 4.8													
LM80	0.10	1.4	0.08	0.10	0.12	0.12	0.68	0.70	0.17	0.18	1.61	5.85	-
East Fork Duck Creek													
LM85	2.00	1.3	0.03	0.05	0.32	0.31	0.48	0.54	0.30	0.31	1.00	1.69	86.00
LM84	0.50	2.4	BD	BD	0.20	0.22	0.26	0.25	0.15	0.13	1.84	1.84	-
Little Duck Creek													
LM86	2.40	0.5	BD	BD	0.45	0.45	0.24	0.24	0.17	0.17	1.00	1.00	-
LM87	1.90	0.5	BD	BD	0.41	0.41	0.27	0.27	0.19	0.19	1.00	1.00	-
LM90	1.00	1.1	BD	BD	0.34	0.34	0.25	0.25	0.18	0.18	1.00	1.00	-
LM92	0.49	1.7	BD	BD	0.54	0.54	0.22	0.22	0.22	0.22	1.00	1.00	-
Unnamed Tributarty to Little Duck Creek at 4.42													
LM82	0.20	0.3	BD	BD	0.57	0.55	0.57	0.55	0.26	0.26	1.00	1.02	-
Clough Creek (LMR RM 2.9)													
LM95	3.20	2.1	BD	BD	0.30	0.30	0.19	0.19	0.11	0.11	1.00	1.00	-
LM98	0.60	7.8	BD	BD	0.12	0.12	BD	BD	0.06	0.06	1.00	1.00	62.30
Headwater Narrative Threshold Rankings	**Exceptional**		<0.09		<0.65		<0.38		<0.03				
	Good		<0.31		<0.96		<0.51		<0.17		<30		<182
	Fair		<0.63		<1.12		<1.70		<1.03		30-100		182-320
	Poor		<1.43		<1.51		<2.15		<2.60		>100		>320
	Very Poor		≥1.43		≥1.51		≥215		≥2.60				
Source	**IPS**		IPS		IPS		IPS		IPS		**OEPA SNAP**		**OEPA SNAP**

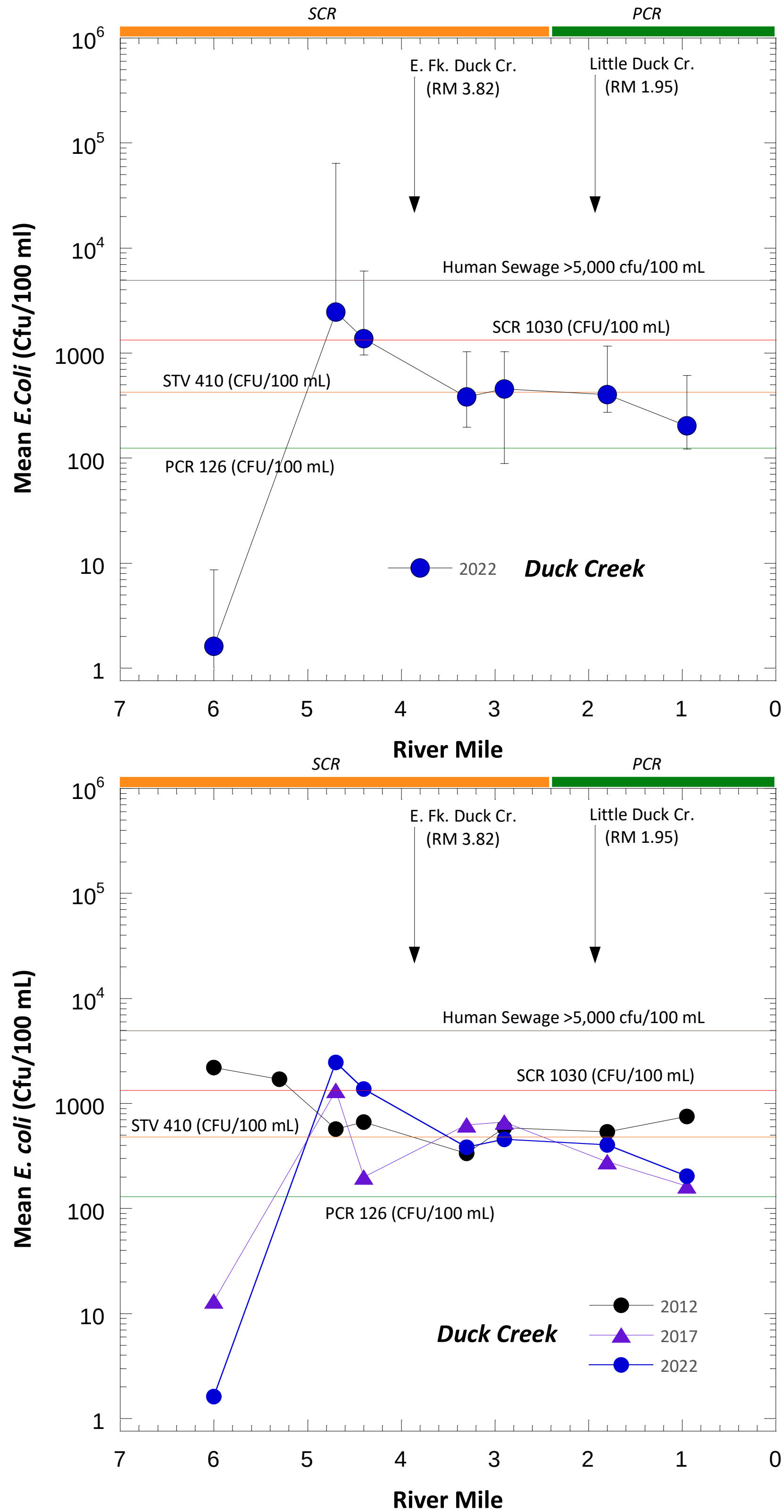


***Figure 24**. Median, maximum, and minimum E. coli values in Duck Creek in 2022. The contact recreation criteria are depicted by the solid colored lines with the level associated with human sewage as the primary source added. The LRW (orange shaded) and WWH (green shaded) designated reaches are indicated across the top.*

Total Phosphorus

Mean and median total phosphorus values were much more frequently in the fair range with the remainder in the good range evidence of the pervasive enrichment in the tributaries (Table 14). However, all except two of the fair values were only slightly outside of the good range. The two highest median and mean values of 0.47 mg/L and 0.49 mg/L, respectively, occurred in upper Sycamore Creek at site LM50 (RM 1.10) which is impacted by two SSOs and urban runoff.

Chlorophyll a

Median and mean sestonic and benthic chlorophyll a values were all within what is considered to be good levels by Ohio EPA (2015b) and not indicative of excessive nutrient enrichment effects (Table 14). Median and mean sestonic chlorophyll a values were very low with the highest mean value of 8.13 µg/L in Duck Creek at site LM76 (RM 2.80) with a median value of 6.41 µg/L. Another elevated mean and median of 6.60 µg/L occurred at LM56 in the unnamed tributary to Sycamore Creek at RM 1.12. Benthic chlorophyll a levels were general well below the good threshold of 182 mg/m^2 with high values of 151 mg/m^2 occurring in lower Sycamore Creek at LM52 (RM 0.10) downstream of the WWTP and 159 mg/m^2 in upper Duck Creek at LM71 (RM 6.10). Values >100 mg/m^2 occurred in Duck Creek at sites LM74 (119 mg/m^2), LM75 (135 mg/m^2), and LM76 (143 mg/m^2) each of which is impacted by numerous CSOs and urban stormwater.

Nutrient Effects (SNAP)

The primary nutrients (phosphorus and nitrates) can pose a threat to aquatic life indirectly through the stimulation of excessive algal production and the corresponding effects that photosynthesis and respiration have on the diel D.O. regime. The SNAP procedure was developed as a combined assessment of the effects of nutrient enrichment which goes beyond a reliance on primary nutrient concentrations alone. The variables included in a SNAP assessment appear in Table 15 and include the aquatic life use attainment status based on the applicable biological criteria, total P, the diel D.O swing, and benthic chlorophyll a as the primary variables and several other supporting variables such as nitrate-N, TKN, BOD_5, and TSS each of which can be affected by excessive nutrient enrichment. The QHEI is also included as stream habitat can be an important factor in how nutrients are processed by the aquatic ecosystem.

Full attainment of the WWH use designation occurred at five (5) tributary sites which is generally sufficient to assign a SNAP status of Attaining, Not Threatened (2 sites) or an Attaining, Threatened (3 sites) regardless of the non-biological SNAP indicators (Table 15). The difference between Not Threatened and Threatened is based on the responses of the non-biological indicators towards a nutrient enrichment effect which included elevate total P, nitrate-N, BOD_5, and TKN. All of these sites had good QHEI scores. Three (3) sites in Duck Creek attained the LRW use and were assigned an Attaining, Threatened SNAP status. Two impaired sites were assigned Impaired, Nutrients as a Likely Cause, one in the WWH designated upper Sycamore Creek site (LM50) and the other in the LRW designated Duck Creek at LM75 (RM 3.40) despite the latter having a very poor QHEI score. Each site had Low to Medium Risk

***Table 15**. The results of the Ohio EPA Stream Nutrient Assessment Procedure (SNAP) for 16 Little Miami River tributary sites with sufficient data in 2022. Color shading is explained in the legend at the bottom of the table (na – not applicable; ns – nonsignificant exceedance). Exceedances are asterisked, poor and very poor values are underlined.*

Site ID	River Mile Fish/Macroin-vertebrates	Drain-age Area (mi.^{2})	Aquatic Life Use[a]	IBI[b]	MIwb[b]	ICI[b]	Aquatic Life Use Status	QHEI	Chlorophyll a: Benthic (mg/m^2)	Chlorophyll a: Sestonic (mg/m^3)	BOD_5 (mg/L	Grab Dissolved Oxygen[a]: Min. (mg/L)	Grab Dissolved Oxygen[a]: Mean (mg/L)	Grab Dissolved Oxygen[a]: Max (mg/L)	Grab Dissolved Oxygen[a]: Max. Swing	Continuous Dissolved Oxygen[a]: Min. (mg/L)	Continuous Dissolved Oxygen[a]: Mean (mg/L)	Continuous Dissolved Oxygen[a]: Max. (mg/L)	Continuous Dissolved Oxygen[a]: Max. Daily D.O. Swing	Total Kjeldahl Nitrogen (mg/L)	Susp. Sed. Conc. (mg/L)	Total Phos-phorus (mg/L)	Nitrate-N (mg/L)	Overall Assessment of Nutrient Effects
Sycamore Creek																								
LM50	1.10/1.10	12.5	WWH	24*	na	46	Non	70.0	72.8	5.1	3.0	4.3				5.3	8.4	13.4	7.7	1.27	7.5	0.49	0.45	Impaired, nutrients as a likely cause
LM51	0.50/0.50	22.8	WWH	49	7.7^{ns}	48	Full	61.5	92.8	2.3	2.0	4.7	6.2	8.5	3.8	5.3	8.6	12.2	6.8	0.30	2.3	0.12	0.25	Attaining, threatened by nutrients
LM52	0.10/0.10	23.3	WWH	47	7.8^{ns}	38	Full	68.0	151.0	1.3	2.3	7.2	8.0	9.2	1.9	8.1	8.5	9.3	0.9	0.67	2.6	0.17	4.76	Attaining, threatened by nutrients
Polk Run																								
LM40	0.30/0.30	10.0	WWH	52	na	50	Full	63.0	62.3	1.0	2.0	7.6	8.7	10.3	2.7	7.4	8.6	11.2	3.5	0.13	3.2	0.08	0.21	Attaining, not threatened by nutrients
Duck Creek																								
LM71	6.10/6.10	2.2	LRW	12*	na	VP*	Non	26.0	143.0	1.0	2.0	6.6	7.2	7.6	1.1	7.7	8.0	8.7	1.0	0.13	1.0	0.21	0.81	Impaired, cause(s) other than nutrients
LM72	5.14/5.14	5.1	LRW	24	na	P	Full	54.5	78.1	1.7	2.3	4.2	5.9	7.7	3.5	2.4	5.5	11.6	9.0	0.49	3.0	0.23	0.78	Attaining, threatened by nutrients
LM73	4.58/4.58	5.8	LRW	12*	na	F	Non	16.0	52.4	1.2	2.3	2.9	5.6	7.4	4.5	0.9	3.5	8.9	8.0	0.49	1.6	0.23	0.66	Impaired, cause(s) other than nutrients
LM74	3.90/3.90	9.6	LRW	28	na	F	Full	63.0	119.0	1.9	2.0	5.2	6.8	8.9	3.7	3.1	6.2	11.9	8.5	0.37	1.5	0.21	0.52	Attaining, may be threatened by nutrients
LM75	3.40/3.40	11.5	LRW	12*	na	F	Non	15.0	135.0	3.3	2.0	7.7	9.5	11.8	4.2	6.3	8.5	13.3	6.8	0.30	3.6	0.15	0.94	Impaired, nutrients as a likely cause
LM76	2.80/2.80	11.7	LRW	24	na	26	Full	66.0	143.0	8.1	3.3	7.5	8.3	9.5	2.0	5.7	7.8	12.1	6.3	0.36	3.7	0.13	0.95	Attaining, threatened by nutrients
LM77	2.00/2.00	14.3	WWH	36^{ns}	na	32	Full	67.0	84.3	4.5	2.3	5.9	6.5	7.4	1.5	5.4	7.9	12.0	6.2	0.35	5.1	0.12	0.59	Attaining, threatened by nutrients
LM79	0.50/0.50	14.6	WWH	26*	na	38	Non	68.8		1.8	2.0	5.0	5.8	6.8	1.8					0.29	6.0	0.14	0.45	Impaired, cause(s) other than nutrients
East Fork Duck Creek																								
LM85	2.00/2.00	1.3	WWH	22*	na	F	Partial	62.5	86.0	1.7	2.0	4.0	5.0	5.3	1.4	3.1	4.5	8.1	4.8	0.54	9.9	0.31	0.32	Impaired, cause(s) other than nutrients
LM84	0.50/0.50	2.0	WWH	28*	na	F	Partial	65.0	1.0	1.8	2.0	5.6	6.7	7.2	1.6					0.25	3.0	0.14	0.23	Impaired, cause(s) other than nutrients
Clough Creek																								
LM95	3.20/3.20	2.0	WWH	30*	na	MG	Partial	59.0		1.0	2.0	6.8	7.0	7.2	0.4					0.19	2.5	0.11	0.31	Impaired, cause(s) other than nutrients
LM98	0.60/0.60	7.8	WWH	38^{ns}	na	G	Full	59.5	62.3	1.0	2.0	6.1	6.1	6.1	0.1	6.7	8.0	10.0	3.0	0.14	3.5	0.07	0.13	Attaining, not threatened by nutrients
		Excellent (Reference)		≥50	≥9.4	≥46	Full	≥75		<2.0	<1.98	>5.0	>6.0	<8.0	<5.0	>5.0	>6.0	<8.0	<5.0	<0.38	<17.0	<0.04	<0.44	Attaining, not threatened by nutrients
		Good (Very Low Risk)		≥40	≥8.1	≥30	Full	≥60	≤182	<5.0	<2.48	>4.0	>5.0	<11.5	≤6.5	>4.0	>5.0	<11.5	≤6.5	<0.51	<64.7	<0.08	<1.10	Attaining, threatened by nutrients
		Fair (Low Risk)		≥28	≥5.9	20-29	Partial	≥45	<320	<10	<2.74	>3.0	>4.0	<14.0	<9.0	>3.0	>4.0	<14.0	<9.0	≤1.70	<165.3	<0.131	<3.60	Impaired, nutrients as a likely cause
		Poor (Medium Risk)		≥18	≥4.5	13-19	Non	≥30	≥320	<25	<3.38	>2.0	>3.0	<17.0	<12.0	>2.0	>3.0	<17.0	<12.0	<2.15	<203.0	>0.400	<6.70	Impaired, nutrients as a likely cause
		Very Poor (High Risk)		<18	<4.5	≤12	Non	<30		>25	>3.38	<2.0	<2.0	>17.0	>12.0	<2.0	<2.0	>17.0	>12.0	<2.15	>203.0	≥0.400	>6.70	Impaired, nutrients as the cause
		Source		OEPA	OEPA	OEPA	OEPA	OEPA	SNAP	MBI	IPS	OEPA	OEPA	MBI	SNAP	OEPA	OEPA	MBI	SNAP	IPS	IPS	IPS	IPS	SNAP

responses in maximum D.O., diel D.O. swing, and total P with LM50 having a High Risk total P mean (Table 15). LM50 also had Low and Medium Risk BOD_5 and TKN mean values.

The remaining sites were Impaired, but with Causes Other Than Nutrients. These sites generally lacked the D.O. responses (e.g., wide diel D.O. swings, maximum D.O.) to nutrient enrichment and while most had elevated total P and allied parameter values, the indications of either habitat or organic enrichment causes (e.g., low minimum D.O.) were sufficient grounds for this SNAP assignment. Five (5) of the six assignments occurred in the Duck Creek subwatershed with the other in the upstream Clough Creek site (LM95). Three (3) of these sites are affected by CSOs while the other two are affected by urban stormwater.

Urban Parameters – Tributary Subwatersheds

The same as that described for the Little Miami River mainstem results, urban parameters include ionic strength measures such as conductivity, total dissolved solids, and total chlorides plus selected heavy metals such as copper, lead, and zinc. Suspended sediment (SSC) is included as a proxy for totals suspended solids (TSS) which is used frequently as an indicator of urban stormwater even though it is seldom directly related to aquatic life impairments. TKN is considered an urban parameter as it has been shown to be an indicator of urban nonpoint source runoff (U.S. EPA 2020). These parameters are commonly elevated in urban areas and are the result of stormwater runoff, but can also be indicative of other industrial and municipal sources of pollution. The IPS biological effect thresholds (MBI 2015) were used to assess urban parameters similar to the preceding analyses of nutrient and demand parameters (Table 16).

Specific Conductance

Specific conductivity was measured by grab samples at all 24 sites (Table 16) and short term continuous monitoring with Datasondes at 13 sites (Figure 25). Median and mean values consistently exceeded the good or WWH threshold at all except two sites, one in the unnamed tributary to Sycamore Creek at RM 1.12 at site LM56 (RM 0.20) and the other in upper Duck Creek at LM71 (RM 6.10). The majority of the values were in the fair range (14 sites) and six (6) sites in the poor range. Two sites, the unnamed tributary to Duck Creek @RM 4.8 (LM80) and the downstream site in the East Fork of Duck Creek (LM84) had both values in the very poor range. The continuous short term results showed seven (7) sites in Sycamore Creek (LM50 and LM51), Duck Creek (LM71, LM72, LM73, LM74), and Clough Creek (LM98) to have virtually all maximum, outlier, median, upper and lower quartile, and minimum values within the good range. Four (4) sites, one in Sycamore Creek (LM52), three in Duck Creek (LM75, LM76, LM77) had values that spanned the good, fair, and poor ranges thus showing considerable variability across a brief period of time. Three sites (LM52, LM40, LM85) had lower outlier values in the excellent range. There were no values in the very poor range. The contrasting results between the grab and continuous results illustrates variability that is likely caused by episodic discharges from CSOs and in urban stormwater.

***Table 16**. Urban source related parameter median and mean values at 24 sites in the Little Miami River tributaries in 2022. Color shading corresponds to IPS and other thresholds for each parameter listed in the legend below the table. The corresponding chronic water quality criteria at 300 mg/L hardness for metals parameters are listed with the good IPS thresholds for wadeable and headwater sites. Exceedances of the Ohio OMZA average criteria for metals is denoted by an asterisk.*

				Specific Conductivity (umhos/cm)		Total Dissolved Solids (TDS) (mg/L)		Suspended Sediment Concentration (SSC)		Chloride (mg/L)		Total Kjeldahl Nitrogen (mg/L)		Total Cadmium (µg/L)		Total Copper (µg/L)		Total Lead (µg/L)		Total Zinc (µg/L)	
Site ID	**River Mile**	**Aquatic Life Use**	**Drainage Area (Sq. mi.)**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**
Sycamore Creek (LMR RM 19.2)																					
LM50	1.10	WWH	14.7	744	751	388	405	7.3	7.5	80	84	0.24	1.27	BD	BD	4.35	5.05	20.40	17.36	20.90	19.73
LM51	0.50	WWH	24.0	710	707	386	386	2.4	2.3	96	98	0.31	0.30	BD	BD	3.35	3.48	14.55	14.56	15.30	23.98
LM52	0.10	WWH	24.0	923	939	502	494	2.7	2.6	135	138	0.68	0.67	BD	BD	3.05	3.08	19.00	17.64	28.80	30.25
Unnamed Tributary to Sycamore Creek @RM 1.12																					
LM55	1.20	WWH	5.3	948	953	521	521	14.5	14.5	175	175	0.18	0.18	-	-	-	-	-	-	-	-
LM56	0.20	WWH	5.6	630	636	314	314	4.9	4.9	93	93	0.22	0.22	-	-	-	-	-	-	-	-
Polk Run (LMR RM 21.55)																					
LM40	0.30	WWH	10.8	821	811	446	449	5.4	5.4	105	110	0.11	0.13	BD	BD	2.60	2.35	22.40	21.20	18.10	21.00
Duck Creek (LMR RM 3.87)																					
LM71	6.10	LRW	2.2	623	618	338	335	0.6	0.6	70	69	0.11	0.11	BD	BD	3.60	3.10	7.70	10.19	15.25	15.85
LM72	5.14	LRW	5.1	728	733	400	420	2.9	2.8	90	88	0.49	0.49	4.55	3.81	4.20	4.58	11.15	13.29	16.45	17.93
LM73	4.58	LRW	5.8	780	729	410	407	1.7	1.6	98	95	0.46	0.49	4.65	3.81	5.30	4.75	24.15	21.98	22.05	19.80
LM74	3.90	LRW	9.6	786	769	410	399	1.6	1.5	98	94	0.35	0.37	4.65	3.81	6.25	5.88	23.80	21.35	23.25	21.88
LM75	3.40	LRW	7.3	1000	959	538	541	1.4	4.2	130	125	0.28	0.30	BD	BD	4.50	4.83	41.15	39.00	22.30	22.33
LM76	2.80	WWH	11.8	1026	1017	586	562	3.9	3.7	135	130	0.32	0.36	BD	BD	3.95	4.15	32.90	28.39	25.65	24.25
LM77	2.00	WWH	14.3	987	934	542	521	3.3	5.1	135	128	0.36	0.35	BD	BD	4.25	4.30	26.25	23.96	20.80	20.28
LM79	0.50	WWH	14.6	869	826	466	425	3.0	6.0	110	103	0.29	0.29	BD	BD	3.95	3.98	23.20	21.31	18.95	18.30
Headwater Sites		Excellent		<397		<284		<17.0		<21.9		<0.38		BD		<5.9		<2.7		<16.4	
		Good		<703		<364		<65.7		<52.6		<0.51		BD/5.8*		<8.9/24.0*		<17.4/26.0*		<39.3/300*	
		Fair		<856		<403		<165.3		<68.0		<1.70		BD		<10.4		<26.8		<50.8	
		Poor		<1240		<503		<203		<106.5		<2.15		BD		<14.1		<50.3		<79.4	
		Very Poor		≥1240		≥503		≥203		≥106.4		≥2.15		BD		≥14.1		≥50.3		≥79.4	
Wadeable Sites		Excellent		<353		<296		<23.0		<28.2		<0.50		BD		<5.9		<2.7		<16.4	
		Good		<660		<384		<70.8		<59.1		<0.58		BD/5.8*		<8.9/24.0*		<17.4/26.0*		<39.3/300*	
		Fair		<814		<428		<159.6		<74.6		<1.63		BD		<10.4		<26.8		<50.8	
		Poor		<1199		<538		<192.9		<113.4		<2.03		BD		<14.1		<50.3		<79.4	
		Very Poor		≥1199		≥538		≥192.9		≥113.4		≥2.03		BD		≥14.1		≥50.3		≥79.4	

***Table 16**. continued.*

Site ID	River Mile	Aquatic Life Use	Drainage Area (Sq. mi.)	Specific Conductivity (umhos/cm) Median	Specific Conductivity (umhos/cm) Mean	Total Dissolved Solids (TDS) (mg/L) Median	Total Dissolved Solids (TDS) (mg/L) Mean	Suspended Sediment Concentration (SSC) Median	Suspended Sediment Concentration (SSC) Mean	Chloride (mg/L) Median	Chloride (mg/L) Mean	Total Kjeldahl Nitrogen (mg/L) Median	Total Kjeldahl Nitrogen (mg/L) Mean	Total Cadmium (µg/L) Median	Total Cadmium (µg/L) Mean	Total Copper (µg/L) Median	Total Copper (µg/L) Mean	Total Lead (µg/L) Median	Total Lead (µg/L) Mean	Total Zinc (µg/L) Median	Total Zinc (µg/L) Mean
Unnamed Tributary to Duck Creek @RM 4.8																					
LM80	5.00	LRW	1.4	1568	1460	874	838	12.3	17.1	270	265	0.68	0.70	2.42	2.42	7.00	6.50	24.05	25.24	21.95	21.30
East Fork Duck Creek																					
LM85	2.00	WWH	1.3	941	917	554	573	9.4	9.9	90	86	0.48	0.54	BD	BD	3.10	3.03	17.80	17.24	11.35	12.65
LM84	0.50	WWH	2.4	1308	1340	741	754	2.9	3.0	215	223	0.26	0.25	BD	BD	2.55	10.35*	19.45	18.89	15.55	18.60
Little Duck Creek																					
LM86	2.40	WWH	0.5	774	789	434	434	8.9	8.9	76	76	0.24	0.24	BD	BD	BD	BD	BD	BD	BD	BD
LM87	1.90	WWH	0.5	804	819	452	452	4.2	4.2	80	80	0.27	0.27	BD	BD	BD	BD	BD	BD	BD	BD
LM90	1.00	WWH	1.1	812	832	474	474	11.5	11.5	86	86	0.25	0.25	BD	BD	BD	BD	BD	BD	BD	BD
LM92	0.49	WWH	1.7	793	793	436	436	6.5	6.5	57	57	0.22	0.22	BD	BD	8.30	8.30	43.00	43.00	27.70	27.70
Unnamed Tributary to Little Duck Creek @4.42																					
LM82	0.20	PHW3A	0.3	749	765	444	448	44.0	44.0	50	60	0.57	0.55	BD	BD	5.70	5.97	39.10	28.85	24.00	22.63
Clough Creek (LMR RM 2.9)																					
LM95	3.20	WWH	2.1	846	838	472	472	2.5	2.5	115	115	0.19	0.19	BD	BD	2.65	2.65	22.40	22.40	14.20	14.20
LM98	0.60	WWH	7.8	762	790	404	404	3.5	3.5	99	99	0.14	0.14	-	-	-	-	-	-	-	-
Headwater Sites		Excellent		<397		<284		<17.0		<21.9		<0.38		BD		<5.9		<2.7		<16.4	
		Good		<703		<364		<65.7		<52.6		<0.51		BD/5.8*		<8.9/24.0*		<17.4/26.0*		<39.3/300*	
		Fair		<856		<403		<165.3		<68.0		<1.70		BD		<10.4		<26.8		<50.8	
		Poor		<1240		<503		<203		<106.5		<2.15		BD		<14.1		<50.3		<79.4	
		Very Poor		≥1240		≥503		≥203		≥106.4		≥2.15		BD		≥14.1		≥50.3		≥79.4	

* - Indicates an individual value exceed the Ohio metal water quality OMZA.

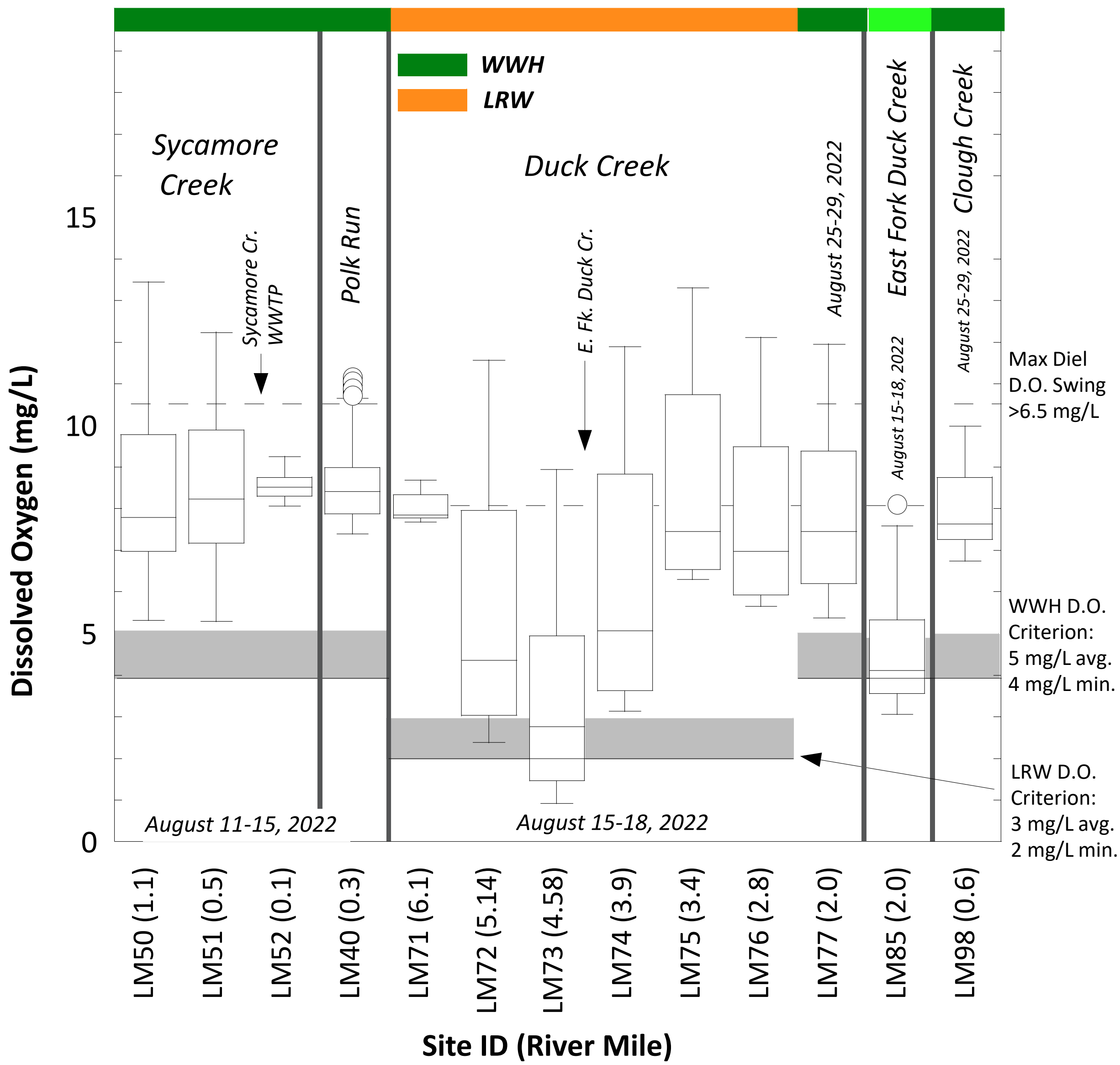


***Figure 25**. Box-and-whisker plots of continuous specific conductivity (µS/cm) from Datasonde continuous recorders at 13 sites in Duck Creek, Sycamore Creek, Polk Run, and Clough Creek during August 11-15, 15-18, and 25-29, 2022. The range of EWH, WWH, and LRW IPS thresholds are indicated by shaded bars and labels. The applicable use designation is shown as a colored bar across the top of the graph (green – WWH; orange – LRW).*

Total Dissolved Solids (TDS)

Median and mean TDS values in grab samples generally tracked specific conductivity, but more sites in the very poor range, seven (7) in all (Table 14). Twelve (12) sites had mean values in the poor range, but two of these sites had median scores in the fair range. Only two sites, the unnamed tributary to Sycamore Creek at RM 1.12 at site LM56 (RM 0.20) and upper Duck Creek at LM71 (RM 6.10) had median and mean values in the good range the same as specific conductivity.

Chloride

Median chloride levels were mostly in the poor range encompassing 13 sites while mean values in the poor range included 13 sites, with all but two coinciding with the median values (Table 14). There were nine (9) sites with median and mean values in the very poor range, with two not coinciding. Only two (2) sites had fair values and a single mean in the unnamed tributary to Little Duck Creek @4.42 had a good value. There were no values within the excellent range at any of the 24 tributary sites. The good IPS threshold corresponds closely to the “safe” level for chloride at 52 mg/L for the protection of high quality waters derived by Miltner (2021). Based on an inspection of the 2012 and 2017 results, chloride median values of 150-250 mg/L in the upper one half of Duck Creek declined to a range of 70-130 mg/L in 2017 and 2022. This is most likely due the diluting effect of higher flows in 2017 and 2022 compared to the very low flows of 2012.

Suspended Sediment Concentration (SSC)

Median and mean SSC values were consistently in the excellent range with the exception of a single site in the unnamed tributary to Little Duck Creek @4.42 which had a good value (Table14). The uniformity of the results suggesting excellent quality is misleading in terms of indicator parameter for urban stormwater. However, it consistently exhibited a poor relationship with the condition of the aquatic biota which serves as the arbiter of designated use attainment in the tributary subwatersheds. A more complex array of parameters as employed herein is needed to better characterize stormwater quality and impacts.

Other Urban Parameters

TKN was previously described as a reflection of organic nitrogen enrichment. Mean and median TKN values were predominantly in the excellent and good ranges at the majority of sites (Table 14). The handful of sites with fair values coincided with SSO and CSO discharge locations, but some are also impacted by urban stormwater of which TKN can be an important indicator (U.S. EPA 2020). Heavy metals included total cadmium, copper, lead, and zinc as indicators of urban impacts (Table 14). The good IPS thresholds for cadmium, copper, and zinc are somewhat lower than the current chronic Outside Mixing Zone Average (OZMA) chronic water quality criteria for each, but lead is the closest with the IPS threshold for fair being equivalent to the OMZA at 300 mg/L hardness (Table 14). All metals except zinc had one or more levels that were elevated above the good IPS threshold. Cadmium was detected at levels just below the Ohio OMZA criterion of 5.80 µg/L at three sites in Duck Creek (LM72, LM73, LM74) and one site in the unnamed tributary to Little Duck Creek @4.42 that were in the very poor range. Median and mean copper values were in the excellent range except for the mean at LM74 with all well below the Ohio OMZA average. Elevated median and mean lead values were more widespread with the majority of values in the fair range and several in the poor range. Four (4) sites, two in Duck Creek (LM75, LM76), one in Little Duck Creek (LM92), and one in the unnamed tributary to Little Duck Creek @4.42 (LM82), were in the poor range and with the mean and median values exceeding the Ohio OMZA criterion at 300 mg/L hardness. Only three (3) sites in Little Duck Creek had below detection results. These results reflect modest impacts by urban stormwater that enters the mainstem via tributaries such as Sycamore and Duck Creeks.

Sediment Chemistry

Sediment samples were collected from 19 sites in the Little Miami River tributary subwatersheds in October 2022 and analyzed for heavy metals and organic compounds. The results were screened with the MacDonald et al. (2000) and Persuad et al. (1993) consensus-based levels for potential adverse effects to aquatic life and Ohio Sediment Reference Values (SRVs). MacDonald et al. (2000) described two levels of contamination - a Threshold Effects Concentration (TEC) and a Probable Effects Concentration (PEC). Persaud et al. (1993) described a similar scheme with a Severe Effect Level (SEL) and Low Effect Level (LEL). The TEC or LEL indicates exceedances for sensitive species and taxa while the PEC or SEL indicates effects for most species and taxa. The Ohio SRVs are based on reference sites data and thus reflect background levels. IPS thresholds have not yet been developed for sediment chemicals.

Sediment Metals

There were only nine (9) exceedances of the sediment metal consensus guideline thresholds among four (4) heavy metal parameters – the majority sample results were below the TEC (Table 17). The TEC threshold was exceeded for arsenic (LM72, LM74), cadmium (LM84, LM87), and lead (LM86, LM87, LM90). The PEC was exceeded for copper in Duck Creek at LM73 (RM 4.58) with a value of 420 mg/kg that was nearly 3 times the PEC threshold. This site is downstream from numerous CSOs that discharge to Duck Creek.

Sediment Organics

Numerous organic chemical parameters were detected in Little Miami River tributary subwatershed sediment samples. Out of 16 PAH compounds, 12 had multiple exceedances of the MacDonald (2000) TEC and PEC and the Persuad et al. (1993) LEL thresholds (Table 18). Six (6) polycyclic aromatic hydrocarbon compounds had multiple exceedances of the more serious PEC threshold. This included anthracene (11 TEC, 4 PEC), benzo(a)anthracene (2 TEC, 9 PEC), chrysene (6 TEC, 9 PEC), fluoranthene (4 TEC, 11 PEC), phenanthrene (5 TEC, 10 PEC), pyrene (5 TEC, 12 PEC), and fluorene (7 TEC, 1 PEC). Other PAH compounds such as benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a)anthracene, indeo(1,2,3-cd)pyrene had numerous TEC or SEL exceedances at the majority of sites. Naphthalene, acenaphthene, and acenapthylene were either below the TEC/LEL or were not detected. Non-PAH compounds that were detected included the aromatic heterocyclic organic carbazole with 6 LEL exceedances, four (4) volatile organic compounds with at least one LEL exceedance, and two forms of Aroclor (PCB) with one LEL exceedance each. These results are indicative of heavy urbanization with inputs of multiple contaminants via CSOs, SSOs, and stormwater conveyances and urban runoff.

Physical Habitat for Aquatic Life

The assessment of stream and riverine habitat is based on the QHEI and its metrics, submetrics, and individual attributes. Habitat, along with flow, is a master variable which means that it is an essential component of an aquatic ecosystem. It is, therefore, an important determinant of biological potential and performance. It is also a key factor in the determination of causes of

Table 17*. Sediment metals concentrations (mg/kg) for parameters with values >detection in the Little Miami River tributary subwatersheds in October 2022. Values above the MacDonald et al. (2000) Threshold Effect Concentration (TEL) and Probable Effect Concentration (PEC) thresholds or above Ohio Sediment Reference Values (SRVs) are shaded in accordance with the color-code key at bottom. BD – below detection.*

Site ID	River Mile	Drainage Area (Sq. mi.)	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
Sycamore Creek (LMR RM 19.2)								
LM50	1.10	14.7	7.80	BD	24.00	27000	22.00	78
LM51	0.50	24.0	7.40	BD	8.80	16000	9.80	31
LM52	0.10	24.0	5.40	BD	6.70	13000	8.10	24
Polk Run (LMR RM 21.55)								
LM40	0.30	10.8	6.00	BD	7.40	13000	10.00	25
Duck Creek (LMR RM 3.87)								
LM71	6.10	2.2	4.70	BD	32.00	-	BD	31
LM72	5.14	5.1	12.00	BD	15.00	-	23.00	56
LM73	4.58	5.8	5.80	BD	420.00	-	17.00	100
LM74	3.90	9.6	11.00	BD	12.00	-	BD	72
LM75	3.40	7.3	7.00	BD	20.00	-	23.00	68
LM76	2.80	11.8	6.40	BD	14.00	-	30.00	43
LM77	2.00	14.3	7.20	BD	13.00	-	22.00	52
LM79	0.50	14.6	5.90	BD	21.00	-	20.00	72
Unnamed Tributary to Duck Creek at RM 4.8								
LM80	0.10	1.4	2.20	0.69	9.80	-	11.00	51
East Fork Duck Creek								
LM85	2.00	1.3	1.20	BD	4.90	-	BD	BD
LM84	0.50	2.4	4.30	1.30	11.00	-	22.00	46
Little Duck Creek								
LM86	2.40	0.5	6.10	0.64	14.00	-	44.00	120
LM87	1.90	0.5	7.90	1.10	11.00	-	35.00	61
LM90	1.00	1.1	3.80	0.74	13.00	-	28.00	43
Clough Creek (LMR RM 2.9)								
LM98	0.60	7.8	4.10	BD	3.40	-	BD	BD
Ohio EPA		**>SRV**	>25.1	>0.8	>33	>51000	>47	>170
MacDonald et al. (2000)		**>PEC**	>33	>5	>149	--	>128	>459
		>TEC	>9.79	>0.99	>32	--	>23	>121
		≤TEC	<9.79	≤0.99	≤32	<51000	≤23	≤121

impairment and in performing use attainability analyses, the latter of which were mostly accomplished in 2012 and verified and refined in 2017.

Little Miami River Mainstem

QHEI scores in 2022 were well above the threshold for excellent quality (>75) in the EWH designated reach of mainstem downstream to Duck Creek. The new site LM16A (RM 3.70) immediately downstream from Duck Creek revealed a decline in habitat quality from excellent to good. Habitat quickly recovered within 0.2 miles with an excellent QHEI score at site LM 16 (RM 3.50). The WWH designated reach that includes site LM17 (RM 1.70) that is impounded by

***Table 18**. Sediment PAH and organic chemical concentrations (µg/kg) in the Little Miami River tributary subwatersheds in October 2022. Values above the MacDonald et al. (2000) TEC and PEC and Persaud et al. (1993) SEL and LEL thresholds are shaded in accordance with the color-code key at the bottom of the table. BD – below detection; AD – above detection.*

Site ID	River Mile	Drain-age Area (Sq. mi.)	Acenaphthylene (mg/kg dry)	Anthracene (mg/kg dry)	Benzo(a)anthracene (mg/kg dry)	Benzo(a)pyrene (mg/kg dry)	Benzo(b)fluoranthene (mg/kg dry)	Benzo(g,h,i)perylene (mg/kg dry)	Benzo(k)fluoranthene (mg/kg dry)	Chrysene (mg/kg dry)	Dibenzo(a,h)anthracene (mg/kg dry)	Fluoranthene (mg/kg dry)	Indeno(1,2,3-cd)pyrene (mg/kg dry)	Phenanthrene (mg/kg dry)	Pyrene (mg/kg dry)	n-Octadecane (mg/kg dry)	Fluorene (mg/kg dry)	Naphthalene (mg/kg dry)	Acenaphthene (mg/kg dry)	Carbazole (mg/kg dry)	Bis(2-ethylhexyl)phthalate (mg/kg dry)	Toluene (mg/kg dry)	1,4-Dichlorobenzene (mg/kg dry)	Aroclor 1221 (mg/kg dry)	Aroclor 1254 (mg/kg dry)
Sycamore Creek (LMR RM 19.2)																									
LM50	1.10	14.7	BD	0.17	0.66	0.84	1.20	0.60	0.40	0.81	0.11	1.90	0.68	0.84	1.40	BD	0.04	BD	0.03	0.10	BD	BD	BD	BD	BD
LM51	0.50	24.0	BD	BD	0.08	0.08	0.12	0.06	0.05	0.05	BD	0.15	0.07	0.04	0.10	BD	BD	0.02	BD	BD	BD	BD	BD	BD	BD
LM52	0.10	24.0	0.05	0.12	0.34	0.36	0.47	0.21	0.16	0.36	0.05	0.91	0.26	0.50	0.66	BD	0.06	BD	0.04	BD	BD	BD	BD	BD	BD
Polk Run (LMR RM 21.55)																									
LM40	0.30	10.8	BD	0.02	0.08	0.10	0.16	0.08	0.06	0.11	0.02	0.25	0.09	0.09	0.18	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
Duck Creek (LMR RM 3.87)																									
LM71	6.10	2.2	BD	1.70	5.10	5.40	6.60	3.30	2.40	4.90	0.76	11.00	3.90	6.00	10.00	BD	0.52	BD	0.36	BD	BD	0.03	BD	BD	BD
LM72	5.14	5.1	BD	0.25	1.70	2.10	3.10	1.40	1.10	2.00	0.29	4.80	1.60	2.00	3.30	BD	0.10	BD	BD	0.49	BD	BD	BD	3.30	BD
LM73	4.58	5.8	BD	0.97	2.20	2.10	2.60	1.40	0.97	1.80	0.35	5.10	1.50	4.10	4.10	BD	0.50	BD	0.47	BD	BD	BD	BD	BD	0.15
LM74	3.90	9.6	0.08	0.44	2.60	3.40	5.20	2.20	1.70	3.40	0.57	8.70	2.60	4.60	6.40	BD	0.19	BD	0.15	0.88	BD	BD	BD	BD	BD
LM75	3.40	7.3	BD	0.76	4.10	4.60	6.50	3.10	2.20	5.30	0.73	11.00	3.80	5.00	9.70	BD	0.21	BD	0.16	0.92	BD	BD	BD	BD	BD
LM76	2.80	11.8	BD	1.30	4.30	4.90	6.80	3.40	2.50	5.20	0.76	13.00	4.00	6.20	9.60	BD	0.46	BD	0.28	BD	BD	BD	BD	BD	BD
LM77	2.00	14.3	BD	0.63	2.50	2.90	4.10	2.10	1.40	2.80	0.46	7.00	2.40	2.90	5.50	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM79	0.50	14.6	BD	0.14	0.69	0.95	1.40	0.75	0.45	1.00	0.16	2.00	0.85	0.74	1.60	BD	BD	BD	BD	BD	1.00	BD	BD	BD	BD
Unnamed Tributary to Duck Creek at RM 4.8																									
LM80	0.10	1.4	BD	1.80	11.00	12.00	17.00	7.30	5.60	14.00	1.60	34.00	8.40	19.00	27.00	BD	0.82	BD	0.56	3.40	BD	BD	0.14	BD	BD
East Fork Duck Creek																									
LM85	2.00	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BD	BD	BD	BD
LM84	0.50	2.4	0.02	0.16	0.85	1.10	1.40	0.79	0.47	1.10	0.15	2.40	0.92	0.91	2.00	BD	0.04	BD	0.03	0.15	BD	BD	BD	BD	BD
Little Duck Creek																									
LM86	2.40	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BD	BD	BD	BD
LM87	1.90	0.5	BD	0.37	1.30	1.40	1.80	0.81	0.71	1.40	BD	3.00	0.97	1.70	2.50	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD
LM90	1.00	1.1	BD	0.26	0.90	1.10	1.40	0.67	0.52	1.10	0.15	2.70	0.77	1.50	2.10	BD	0.09	BD	BD	BD	BD	BD	BD	BD	BD
Clough Creek (LMR RM 2.9)																									
LM98	0.60	7.8	0.04	0.17	0.63	0.66	0.93	0.46	0.32	0.73	0.14	1.70	0.56	0.91	1.30	BD	0.07	BD	0.04	BD	BD	BD	BD	BD	BD
MacDonald et al. (2000) Thresholds		PEC	--	>0.845	>1.050	--	--	--	--	>1.29	--	>2.230	--	>1.170	>1.520	--	>0.536	>0.561	>88.90	--	--	--	--	--	--
		TEC	--	>0.057	>0.108	--	--	--	--	>0.166	>0.033	>0.423	--	>0.204	>0.195	--	>0.077	>0.176	>6.710	--	--	--	--	--	--
Persaud et al. (1993) Thresholds		SEL	>0.088	>370	>1480	>1440	>1340	>320	>1340	>460	>130	>1020	>320	>950	>850	--	>160	>0.391	>88.9	--	--	--	--	--	>340
		LEL	>0.0067	>0.220	>0.320	>0.370	>0.240	>0.170	>0.240	>0.340	>0.060	>0.750	>0.200	>0.560	>0.490	AD	>0.190	>0.034	>6.710	AD	AD	AD	AD	AD	>60
		<LEL/TEC	<0.0067	<0.057	<0.108	<0.370	<0.240	<0.170	<0.240	<0.166	<0.033	<0.423	<0.200	<0.204	<0.195	BD	<0.077	<0.034	<6.710	BD	BD	BD	BD	BD	<60

the Ohio River resulting in only good quality habitat (Table 19; Figure 26). Good habitat attributes overwhelmingly prevailed downstream to site LM16A with only two moderate influence modified attributes at LM03 (RM 22.30). Moderate influence modified attributes appeared in mush higher numbers at site LM16A and at the expense of fewer good attributes. It and the impounded site LM17 (RM 1.70) each had seven modified attributes which is a poor result for that factor. These sites also had ratios of modified:good attributes of 1.75 and 2.00, respectively, each of which is below the excellent threshold. LM16A is directly subjected to inputs of sediment and fine materials from Duck Creek as evidenced by moderate to high siltation, an increase in sand substrates, and moderate substrate embeddedness. This site was comprised largely of pool habitat with no riffle development the result of "ponding" by the Beechmont Ave. bridge. This likely has little effect on the potential to attain EWH because it is flanked by excellent quality upstream and downstream. The current limitations to EWH attainment at this site are due primarily to organic enrichment and toxic impacts that emanate from Duck Creek. Site LM16 (RM 3.50) downstream of Beechmont Ave. usually exhibits excellent habitat characteristics, the recent effects of a temporary coffer dam constructed for the Beechmont bike path bridge were evident between the two sampling passes in 2022. The first pass (LM16-Pre in Table 19) was conducted with the coffer dam still present and there were three modified attributes including two that revealed substrate degradation. The second pass (LM16-Post) was conducted after the coffer dam was removed and the modified attributes had disappeared and the QHEI score increased by 4.5 points.

Little Miami River Tributary Subwatersheds

QHEI scores in the tributary subwatersheds varied in accordance with legacy modifications to stream habitat in Duck Creek, interceptor sewer line construction in portions of Sycamore Creek, and urban land use and riparian encroachment in other tributaries. QHEI scores were mostly good among the 24 sites evaluated being at or above the good threshold at 17 sites and one site in Sycamore Creek (LM50) with excellent habitat quality (Table 20). Each of these 18 sites had at least one modified attribute and most had 4-5 modified attributes. Ten (10) sites had only five (5) or fewer good attributes which is a fair quality result. The lower numbers of good attributes and elevated numbers of modified attributes are an indication of the urban character of these subwatersheds.

QHEI scores and attributes reflected the extensively modified channel in the LRW designated reach of Duck Creek (Figure 27) and tributaries. Modified attributes predominated with multiple high influence modified attributes, high numbers of modified attributes, and high ratios of modified:good attributes and four sites exhibiting very poor quality (Table 20). No recovery from prior channelization, no sinuosity, sparse or no cover, and maximum pool depths <40 cm were the most pervasive modified attributes at 10 of 14 sites. QHEI scores were good in the WWH designated reach of Duck Creek (2), Little Duck Creek (4 sites), and the two downstream sites in the East Fork of Duck Creek (Table 20). A single site in the LRW reach of Duck Creek had a good QHEI score of 63.0 which is a marked improvement over prior years that had very poor QHEI scores (Figure 26). While this result suggests better restoration potential than what was previously demonstrated, the concrete channel portions of the upper mainstem and selected tributaries is a deterrent to widespread improvement without direct remediation.

***Table 19**. Qualitative Habitat Evaluation Index (QHEI) matrix for the Little Miami River mainstem showing good (■) and modified (● and 🔴) habitat attributes at 14 sites in 2022. Ranges of excellent to very poor quality for the number of good and modified attributes are shown in the footnotes at the bottom of the table.*

			Good Habitat Attributes											High Influence Modified Attributes						Moderate Influence Modified Attributes														
Site ID	River Mile	QHEI	No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	Good Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	< 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	Poor Habitat Attributes	Ratio of Modified (High) to Good	Ratio of Modified (All) to Good
Little Miami River																																
LM01	27.90	**89.50**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM02	24.10	**91.00**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM03	22.30	**84.50**	■	■		■		■	■	■	■	■	8						0					●	●							2	0	0.25
LM05	21.50	**89.50**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM07	18.50	**89.50**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM08	17.70	**85.50**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM09	13.10	**87.80**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM11	10.90	**85.00**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM12	8.10	**89.30**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM13	6.83	**87.00**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM15	4.10	**87.50**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM16A	3.70	**65.00**	■	■				■			■		4						0		●	●		●	●			●	●		●	7	0	1.75
LM16-Pre	3.50	**84.00**	■	■		■		■	■	■	■	■	8						0		●				●				●			3	0	0.38
LM16-Post	3.50	**88.50**	■	■		■	■	■	■	■	■	■	9						0													0	0	0.00
LM17	1.60	**62.00**	■	■				■			■		4				🔴		1		●	●		●	●			●	●		●	7	0.25	2.00

LM16-Pre sampled during presence of bridge construction coffer dam**; LM16-Post** sampled after coffer dam removal.

Boatable Sites		QHEI	Good Habitat Attributes	High Influence Poor Attributes	Poor Habitat Attributes	Ratio of Modified (High) to Good	Ratio of Modified (All) to Good
Excellent		≥75	≥9	0	≤1	<0.20	<0.50
Good		≥60	≥6	0	≤4	<0.50	<2.00
Fair		≥45	≥4	1	≤5	>1.00	>2.00
Poor		≥30	≥2	2	≥6	>2.00	>6.00
Very Poor		<30	≤1	3	≥7	>4.00	>10.00

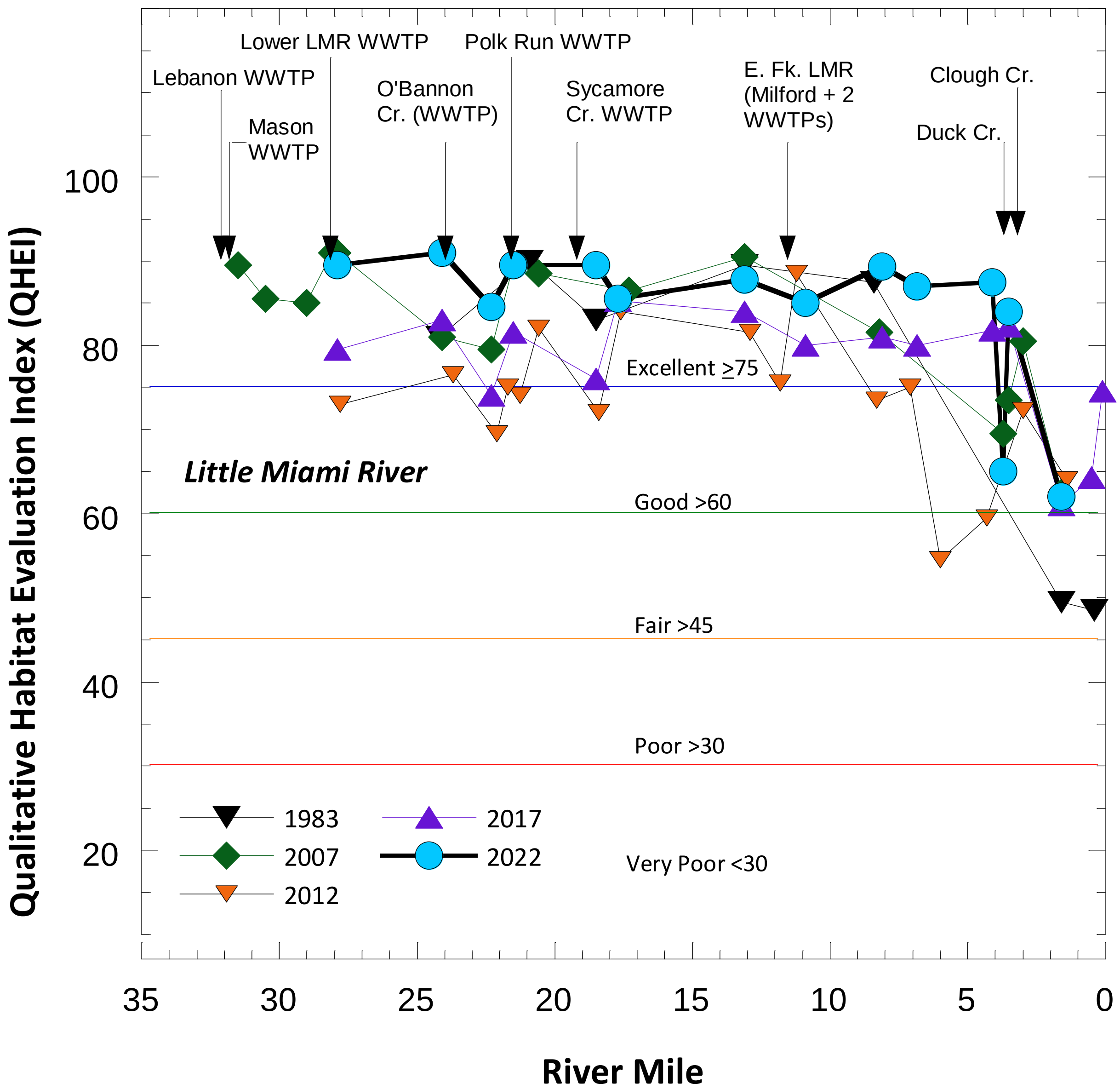


***Figure 26**. Qualitative Habitat Evaluation Index (QHEI) scores in the Little Miami River mainstem in 1983, 2007, 2012, 2017 and 2022 with QHEI narrative ranges as colored solid lines.*

***Table 20**. Qualitative Habitat Evaluation Index (QHEI) matrix for the Little Miami River tributary subwatersheds showing good (■) and modified (● and ●) habitat attributes at 14 sites in 2022. Ranges of excellent to very poor quality for the number of good and modified attributes are shown in the footnotes at the bottom of the table.*

			Good Habitat Attributes											High Influence Modified Attributes						Moderate Influence Modified Attributes														
Site ID	River Mile	QHEI	No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	Good Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	< 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	Poor Habitat Attributes	Ratio of Modified (High) to Good	Ratio of Modified (All) to Good
Sycamore Creek																																		
LM50	1.10	**70.00**	■	■	■	■	■	■		■	■	■	9				●		1									●				1	0.11	0.22
LM51	0.50	**61.50**						■		■	■	■	4						0	●				●	●			●		●		5	0.00	1.25
LM52	0.10	**68.00**		■		■	■	■	■		■	■	7						0	●	●								●	●		4	0.00	0.57
Unnamed Tributary to Sycamore Creek @RM 1.12																																		
LM55	1.20	**60.80**		■	■			■		■	■	■	6						0	●				●	●	●		●				5	0.00	0.83
LM56	0.20	**63.00**		■	■		■	■		■	■	■	7						0	●				●		●		●				4	0.00	0.57
Polk Run																																		
LM40	0.30	**63.00**		■	■			■		■	■	■	6						0	●				●	●			●				4	0.00	0.67
Duck Creek																																		
LM71	6.10	**26.00**			■					■			2	●		●	●	●	4					●	●			●			●	4	2.00	4.00
LM72	5.14	**54.50**		■				■		■			3					●	1	●				●	●			●		●		5	0.33	2.00
LM73	4.58	**16.00**			■				■				2	●		●	●	●	4					●		●			●		●	4	2.00	4.00
LM74	3.90	**63.00**		■			■	■		■	■		5						0	●	●			●	●			●	●	●		7	0.00	1.40
LM75	3.40	**15.00**			■								1	●		●	●	●	4					●		●		●	●		●	5	4.00	9.00
LM76	2.80	**66.00**		■			■	■		■	■		5						0	●				●	●			●		●		5	0.00	1.00
LM77	2.00	**67.00**		■		■		■		■	■	■	6						0	●				●	●			●				4	0.00	0.67
LM79	0.50	**68.80**		■		■	■	■		■	■	■	7						0	●				●				●				3	0.00	0.43
Wadeable Sites																																		
Excellent		≥75											≥9						0													≤1	<0.20	<0.50
Good		≥60											≥6						0													≤4	<0.50	<2.00
Fair		≥45											≥4						1													≤5	>1.00	>2.00
Poor		≥30											≥2						2													≥6	>2.00	>4.00
Very Poor		<30											≤1						3													≥7	>4.00	>6.00
Headwater Sites																																		
Excellent		≥70											≥8						0													≤1	<0.20	<0.50
Good		≥55											≥6						0													≤4	<0.50	<2.00
Fair		≥43											≤3						1													≤5	>1.00	>2.00
Poor		≥30											≥2						2													≥6	>2.00	>4.00
Very Poor		<30											0						3													≥7	>4.00	>6.00

***Table 20**. continued.*

Site ID	River Mile	QHEI	Good Habitat Attributes											High Influence Modified Attributes						Moderate Influence Modified Attributes														
			No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	Good Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	< 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	Poor Habitat Attributes	Ratio of Modified (High) to Good	Ratio of Modified (All) to Good
Unnamed Tributary to Duck Creek @RM 4.8																																		
LM80	0.10	**34.50**		■				■					2	●				●	2					●	●	●		●	●	●		6	1.00	4.00
East Fork Duck Creek																																		
LM85	2.00	**62.50**		■	■			■		■	■		5						0	●				●	●			●		●		5	0.00	1.00
LM84	0.50	**65.00**		■				■		■	■	■	5						0	●				●	●			●				4	0.00	0.80
Little Duck Creek																																		
LM86	2.40	**56.50**		■				■		■			3			●		●	2	●				●	●			●		●		5	0.67	2.33
LM87	1.90	**61.00**		■	■		■	■		■			5					●	1	●				●	●			●		●		5	0.20	1.20
LM90	1.00	**61.00**		■				■		■	■	■	5						0	●				●	●			●				4	0.00	0.80
LM92	0.49	**66.50**		■	■	■	■	■		■	■	■	8						0	●								●				2	0.00	0.25
Unnamed Tributary to Little Duck Cr. @RM 4.42																																		
LM82	0.20	**50.50**		■				■		■	■		4	●			●		2	●	●			●	●			●	●	●		7	0.50	2.25
Clough Creek																																		
LM95	3.20	**59.00**		■	■			■		■	■		5						0	●				●	●			●		●		5	0.00	1.00
LM98	0.60	**59.50**		■				■		■	■	■	5						0	●				●	●			●				4	0.00	0.80
Headwater Sites																																		
Excellent		≥70											≥8						0													≤1	<0.20	<0.50
Good		≥55											≥6						0													≤4	<0.50	<2.00
Fair		≥43											≤3						1													≤5	>1.00	>2.00
Poor		≥30											≥2						2													≥6	>2.00	>4.00
Very Poor		<30											0						3													≥7	>4.00	>6.00

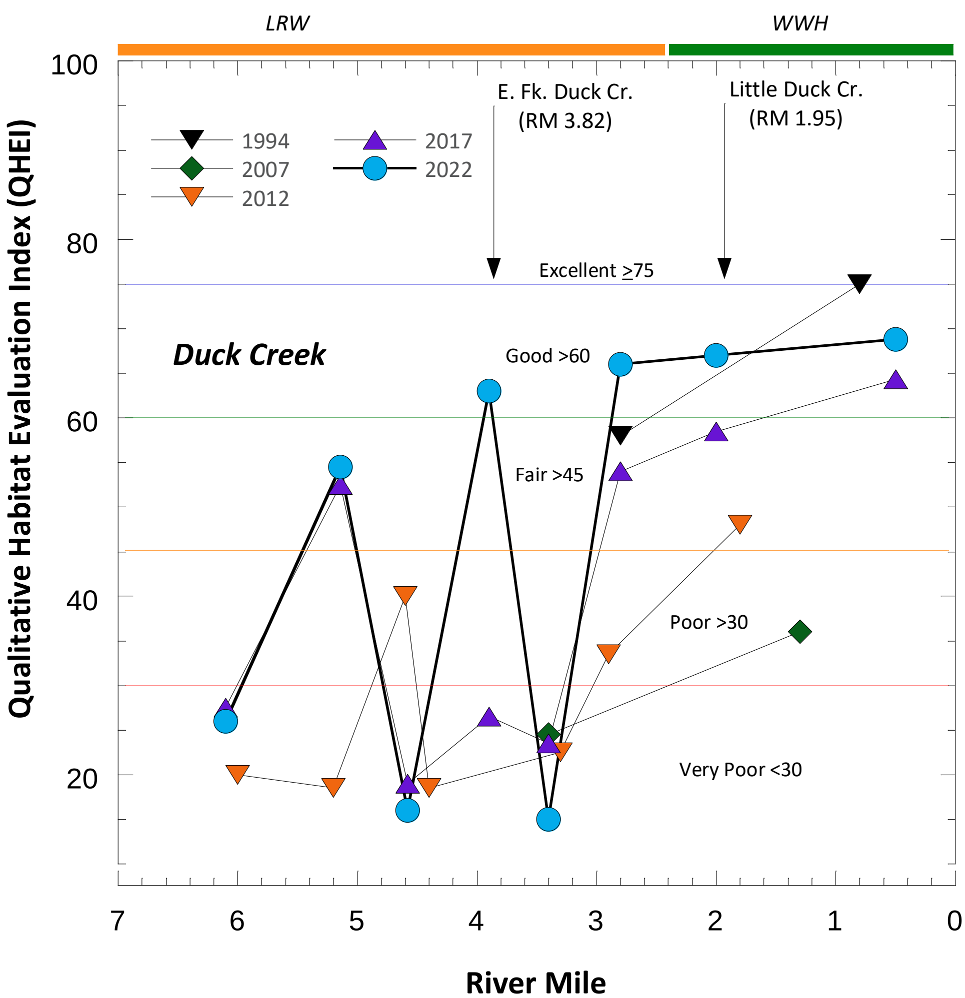


***Figure 27**. A modified site in Duck Creek at Erie Ave. (LM75; upper) and QHEI scores in 1994, 2007, 2012, 2017, and 2022 in the Duck Creek mainstem with QHEI narrative ranges as colored solid lines.*

Biological Assemblages

Fish and macroinvertebrates were sampled at 40 of the 41 sites (one site was dry) in 2022 following standardized procedures specified by the 2011 Plan (MBI 2011) and consistent with Level 3 specifications and the Ohio WQS. Five (5) of the 41 sites were recommended for one of the Primary Headwater Habitat (PHWH) classification tiers, thus the remaining 36 sites were evaluated against the fish and macroinvertebrate biological criteria in the Ohio WQS (3745-1-07, Table 7-1) following Ohio EPA procedures for determining aquatic life use attainment (Ohio EPA 1987b; 1989b; 2015a) and as described previously in the methods.

Fish Assemblage Results

Key fish assemblage indices and attributes such as %DELT, sensitive species, and %tolerant species are depicted in Table 21. Of the 36 sites designated for one of the WWH suite of uses, two (2) failed to attain EWH in the Little Miami River mainstem, 10 failed to attain the WWH IBI biocriteria and another three (3) failed LRW at Little Miami River tributary sites. The remaining 21 sites met their applicable biocriterion including 11 of the EWH designated sites on the Little Miami River mainstem.

Little Miami River

Eleven (11) of the 14 sites sampled met the EWH IBI biocriterion in the Little Miami River mainstem with six (6) sites in the non-significant departure range (Table 21; Figure 28). Two sites in the EWH designated reach (LM16A and LM16) failed to meet the IBI biocriterion (Table 21). The IBI at the single site in the WWH designated reach (LM17) met the IBI biocriterion. This was a slight decline from 2017, but still a substantial improvement over 2012 when 12 of 15 sites sampled in the EWH reach failed to attain the IBI biocriterion with the remaining three in the non-significant departure range. The 2017 and 2022 results were in line with the 2007 results and a substantial improvement over years prior (1983, 1989; Figure 28).

The MIwb met the EWH biocriterion at 12 of 13 Little Miami River mainstem EWH sites with three (3) in the non-significant departure range (Table 21; Figure 29). The MIwb at the single site (LM17) in the WWH designated reach failed meet that criterion. The MIwb values were slightly higher in 2017 hence the 2022 results represent a minor decline in that fish assemblage indicator. In 2012, only two of the 15 MIwb values failed to meet the EWH biocriterion in 2012, but all were nearly a full MIwb unit lower in 2012 than in 2017 when all 11 values fully met the EWH biocriterion (Table 21; Figure 29).

Other assemblage indicators showing meaningful responses in the Little Miami River mainstem included elevated DELT anomalies at LM16A (poor) and LM16 (fair). The results in Table 21 are the mean of two sampling passes which individually at LM16A were 2.6% in August and 6.0% in September 2022, an increase over values of 0 and 0.6% in 2019, thus reflecting an increase in sublethal stress that is likely related to the comparatively low D.O. values that exceeded the EWH criteria in 2022. The mean of 1.8% at LM16 is a three-fold increase over the value of 0.6%

***Table 21**. Selected fish assemblage attributes at 14 sites Little Miami River mainstem sampled in the 2020. Color shading in the cells indicates the narrative quality of the index or attribute value in accordance with the thresholds in the footnotes at the bottom of the table (ns – nonsignificant departure; exceedances are asterisked).*

Site ID	River Mile	Drainage Area (sq mi)	Ohio IBI	MIwb	Native Sp.	% DELT	Intol-erant Sp.	% Simple Lithophil Spawners	% Tolerant
Little Miami River									
LM01	27.90	1070	50	10.3	29.5	0.0	16.0	37.2	0.7
LM02	24.10	1090	52	10.9	35.5	1.0	18.5	45.9	1.0
LM03	22.30	1150	47^{ns}	9.5^{ns}	25.0	0.5	12.0	37.0	4.5
LM05	21.50	1160	47^{ns}	10.3	34.0	0.6	17.0	30.7	0.4
LM07	18.50	1190	51	10.3	26.5	0.3	14.5	48.0	1.7
LM08	17.70	1190	52	10.2	25.0	0.3	14.0	50.5	0.0
LM09	13.10	1200	48	10.0	29.5	0.0	16.0	33.7	0.2
LM11	10.90	1710	44^{ns}	9.8	26.5	0.6	10.0	29.8	1.2
LM12	8.10	1710	44^{ns}	9.3^{ns}	26.5	0.9	14.0	20.9	1.2
LM13	6.83	1720	46^{ns}	9.8	26.5	0.9	12.5	16.0	0.8
LM15	4.10	1730	44^{ns}	10.1	25.5	0.6	9.5	19.2	1.3
LM16A	3.70	1740	30*	8.8*	17.0	4.3	4.5	2.5	11.8
LM16	3.50	1750	41*	9.2^{ns}	20.5	1.8	8.5	19.3	0.9
LM17	1.60	1760	36^{ns}	7.8*	16.0	0.0	3.0	3.9	1.0
	Narrative Category		OH IBI	MIwb	Nat. Sp	Anom.	Intols	Smp Lith	% Tolerant
	Excellent		≥48	≥9.6	>25	0.0	>8	>30	≤15
	Good		≥38	≥8.5	>14	<1.3	6-8	>20-30	>15-30
	Fair		>28	>5.9	>10	<3.0	3-5	>10-20	>30-50
	Poor		≥16	>4.0	>7	<10	1-2	>5-10	>50-70
	Very Poor		<16	≤4.0	≤7	>10	0	≤5	≥70

in 2017. The declining results in these indicators between August and September reflects a longer term response as opposed to an episodic event with Duck Creek as the likely source. The number of intolerant species was reduced to fair at LM16A and the impounded site at LM17, the first a response to organic enrichment and toxicity, the second to the impounded habitat. The percentage simple lithophilic spawners declined in the lower mainstem beginning further upstream at LM11 downstream from the East Fork (3 WWTPs) and worsening downstream becoming fair at LM13 and LM15 to very poor at LM16A and LM17. While this metric has overlap with the intolerant species metric, its response is primarily to substrate degradation in the form of finer sediments and sand either replacing or embedding coarser substrate types such as cobbles and gravel. Highly tolerant species were low and in the excellent range at all sites.

Little Miami River Tributary Subwatersheds

Of the 22 sites sampled in the Little Miami River tributary subwatersheds 16 are either designated or recommended for the WWH use designation with six (6) Duck Creek sites

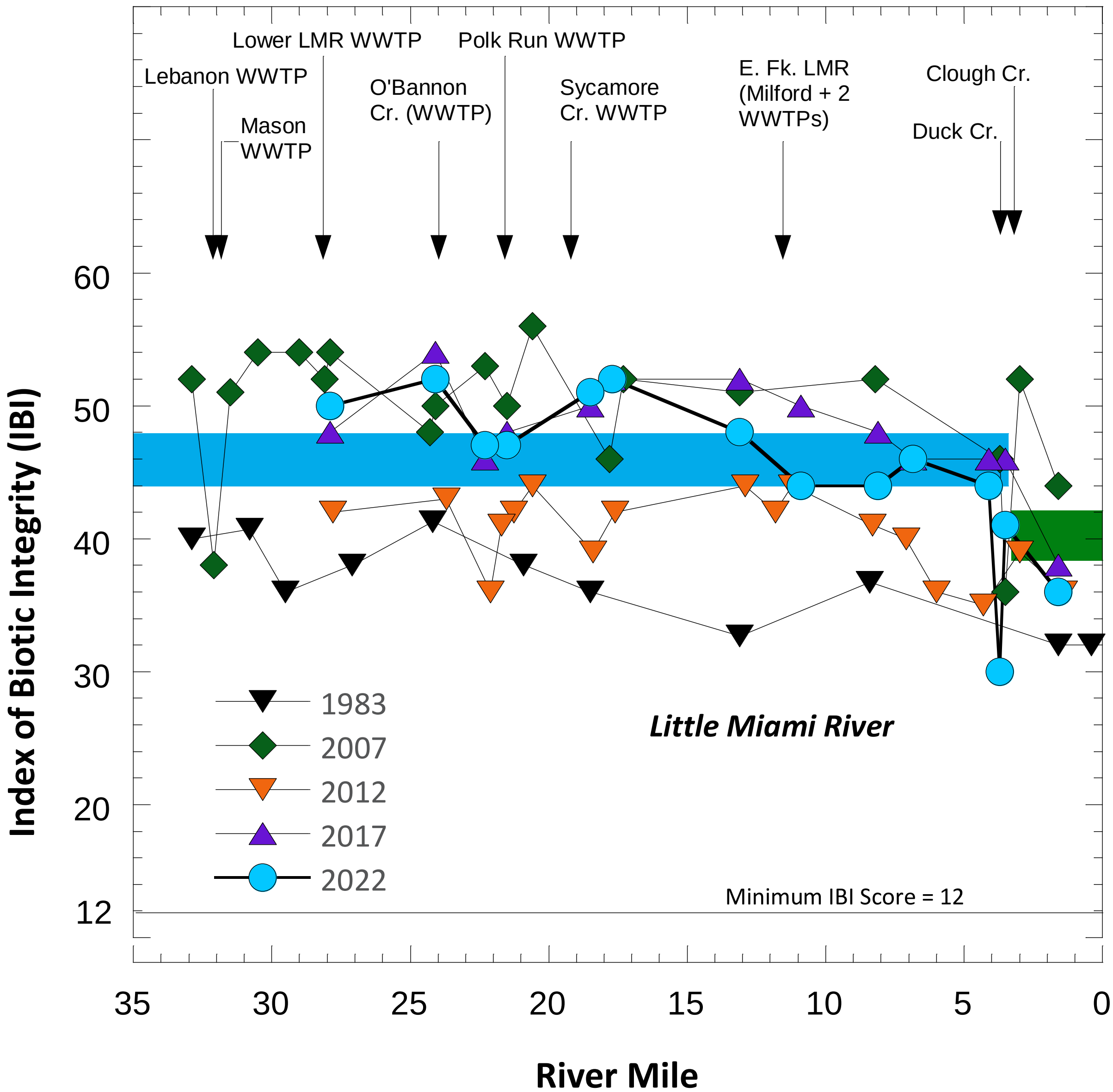


Figure 28. *Index of Biotic Integrity (IBI) results for the Little Miami River mainstem in 1983, 2007, 2012, 2017, and 2020. The EWH and WWH biocriteria are depicted as shaded areas between the biocriterion and the non-significant departure with major pollution sources and tributaries along the top of the graph.*

designated as LRW (Table 22). The WWH IBI biocriterion was met at only five (5) sites, two (2) in Sycamore Creek, one in Polk Run, a non-significant departure at site LM77 in the WWH designated reach of Duck Creek, and another non-significant departure in Clough Creek site LM98 (Table 22). Three of the six (6) LRW designated sites in Duck Creek surpassed the LRW threshold for the IBI (Table 22; Figure 30). Of the non-attaining WWH designated sites, five (5) had fair IBI scores, four (4) had poor IBIs, and one had a very poor IBI of 12 (LM92). Of the three

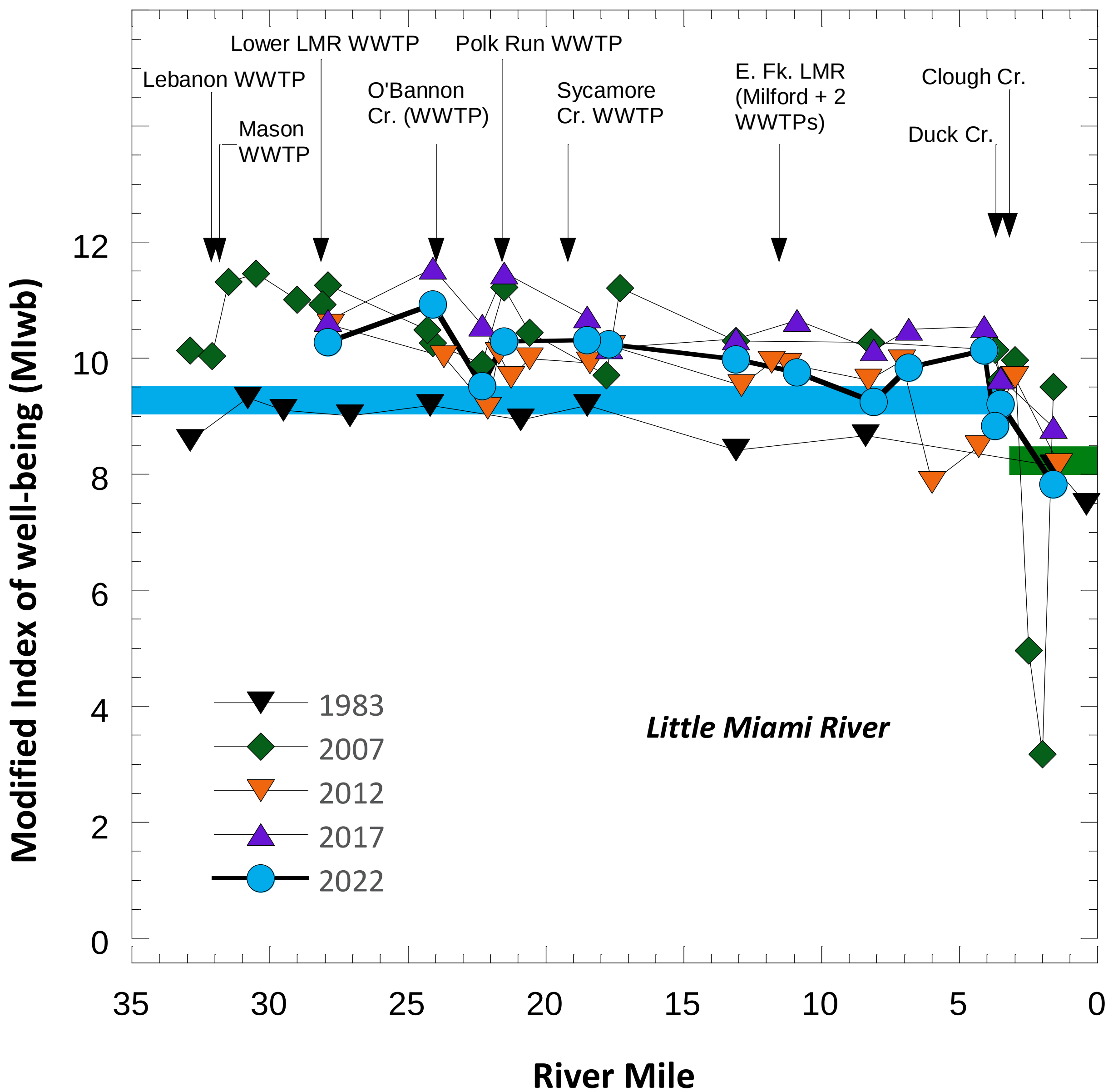


***Figure 29**. Modified Index of Well-Being (MIwb) results for the Little Miami River mainstem in 1983, 2007, 2012, 2017, and 2022. The EWH and WWH biocriteria are depicted as shaded areas between the biocriterion and the non-significant departure with major pollution sources and tributaries along the top of the graph.*

(3) non-attaining LRW sites all had very poor IBI scores of 12. The MIwb applied to only two tributary sites (drainage area >20 sq. mi.) and both were in non-significant departure of WWH. Of the other metrics and attributes in Table 22, the richness of native species was consistently poor or very poor, intolerant species were widely absent, simple lithophils were below expectations at one-half the sites, and tolerant species were poor or very poor at 15 sites. The percentage of DELT anomalies were elevated out of the good range at only two sites, but this can be misleading when there are few fish that would accrue anomalies under sublethal stress anyway. In the aggregate the results demonstrate the severity of the urban impacts in Duck

***Table 22**. Selected fish assemblage attributes at 22 sites Little Miami River tributary subwatersheds sampled in the 2020. Color shading in the cells indicates the narrative quality of the index or attribute value in accordance with the thresholds in the footnotes at the bottom of the table (ns – nonsignificant departure; exceedances are asterisked).*

Site ID	River Mile	Drainage Area (sq mi)	Ohio IBI	MIwb	Native Sp.	% DELT	Intol-erant Sp.	% Simple Lithophil Spawners	% Tolerant
Sycamore Creek									
LM50	1.10	12.5	24*	NA	9.0	0.0	0.0	9.3	63.6
LM51	0.50	22.8	49	7.7^{ns}	21.5	0.0	10.0	8.7	10.3
LM52	0.10	23.3	47	7.8^{ns}	22.0	0.1	9.5	14.1	12.5
Unnamed Tributary to Sycamore Cr. at RM 1.12									
LM55	1.20	5.3	26*	NA	3.0	0.5	0.0	0.0	48.2
LM56	0.20	5.6	28*	NA	8.0	0.0	0.0	20.2	70.3
Polk Run									
LM40	0.30	10.0	52	NA	20.0	0.0	7.0	10.2	17.0
Duck Creek									
LM71	6.10	2.2	12*	NA	0.0	0.0	0.0	0.0	0.0
LM72	5.14	5.1	24	NA	3.0	1.4	0.0	4.2	100.0
LM73	4.58	5.8	12*	NA	1.0	0.0	0.0	0.0	100.0
LM74	3.90	9.6	28	NA	8.0	0.2	0.0	11.8	84.9
LM75	3.40	11.5	12*	NA	1.0	0.0	0.0	100.0	100.0
LM76	2.80	11.7	24	NA	5.0	0.0	0.0	11.0	97.4
LM77	2.00	14.3	36^{ns}	NA	14.0	1.0	3.0	22.2	62.6
LM79	0.50	14.6	26*	NA	6.0	0.0	1.0	0.0	68.9
East Fork Duck Creek									
LM85	2.00	1.3	22*	NA	3.0	3.3	0.0	33.3	90.0
LM84	0.50	2.0	28*	NA	3.0	0.0	0.0	62.5	70.1
Little Duck Creek									
LM86	2.40	0.2	32*	NA	3.0	0.0	0.0	56.3	77.5
LM87	1.90	0.5	32*	NA	4.0	0.0	0.0	49.1	88.5
LM90	1.00	0.6	32*	NA	4.0	0.0	0.0	37.4	82.4
LM92	0.49	1.7	12*	NA	0.0	0.0	0.0	0.0	0.0
Clough Creek									
LM95	3.20	2.0	30*	NA	5.0	0.0	0.0	43.8	73.6
LM98	0.60	7.8	38^{ns}	NA	10.0	0.0	1.0	42.3	47.6
	Narrative Category	OH IBI	MIwb	Nat. Sp	Anom.	Intols	Smp Lith	% Tolerant	
	Excellent	≥50	na	>25	0.0	>8	>30	≤15	
	Good	≥40	na	>14	<1.3	6-8	>20-30	>15-30	
	Fair	>26	na	>10	<3.0	3-5	>10-20	>30-50	
	Poor	≥18	na	>7	<10	1-2	>5-10	>50-70	
	Very Poor	<18	na	≤7	>10	0	≤5	≥70	

Creek especially. The two downstream Sycamore Creek sites, the Polk Run, and the Clough Creek sites were the only ones to have consistently good to exceptional index scores and attributes and demonstrate the potential for streams with their degree of urban land use.

Fish Assemblage Composition Changes Since 2017

Changes in fish assemblage composition in the Little Miami River mainstem since 2017 are summarized in Table 23. Emerald Shiner *(Notropis atherinoides)* was the numerically predominant species again in 2020 comprising 25.7% of the assemblage. Smallmouth Redhorse *(Moxostoma breviceps)* and Gizzard Shad *(Dorosoma cepedianum)* traded the number two and three spots in 2022 at 10.9% and 7.0%, respectively. From there the changes were more apparent with Smallmouth Buffalo (Ictiobus bubalus), Freshwater Drum *(Aplodinotus grannies)*, and Channel Catfish *(Ictalurus punctatus)* moving up 10 and eight (8) places, respectively. Mountain madtom *(Noturus eleuthurus)* moved from 30th to ninth with a nearly threefold increase in numbers (7.8/Km to 21.5/Km). Of the top 20 most numerous species in 2022, four (4) are highly intolerant and eight (8) are moderately intolerant. Five (5) of these species ranked outside the top 20 in 2017. Only one moderately tolerant and no tolerant species were included in the top 20 species.

Macroinvertebrate Assemblage Results

Macroinvertebrates were sampled in all except one of the 41 sites in the 2022 Little Miami River study area following standardized procedures specified by the 2011 Plan (MBI 2011) and consistent with Level 3 specifications and the Ohio WQS the same as the fish assemblage. Like fish, they were assessed against the WWH suite of uses at 35 sites and factored into the PHWH assessment at four (4) of the PHW classified sites.

Little Miami River Mainstem

All except one of the 13 sites sampled in the EWH designated reach of the Little Miami River mainstem met the ICI biocriterion with three sites in the insignificant departure range (Table 24). In 2017 no ICI results were in the non-significant departure range for EWH (Figure 31). Both 2017 and 2022 are a substantial improvement over 2012 when eight (8) of the 15 sites sampled in the EWH reach were in the non-significant departure range of EWH for the ICI. The only non-attaining site in 2022 is LM16A immediately downstream from Duck Creek and it has never been sampled previously. The ICI score of 40 is only 2 points below the non-significant departure range, but it was 18 points below the upstream site LM15. The impact is lasting as evidenced by only a two point improvement at LM16 some 0.2 miles downstream. Other key macroinvertebrate assemblage indices and attributes such as total taxa, sensitive taxa, %tolerant taxa, qualitative EPT taxa, %toxic tolerant taxa, and %organic enrichment taxa are depicted in Table 24. All of the attributes and metrics were excellent or good with the exception of %Mayflies which was only fair at LM07 downstream from Sycamore Creek. It worsened to poor at LM08 and stayed in the fair range until it recovered to excellent at LM13. The %Mayflies declined to very poor at LM16A downstream from Duck Creek and along with an elevated %Organic Tolerant taxa affirmed the impact from Duck Creek that was expressed in the fish assemblage and several chemical indicators. %Mayflies and %Organic Tolerant taxa recovered only incrementally at LM16. The general pattern was for the excellent attribute characteristics in the upper mainstem to decline to good, fair, and even poor and very poor in two instances in a downstream direction.

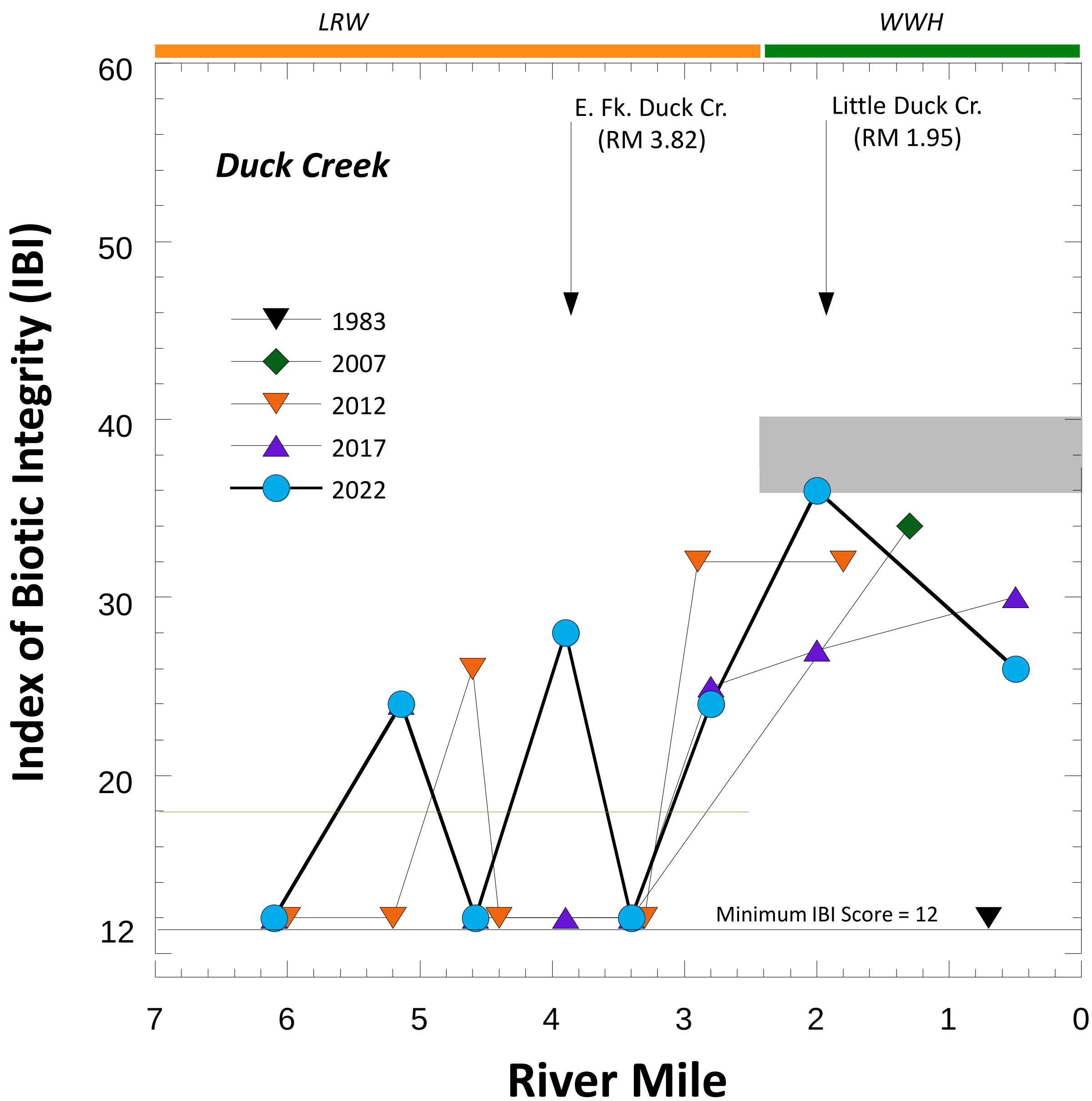


***Figure 30**. Index of Biotic Integrity (IBI) results for the Duck Creek mainstem in 1983, 2007, 2012, 2017, and 2022. The WWH and LRW biocriteria are depicted as a shaded bar and a colored line. The LRW (orange) and WWH (green) designated reaches are indicated along the top of the graph.*

Little Miami River Tributary Subwatersheds

Of the 16 tributary sites that were assessed against the WWH biocriterion, three (3) sites had excellent ICI scores, 10 sites had good ICI or Good or Marginally Good narrative equivalents, and three had fair narrative equivalents (Table 25). In the LRW designated reach of Duck Creek four (4) sites had a fair ICI or equivalent narrative rating, one had a poor narrative rating, and one site had a very poor narrative rating (Table 25). The trend in Duck Creek was a sharp

***Table 23**. A comparison in the numerical ranking of fish species in the Little Miami River mainstem between 2017 and 2022 using the catch-per-unit-effort (CPUE) and proportion of the assemblage (% numbers). The Ohio tolerance classification is included for intolerant (I and R), moderately intolerant (M), moderately tolerant (p), and highly tolerant (T). Species with a blank are intermediate.*

			2022		2017	
Species Name	**Ohio Tolerance**	**Rank in 2017**	**CPUE**	**% Numbers**	**CPUE**	**% Numbers**
Emerald Shiner		1	212.7	25.80	233.4	19.18
Smallmouth Redhorse	M	3	89.8	10.89	131.5	10.81
Gizzard Shad		2	57.8	7.01	168.9	13.88
Smallmouth Buffalo		8	44.2	5.35	33.7	2.76
Northern Hog Sucker	M	4	40.2	4.87	72.5	5.96
Freshwater Drum	P	16	25.5	3.09	22.1	1.82
Channel Catfish		15	22.4	2.71	23.3	1.91
Mimic Shiner	I	5	21.8	2.64	62.8	5.16
Mountain Madtom	R	30	21.5	2.61	7.8	0.64
Golden Redhorse	M	6	19.3	2.34	39.3	3.23
Logperch	M	20	17.5	2.12	12.9	1.06
River Carpsucker		14	15.3	1.85	24.0	1.97
Banded Darter	I	23	15.1	1.83	11.1	0.91
Longear Sunfish	M	12	14.8	1.80	26.4	2.17
Smallmouth Bass	M	11	13.0	1.58	27.1	2.22
Greenside Darter	M	31	12.0	1.46	7.1	0.58
Variegate Darter	I	46	11.6	1.40	1.9	0.15
Spotfin Shiner		17	11.3	1.37	15.8	1.30
Gravel Chub	M	38	10.8	1.31	4.0	0.33
Central Stoneroller		10	10.5	1.28	29.9	2.46
Longnose Gar		25	9.8	1.19	9.2	0.75
Channel Shiner	I	22	9.8	1.19	12.5	1.02
Spotted Bass		18	9.5	1.15	14.1	1.16
Stonecat Madtom	I	35	9.3	1.13	4.7	0.39
Black Buffalo		21	7.4	0.90	12.7	1.04
Bluegill Sunfish	P	9	7.3	0.88	32.0	2.63
Common Carp	T	39	7.1	0.86	4.0	0.33
Sand Shiner	M	24	6.5	0.79	10.1	0.83
Black Redhorse	I	32	6.4	0.77	6.1	0.50
Steelcolor Shiner	P	26	5.9	0.72	8.9	0.73
Rainbow Darter	M	19	5.5	0.66	13.9	1.14
Rosyface Shiner	I	13	5.2	0.63	25.9	2.13
Largemouth Bass		43	5.0	0.61	2.6	0.21
Striped X White Bass		33	4.9	0.59	5.9	0.48
Flathead Catfish		45	4.7	0.58	2.6	0.21

***Table 23**. continued.*

Species Name	Ohio Tolerance	Rank in 2017	2022		2017	
			CPUE	% Numbers	CPUE	% Numbers
Quillback Carpsucker		27	4.4	0.54	8.5	0.70
River Redhorse	I	42	4.2	0.50	3.1	0.25
Slenderhead Darter	R	40	4.2	0.50	3.8	0.31
Green Sunfish	T	29	3.6	0.43	8.0	0.66
Bluntnose Minnow	T	7	3.4	0.41	33.9	2.78
Mooneye	R	52	2.4	0.29	0.9	0.08
Silver Redhorse	M	41	1.6	0.20	3.8	0.31
Sauger		36	0.9	0.11	4.5	0.37
Sauger X Walleye		50	0.9	0.11	0.9	0.08
Suckermouth Minnow		48	0.7	0.09	1.2	0.10
Fantail Darter		54	0.7	0.09	0.5	0.04
White Crappie		28	0.6	0.07	8.2	0.68
Silver Chub		49	0.3	0.04	1.2	0.10
Grass Carp		0	0.3	0.04	0.0	0.00
Black Crappie		59	0.3	0.04	0.2	0.02
Rock Bass		56	0.3	0.04	0.5	0.04
Highfin Carpsucker		0	0.2	0.02	0.0	0.00
Striped Shiner		61	0.2	0.02	0.2	0.02
Bullhead Minnow		37	0.2	0.02	4.5	0.37
Orangespotted Sunfish		55	0.2	0.02	0.5	0.04
Redear Sunfish		0	0.2	0.02	0.0	0.00
Green Sf X Bluegill Sf		0	0.2	0.02	0.0	0.00
Longear Sf X Bluegill Sf		0	0.2	0.02	0.0	0.00
Walleye		58	0.2	0.02	0.2	0.02
Johnny Darter		0	0.2	0.02	0.0	0.00
Unspecified Sucker		0	0.2	0.02	0.0	0.00
Bigmouth Buffalo		57	0.0	0.00	0.5	0.04
River Chub	I	62	0.0	0.00	0.2	0.02
Silver Shiner	I	34	0.0	0.00	5.7	0.46
River Shiner		51	0.0	0.00	0.9	0.08
Yellow Bullhead	T	60	0.0	0.00	0.2	0.02
Brook Silverside	M	47	0.0	0.00	1.2	0.10
White Bass		44	0.0	0.00	2.6	0.21

improvement from the very poor upstream site at LM71 to poor at LM72 to fair at sites LM73, LM74, LM75, and LM76 each of which meets the expectation for macroinvertebrates in a LRW designated stream (Figure 32). The improvement continued into the WWH designated reach of Duck Creek with ICI scores that met and surpassed the WWH biocriterion.

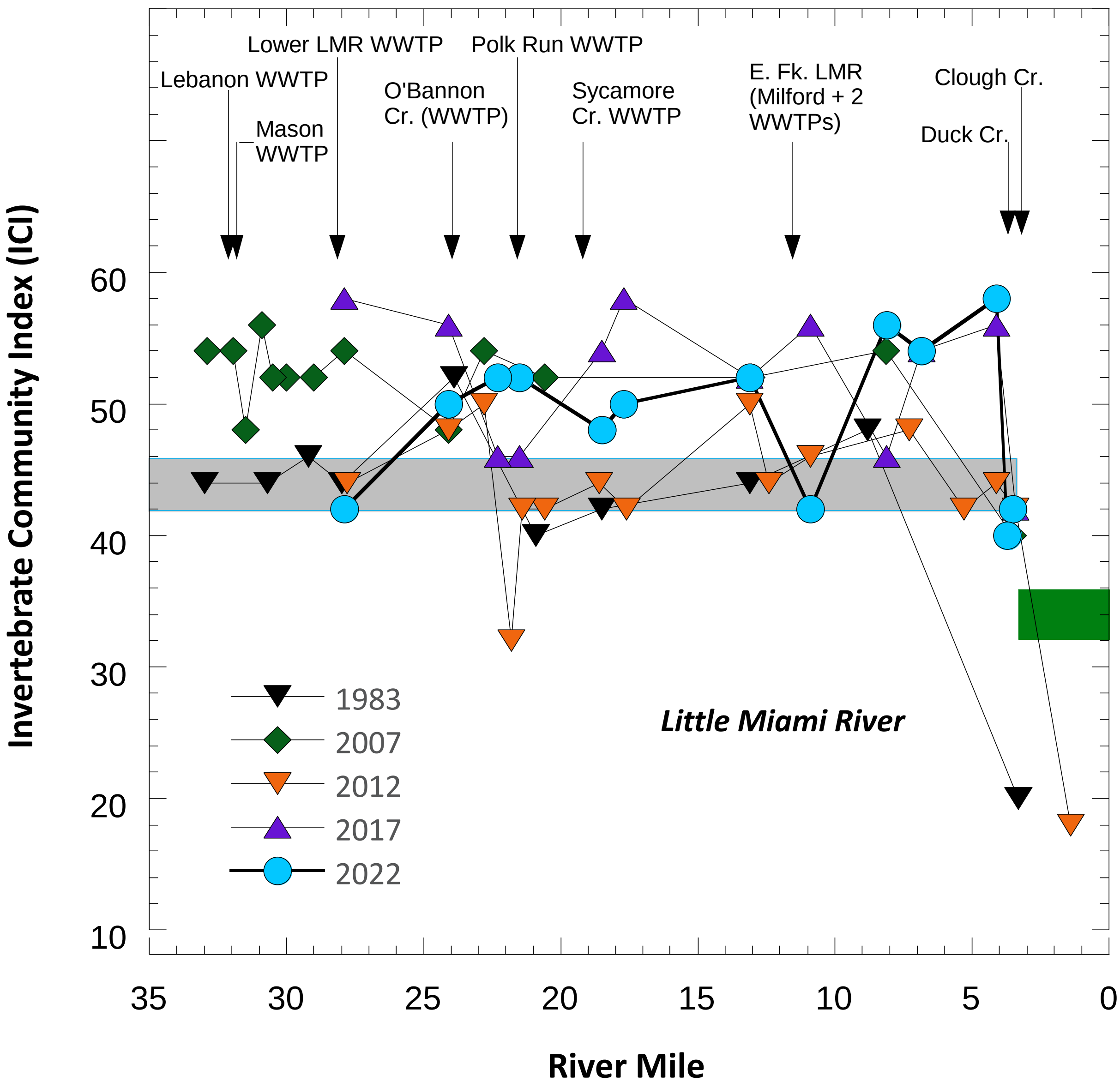


Figure 31. *Invertebrate Community Index (ICI) results for the Little Miami River mainstem in 1983, 2007, 2012, 2017, and 2022. The EWH and WWH biocriteria are depicted as shaded areas between the biocriterion and the non-significant departure with major pollution sources and tributaries along the top of the graph.*

The most urban impacted sites had numerous fair, poor, and very poor values for selected macroinvertebrate attributes, namely sensitive taxa, qualitative EPT taxa, and % or number of Mayflies, which was zero in most of the Duck Creek watershed, the unnamed tributary to Sycamore Creek, and Clough Creek. The % or number of toxic tolerant taxa was elevated well into the fair range at only one site, LM76 in Duck Creek and the number of % Organic Tolerant taxa was elevated into the poor range at the next site LM77.

***Table 24**. Selected macroinvertebrate assemblage attributes at 13 sites Little Miami River mainstem sampled in the 2022. Color shading in the cells indicates the narrative quality of the index or attribute value in accordance with the thresholds in the footnotes at the bottom of the table (ns – nonsignificant departure; exceedances are asterisked).*

Site ID	River Mile	Drainage Area (mi.^{2})	Macroinvertebrate Assemblage Response Indicators							
			ICI	Total Site Taxa	Sensitive Taxa (Qualitative)	%Tolerant Macros	%Mayflies	Qualitative EPT Taxa	%Toxic Tolerant Taxa[a]	%Organic Tolerant Taxa[a]
Little Miami River										
LM01	27.90	1070	42[ns]	97	33	0.12	21.6	33	0.1	12.7
LM02	24.10	1090	50	85	28	0.00	21.3	30	0.0	2.0
LM03	22.30	1150	52	78	30	0.18	29.6	28	0.2	6.8
LM05	21.50	1160	52	81	29	1.15	47.1	27	0.5	8.4
LM07	18.50	1190	48	90	30	0.39	12.0	30	0.3	8.9
LM08	17.70	1190	50	81	24	1.14	8.1	25	1.1	4.8
LM09	13.10	1200	52	79	28	0.93	14.8	27	0.9	2.0
LM11	10.90	1710	42[ns]	85	30	0.00	14.2	26	0.0	5.9
LM12	8.10	1710	56	75	27	0.03	15.3	24	0.0	2.1
LM13	6.83	1720	54	79	31	0.25	35.9	29	0.3	14.5
LM15	4.10	1730	58	71	25	0.00	23.8	24	0.0	6.4
LM16A	3.70	1740	40*	72	12	2.19	4.8	15	0.0	16.9
LM16	3.50	1750	42[ns]	76	20	1.11	8.6	25	0.5	11.5
	Excellent		≥46	>60	>16	≤5	≥30	>15	0	<5
	Good		>36	>40-60	11-16	>5-10	>20-30	11-15	<5	<15
	Fair		>14	>20-40	6-10	>10-25	>10-20	6-10	<20	≥15
	Poor		>6	>10-20	2-5	>25-50	>5-10	2-5	≥35	≥35
	Very Poor		≤6	<10	<2	≥50	≤5	<2	<60	>60

Synthesis of Results

Table 26 represents a synthesis of the aquatic life use attainment status, the biological criteria by which attainment status is derived, the principal indicators of biological quality and response to predominant stressors, indicators of habitat quality, key aspects of the D.O. regime that are affected by organic and nutrient enrichment, and key chemical indicators consisting of water column and sediment chemistry in 2022. Each index score, metric, attribute, or response signature was normalized to a narrative scale of exceptional, good, fair, poor, and very poor quality with the results color coded accordingly. This analysis presents a synthesis of the results that were previously described on an individual assemblage, attribute, or parameter basis.

The Southwest Ohio IPS thresholds for land use, water chemistry, and physical habitat attributes (MBI 2015) were used to assess causes of impairment and their comparative severity. Threats to attaining sites are also determined by the IPS and these are evaluated as well. The approach for deriving these thresholds included a more refined stratification of biological effect threshold values for parameters that showed valid relationships with biological responses based on species and taxa level analyses and then correlated with the corresponding fish and

***Table 25**. Selected macroinvertebrate assemblage attributes at 22 sites in Little Miami River tributary subwatersheds sampled in the 2022. Color shading in the cells indicates the narrative quality of the index or attribute value in accordance with the thresholds in the footnotes at the bottom of the table (ns – nonsignificant departure; exceedances are asterisked).*

Site ID	River Mile	Drainage Area (mi.²)	Macroinvertebrate Assemblage Response Indicators							
			ICI	Total Site Taxa	Sensitive Taxa (Qualitative)	%Tolerant Macros	%Mayflies	Qualitative EPT Taxa	%/# Toxic Tolerant Taxa[a]	%/# Organic Tolerant Taxa[a]
Sycamore Creek										
LM50	1.10	12.5	46	58	4	2.29	21.6	11	0.6	7.0
LM51	0.50	22.8	48	65	13	0.03	36.8	15	0.0	6.0
LM52	0.10	23.3	38	62	10	1.62	6.1	13	0.0	4.9
Unnamed Tributary to Sycamore Cr. at RM 1.12										
LM55	1.20	5.3	G	24	3	0.00	0.0	8	1	4
LM56	0.20	5.6	36	45	4	10.99	0.0	10	9.6	19.0
Polk Run (LMR RM 21.55)										
LM40	0.30	10.0	50	57	12	0.09	39.3	14	0.0	1.1
Duck Creek (LMR RM 3.87)										
LM71	6.10	2.2	VP	11	0	0.00	0.0	0	1	1
LM72	5.14	5.1	P	18	0	0.00	0.0	3	1	2
LM73	4.58	5.8	F	17	0	0.00	0.0	5	1	3
LM74	3.90	9.6	F	20	1	0.00	0.0	6	1	3
LM75	3.40	11.5	F	25	0	0.00	0.0	5	1	4
LM76	2.80	11.7	26	39	2	42.82	27.6	7	32.8	12.6
LM77	2.00	14.3	32	42	1	18.71	22.2	7	3.0	35.0
LM79	0.50	14.6	38	49	2	4.83	55.9	10	4.0	8.4
East Fork Duck Creek										
LM85	2.00	1.3	F	26	0	0.00	0.0	5	1	4
LM84	0.50	2.0	F	29	0	0.00	0.0	5	1	4
Little Duck Creek										
LM86	2.40	0.2	MG	24	3	0.00	0.0	7	1	4
LM87	1.90	0.5	G	28	4	0.00	0.0	9	1	4
LM90	1.00	0.6	G	29	4	0.00	0.0	8	1	4
LM92	0.49	1.7								
Clough Creek (LMR RM 2.9)										
LM95	3.20	2.0	MG	19	3	0.00	0.0	7	0	0
LM98	0.60	7.8	G	36	6	0.00	0.0	11	0	4
	Excellent		≥46/E	>60	>16	≤5	≥30	>15	0/0	<5/0
	Good		>36/G	>40-60	11-16	>5-10	>20-30	11-15	<5/1	<15/≤2
	Fair		>14/F	>20-40	6-10	>10-25	>10-20	6-10	<20/>2	≥15/≤5
	Poor		>6/P	>10-20	2-5	>25-50	>5-10	2-5	≥35/>3	≥35/≤8
	Very Poor		≤6/VP	<10	<2	≥50	≤5	<2	<60/≥4	>60/≥9

macroinvertebrate index attainment thresholds for the Ohio tiered aquatic life uses and narrative ratings (MBI 2015). This produced thresholds across five narrative categories of quality (excellent, good, fair, poor, and very poor) with excellent corresponding to the EWH,

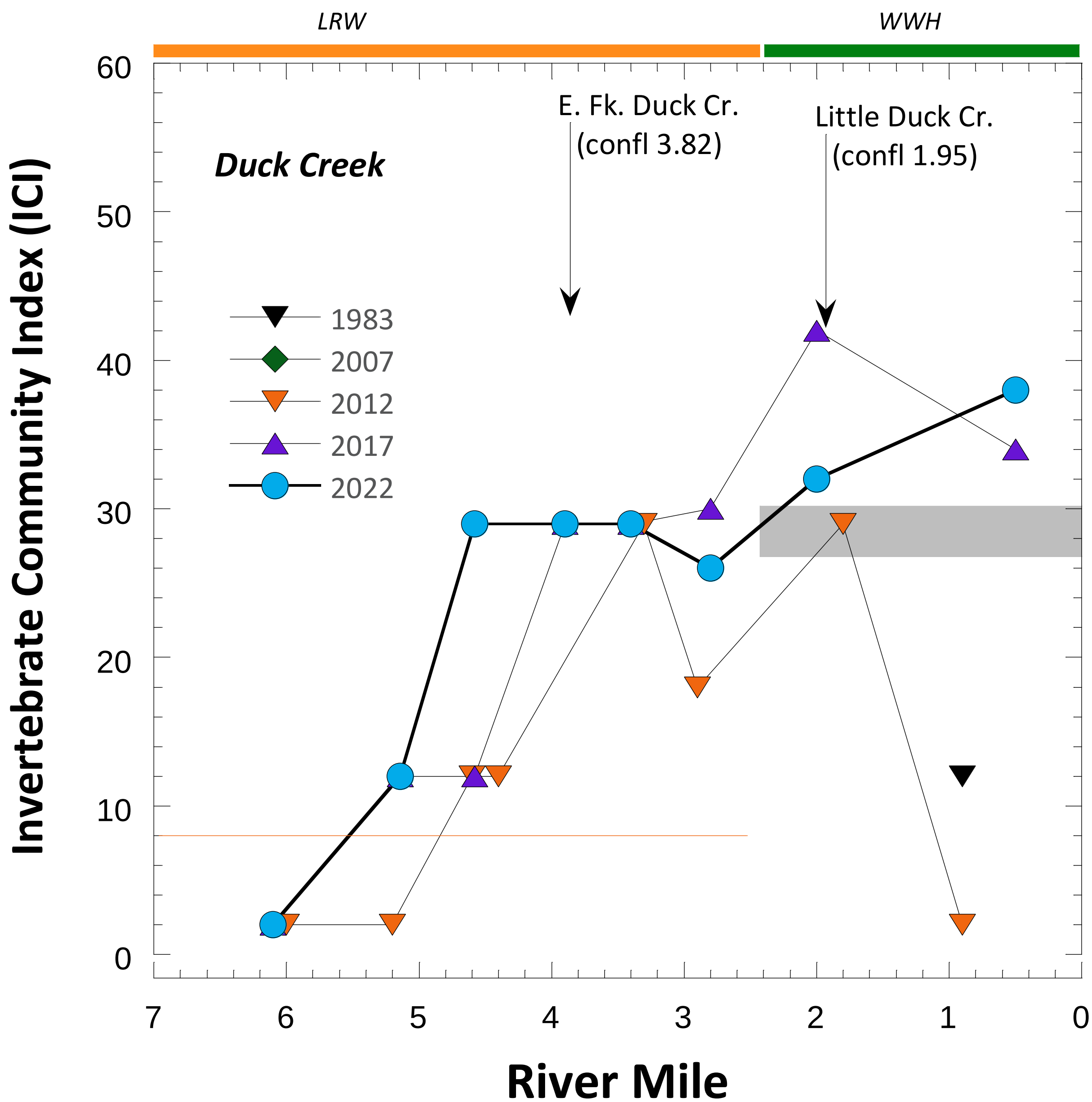


***Figure 32**. Invertebrate Community Index (ICI) results for the Duck Creek mainstem in 1983, 2007, 2012, 2017, and 2020. The WWH and LRW biocriteria are depicted as a shaded bar and a colored line. The LRW (orange) and WWH (green) designated reaches are indicated along the top of the graph.*

good to the WWH, and poor to the LRW use designations. This replaces the binary (i.e., "pass/fail") approach to evaluating exceedances of chemical and physical effect thresholds and criteria by providing a gradient approach to the assignment of causes and sources of biological impairments. The IPS framework is anchored in the tiered aquatic life use (TALU) framework by stratifying goals and thresholds that are incorporated into all IPS outputs to support local restoration and protection efforts by MSDGC and the respective watershed groups and stakeholders.

***Table 26**. Key chemical, physical, and biological response indicators of impairment observed at each site in the Little Miami River study area in 2020. The causes associated with biological impairments are drawn from analyses of habitat, nutrient effects, chemical IPS, and other threshold exceedances, and biological response signatures. Causes of impairment are classified as fair, poor, or very poor in accordance with the exceedance of corresponding thresholds. Threats to attainment are listed for attaining sites. See footnotes for table references and biological, physical, and chemical thresholds ((ns – nonsignificant departure; exceedances are asterisked).*

Site ID	River Mile Fish/Macros	Drainage Area (sq. mi.)	Aquatic Life Use	IBI	MIwb	ICI	Aq. Life Status	QHEI	Good QHEI Attributes	Poor QHEI Attributes	%/# Toxic Tolerant Taxa	%/# Organic Tolerant Taxa	Min. D.O. (mg/L)	Max. D.O. (mg/L)	Max. Daily D.O. Swing	Nutrient Box/SNAP Status	Water Column Poor/VP Exceedances	Sediment Metals Exceedances	Sediment PAH Exceedances	Very Poor	Poor	Fair
Little Miami River (EWH Aquatic Life Use –Existing)																						
LM01	27.90/27.80	1070	EWH	50	10.3	42^{ns}	Full	89.5	9	0	0.1	12.7	4.5	9.5	3.5	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Chloride; TDS; Nitrate; Cond; Min DO		
LM02	24.10/23.90	1090	EWH	52	10.9	50	Full	91.0	9	0	0.0	2.0	7.1	9.2	1.8	Acceptable	0	0	0	TDS; H. Urb (Cat); H. Urb (Buff); Nitrate; Cond;		
LM03	22.30/22.20	1150	EWH	47^{ns}	9.5^{ns}	52	Full	84.5	8	2	0.2	6.8	6.9	10.0	2.8	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate;		
LM05	21.50/20.90	1160	EWH	47^{ns}	10.3	52	Full	89.5	9	0	0.5	8.4	7.0	10.8	3.8	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate; Max. Temperature		
LM07	18.50/18.50	1190	EWH	51	10.3	48	Full	89.5	9	0	0.3	8.9	6.9	10.6	3.2	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate;		
LM08	17.70/16.90	1190	EWH	52	10.2	50	Full	85.5	9	0	1.1	4.8	7.1	10.3	3.0	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate; Chloride;		
LM09	13.10/13.10	1200	EWH	48	10.0	52	Full	87.8	9	0	0.9	2.0	7.0	9.5	1.9	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); BOD; Nitrate;		
LM11	10.90/10.90	1710	EWH	44^{ns}	9.8	42^{ns}	Full	85.0	9	0	0.0	5.9	6.9	9.0	1.1	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate;		
LM12	8.10/8.00	1710	EWH	44^{ns}	9.3^{ns}	56	Full	89.3	9	0	0.0	2.1	6.8	8.6	1.1	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate;		
LM13	6.83/7.30	1720	EWH	46^{ns}	9.8	54	Full	87.0	9	0	0.3	14.5	6.8	8.5	0.6	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Nitrate; Copper		
LM15	4.10/4.10	1730	EWH	44^{ns}	10.1	58	Full	87.5	9	0	0.0	6.4	6.7	8.3	0.7	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); BOD; Nitrate;		
LM16A	3.70/3.70	1740	EWH	30*	8.8*	40*	Non	65.0	4	7	0.0	16.9	3.1	8.5	5.3	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff);		Channel; BOD; Org., Enrich;
LM16	3.50/3.50	1750	EWH	41*	9.2^{ns}	42^{ns}	Partial	84.0	8	3	0.5	11.5	6.6	8.3	0.8	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff);		
Little Miami River (WWH Aquatic Life Use –Existing)																						
LM17	1.60/1.40	1760	WWH	36^{ns}	7.8*		Partial	62.0	4	7			7.1	11.0	3.6	Acceptable	2	0	0	H. Urb (Cat);		Channel; Lead
Sycamore Creek (WWH Aquatic Life Use - Existing)																						
LM50	1.10/1.00	12.5	WWH	24*	NA	46	Non	70.0	9	1	0.6	7.0				Nutrients	5	0	0	H. Urb (Cat); H. Urb (Buff);	Chloride; BOD; TDS; TAmm;	TKN; Cond;
LM51	0.50/0.24	22.8	WWH	49	7.7^{ns}	48	Full	61.5	4	5	0.0	6.0	4.7	8.5	3.8	Threats	0	0	0	H. Urb (Cat); H. Urb (Buff); Chloride; Channel; TDS; Cond;		
LM52	0.10/0.10	23.3	WWH	47	7.8^{ns}	38	Full	68.0	7	4	0.0	4.9	7.2	9.2	1.9	Threats	0	0	0	Chloride; pH; Nitrate; H. Urb (Cat); H. Urb (Buff); TDS; Cond; TKN;		
Unnamed Tributary at RM 1.82 Unnamed Tributary to Sycamore Cr. at RM 1.12 (PHW2 Existing Use)																						
LM54	2.40/2.40	1.58	PHW3	12	NA		PHW3A				0	3				Acceptable				QHEI; Substr; Channel; H. Urb (Cat); Org. Enrich		
Unnamed Tributary to Sycamore Cr. at RM 1.12 (WWH Aquatic Life Use - Existing)																						
LM55	1.20/1.00	5.32	WWH	26*	NA	G	Non	60.8	6	5	9.6	19.0	2.9	5.2	2.3	Acceptable	3			Chloride; TDS; H. Urb (Cat);	Cond;	Channel; Toxics; Org., Enrich
LM56	0.20/0.20	5.61	WWH	28*	NA	36	Partial	63.0	7.0	4.0	1	4	3.3	5.9	2.6	Acceptable	1			QHEI; Substr; Channel; H. Urb (Cat);	Chloride;	Org. Enrich
Polk Run (WWH Aquatic Life Use - Existing)																						
LM40	0.30/0.30	9.97	WWH	52	NA	50	Full	63.0	6	4	0.0	1.1	7.6	10.3	2.7	Acceptable	0	0	0	Chloride; H. Urb (Cat); H. Urb (Buff); TDS; Channel; Cond;		
Duck Creek (LRW Aquatic Life Use – Existing)																						
LM71	6.10/6.00	2.24	LRW	12*	NA	VP*	Non	26.0	2	4	1	1	6.6	7.6	1.1	Nutrients	3	0	0	Substr; H. Urb (Cat);	QHEI; Chloride;	Channel;
LM72	5.14/4.60	5.05	LRW	24	NA	P	Full	54.5	3	5	1	2	4.2	7.7	3.5	Threats	0	0	0	H. Urb (Cat); H. Urb (Buff); Chloride; TDS; QHEI; Channel; Cond; Org. Enrich		
LM73	4.58/4.40	5.84	LRW	12*	NA	F	Non	16.0	2	4	1	3	2.9	7.4	4.5	Nutrients	3	1	0	QHEI; Substr; H. Urb (Cat); H. Urb (Buff);	Chloride; TDS;	Channel; Cond;
LM74	3.90/3.90	9.59	LRW	28	NA	F	Full	63.0	5	7	1	3	5.2	8.9	3.7	Threats	0	0	0	H. Urb (Cat); H. Urb (Buff); Chloride; Channel; TDS; Cond;		
LM75	3.40/3.30	11.5	LRW	12*	NA	F	Non	15.0	1	5	1	4	7.7	11.8	4.2	Nutrients	3	0	0	QHEI; Substr; Chloride; TDS; H. Urb (Cat); H. Urb (Buff)	Cond;	Channel;
LM76	2.80/2.90	11.7	LRW	24	NA	26	Full	66.0	5	5	32.8	12.6	7.5	9.5	2.0	Threats	0	0	0	Chloride; TDS; H. Urb (Cat); H. Urb (Buff); BOD; Cond; Channel;		
Duck Creek (WWH Aquatic Life Use – Existing)																						
LM77	2.00/1.80	14.3	WWH	36^{ns}	NA	32	Full	67.0	6	4	3.0	35.0	5.9	7.4	1.5	Threats	0	0		Chloride; TDS; H. Urb (Cat); H. Urb (Buff); Cond; Channel;		
LM79	0.50/0.90	14.6	WWH	26*	NA	38	Non	68.8	7	3	4.0	8.4	5.0	6.8	1.8	Nutrients	4	0		H. Urb (Cat); H. Urb (Buff);	Chloride; TDS;	Cond;
Unnamed Tributary to Duck Creek at RM 4.8 (PHW2 Existing Use)																						
LM83	0.00/0.80	1.20	PHW2	12	NA		PHW2									PHW2				QHEI; Substr; Channel; H. Urb (Cat); H. Urb (Buff);		
LM80	0.10/0.20	1.42	PHW2	12	NA	P	PHW2	34.5	2	6	1	6	0.7	6.2	5.4	PHW2	0	0		Chloride; BOD; TDS; pH; Cond; H. Urb (Cat); H. Urb (Buff); QHEI; Substr; Channel; TKN; Org. Enrich;		
East Fork Duck Creek (WWH Aquatic Life Use - Existing)																						
LM81	2.30/2.30	0.29	PHW1		NA		PHW1	Dry - no samples (HHEI only)												Dry - no samples		
LM85	2.00/1.50	1.31	WWH	22*	NA	F	Non	62.5	5	5	1	4	4.0	5.3	1.4	Nutrients	5	0		TDS; H. Urb (Cat); H. Urb (Buff);	Chloride; Cond;	Channel; TKN; Org. Enrich;
LM84	0.50/0.60	1.99	WWH	28*	NA	F	Non	65.0	5	4	1	4	5.6	7.2	1.6	Nutrients	5	0		Chloride; TDS; Cond; H. Urb (Cat); H. Urb (Buff);		Channel; Org. Enrich; Copper
Little Duck Creek (WWH Existing Use)																						
LM86	2.40/2.70	0.22	WWH	32*	NA	MG	Partial	56.5	3	5	1	4	5.6	7.8	2.2	Nutrients	3	0		H. Urb (Cat);	Chloride; TDS;	QHEI; Channel; Cond; Org Enrich
LM87	1.90/2.60	0.45	WWH	32*	NA	G	Partial	61.0	5	5	1	4	5.6	7.1	1.5	Nutrients	3	0		H. Urb (Cat);	Chloride; TDS;	Channel; Cond; Org Enrich
LM90	1.00/2.30	0.55	WWH	32*	NA	G	Partial	61.0	5	4	1	4	5.9	8.3	2.5	Nutrients	4	0		H. Urb (Cat); H. Urb (Buff);	Chloride; TDS; Cond;	Channel; Org Enrich
LM92	0.49/0.49	1.68	WWH	12*	NA		Non	66.5	8	2			3.8	3.8	0.0	Nutrients	3	0		H. Urb (Cat); H. Urb (Buff);	TDS;	Chloride; Cond;
Unnamed Tributary to Little Duck Creek at RM 4.42 (PHW3A Existing Use)																						
LM82	0.20/0.10	0.59	PHW3A	28	NA		PHW3A	50.5	4	7	0	2	3.0	6.0	2.9	PHW2	0	0		H. Urb (Cat); TDS; QHEI; Channel; TKN; Chloride; Cond;		
Clough Creek (WWH Aquatic Life Use – Existing)																						
LM95	3.20/3.20	1.95	WWH	30*	NA	MG	Partial	59.0	5	5	0	0	6.8	7.2	0.4	Acceptable	4			Chloride; pH; H. Urb (Cat); H. Urb (Buff);	TDS;	QHEI; Channel; Cond;
LM98	0.60/0.40	7.81	WWH	38^{ns}	NA	G	Full	59.5	5	4	0	4	6.1	6.1	0.1	Acceptable	0	0	0	H. Urb (Cat); H. Urb (Buff); Chloride; TDS;QHEI; Channel; Cond; Org. Enrich		

Biological Criteria – Interior Plateau Ecoregion				
Index	**EWH**	**WWH**	**MWH**	**LRW**
IBI – Boat	48	38	26	16.0
IBI – Wading	50	40	28	18.0
IBI - HW	50	40	28	18.0
MIwb - Boat	9.6	8.7	6.4	5.0
MIwb – Wading	9.4	8.1	5.9	4.5
ICI	46	30	14	8.0
ICI Narrative	E	G	F	P

QHEI	Good QHEI Attributes	Poor QHEI Attributes	%/# Toxic Tolerant Taxa	%/# Organic Tolerant Taxa	Min. D.O. (mg/L)	Max. D.O. (mg/L)	Max. Daily D.O. Swing	Nutrient Box/SNAP Status	Water Column Poor/VP Exceedances	Sediment Metals Exceedances	Sediment PAH Exceedances
>75	≥9	≤1	0	<5				Acceptable	0	0	0
60-74	≥6	≤4	<5	<15	>4	<12	<7.0	Acceptable	1	0	<4
46-59	≥4	≤5	<20	≥15	<4	>12	7.0 - 8.9	Enriched	2	1	<7
30-45	≥2	≥6	≥35	≥35	<2	>15	>9.0	Over Enrich.	3	3	<10
<30	≤1	≥7	<60	>60					4	5	≥10

The delineation of causes and sources was based on integrating and synthesizing the preceding analyses of categorical and parameter-specific stressor threshold exceedances. The most influential of these in 2022 are included in Table 26 along with the fish and macroinvertebrate index scores and other indicators of stress and response. Habitat alteration is represented by the QHEI and the QHEI modified and good attributes, D.O. includes the minimums measured by Datasondes, the effect of nutrient enrichment by the diel D.O. swing narrative, the nutrient enrichment effect status, the IPS chemical threshold exceedances for water and sediment, and biological response signatures for organic enrichment and toxic tolerant indicators.

These were accounted for in the Duck Creek subwatershed and the Sycamore Creek, Polk Run, and Clough Creek partial subwatersheds separately and are the basis for Figure 4 in the Executive Summary. The Little Miami River mainstem had a very brief reach of impairment that was caused by a combination of organic enrichment and toxicity emanating from Duck Creek as shown in the Synthesis table. The predominant causal categories in the Duck Creek subwatershed in 2022 were as follows:

- **Urban Land Uses** (19 observations; weighted frequency of 21.1%) – includes urban land use in the HUC12 catchment and in the 500-meter buffer expressed as the percent of that area;
- **Habitat Related** (29 observations; weighted frequency of 32.2%) – any high influence or moderate influence modified attribute in the QHEI attributes matrix (Table 20) or a fair, poor, or very poor QHEI score;
- **Ionic Strength/Demand** (28 observations; weighted frequency of 31.1%) – any exceedance of a fair, poor, or very poor threshold for a chloride, total dissolved solids, or specific conductivity parameter;
- **Toxics** (0 observations; weighted frequency of 0%) – any exceedance of a sediment metal or PAH TEC or PEC threshold, fair, poor, or very poor ammonia-N, any toxic parameter criteria exceedance, and any toxic response signature in the biological data;
- **Organic Enrichment/Low D.O.** (7 observations; weighted frequency of 7.8%) – any low D.O., fair, poor, or very poor TKN value, or any organic enrichment response signature in the biological data; and
- **Nutrient Enrichment/Effects** (7 observations; weighted frequency of 7.8%) – excessive diel D.O. swing narrative rating, fair, poor, or very poor total phosphorus, nitrate-N, or BOD_5 result.

As expected, the leading causes are directly related to the heavily urbanized characteristics of the Duck Creek subwatershed that include a mix of physical and chemical impacts. The predominant causal categories in the Sycamore Creek, Polk Run, and Clough Creek partial subwatersheds in 2022 were as follows:

- **Urban Land Uses** (4 observations; weighted frequency of 11.4%) – includes urban land use in the HUC12 catchment and in the 500 meter buffer expressed as the percent of that area;

- **Habitat Related** (13 observations; weighted frequency of 37.1%) – any high influence or moderate influence modified attribute in the QHEI attributes matrix (Table 20) or a fair, poor, or very poor QHEI score;
- **Ionic Strength/Demand** (8 observations; weighted frequency of 22.9%) – any exceedance of a fair, poor, or very poor threshold for a chloride, total dissolved solids, or specific conductivity parameter;
- **Toxics** (1 observations; weighted frequency of 2.9%) – any exceedance of a sediment metal or PAH TEC or PEC threshold, fair, poor, or very poor ammonia-N, any toxic parameter criteria exceedance, and any toxic response signature in the biological data;
- **Organic Enrichment/Low D.O.** (3 observations; weighted frequency of 8.6%) – any low D.O., fair, poor, or very poor TKN value, or any organic enrichment response signature in the biological data; and
- **Nutrient Enrichment/Effects** (6 observations; weighted frequency of 17.1%) – excessive diel D.O. swing narrative rating, fair, poor, or very poor total phosphorus, nitrate-N, or BOD_5 result.

The influence of urban related impacts was less than in Duck Creek in these partial subwatersheds, but the influence of habitat alterations and urban pollutants were the two dominant causal categories.

The SW Ohio IPS also offers susceptibility and threat delineations for sites that attain their respective aquatic life use tier. The Little Miami River mainstem was in full attainment of the EWH use at all except the two downstream most sites, LM16A and LM16, in the EWH designated reach. The predominant threat categories in 2022 were as follows:

- **Urban Land Uses** (22 observations) – threats include elevated urban land use in the HUC12 catchment and in the 500 meter buffer expressed as the percent of that area;
- **Organic Enrichment/Low D.O.** (13 observations) – threats included low D.O. and elevated BOD_5 and nitrate-N;
- **Ionic Strength/Demand** (5 observations) – threats included elevated chloride, total dissolved solids, or specific conductivity;
- **Toxics** (1 observation) – a single threat was in the form of an elevated copper value that exceeded the water quality criterion for EWH; and
- **Habitat Related** (0 observations) – no threat was posed by deficient or marginal habitat attributes at any of the attaining sites.

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Appendix A

Little Miami River 2022 Fish Assemblage Data
A-1: IBI Metrics and Scores and MIwb Scores
A-2: Fish Species Grand Report
A-3: Fish Species by Date

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Number of: Sunfish species	Number of: Sucker species	Number of: Intolerant species	Percent of Individuals: Rnd-bodied suckers	Percent of Individuals: Simple Lithophils	Percent of Individuals: Tolerant fishes	Percent of Individuals: Omni-vores	Percent of Individuals: Top carnivores	Percent of Individuals: Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
Little Miami River - (11001)																			
Year: 2022																			
LM01	27.90	P	09/19/2022	1069	32(5)	3(3)	7(5)	8(5)	28(3)	45(5)	1(5)	10(5)	2(1)	86(5)	0.0(5)	676(5)	52	10.5	MBI
LM01	27.90	P	08/01/2022	1069	27(5)	1(1)	6(5)	8(5)	20(3)	29(3)	1(5)	6(5)	2(1)	85(5)	0.0(5)	848(5)	48	10.0	MBI
LM02	24.10	P	08/01/2022	1085	34(5)	2(3)	7(5)	9(5)	24(3)	36(3)	1(5)	12(5)	12(5)	69(5)	0.8(3)	486(5)	52	10.9	MBI
LM02	24.10	P	09/19/2022	1085	37(5)	3(3)	10(5)	9(5)	39(5)	55(5)	1(5)	7(5)	5(1)	81(5)	1.2(3)	506(5)	52	11.0	MBI
LM03	22.30	P	08/02/2022	1148	27(5)	3(3)	6(5)	5(5)	23(3)	29(3)	7(5)	9(5)	5(3)	82(5)	0.5(5)	372(3)	50	10.0	MBI
LM03	22.30	P	09/20/2022	1148	23(5)	3(3)	5(3)	5(5)	18(1)	45(5)	2(5)	6(5)	3(1)	91(5)	0.5(3)	388(3)	44	9.0	MBI
LM05	21.50	P	08/02/2022	1160	35(5)	3(3)	10(5)	7(5)	18(1)	26(3)	1(5)	5(5)	5(1)	85(5)	0.8(3)	506(5)	46	10.5	MBI
LM05	21.50	P	09/20/2022	1160	33(5)	2(3)	8(5)	8(5)	14(1)	35(3)	0(5)	6(5)	3(1)	84(5)	0.5(5)	428(5)	48	10.0	MBI
LM07	18.50	P	08/02/2022	1187	28(5)	2(3)	8(5)	7(5)	30(3)	37(3)	3(5)	10(5)	7(3)	74(5)	0.6(5)	336(3)	50	10.5	MBI
LM07	18.50	P	09/20/2022	1187	25(5)	2(3)	8(5)	6(5)	29(3)	59(5)	0(5)	3(5)	5(3)	86(5)	0.0(5)	314(3)	52	10.1	MBI
LM08	17.70	P	08/02/2022	1190	27(5)	2(3)	8(5)	8(5)	33(3)	47(5)	0(5)	7(5)	11(5)	71(5)	0.0(5)	230(3)	54	10.6	MBI
LM08	17.70	P	09/20/2022	1190	23(5)	1(1)	7(5)	5(5)	46(5)	54(5)	0(5)	9(5)	5(3)	77(5)	0.7(3)	296(3)	50	9.9	MBI
LM09	13.10	P	08/03/2022	1203	34(5)	3(3)	9(5)	8(5)	27(3)	30(3)	0(5)	3(5)	3(1)	89(5)	0.0(5)	638(5)	50	10.1	MBI
LM09	13.10	P	09/22/2022	1203	25(5)	1(1)	5(3)	5(5)	25(3)	37(3)	0(5)	8(5)	8(3)	79(5)	0.0(5)	404(3)	46	9.9	MBI
LM11	10.90	P	09/02/2022	1707	25(5)	1(1)	5(3)	3(3)	17(1)	27(3)	0(5)	6(5)	4(1)	79(5)	0.0(5)	326(3)	40	9.5	MBI
LM11	10.90	P	08/03/2022	1707	28(5)	6(5)	8(5)	4(5)	31(3)	33(3)	2(5)	9(5)	4(1)	83(5)	1.2(3)	330(3)	48	10.0	MBI
LM12	8.10	P	08/03/2022	1710	30(5)	3(3)	7(5)	4(5)	7(1)	10(1)	1(5)	16(5)	5(3)	74(5)	0.7(3)	560(5)	46	9.3	MBI
LM12	8.10	P	09/22/2022	1710	23(5)	3(3)	3(3)	6(5)	12(1)	32(3)	2(5)	5(5)	5(1)	86(5)	1.1(3)	364(3)	42	9.2	MBI
LM13	6.83	P	08/03/2022	1720	28(5)	4(5)	10(5)	5(5)	13(1)	14(1)	2(5)	18(3)	11(5)	54(5)	0.0(5)	354(3)	48	10.3	MBI
LM13	6.83	P	09/22/2022	1720	25(5)	1(1)	9(5)	4(5)	9(1)	18(1)	0(5)	6(5)	20(5)	70(5)	1.9(3)	216(3)	44	9.4	MBI
LM15	4.10	P	08/03/2022	1730	28(5)	2(3)	6(5)	4(5)	7(1)	13(1)	2(5)	18(3)	3(1)	64(5)	0.7(3)	582(5)	42	10.2	MBI
LM15	4.10	P	09/21/2022	1730	23(5)	2(3)	6(5)	2(3)	13(1)	25(3)	1(5)	12(5)	10(3)	57(5)	0.6(5)	344(3)	46	10.1	MBI
LM16A	3.70	P	08/04/2022	1752	20(3)	2(3)	6(5)	2(3)	3(1)	3(1)	11(5)	31(1)	3(1)	48(3)	2.6(3)	334(3)	32	8.6	MBI
LM16A	3.70	P	09/21/2022	1752	14(3)	1(1)	4(3)	1(1)	1(1)	2(1)	13(5)	37(1)	18(5)	43(3)	6.0(1)	204(3)	28	9.1	MBI

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

					Number of				Percent of Individuals							Rel.No.			
Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM16	3.50	P	08/04/2022	1752	18(3)	0(1)	7(5)	3(3)	15(1)	16(1)	1(5)	16(5)	7(3)	64(5)	0.5(5)	362(3)	40	9.1	MBI
LM16	3.50	P	09/21/2022	1752	23(5)	1(1)	6(5)	4(5)	9(1)	23(3)	1(5)	18(3)	7(3)	63(5)	3.0(3)	332(3)	42	9.3	MBI
LM17	1.60	P	08/04/2022	1754	16(3)	1(1)	5(3)	1(1)	3(1)	4(1)	1(5)	12(5)	10(3)	75(5)	0.0(5)	204(3)	36	7.8	MBI
Year: 2020																			
LM02	24.10	A	08/25/2020	1085	32(5)	4(5)	10(5)	3(3)	19(1)	22(3)	0(5)	32(1)	9(3)	53(3)	0.0(5)	69(1) *	40	9.1	OEPA
LM02	24.10	A	09/15/2020	1085	38(5)	4(5)	9(5)	9(5)	4(1)	6(1)	15(5)	16(3)	3(1)	78(5)	0.2(5)	424(5)	46	9.1	OEPA
LM09	13.07	A	08/19/2020	1203	28(5)	2(3)	9(5)	7(5)	14(1)	16(1)	1(5)	10(5)	4(1)	80(5)	0.0(5)	75(1) *	42	8.0	OEPA
LM09	13.07	A	09/22/2020	1203	30(5)	2(3)	7(5)	4(5)	11(1)	13(1)	1(5)	2(5)	12(5)	80(5)	0.0(5)	105(1) *	46	7.9	OEPA
LM16	3.50	A	08/21/2020	1752	27(5)	2(3)	5(3)	4(5)	3(1)	3(1)	0(5)	6(5)	7(3)	70(5)	0.0(5)	100(1) *	42	7.4	OEPA
Year: 2019																			
LM16a	3.70	P	09/06/2019	1752	26(5)	5(5)	7(5)	1(1)	1(1)	2(1)	8(5)	28(1)	3(1)	49(3)	0.0(5)	620(5)	38	9.6	MBI
LM16a	3.70	P	09/24/2019	1752	30(5)	5(5)	7(5)	2(3)	1(1)	4(1)	7(5)	20(3)	4(1)	67(5)	0.0(5)	938(5)	44	10.5	MBI
LM16	3.50	P	09/06/2019	1752	30(5)	4(5)	8(5)	3(3)	5(1)	8(1)	1(5)	13(5)	4(1)	55(5)	0.6(3)	674(5)	44	9.6	MBI
LM16	3.50	P	09/24/2019	1752	31(5)	4(5)	7(5)	4(5)	5(1)	7(1)	2(5)	12(5)	4(1)	66(5)	0.0(5)	1268(5)	48	10.3	MBI
Year: 2017																			
LM01	27.90	P	08/28/2017	1069	37(5)	3(3)	7(5)	9(5)	30(3)	43(3)	9(5)	21(3)	2(1)	72(5)	0.0(5)	830(5)	48	10.7	MBI
LM02	24.10	P	08/29/2017	1085	34(5)	3(3)	8(5)	8(5)	31(3)	46(5)	6(5)	13(5)	6(3)	73(5)	0.0(5)	726(5)	54	11.5	MBI
LM03	22.30	P	08/29/2017	1148	34(5)	5(5)	8(5)	4(5)	20(3)	28(3)	4(5)	29(1)	4(1)	63(5)	1.3(3)	444(5)	46	10.6	MBI
LM05	21.50	P	08/29/2017	1160	35(5)	3(3)	9(5)	6(5)	24(3)	30(3)	3(5)	19(3)	6(3)	71(5)	0.7(3)	574(5)	48	11.5	MBI
LM07	18.50	P	09/08/2017	1187	37(5)	4(5)	7(5)	9(5)	18(1)	28(3)	8(5)	16(3)	5(1)	73(5)	0.0(5)	592(5)	48	10.8	MBI
LM07	18.50	P	10/06/2017	1187	36(5)	2(3)	10(5)	11(5)	32(3)	50(5)	6(5)	7(5)	5(1)	78(5)	0.0(5)	452(5)	52	10.6	MBI
LM08	17.70	P	09/08/2017	1190	28(5)	2(3)	7(5)	5(5)	39(5)	44(5)	4(5)	17(3)	4(1)	72(5)	0.0(5)	522(5)	52	10.4	MBI
LM08	17.70	P	10/06/2017	1190	26(5)	1(1)	8(5)	7(5)	47(5)	53(5)	5(5)	12(5)	6(3)	74(5)	0.0(5)	318(3)	52	9.9	MBI
LM09	13.10	P	09/11/2017	1203	30(5)	3(3)	8(5)	5(5)	44(5)	50(5)	2(5)	17(3)	5(1)	71(5)	0.0(5)	686(5)	52	10.3	MBI
LM11	10.90	P	09/11/2017	1707	32(5)	1(1)	7(5)	8(5)	17(1)	23(3)	1(5)	10(5)	13(5)	66(5)	0.4(5)	524(5)	50	10.7	MBI
LM12	8.10	P	09/11/2017	1710	33(5)	2(3)	7(5)	8(5)	14(1)	20(3)	1(5)	12(5)	4(1)	78(5)	0.0(5)	604(5)	48	10.1	MBI

♦ - IBI is low end adjusted.
* - < 200 Total individuals in sample
** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Number of: Sunfish species	Number of: Sucker species	Number of: Intolerant species	Percent of Individuals: Rnd-bodied suckers	Percent of Individuals: Simple Lithophils	Percent of Individuals: Tolerant fishes	Percent of Individuals: Omni-vores	Percent of Individuals: Top carnivores	Percent of Individuals: Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM13	6.83	P	09/11/2017	1720	29(5)	4(5)	7(5)	5(5)	7(1)	13(1)	3(5)	22(3)	4(1)	64(5)	0.0(5)	834(5)	46	10.5	MBI
LM15	4.10	P	09/11/2017	1730	32(5)	3(3)	8(5)	3(3)	16(1)	21(3)	1(5)	24(3)	7(3)	63(5)	0.3(5)	774(5)	46	10.6	MBI
LM16	3.50	P	09/10/2017	1752	36(5)	4(5)	7(5)	7(5)	5(1)	11(1)	1(5)	26(3)	6(3)	61(5)	0.4(5)	904(5)	48	9.6	MBI
LM16	3.50	P	10/04/2017	1752	27(5)	2(3)	7(5)	5(5)	11(1)	16(1)	1(5)	20(3)	6(3)	68(5)	0.8(3)	500(5)	44	9.7	MBI
LM17	1.60	P	09/09/2017	1754	23(5)	3(3)	6(5)	2(3)	2(1)	3(1)	4(5)	48(1)	5(3)	43(3)	0.0(5)	442(5)	40	9.1	MBI
LM17	1.60	P	10/04/2017	1754	18(3)	4(5)	5(3)	2(3)	2(1)	3(1)	3(5)	31(1)	3(1)	60(5)	0.0(5)	226(3)	36	8.5	MBI
Year: 2013																			
LMRB07	28.90	A	09/26/2013	1059	28(5)	5(5)	8(5)	1(1)	29(3)	30(3)	6(5)	29(1)	8(3)	56(5)	0.5(3)	366(3)	42	10.2	MBI
LM01	27.90	A	09/27/2013	1069	30(5)	2(3)	5(3)	7(5)	36(3)	46(5)	8(5)	19(3)	4(1)	74(5)	0.0(5)	752(5)	48	10.5	MBI
LM01	27.90	A	08/26/2013	1069	29(5)	2(3)	5(3)	8(5)	41(5)	55(5)	4(5)	6(5)	2(1)	90(5)	0.3(5)	815(5)	52	10.3	OEPA
LM02	24.10	A	10/01/2013	1085	23(5)	2(3)	8(5)	2(3)	39(5)	44(5)	0(5)	29(1)	5(1)	59(5)	0.9(3)	434(5)	46	10.6	MBI
LM03	22.30	A	10/02/2013	1148	25(5)	3(3)	8(5)	3(3)	14(1)	20(1)	16(3)	26(3)	6(3)	62(5)	0.3(5)	484(5)	42	10.4	MBI
LM05	21.50	A	10/02/2013	1160	30(5)	2(3)	9(5)	4(5)	35(3)	41(3)	3(5)	14(5)	4(1)	71(5)	0.0(5)	562(5)	50	11.1	MBI
LM06	20.60	A	10/02/2013	1161	24(5)	2(3)	8(5)	3(3)	40(5)	49(5)	1(5)	23(3)	7(3)	61(5)	0.5(5)	410(3)	50	10.2	MBI
LM07	18.50	A	10/02/2013	1187	19(3)	2(3)	7(5)	1(1)	15(1)	22(3)	1(5)	46(1)	10(5)	36(3)	0.0(5)	286(3)	38	9.6	MBI
LM08	17.70	A	10/02/2013	1190	21(5)	0(1)	7(5)	1(1)	45(5)	46(5)	1(5)	8(5)	5(3)	68(5)	0.4(5)	502(5)	50	10.2	MBI
LM09	13.10	A	08/26/2013	1203	28(5)	2(3)	10(5)	3(3)	31(3)	38(3)	0(5)	12(5)	10(5)	70(5)	0.0(5)	514(5)	52	10.9	OEPA
LM09	13.10	A	09/30/2013	1203	29(5)	3(3)	6(5)	5(5)	27(3)	34(3)	2(5)	22(3)	11(5)	64(5)	1.8(3)	462(5)	50	10.3	OEPA
LM09	12.90	A	10/18/2013	1200	21(5)	2(3)	2(1)	4(5)	12(1)	21(1)	3(5)	20(3)	4(1)	73(5)	0.0(5)	608(5)	40	9.0	MBI
LM11	10.90	A	09/30/2013	1707	21(5)	2(3)	5(3)	1(1)	26(3)	29(3)	0(5)	30(1)	6(3)	50(3)	0.7(3)	558(5)	38	10.1	MBI
LM12	8.10	A	10/03/2013	1710	20(3)	3(3)	6(5)	2(3)	27(3)	28(3)	2(5)	23(3)	3(1)	63(5)	1.0(3)	396(3)	40	10.0	MBI
LM13	6.83	A	10/03/2013	1720	22(5)	3(3)	6(5)	1(1)	14(1)	15(1)	4(5)	34(1)	9(3)	45(3)	0.8(3)	254(3)	34	9.6	MBI
LMRB03	4.45	A	10/03/2013	1730	18(3)	0(1)	7(5)	3(3)	29(3)	51(5)	0(5)	8(5)	2(1)	83(5)	0.0(5)	398(3)	44	9.4	MBI
LM15	4.10	A	10/03/2013	1730	18(3)	1(1)	7(5)	1(1)	25(3)	26(3)	1(5)	53(1)	3(1)	35(3)	0.0(5)	530(5)	36	10.0	MBI
LM16	3.50	A	10/18/2013	1752	16(3)	0(1)	5(3)	0(1)	14(1)	19(1)	3(5)	19(3)	5(3)	66(5)	0.5(3)	354(3)	32	8.1	MBI
Year: 2012																			

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Percent of Individuals: Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM01	27.80	A	09/12/2012	1070	22(5)	1(1)	6(5)	1(1)	28(3)	29(3)	1(5)	22(3)	7(3)	55(5)	3.1(1)	840(5)	40	10.6	MBI
LM01	27.80	A	07/23/2012	1070	22(5)	3(3)	5(3)	1(1)	24(3)	25(3)	4(5)	17(3)	9(3)	69(5)	0.0(5)	713(5)	44	10.5	MBI
LM02	23.70	A	07/17/2012	1150	25(5)	3(3)	7(5)	2(3)	17(1)	22(3)	13(5)	26(3)	10(3)	58(5)	0.0(5)	294(3)	44	10.1	MBI
LM02	23.70	A	09/13/2012	1150	22(5)	4(5)	6(5)	2(3)	10(1)	11(1)	5(5)	30(1)	7(3)	62(5)	0.6(3)	934(5)	42	10.0	MBI
LM03	22.10	A	07/17/2012	1148	19(3)	2(3)	4(3)	2(3)	6(1)	7(1)	10(5)	34(1)	13(5)	52(3)	0.0(5)	348(3)	36	8.9	MBI
LM03	22.10	A	09/13/2012	1148	19(3)	3(3)	6(5)	1(1)	13(1)	13(1)	2(5)	21(3)	5(1)	74(5)	1.0(3)	822(5)	36	9.4	MBI
LM04	21.70	A	07/17/2012	1150	18(3)	3(3)	6(5)	1(1)	36(3)	38(3)	0(5)	18(3)	10(3)	68(5)	0.0(5)	386(3)	42	9.5	MBI
LM04	21.70	A	09/13/2012	1150	27(5)	3(3)	9(5)	5(5)	18(1)	19(1)	6(5)	42(1)	5(3)	48(3)	0.6(3)	582(5)	40	10.7	MBI
LM05	21.25	A	07/17/2012	1160	18(3)	1(1)	7(5)	1(1)	22(3)	22(3)	14(5)	18(3)	8(3)	56(5)	1.5(3)	224(3)	38	9.5	MBI
LM05	21.25	A	09/13/2012	1160	27(5)	3(3)	8(5)	3(3)	7(1)	7(1)	6(5)	12(5)	7(3)	79(5)	0.2(5)	1082(5)	46	9.9	MBI
LM06	20.60	A	07/24/2012	1161	24(5)	4(5)	5(3)	2(3)	12(1)	12(1)	21(3)	25(3)	7(3)	65(5)	0.3(5)	564(5)	42	9.8	MBI
LM06	20.60	A	09/19/2012	1161	27(5)	4(5)	6(5)	3(3)	4(1)	5(1)	7(5)	22(3)	8(3)	66(5)	0.3(5)	1180(5)	46	10.2	MBI
LM07	18.40	A	07/31/2012	1190	24(5)	4(5)	6(5)	1(1)	9(1)	9(1)	39(1)	40(1)	10(5)	44(3)	0.5(5)	512(5)	38	9.9	MBI
LM07	18.40	A	09/19/2012	1190	23(5)	4(5)	6(5)	3(3)	5(1)	6(1)	7(5)	34(1)	9(3)	53(3)	1.4(3)	906(5)	40	10.0	MBI
LM08	17.60	A	07/31/2012	1190	21(5)	3(3)	7(5)	1(1)	19(1)	20(1)	5(5)	8(5)	25(5)	50(3)	0.0(5)	302(3)	42	10.2	MBI
LM08	17.60	A	09/19/2012	1190	23(5)	3(3)	6(5)	3(3)	13(1)	14(1)	7(5)	29(1)	8(3)	61(5)	0.4(5)	1008(5)	42	10.2	MBI
LM09	12.90	A	08/01/2012	1200	21(5)	1(1)	8(5)	2(3)	18(1)	18(1)	1(5)	2(5)	9(3)	82(5)	0.4(5)	486(5)	44	9.4	MBI
LM09	12.90	A	09/20/2012	1200	23(5)	3(3)	6(5)	2(3)	9(1)	9(1)	1(5)	16(3)	8(3)	75(5)	0.3(5)	1380(5)	44	9.7	MBI
LM10	11.80	A	08/01/2012	1210	22(5)	3(3)	6(5)	1(1)	10(1)	10(1)	19(3)	21(3)	11(5)	64(5)	0.2(5)	770(5)	42	9.9	MBI
LM10	11.80	A	09/20/2012	1210	24(5)	3(3)	5(3)	4(5)	7(1)	8(1)	3(5)	31(1)	13(5)	54(3)	0.0(5)	1164(5)	42	9.9	MBI
LM11	11.20	A	08/01/2012	1710	21(5)	3(3)	6(5)	0(1)	8(1)	8(1)	2(5)	19(3)	14(5)	57(5)	0.0(5)	446(5)	44	9.8	MBI
LM11	11.20	A	09/20/2012	1710	24(5)	4(5)	7(5)	0(1)	10(1)	10(1)	4(5)	16(3)	13(5)	65(5)	0.8(3)	708(5)	44	10.0	MBI
LM12	8.30	A	07/11/2012	1713	23(5)	3(3)	4(3)	1(1)	10(1)	12(1)	13(5)	15(5)	11(5)	63(5)	1.1(3)	310(3)	40	9.6	MBI
LM12	8.30	A	09/26/2012	1713	22(5)	4(5)	5(3)	0(1)	5(1)	7(1)	4(5)	23(3)	22(5)	47(3)	0.0(5)	494(5)	42	9.7	MBI
LM13	7.10	A	07/11/2012	1720	21(5)	4(5)	5(3)	2(3)	5(1)	7(1)	15(5)	25(3)	15(5)	51(3)	0.6(3)	308(3)	40	9.8	MBI
LM13	7.10	A	09/27/2012	1720	22(5)	5(5)	4(3)	1(1)	3(1)	3(1)	4(5)	35(1)	15(5)	37(3)	0.2(5)	1150(5)	40	10.1	MBI

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

					Number of				Percent of Individuals										
Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM14	6.00	A	07/10/2012	1720	12(3)	0(1)	1(1)	2(3)	15(1)	16(1)	0(5)	5(5)	6(3)	87(5)	0.0(5)	248(3)	36	6.2	MBI
LM14	6.00	A	09/27/2012	1720	20(3)	3(3)	5(3)	0(1)	15(1)	16(1)	4(5)	51(1)	12(5)	28(3)	0.0(5)	690(5)	36	9.6	MBI
LM15	4.30	A	07/10/2012	1730	18(3)	3(3)	4(3)	2(3)	10(1)	11(1)	13(5)	24(3)	6(3)	60(5)	0.0(5)	198(1)	36	8.0	MBI
LM15	4.30	A	09/27/2012	1730	21(5)	3(3)	7(5)	1(1)	5(1)	5(1)	1(5)	79(1)	4(1)	14(1)	0.3(5)	1358(5)	34	9.0	MBI
600580	3.00	A	07/10/2012	1752	21(5)	3(3)	4(3)	0(1)	9(1)	10(1)	4(5)	10(5)	16(5)	59(5)	0.0(5)	188(1) *	40	9.5	MBI
600580	3.00	A	10/01/2012	1752	21(5)	5(5)	4(3)	0(1)	1(1)	1(1)	2(5)	60(1)	8(3)	27(3)	0.1(5)	1554(5)	38	9.8	MBI
LM17	1.40	A	07/11/2012	1760	15(3)	3(3)	3(3)	0(1)	3(1)	3(1)	6(5)	17(3)	24(5)	56(5)	0.0(5)	132(1) *	36	8.3	MBI
LM17	1.40	A	10/01/2012	1760	15(3)	2(3)	3(3)	2(3)	1(1)	1(1)	1(5)	69(1)	10(5)	21(1)	0.3(5)	698(5)	36	8.0	MBI
Year: 2008																			
LM06	20.60	A	10/03/2008	1161	32(5)	3(3)	6(5)	5(5)	10(1)	21(1)	9(5)	26(3)	6(3)	65(5)	0.3(5)	646(5)	46	10.3	MBI
M05P11	13.10	A	10/02/2008	1203	24(5)	3(3)	5(3)	2(3)	34(3)	43(5)	3(5)	10(5)	12(5)	77(5)	1.5(3)	256(3)	48	9.9	OEPA
LMRB03	8.80	A	09/23/2008	1713	35(5)	3(3)	8(5)	6(5)	17(1)	23(3)	2(5)	13(5)	4(1)	79(5)	0.1(5)	693(5)	48	5.5	OEPA
LMRB03	8.70	A	09/23/2008	1713	31(5)	3(3)	8(5)	6(5)	17(1)	23(3)	1(5)	17(3)	4(1)	76(5)	0.0(5)	648(5)	46	5.6	OEPA
LM12	8.20	A	10/02/2008	1713	34(5)	2(3)	7(5)	4(5)	8(1)	11(1)	3(5)	7(5)	4(1)	87(5)	0.6(3)	1220(5)	44	10.0	MBI
Year: 2007																			
LMRB07	29.00	A	06/21/2007	1064	32(5)	3(3)	9(5)	5(5)	33(3)	45(5)	3(5)	6(5)	5(1)	83(5)	0.3(5)	746(5)	52	10.9	OEPA
LMRB07	29.00	A	08/03/2007	1064	39(5)	4(5)	10(5)	8(5)	38(5)	43(3)	5(5)	11(5)	8(3)	78(5)	0.3(5)	563(5)	56	11.1	OEPA
LM01	28.10	A	09/07/2007	1069	33(5)	3(3)	6(5)	8(5)	25(3)	50(5)	3(5)	5(5)	7(3)	79(5)	2.0(3)	890(5)	52	10.9	OEPA
LM01	27.90	A	08/01/2007	1069	33(5)	3(3)	7(5)	8(5)	27(3)	44(5)	10(5)	13(5)	9(3)	69(5)	0.0(5)	564(5)	54	11.1	OEPA
LM01	27.90	A	09/07/2007	1069	31(5)	2(3)	7(5)	8(5)	27(3)	50(5)	4(5)	7(5)	6(3)	71(5)	0.2(5)	962(5)	54	11.4	OEPA
LM02	24.30	A	09/04/2007	1085	30(5)	3(3)	6(5)	7(5)	11(1)	42(3)	7(5)	13(5)	6(3)	68(5)	1.4(3)	546(5)	48	10.5	OEPA
LM02	24.10	A	07/25/2007	1085	30(5)	4(5)	7(5)	5(5)	8(1)	29(3)	6(5)	15(5)	8(3)	72(5)	0.0(5)	386(3)	50	10.3	OEPA
LM03	22.30	A	07/26/2007	1148	26(5)	2(3)	4(3)	5(5)	22(3)	44(5)	9(5)	9(5)	4(1)	84(5)	0.0(5)	718(5)	50	9.8	OEPA
LM03	22.30	A	09/11/2007	1148	29(5)	3(3)	6(5)	6(5)	38(5)	60(5)	2(5)	9(5)	7(3)	82(5)	0.0(5)	708(5)	56	10.0	OEPA
LM05	21.50	A	07/26/2007	1160	33(5)	4(5)	7(5)	7(5)	18(1)	31(3)	1(5)	3(5)	3(1)	81(5)	0.0(5)	766(5)	50	11.1	OEPA
LM05	21.50	A	09/11/2007	1160	38(5)	3(3)	9(5)	8(5)	20(3)	32(3)	9(5)	15(5)	6(3)	73(5)	0.6(3)	606(5)	50	11.3	OEPA

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

					Number of				Percent of Individuals										
Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM06	20.60	A	07/25/2007	1161	36(5)	4(5)	7(5)	8(5)	23(3)	44(5)	7(5)	14(5)	8(3)	75(5)	0.0(5)	722(5)	56	10.7	OEPA
LM06	20.60	A	09/06/2007	1161	33(5)	4(5)	8(5)	7(5)	32(3)	44(5)	4(5)	10(5)	8(3)	80(5)	0.0(5)	788(5)	56	10.2	OEPA
LM08	17.80	A	07/25/2007	1187	23(5)	3(3)	5(3)	2(3)	21(3)	24(3)	8(5)	19(3)	8(3)	65(5)	0.0(5)	486(5)	46	9.7	OEPA
LM08	17.30	A	09/11/2007	1188	36(5)	4(5)	10(5)	5(5)	24(3)	31(3)	13(5)	23(3)	18(5)	50(3)	0.0(5)	696(5)	52	11.2	OEPA
M05P11	13.10	A	07/24/2007	1203	28(5)	2(3)	6(5)	4(5)	11(1)	14(1)	4(5)	8(5)	15(5)	67(5)	0.0(5)	786(5)	50	10.0	OEPA
M05P11	13.10	A	09/05/2007	1203	32(5)	3(3)	8(5)	5(5)	18(1)	28(3)	5(5)	8(5)	14(5)	66(5)	0.0(5)	709(5)	52	10.6	OEPA
LM12	8.20	A	07/31/2007	1713	29(5)	4(5)	4(3)	4(5)	6(1)	12(1)	2(5)	8(5)	13(5)	67(5)	0.0(5)	486(5)	50	9.6	OEPA
LM12	8.20	A	09/10/2007	1713	35(5)	4(5)	8(5)	4(5)	21(3)	24(3)	1(5)	12(5)	14(5)	57(5)	1.7(3)	700(5)	54	11.0	OEPA
LMRB02	3.70	A	08/28/2007	1752	31(5)	4(5)	6(5)	2(3)	2(1)	6(1)	5(5)	19(3)	8(3)	59(5)	0.0(5)	1464(5)	46	10.1	OEPA
LM16	3.50	A	07/24/2007	1752	22(5)	4(5)	5(3)	1(1)	2(1)	2(1)	7(5)	43(1)	4(1)	44(3)	0.3(5)	790(5)	36	9.3	OEPA
LM16	3.50	A	09/05/2007	1752	19(3)	4(5)	4(3)	1(1)	5(1)	8(1)	11(5)	27(3)	10(3)	39(3)	0.0(5)	346(3)	36	9.9	OEPA
600580	3.00	A	08/28/2007	1752	30(5)	3(3)	8(5)	4(5)	20(3)	28(3)	2(5)	7(5)	14(5)	59(5)	0.5(3)	760(5)	52	10.0	MBI
LMR 2.5	2.50	P	08/28/2007	1753	6(1)	0(1)	0(1)	1(1)	0(1)	0(1)	0(5)	37(1)	0(1)	29(3)	0.0(5)	126(1) *	22	5.0	OEPA
LMR 2.0	2.00	P	08/28/2007	1754	3(1)	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	50(1)	0(1)	25(1)	0.0(1)	13(1)**	12	3.2	OEPA
LM17	1.60	A	08/28/2007	1754	23(5)	3(3)	6(5)	2(3)	0(1)	2(1)	1(5)	25(3)	6(3)	62(5)	0.0(5)	1056(5)	44	9.5	MBI
Year: 1998																			
610510	28.30	A	07/16/1998	1060	26(5)	2(3)	5(3)	4(5)	22(3)	27(3)	11(5)	14(5)	3(1)	78(5)	3.7(1)	520(5)	44	10.1	OEPA
610510	28.30	A	09/02/1998	1060	28(5)	3(3)	6(5)	2(3)	26(3)	29(3)	4(5)	8(5)	10(5)	80(5)	2.9(3)	430(5)	50	10.4	OEPA
LM01	27.90	A	07/16/1998	1069	21(5)	3(3)	5(3)	2(3)	46(5)	48(5)	5(5)	17(3)	4(1)	74(5)	2.1(3)	484(5)	46	10.2	OEPA
LM01	27.90	A	09/02/1998	1069	20(3)	1(1)	4(3)	3(3)	39(5)	40(3)	2(5)	27(3)	7(3)	63(5)	4.5(1)	436(5)	40	9.6	OEPA
LM02	23.90	A	07/16/1998	1145	20(3)	3(3)	5(3)	2(3)	45(5)	49(5)	5(5)	33(1)	2(1)	63(5)	3.4(1)	246(3)	38	9.1	OEPA
LM02	23.90	A	09/02/1998	1145	21(5)	2(3)	6(5)	0(1)	59(5)	62(5)	1(5)	18(3)	8(3)	69(5)	9.9(1)	282(3)	44	9.1	OEPA
M05S39	21.90	A	07/27/1998	1148	24(5)	3(3)	6(5)	2(3)	22(3)	30(3)	9(5)	23(3)	5(1)	70(5)	1.1(3)	334(3)	42	9.6	OEPA
M05S39	21.90	A	09/03/1998	1148	25(5)	2(3)	7(5)	2(3)	13(1)	19(1)	6(5)	18(3)	7(3)	73(5)	3.7(1)	354(3)	38	9.8	OEPA
LM04	21.80	A	07/27/1998	1150	12(3)	3(3)	3(3)	0(1)	11(1)	22(3)	5(5)	16(3)	5(3)	78(5)	0.0(5)	350(3)	38	8.8	OEPA
LM04	21.80	A	09/03/1998	1150	8(1)	2(3)	1(1)	0(1)	18(1)	21(1)	14(5)	29(1)	7(3)	64(5)	3.6(5)	240(3)	30	7.8	OEPA

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

					Number of				Percent of Individuals							Rel.No.			
Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM05	21.10	A	07/27/1998	1160	19(3)	1(1)	7(5)	3(3)	32(3)	38(3)	3(5)	25(3)	6(3)	60(5)	0.9(5)	210(3)	42	9.5	OEPA
LM05	21.10	A	09/03/1998	1160	25(5)	3(3)	7(5)	2(3)	27(3)	30(3)	2(5)	15(5)	7(3)	58(5)	2.2(3)	350(3)	46	10.2	OEPA
LM07	18.50	A	07/27/1998	1187	26(5)	5(5)	4(3)	2(3)	7(1)	10(1)	10(5)	20(3)	8(3)	54(3)	0.0(5)	250(3)	40	9.3	OEPA
LM07	18.50	A	09/03/1998	1187	25(5)	3(3)	7(5)	2(3)	16(1)	27(3)	9(5)	23(3)	9(3)	51(3)	4.5(1)	204(3)	38	10.0	OEPA
LMRB06	13.50	A	07/28/1998	1199	21(5)	2(3)	5(3)	3(3)	19(1)	25(3)	5(5)	31(1)	4(1)	49(3)	1.5(3)	260(3)	34	9.8	OEPA
LMRB06	13.50	A	09/03/1998	1199	20(3)	3(3)	5(3)	1(1)	28(3)	33(3)	2(5)	17(3)	11(5)	65(5)	3.7(1)	346(3)	38	9.7	OEPA
LM11	10.90	A	07/28/1998	1707	21(5)	2(3)	5(3)	6(5)	11(1)	14(1)	6(5)	27(3)	4(1)	54(3)	5.1(1)	275(3)	34	9.6	OEPA
LM11	10.90	A	09/04/1998	1707	28(5)	3(3)	7(5)	4(5)	16(1)	19(1)	11(5)	24(3)	15(5)	53(3)	3.9(1)	368(3)	40	10.3	OEPA
LM16a	3.70	A	07/30/1998	1752	19(3)	2(3)	5(3)	0(1)	9(1)	11(1)	24(3)	45(1)	8(3)	19(1)	7.1(1)	172(1)	22	8.9	OEPA
LM16	3.50	A	09/05/1998	1752	21(5)	2(3)	6(5)	2(3)	18(1)	18(1)	10(5)	26(3)	9(3)	49(3)	8.8(1)	378(3)	36	10.0	OEPA
Year: 1993																			
610510	28.30	A	08/09/1993	1060	15(3)	3(3)	5(3)	0(1)	34(3)	34(3)	21(3)	41(1)	5(3)	47(3)	4.1(1)	250(3)	30	8.7	OEPA
610510	28.30	A	08/30/1993	1060	16(3)	3(3)	4(3)	0(1)	31(3)	32(3)	9(5)	42(1)	5(3)	45(3)	3.8(1)	292(3)	32	9.3	OEPA
610510	28.30	A	09/27/1993	1060	19(3)	5(5)	5(3)	0(1)	35(3)	35(3)	6(5)	18(3)	10(5)	68(5)	4.0(1)	326(3)	40	9.1	OEPA
LM01	27.90	A	08/09/1993	1069	26(5)	3(3)	7(5)	2(3)	67(5)	68(5)	2(5)	9(5)	5(1)	73(5)	2.3(3)	908(5)	50	10.9	OEPA
LM01	27.90	A	08/30/1993	1069	25(5)	2(3)	5(3)	2(3)	52(5)	54(5)	3(5)	13(5)	8(3)	67(5)	2.1(3)	685(5)	50	10.5	OEPA
LM01	27.90	A	09/27/1993	1069	29(5)	3(3)	7(5)	4(5)	30(3)	32(3)	5(5)	20(3)	7(3)	57(5)	1.5(3)	767(5)	48	10.7	OEPA
LM02	23.90	A	08/09/1993	1145	21(5)	1(1)	7(5)	2(3)	62(5)	64(5)	1(5)	17(3)	3(1)	69(5)	1.9(3)	564(5)	46	9.9	OEPA
LM02	23.90	A	08/31/1993	1145	20(3)	1(1)	6(5)	3(3)	57(5)	60(5)	1(5)	16(3)	6(3)	66(5)	1.6(3)	504(5)	46	10.0	OEPA
LM02	23.90	A	09/28/1993	1145	27(5)	3(3)	6(5)	2(3)	34(3)	36(3)	4(5)	14(5)	9(3)	70(5)	3.4(1)	848(5)	46	10.8	OEPA
LM03	22.10	A	08/10/1993	1148	14(3)	2(3)	4(3)	1(1)	58(5)	61(5)	10(5)	15(5)	6(3)	73(5)	1.6(3)	222(3)	44	8.1	OEPA
LM03	22.10	A	08/31/1993	1148	20(3)	2(3)	8(5)	2(3)	47(5)	48(5)	2(5)	21(3)	10(3)	65(5)	1.2(3)	314(3)	46	9.2	OEPA
LM03	22.10	A	09/28/1993	1148	22(5)	4(5)	6(5)	1(1)	15(1)	15(1)	7(5)	19(3)	7(3)	74(5)	0.0(5)	708(5)	44	9.0	OEPA
LM05	21.50	A	08/10/1993	1160	21(5)	2(3)	7(5)	1(1)	51(5)	52(5)	3(5)	20(3)	5(3)	63(5)	1.1(3)	620(5)	48	10.3	OEPA
LM05	21.50	A	08/31/1993	1160	25(5)	2(3)	6(5)	3(3)	47(5)	51(5)	2(5)	12(5)	4(1)	67(5)	3.8(1)	622(5)	48	10.6	OEPA
LM05	21.50	A	09/28/1993	1160	30(5)	4(5)	7(5)	4(5)	27(3)	29(3)	2(5)	17(3)	8(3)	61(5)	2.7(3)	866(5)	50	10.4	OEPA

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Number of: Sunfish species	Number of: Sucker species	Number of: Intolerant species	Percent of Individuals: Rnd-bodied suckers	Percent of Individuals: Simple Lithophils	Percent of Individuals: Tolerant fishes	Percent of Individuals: Omni-vores	Percent of Individuals: Top carnivores	Percent of Individuals: Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM05	20.90	A	08/10/1993	1161	19(3)	1(1)	7(5)	2(3)	48(5)	49(5)	0(5)	32(1)	3(1)	56(5)	1.4(3)	328(3)	40	9.8	OEPA
LM05	20.90	A	08/31/1993	1161	23(5)	2(3)	7(5)	0(1)	45(5)	49(5)	9(5)	20(3)	11(5)	56(5)	3.2(1)	270(3)	46	9.8	OEPA
LM05	20.90	A	09/28/1993	1161	24(5)	2(3)	7(5)	4(5)	24(3)	25(3)	5(5)	28(1)	10(3)	59(5)	2.2(3)	434(5)	46	9.5	OEPA
LM07	18.50	A	08/09/1993	1187	21(5)	1(1)	5(3)	1(1)	42(5)	46(5)	4(5)	15(5)	6(3)	65(5)	3.1(1)	368(3)	42	9.7	OEPA
LM07	18.50	A	08/30/1993	1187	21(5)	1(1)	8(5)	1(1)	37(3)	39(3)	1(5)	14(5)	7(3)	54(3)	8.3(1)	382(3)	38	9.9	OEPA
LM07	18.50	A	09/29/1993	1187	29(5)	3(3)	8(5)	2(3)	20(3)	23(3)	6(5)	22(3)	11(5)	59(5)	3.5(1)	490(5)	46	10.6	OEPA
LMRB06	13.30	A	08/10/1993	1200	24(5)	2(3)	8(5)	4(5)	12(1)	12(1)	2(5)	46(1)	5(3)	37(3)	3.9(1)	400(3)	36	9.8	OEPA
LMRB06	13.30	A	08/31/1993	1200	26(5)	3(3)	8(5)	2(3)	16(1)	17(1)	3(5)	22(3)	10(3)	37(3)	0.8(3)	468(5)	40	10.4	OEPA
LMRB06	13.30	A	10/14/1993	1200	30(5)	3(3)	7(5)	6(5)	3(1)	4(1)	1(5)	86(1)	3(1)	9(1)	0.9(3)	2444(5)	36	9.5	OEPA
LM12	8.30	A	08/10/1993	1713	19(3)	1(1)	9(5)	0(1)	12(1)	14(1)	8(5)	27(3)	6(3)	42(3)	4.5(1)	284(3)	30	9.5	OEPA
LM12	8.30	A	09/01/1993	1713	27(5)	2(3)	8(5)	0(1)	13(1)	16(1)	2(5)	22(3)	11(5)	45(3)	2.7(3)	294(3)	38	10.1	OEPA
LM12	8.30	A	09/29/1993	1713	23(5)	1(1)	8(5)	3(3)	13(1)	16(1)	3(5)	51(1)	6(3)	36(3)	0.6(3)	666(5)	36	9.5	OEPA
LM12	8.00	A	09/01/1993	1714	31(5)	1(1)	6(5)	5(5)	15(1)	23(3)	1(5)	5(5)	4(1)	44(3)	1.1(3)	560(5)	42	10.4	OEPA
LM12	8.00	A	09/29/1993	1714	35(5)	2(3)	7(5)	3(3)	10(1)	12(1)	4(5)	24(3)	6(3)	61(5)	3.3(1)	829(5)	40	10.4	OEPA
LM16	3.50	A	08/11/1993	1752	28(5)	1(1)	10(5)	4(5)	5(1)	6(1)	5(5)	22(3)	6(3)	50(3)	1.8(3)	756(5)	40	10.2	OEPA
LM16	3.50	A	09/01/1993	1752	26(5)	2(3)	9(5)	3(3)	11(1)	13(1)	5(5)	17(3)	12(5)	28(3)	4.4(1)	438(5)	40	10.3	OEPA
LM16	3.50	A	09/30/1993	1752	23(5)	0(1)	7(5)	4(5)	2(1)	3(1)	2(5)	74(1)	4(1)	20(1)	1.3(3)	1282(5)	34	9.2	OEPA
LM17	1.60	A	08/11/1993	1754	9(1)	1(1)	2(1)	0(1)	0(1)	1(1)	4(5)	16(3)	2(1)	77(5)	0.0(5)	344(3)	28	6.9	OEPA
LM17	1.60	A	09/01/1993	1754	17(3)	4(5)	3(3)	0(1)	0(1)	10(1)	0(5)	18(3)	26(5)	40(3)	0.0(5)	124(1) *	36	8.3	OEPA
LM17	1.60	A	09/30/1993	1754	10(3)	3(3)	2(1)	1(1)	0(1)	0(1)	0(5)	93(1)	0(1)	6(1)	0.1(5)	1328(5)	28	6.8	OEPA
LMRB01	0.20	A	08/11/1993	1757	14(3)	2(3)	4(3)	0(1)	0(1)	8(1)	1(5)	28(1)	11(5)	33(3)	0.0(5)	176(1) *	32	7.8	OEPA
LMRB01	0.20	A	09/01/1993	1757	11(3)	1(1)	3(3)	0(1)	0(1)	4(1)	0(5)	54(1)	19(5)	12(1)	1.8(3)	114(1) *	26	7.1	OEPA
LMRB01	0.20	A	09/30/1993	1757	13(3)	1(1)	2(1)	0(1)	0(1)	0(1)	0(5)	84(1)	1(1)	15(1)	0.2(5)	1288(5)	26	6.9	OEPA
Year: 1989																			
LM10	11.40	H	10/12/1989	1210	15(3)	3(3)	1(1)	0(1)	3(0)	7(1)	17(3)	27(3)	7(5)	60(5)	0.0(5)	75(1) *	32	4.5	OEPA
LMRB04	10.00	H	10/12/1989	1711	9(1)	0(1)	0(1)	2(1)	0(0)	20(3)	0(5)	10(5)	0(1)	83(5)	0.0(5)	90(1) *	30	4.3	OEPA

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Percent of Individuals: Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb	Source
LM12	8.00	H	10/12/1989	1714	16(3)	2(3)	0(1)	3(3)	0(0)	15(1)	3(5)	5(5)	1(3)	92(5)	0.0(5)	483(3)	38	4.6	OEPA
LM12	8.00	H	11/07/1989	1714	13(3)	1(1)	0(1)	2(1)	0(0)	3(1)	2(5)	29(3)	0(1)	71(5)	0.0(5)	612(3)	30	5.3	OEPA
Year: 1988																			
LM06	19.30	B	08/04/1988	1162	22(5)	3(3)	6(5)	1(1)	7(1)	10(1)	13(5)	34(1)	21(5)	41(3)	4.1(1)	525(5)	36	9.9	OEPA
LM06	19.30	H	08/04/1988	1162	4(1)	1(1)	0(1)	0(1)	0(0)	0(1)	92(1)	86(1)	6(5)	8(1)	0.0(5)	8(1) *	20	2.9	OEPA
LM09	13.00	B	07/29/1988	1203	19(3)	2(3)	5(3)	2(3)	16(1)	23(3)	2(5)	27(3)	23(5)	44(3)	0.8(3)	630(5)	40	10.4	OEPA
LM09	13.00	H	07/29/1988	1203	5(1)	0(1)	0(1)	1(1)	0(0)	53(5)	37(1)	37(1)	0(1)	61(5)	0.0(5)	152(1)	24	4.9	OEPA
LM11	11.00	B	07/25/1988	1707	16(3)	2(3)	3(3)	1(1)	30(3)	36(3)	4(5)	20(3)	17(5)	54(5)	0.0(5)	880(5)	44	10.1	OEPA
LM11	11.00	H	07/25/1988	1707	13(3)	2(3)	1(1)	2(1)	0(0)	85(5)	1(5)	3(5)	7(5)	90(5)	0.0(5)	1062(5)	44	6.0	OEPA
LM13	7.00	D	08/05/1988	1723	17(3)	3(3)	3(1)	1(1)	11(0)	12(1)	11(3)	34(3)	26(5)	38(3)	0.0(5)	98(1) *	30	8.0	OEPA
LM13	7.00	H	08/05/1988	1723	12(3)	3(3)	1(1)	0(1)	0(0)	0(1)	9(3)	10(5)	3(3)	86(5)	0.0(5)	294(3)	34	6.1	OEPA
600580	3.30	B	07/11/1988	1752	9(1)	1(1)	2(1)	0(1)	0(1)	0(1)	0(5)	85(1)	5(1)	6(1)	0.0(5)	170(1) *	20	6.9	OEPA
Year: 1983																			
M05S08	29.50	A	07/25/1983	1064	20(3)	2(3)	8(5)	1(1)	17(1)	19(1)	7(5)	52(1)	7(3)	35(3)	0.0(5)	280(3)	34	9.0	OEPA
M05S08	29.50	A	08/29/1983	1064	20(3)	3(3)	6(5)	0(1)	15(1)	17(1)	10(5)	37(1)	10(5)	47(3)	0.0(5)	302(3)	36	9.0	OEPA
M05S08	29.50	A	09/26/1983	1064	22(5)	4(5)	5(3)	1(1)	5(1)	6(1)	5(5)	37(1)	13(5)	47(3)	0.0(5)	414(3)	38	9.3	OEPA
LM01	27.10	A	07/26/1983	1075	20(3)	4(5)	4(3)	1(1)	18(1)	19(1)	6(5)	37(1)	8(3)	45(3)	0.5(5)	356(3)	34	8.8	OEPA
LM01	27.10	A	08/30/1983	1075	20(3)	3(3)	5(3)	1(1)	20(3)	22(1)	4(5)	9(5)	6(3)	76(5)	1.1(3)	518(5)	40	9.5	OEPA
LM01	27.10	A	09/27/1983	1075	17(3)	2(3)	6(5)	1(1)	13(1)	13(1)	1(5)	20(3)	8(3)	67(5)	0.0(5)	492(5)	40	8.8	OEPA
LM02	24.20	A	07/26/1983	1145	14(3)	1(1)	5(3)	2(3)	47(5)	51(5)	3(5)	28(3)	6(3)	53(3)	3.8(1)	154(1) *	36	8.7	OEPA
LM02	24.20	A	08/30/1983	1145	24(5)	4(5)	5(3)	3(3)	30(3)	32(3)	4(5)	17(3)	6(3)	70(5)	2.0(3)	494(5)	46	9.4	OEPA
LM02	24.20	A	09/27/1983	1145	23(5)	3(3)	5(3)	2(3)	21(3)	23(3)	0(5)	48(1)	9(3)	41(3)	0.0(5)	604(5)	42	9.5	OEPA
LM05	20.90	A	07/26/1983	1161	17(3)	4(5)	5(3)	1(1)	30(3)	30(3)	1(5)	45(1)	11(5)	39(3)	2.7(3)	242(3)	38	8.6	OEPA
LM05	20.90	A	08/30/1983	1161	19(3)	3(3)	7(5)	1(1)	29(3)	29(3)	1(5)	24(3)	6(3)	67(5)	0.0(5)	456(5)	44	9.1	OEPA
LM05	20.90	A	09/27/1983	1161	14(3)	2(3)	5(3)	1(1)	12(1)	12(1)	1(5)	56(1)	5(1)	35(3)	0.0(5)	690(5)	32	9.1	OEPA
LM07	18.50	A	07/26/1983	1187	16(3)	2(3)	5(3)	1(1)	32(3)	33(3)	1(5)	41(1)	8(3)	46(3)	5.0(1)	276(3)	32	9.0	OEPA

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table A-1. Boatable Ohio IBI scores and metrics for data collected in lower Little Miami River study area including historical data.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Percent of Individuals: Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)		IBI	Modified Iwb	Source
LM07	18.50	A	08/30/1983	1187	20(3)	3(3)	6(5)	1(1)	15(1)	15(1)	1(5)	23(3)	3(1)	71(5)	0.7(3)	1002(5)		36	9.1	OEPA
LM07	18.50	A	09/27/1983	1187	20(3)	2(3)	8(5)	2(3)	21(3)	21(1)	0(5)	40(1)	8(3)	43(3)	0.0(5)	456(5)		40	9.5	OEPA
M05P11	13.10	A	07/26/1983	1203	16(3)	1(1)	6(5)	1(1)	10(1)	11(1)	2(5)	69(1)	14(5)	15(1)	4.4(1)	194(1)	*	26	8.0	OEPA
M05P11	13.10	A	08/30/1983	1203	22(5)	3(3)	7(5)	1(1)	7(1)	7(1)	3(5)	35(1)	6(3)	52(3)	0.0(5)	580(5)		38	8.9	OEPA
M05P11	13.10	A	09/27/1983	1203	16(3)	2(3)	5(3)	2(3)	6(1)	6(1)	2(5)	70(1)	7(3)	20(1)	0.3(5)	622(5)		34	8.4	OEPA
LM12	8.40	A	07/27/1983	1713	18(3)	4(5)	3(3)	1(1)	3(1)	3(1)	1(5)	11(5)	4(1)	84(5)	0.3(5)	734(5)		40	8.0	OEPA
LM12	8.40	A	08/30/1983	1713	20(3)	3(3)	6(5)	0(1)	7(1)	7(1)	1(5)	18(3)	4(1)	73(5)	0.4(5)	910(5)		38	9.1	OEPA
LM12	8.40	A	09/28/1983	1713	19(3)	3(3)	5(3)	0(1)	8(1)	10(1)	2(5)	63(1)	7(3)	26(1)	0.3(5)	630(5)		32	8.9	OEPA
LM17	1.60	A	07/27/1983	1754	13(3)	2(3)	4(3)	0(1)	1(1)	1(1)	1(5)	32(1)	6(3)	61(5)	0.0(5)	352(3)		34	7.0	OEPA
LM17	1.60	A	08/31/1983	1754	14(3)	3(3)	2(1)	0(1)	0(1)	0(1)	0(5)	36(1)	0(1)	64(5)	0.0(5)	15712(5)		32	8.8	OEPA
LM17	1.60	A	09/28/1983	1754	16(3)	3(3)	2(1)	0(1)	0(1)	0(1)	1(5)	79(1)	9(3)	9(1)	0.0(5)	1684(5)		30	8.6	OEPA
LMRB01	0.40	A	07/27/1983	1757	12(3)	2(3)	3(3)	0(1)	0(1)	0(1)	2(5)	5(5)	16(5)	70(5)	0.0(5)	105(1)	*	38	7.1	OEPA
LMRB01	0.40	A	08/31/1983	1757	13(3)	2(3)	2(1)	0(1)	0(1)	0(1)	0(5)	98(1)	1(1)	1(1)	0.0(5)	6903(5)		28	7.8	OEPA
LMRB01	0.40	A	09/28/1983	1757	15(3)	2(3)	1(1)	1(1)	0(1)	1(1)	0(5)	76(1)	7(3)	11(1)	0.0(5)	1358(5)		30	7.6	OEPA

♦ - IBI is low end adjusted.
* - < 200 Total individuals in sample
** - < 50 Total individuals in sample

Appendix Table A-1. Wadeable IBI scores and metrics for the Little Miami River study area including historical data.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)		IBI	Modified Iwb
Sycamore Creek - (11007)																		
Year: 2022																		
0.50	D	08/11/2022	24.0	23(5)	4(5)	4(5)	4(5)	4(5)	8(1)	10(5)	6(5)	3.8(3)	90(5)	0.0(5)	492(3)		52	7.9
0.50	D	09/23/2022	24.0	20(5)	3(3)	3(5)	3(3)	2(3)	10(1)	10(5)	7(5)	16.2(5)	75(5)	0.0(5)	141(1)	*	46	7.4
0.10	D	08/17/2022	24.0	23(5)	3(3)	2(3)	5(5)	4(5)	17(1)	5(5)	4(5)	5.5(5)	87(5)	0.0(5)	363(3)		50	7.5
0.10	D	09/23/2022	24.0	21(5)	3(3)	3(5)	4(5)	3(3)	11(1)	19(5)	19(3)	4.5(3)	76(5)	0.3(3)	429(3)		44	8.1
Year: 2017																		
0.50	D	09/21/2017	24.0	17(3)	3(3)	1(1)	2(3)	3(3)	15(1)	43(3)	42(1)	1.8(3)	45(3)	0.0(5)	293(3)		32	7.2
0.50	E	07/26/2017	24.0	24(5)	2(3)	5(5)	3(3)	4(5)	17(1)	33(3)	32(3)	1.6(3)	33(3)	0.2(3)	752(5)		42	8.6
0.10	D	07/26/2017	24.0	22(5)	3(3)	2(3)	4(5)	3(3)	29(3)	8(5)	10(5)	3.6(3)	75(5)	0.9(3)	458(3)		46	8.7
0.10	D	09/21/2017	24.0	19(5)	4(5)	1(1)	3(3)	3(3)	39(5)	16(5)	14(5)	8.4(5)	76(5)	0.0(5)	165(1)	*	48	7.5
Year: 2012																		
0.50	D	07/30/2012	24.0	18(5)	4(5)	1(1)	2(3)	3(3)	6(1)	44(3)	32(3)	2.5(3)	65(5)	0.5(5)	167(1)		38	6.9
0.50	D	09/25/2012	24.0	19(5)	4(5)	2(3)	2(3)	3(3)	5(1)	21(5)	6(5)	9.9(5)	82(5)	0.5(3)	263(3)		46	7.7
0.20	D	07/30/2012	24.0	19(5)	4(5)	3(5)	2(3)	3(3)	18(3)	5(5)	0(5)	6.7(5)	88(5)	0.0(5)	339(3)		52	8.2
0.20	D	09/25/2012	24.0	19(5)	4(5)	2(3)	2(3)	4(5)	16(1)	5(5)	0(5)	11.4(5)	80(5)	0.5(5)	314(3)		50	7.5
Year: 2007																		
0.50	E	08/16/2007	24.0	24(5)	2(3)	2(3)	4(5)	5(5)	23(3)	6(5)	3(5)	3.8(3)	33(3)	0.1(5)	2526(5)		50	8.8
0.50	E	09/12/2007	24.0	25(5)	4(5)	4(5)	4(5)	4(5)	23(3)	8(5)	5(5)	11.0(5)	51(3)	0.0(5)	1218(5)		56	9.1
0.10	D	08/16/2007	24.0	28(5)	4(5)	6(5)	3(3)	5(5)	42(5)	33(3)	33(3)	2.6(3)	46(3)	0.0(5)	1465(5)		50	9.4
0.10	D	09/12/2007	24.0	25(5)	2(3)	3(5)	3(3)	4(5)	27(3)	6(5)	7(5)	5.3(5)	73(5)	0.0(5)	1878(5)		54	9.4

na - Qualitative data, Modified Iwb not applicable.
♦ - IBI is low end adjusted.
* - < 200 Total individuals in sample
** - < 50 Total individuals in sample
● - One or more species excluded from IBI calculation.

Appendix Table A-1. Wadeable IBI scores and metrics for the Little Miami River study area including historical data.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb
Year: 1998																	
0.40	E	09/10/1998	24.0	13(3)	4(5)	1(1)	0(1)	1(1)	3(1)	15(5)	8(5)	7.8(5)	44(3)	0.0(5)	292(3)	38	7.5
0.40	D	07/21/1998	24.0	18(5)	3(3)	2(3)	0(1)	1(1)	12(1)	42(3)	31(3)	0.5(1)	26(3)	0.0(5)	400(3)	32	7.6
0.24	D	07/21/1998	24.0	10(3)	3(3)	0(1)	0(1)	0(1)	20(3)	10(5)	0(5)	25.0(5)	65(5)	0.0(5)	108(1) *	38	5.5
0.24	D	09/10/1998	24.0	13(3)	1(1)	0(1)	0(1)	1(1)	31(3)	34(3)	28(3)	0.6(1)	53(5)	0.0(5)	696(3)	30	7.7
0.20	D	09/10/1998	24.0	15(3)	4(5)	1(1)	0(1)	1(1)	28(3)	29(5)	24(3)	1.6(3)	71(5)	0.0(5)	446(3)	38	8.0
0.20	D	07/21/1998	24.0	10(3)	3(3)	0(1)	0(1)	1(1)	6(1)	36(3)	8(5)	5.2(5)	82(5)	0.0(5)	124(1) *	34	6.1
Year: 1993																	
0.40	D	07/28/1993	24.0	12(3)	1(1)	2(3)	0(1)	2(3)	28(3)	35(3)	26(3)	0.2(1)	4(1)	0.0(5)	838(5)	32	6.1
0.40	D	09/09/1993	24.0	17(3)	3(3)	4(5)	1(1)	2(3)	15(1)	26(5)	13(5)	0.1(1)	12(1)	0.1(5)	1326(5)	38	7.2
0.24	D	07/28/1993	24.0	8(1)	0(1)	2(3)	0(1)	2(3)	29(3)	56(1)	13(5)	0.0(1)	3(1)	0.0(5)	1140(5)	30	6.6
0.24	D	09/09/1993	24.0	8(1)	1(1)	1(1)	0(1)	1(1)	30(3)	44(3)	11(5)	0.6(1)	6(1)	0.0(5)	875(5)	28	6.6
0.20	D	07/27/1993	24.0	17(3)	3(3)	3(5)	1(1)	1(1)	10(1)	15(5)	20(3)	2.4(3)	10(1)	0.4(5)	324(3)	34	7.3
0.20	D	09/09/1993	24.0	21(5)	3(3)	5(5)	0(1)	2(3)	32(3)	15(5)	13(5)	5.2(5)	49(3)	1.3(3)	297(3)	44	8.1
Year: 1983																	
0.40	S	07/27/1983	24.0	10(3)	2(3)	1(1)	0(1)	1(1)	19(3)	51(1)	3(5)	0.0(1)	13(1)	0.4(3)	613(3)	26	6.9
0.40	S	10/06/1983	24.0	10(3)	2(3)	1(1)	0(1)	0(1)	21(3)	48(3)	25(3)	0.3(1)	12(1)	0.0(5)	597(3)	28	6.9
0.10	S	07/28/1983	24.0	4(1)	2(3)	1(1)	0(1)	0(1)	4(1)	11(1)	64(1)	0.0(1)	36(1)	0.0(3)	83(1) *	16 ♦	4.9
0.10	S	10/06/1983	24.0	7(1)	2(3)	1(1)	0(1)	0(1)	60(1)	13(1)	21(3)	0.0(1)	72(1)	0.0(3)	137(1) *	18 ♦	5.5

na - Qualitative data, Modified Iwb not applicable.
♦ - IBI is low end adjusted.
* - < 200 Total individuals in sample
** - < 50 Total individuals in sample
● - One or more species excluded from IBI calculation.

Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

					Number of						Percent of Individuals						
Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
(11-002) - Clough Creek																	
Year: 2022																	
LM95	3.20	F	07/21/2022	1.9	5(3)	3(3)	1(1)	0(1)	1(1)	3(3)	74(1)	1(5)	32(3)	1(1)	0.0(5)	186(3)	30
LM98	0.60	F	07/21/2022	7.8	10(3)	5(3)	2(3)	1(1)	3(3)	4(3)	48(3)	6(5)	13(5)	14(1)	0.0(5)	488(3)	38
(11-004) - Duck Creek																	
Year: 2022																	
LM71	6.10	F	07/14/2022	2.2	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM72	5.14	F	07/13/2022	5.0	3(1)	2(1)	1(1)	0(1)	0(1)	1(1)	100(1)	0(5)	96(1)	93(5)	1.4(5)	0(1) *	24
LM73	4.58	F	07/22/2022	5.8	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	100(1)	0.0(1)	0(1) * *	12
LM74	3.90	F	07/21/2022	9.5	8(3)	5(3)	1(1)	0(1)	0(1)	2(1)	85(1)	4(5)	81(1)	54(5)	0.2(5)	154(1)	28
LM75	3.40	E	07/13/2022	11.5	1(1)	1(1)	1(1)	0(1)	0(1)	1(1)	100(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM76	2.80	E	07/13/2022	11.7	5(1)	3(1)	1(1)	0(1)	0(1)	2(1)	97(1)	1(5)	87(1)	79(5)	0.0(5)	8(1)	24
LM77	2.00	E	07/22/2022	14.3	14(3)	7(5)	2(3)	3(3)	3(3)	4(3)	63(1)	12(5)	39(3)	33(3)	1.0(3)	152(1)	36
LM79	0.50	E	07/22/2022	14.6	6(1)	1(1)	0(1)	1(1)	0(1)	0(1)	69(1)	0(5)	36(3)	98(5)	0.0(5)	28(1) *	26
(11-007) - Sycamore Creek																	
Year: 2022																	
LM50	1.10	E	09/09/2022	12.5	9(3)	5(3)	2(3)	0(1)	1(1)	2(1)	64(1)	36(1)	57(1)	7(1)	0.0(5)	432(3)	24
(11-049) - Unnamed Tributary to Sycamore Cr. at RM 1.12																	
Year: 2022																	
LM55	1.20	F	07/22/2022	5.3	3(1)	2(1)	0(1)	0(1)	0(1)	0(1)	48(3)	0(5)	48(3)	1(1)	0.5(5)	336(3)	26
LM56	0.20	F	09/09/2022	5.6	8(3)	5(3)	2(3)	0(1)	1(1)	2(1)	70(1)	14(3)	51(3)	5(1)	0.0(5)	212(3)	28
(11-051) - East Fork Duck Creek																	
Year: 2022																	
LM81	2.30	F	07/13/2022	0.5	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

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Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
LM85	2.00	F	07/13/2022	1.3	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	90(1)	0(5)	57(1)	0(1)	3.3(5)	6(1) *	22
LM84	0.50	F	07/14/2022	1.9	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	70(1)	0(5)	8(5)	0(1)	0.0(5)	196(3)	28
(11-075) - Unnamed Tributary to Duck Creek at RM 4.8																	
Year: 2022																	
LM83	0.80	F	07/13/2022	1.2	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
(11-076) - Little Duck Creek																	
Year: 2022																	
LM86	2.40	F	07/14/2022	0.2	3(1)	3(3)	1(1)	0(1)	0(1)	1(3)	77(1)	0(5)	21(5)	0(1)	0.0(5)	226(5)	32
LM87	1.90	F	07/14/2022	0.4	4(3)	3(3)	1(1)	0(1)	0(1)	2(5)	88(1)	3(5)	39(3)	0(1)	0.0(5)	86(3)	32
LM90	1.00	F	07/22/2022	0.5	4(3)	3(3)	1(1)	0(1)	0(1)	2(3)	82(1)	2(5)	45(3)	0(1)	0.0(5)	186(5)	32
LM92	0.49	F	07/21/2022	1.6	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
(11-077) - Unnamed Tributary to Little Duck Creek at RM 4.42																	
Year: 2022																	
LM82	0.20	F	07/13/2022	0.5	2(1)	2(3)	1(1)	0(1)	0(1)	1(3)	100(1)	0(5)	26(5)	0(1)	0.0(5)	0(1)	28
(11-086) - Unnamed Tributary (1.82) to Tributary to Sycamore Creek (1.1)																	
Year: 2022																	
LM54	2.40	F	07/14/2022	1.6	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
(11-004) - Duck Creek																	
Year: 2017																	
LM71	6.10	E	07/25/2017	2.2	1(1)	1(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	0(1)	0.0(1)	0(1) * *	12
LM72	5.14	F	07/25/2017	5.0	6(3)	5(3)	1(1)	0(1)	0(1)	1(1)	97(1)	12(5)	84(1)	16(1)	0.0(5)	8(1)	24
LM73	4.58	F	07/27/2017	5.8	1(1)	1(1)	1(1)	0(1)	0(1)	1(1)	100(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM74	3.90	E	07/25/2017	9.5	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM74	3.90	F	09/20/2017	9.5	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

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Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
LM75	3.40	E	07/25/2017	11.5	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM75	3.40	E	09/20/2017	11.5	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM76	2.80	E	07/25/2017	11.7	8(3)	5(3)	1(1)	0(1)	1(1)	3(1)	80(1)	13(5)	37(3)	2(1)	0.0(5)	102(1)	26
LM76	2.80	E	09/20/2017	11.7	7(1)	5(3)	1(1)	0(1)	0(1)	2(1)	82(1)	9(5)	34(3)	3(1)	0.0(5)	54(1)	24
LM77	2.00	E	07/27/2017	14.3	9(3)	5(3)	1(1)	0(1)	0(1)	2(1)	86(1)	14(5)	43(3)	6(1)	0.0(5)	60(1)	26
LM77	2.00	E	09/20/2017	14.3	12(3)	5(3)	1(1)	1(1)	2(1)	4(3)	77(1)	12(5)	35(3)	4(1)	0.0(5)	184(1)	28
LM79	0.50	E	09/20/2017	14.6	13(3)	6(3)	1(1)	3(3)	0(1)	4(3)	62(1)	40(1)	46(3)	36(3)	0.0(5)	136(1)	28
LM79	0.50	E	07/27/2017	14.6	15(3)	8(5)	1(1)	2(1)	1(1)	5(3)	49(3)	26(3)	44(3)	36(3)	0.0(5)	186(1)	32
(11-007) - Sycamore Creek																	
Year: 2017																	
LM50	1.10	P	07/24/2017	12.5	9(3)	6(3)	2(3)	1(1)	2(1)	4(3)	41(3)	11(5)	22(5)	11(1)	0.0(5)	3734(5)	26
LM50	1.10	E	09/21/2017	12.5	6(1)	4(3)	2(3)	0(1)	1(1)	2(1)	36(3)	8(5)	17(5)	12(1)	0.0(5)	1162(5)	34
LM51	0.50	E	09/26/2017	22.8	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.0(0)	0(0) * *	0
(11-049) - Unnamed Tributary to Sycamore Cr. at RM 1.12																	
Year: 2017																	
LM55	1.20	F	07/24/2017	5.3	2(1)	2(1)	0(1)	0(1)	0(1)	0(1)	56(3)	0(5)	56(1)	0(1)	0.0(5)	260(3)	24
LM56	0.20	F	07/24/2017	5.6	7(3)	5(3)	2(3)	0(1)	1(1)	2(1)	46(3)	9(5)	38(3)	3(1)	0.0(5)	744(5)	34
(11-051) - East Fork Duck Creek																	
Year: 2017																	
LM81	2.30	F	08/30/2017	0.4	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM85	2.00	F	07/26/2017	1.3	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	82(1)	0(5)	49(3)	0(1)	0.0(5)	70(3)	26
LM84	0.50	F	07/27/2017	2.4	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	69(1)	0(5)	34(3)	0(1)	0.0(5)	52(1) *	24
(11-075) - Unnamed Tributary to Duck Creek at RM 4.8																	
Year: 2017																	

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Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	
LM83	0.80	F	07/25/2017	1.2	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12	
	0.20	E	07/25/2017	0.0	1(1)	1(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	0(1)	0.0(1)	0(1) * *	12	
(11-076) - Little Duck Creek																		
Year: 2017																		
LM86	2.40	F	07/26/2017	0.5	4(3)	3(3)	1(1)	0(1)	0(1)	2(5)	79(1)	1(5)	15(5)	0(1)	0.0(5)	126(5)	36	
LM87	1.90	F	07/26/2017	0.4	4(3)	3(3)	1(1)	0(1)	0(1)	2(5)	83(1)	2(5)	32(3)	0(1)	0.0(5)	144(5)	34	
LM90	1.00	F	07/27/2017	1.1	4(3)	3(3)	1(1)	0(1)	0(1)	2(3)	88(1)	1(5)	42(3)	0(1)	0.0(5)	48(3)	30	
LM92	0.49	F	07/27/2017	1.6	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12	
(11-077) - Unnamed Tributary to Little Duck Creek at RM 4.42																		
Year: 2017																		
LM82	0.20	F	08/30/2017	0.3	1(1)	1(1)	1(1)	0(1)	0(1)	1(3)	100(1)	0(5)	0(5)	0(1)	0.0(5)	0(1)	26	
(11-086) - Unnamed Trib (1.82) to Trib to Sycamore Creek (1.1)																		
Year: 2017																		
LM54	2.40	F	07/26/2017	1.5	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12	
(11-002) - Clough Creek																		
Year: 2012																		
LM99	4.60	F	08/30/2012	0.9	2(1)	2(3)	1(1)	0(1)	0(1)	1(3)	100(1)	0(3)	64(1)	0(1)	0.0(3)	0(1) *	20	♦
LM95	3.20	F	08/29/2012	2.0	5(3)	4(3)	1(1)	1(1)	1(1)	2(3)	79(1)	0(5)	40(3)	1(1)	0.0(5)	98(3)	30	
LM96	3.00	F	08/29/2012	5.4	9(5)	6(5)	1(1)	1(1)	1(3)	3(3)	73(1)	11(3)	48(3)	12(1)	0.0(5)	404(5)	36	
LM97	1.20	E	08/30/2012	7.5	10(3)	6(5)	1(1)	1(1)	1(1)	4(3)	74(1)	47(1)	65(1)	18(1)	0.0(5)	500(3)	26	
LM98	0.60	F	08/30/2012	7.8	7(3)	5(3)	1(1)	1(1)	1(1)	2(1)	72(1)	20(3)	32(3)	16(1)	0.0(5)	212(3)	26	
(11-004) - Duck Creek																		
Year: 2012																		
LM71	6.00	F	08/30/2012	2.2	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12	

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** - < 50 Total individuals in sample

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LM78	5.20	E	08/15/2012	3.5	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	2(1) * *	12	
LM72	4.60	E	08/07/2012	5.1	4(1)	3(3)	0(1)	0(1)	0(1)	0(1)	97(1)	1(5)	97(1)	95(5)	0.7(5)	8(1)	26	
LM73	4.40	F	08/07/2012	5.8	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	100(1)	0.0(1)	0(1) * *	12	
LM75	3.30	F	08/07/2012	11.4	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12	
LM76	2.90	F	08/15/2012	11.8	4(1)	3(1)	1(1)	0(1)	0(1)	1(1)	30(5)	2(5)	6(5)	74(5)	0.0(5)	180(1)	32	
LM77	1.80	E	08/15/2012	14.3	9(3)	7(5)	1(1)	0(1)	0(1)	1(1)	56(1)	7(5)	38(3)	41(3)	0.0(5)	604(3)	32	
LM79	0.90	E	08/15/2012	14.6	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦

(11-007) - Sycamore Creek

Year: 2012

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	
LM47	3.50	F	08/21/2012	3.5	4(1)	3(3)	1(1)	0(1)	0(1)	2(1)	86(1)	0(5)	54(3)	0(1)	0.0(5)	262(3)	26	
LM48	2.40	F	08/22/2012	4.8	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	77(1)	0(5)	53(3)	0(1)	0.0(5)	262(3)	26	
LM49	1.60	F	08/22/2012	6.6	5(1)	4(3)	1(1)	0(1)	0(1)	2(1)	71(1)	5(5)	36(3)	0(1)	1.2(3)	198(3)	24	
LM50	0.70	E	08/06/2012	12.7	11(3)	5(3)	2(3)	2(1)	1(1)	4(3)	60(1)	41(1)	50(3)	3(1)	0.0(5)	264(3)	28	

(11-049) - Unnamed Tributary to Sycamore Cr. at RM 1.12

Year: 2012

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	
LM55	1.00	F	08/25/2012	5.3	3(1)	3(3)	0(1)	0(1)	0(1)	0(1)	45(3)	1(5)	45(3)	0(1)	5.1(1)	408(3)	24	
LM56	0.30	F	08/25/2012	5.6	6(1)	4(3)	2(3)	0(1)	1(1)	2(1)	53(3)	7(5)	48(3)	0(1)	0.0(5)	586(5)	32	
LM53	0.10	E	09/25/2012	5.7	5(1)	4(3)	2(3)	0(1)	1(1)	1(1)	69(1)	24(3)	61(1)	1(1)	0.0(5)	432(3)	24	

(11-051) -

Year: 2012

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	
	2.70	E	08/29/2012	0.0	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
LM85	1.90	E	08/16/2012	1.5	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	79(1)	0(3)	71(1)	0(1)	0.0(3)	6(1) * *	18	♦
LM84	0.50	E	08/16/2012	2.4	4(1)	4(3)	1(1)	0(1)	0(1)	1(1)	73(1)	3(5)	68(1)	0(1)	0.9(5)	58(3)	24	

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Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	
LM74	0.15	E	08/07/2012	3.4	8(3)	6(5)	1(1)	0(1)	0(1)	2(1)	69(1)	14(3)	58(1)	18(3)	0.2(5)	306(3)	28	
(11-075) - Unnamed Tributary to Duck Creek at RM 4.8																		
Year: 2012																		
LM83	0.80	F	08/02/2012	1.2	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
LM80	0.20	F	08/15/2012	1.4	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	100(1)	0.0(1)	0(1) * *	12	
(11-076) - Little Duck Creek																		
Year: 2012																		
LM86	2.70	E	08/16/2012	0.4	4(3)	3(3)	1(1)	0(1)	0(1)	2(5)	82(1)	0(5)	39(3)	0(1)	0.1(5)	320(5)	34	
LM87	2.60	E	08/09/2012	0.5	4(3)	3(3)	1(1)	0(1)	0(1)	2(5)	74(1)	2(5)	41(3)	0(1)	0.0(5)	246(5)	34	
LM90	2.40	F	08/09/2012	0.5	4(3)	3(3)	1(1)	0(1)	0(1)	2(5)	73(1)	0(5)	47(3)	0(1)	0.0(5)	394(5)	34	
LM88	1.80	F	08/09/2012	0.8	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
LM89	1.40	F	08/09/2012	1.1	5(3)	3(3)	1(1)	0(1)	0(1)	2(3)	73(1)	1(5)	69(1)	1(1)	0.0(5)	496(5)	30	
LM89	1.00	F	08/02/2012	1.1	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
LM92	0.20	F	08/09/2012	1.7	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
(11-077) - Unnamed Tributary to Little Duck Creek at RM 4.42																		
Year: 2012																		
LM82	0.10	F	08/15/2012	1.4	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
(11-086) - Unnamed Trib (1.82) to Trib to Sycamore Creek (1.1)																		
Year: 2012																		
LM54	0.40	F	08/29/2012	1.6	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	-9	♦
(11-002) - Clough Creek																		
Year: 2007																		
LM98	0.40	E	08/22/2007	8.0	8(3)	6(5)	1(1)	1(1)	1(1)	4(3)	14(5)	6(5)	10(5)	3(1)	0.0(5)	18400(5)	40	
(11-004) - Duck Creek																		
Year: 2007																		

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

Site ID	River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
LM75	3.40	E	08/22/2007	7.3	1(1)	1(1)	1(1)	0(1)	0(1)	1(1)	100(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM91	1.30	E	08/22/2007	14.5	9(5)	5(5)	1(1)	1(3)	0(1)	2(5)	75(1)	40(1)	63(1)	3(1)	0.0(5)	156(5)	34
(11-007) - Sycamore Creek																	
Year: 2007																	
LM50	1.10	E	09/12/2007	14.7	8(3)	5(3)	2(3)	1(1)	2(1)	3(1)	23(5)	5(5)	16(5)	2(1)	0.0(5)	6318(5)	38
(11-004) - Duck Creek																	
Year: 1994																	
LM76	2.80	F	09/29/1994	11.8	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
LM79	0.80	E	09/29/1994	14.7	6(1)	2(1)	0(1)	1(1)	0(1)	1(1)	1(5)	0(5)	1(5)	99(5)	0.0(5)	510(3)	34
(11-051) - East Fork Duck Creek																	
Year: 1994																	
LM84	0.50	F	09/29/1994	2.4	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	89(1)	0(5)	16(5)	0(1)	0.0(5)	38(1)	26
(11-002) - Clough Creek																	
Year: 1991																	
LM95	3.20	F	09/11/1991	2.1	3(1)	3(3)	1(1)	0(1)	0(1)	1(1)	94(1)	0(5)	17(5)	0(1)	0.0(5)	42(1)	26
(11-007) - Sycamore Creek																	
Year: 1991																	
LM49	1.40	F	09/06/1991	9.4	9(3)	7(5)	1(1)	1(1)	0(1)	4(3)	35(3)	2(5)	23(5)	1(1)	0.0(5)	920(5)	38
LM50	0.70	E	09/06/1991	15.1	16(5)	6(3)	1(1)	2(1)	3(3)	6(3)	48(3)	6(5)	33(3)	4(1)	0.0(5)	1131(5)	38
(11-049) - Unnamed Tributary to Sycamore Cr. at RM 1.12																	
Year: 1991																	
LM53	0.10	E	09/05/1991	5.7	4(1)	3(3)	0(1)	0(1)	0(1)	0(1)	50(1)	17(1)	50(1)	0(1)	0.0(1)	6(1) * *	14
(11-004) - Duck Creek																	
Year: 1983																	
600620	0.70	D	08/08/1983	14.7	2(1)	1(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	50(1)	0.0(1)	0(1) * *	12

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table A-1. Headwater IBI scores and metrics for the Little Miami River study area including historical data also sampled in 2022.

					Number of						Percent of Individuals					Rel.No. minus tolerants		
Site ID	River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	/(0.3km)		IBI
600620	0.70	D	10/06/1983	14.7	4(1)	3(1)	0(1)	0(1)	0(1)	1(1)	10(1)	10(1)	10(1)	86(1)	0.0(1)	28(1)	* *	12 ♦

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix A-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Little Miami River*

Years: 2022

Number of Samples: 27 Data Sources: 99 Data Types: P

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		66	4.9	1.19	2238	3.39	458.3
18-002	MOONEYE	I	R	M		16	1.2	0.29	89	0.14	75.6
20-001	SKIPJACK HERRING	P		M		21	1.6	0.38	27	0.04	17.3
20-003	GIZZARD SHAD	O		M		390	28.9	7.01	3108	4.70	107.6
40-003	BLACK BUFFALO	I		M	C	50	3.7	0.90	5672	8.58	1533.0
40-004	SMALLMOUTH BUFFALO	I		M	C	298	22.1	5.35	9986	15.10	452.8
40-005	QUILLBACK CARPSUCKER	O		M	C	30	2.2	0.54	1235	1.87	556.6
40-006	RIVER CARPSUCKER	O		M	C	103	7.6	1.85	4214	6.37	552.9
40-007	HIGHFIN CARPSUCKER	O		M	C	1	0.1	0.02	37	0.06	500.0
40-008	SILVER REDHORSE	I	M	S	R	11	0.8	0.20	680	1.03	836.3
40-009	BLACK REDHORSE	I	I	S	R	43	3.2	0.77	870	1.32	273.5
40-010	GOLDEN REDHORSE	I	M	S	R	130	9.6	2.34	3016	4.56	313.5
40-013	RIVER REDHORSE	I	I	S	R	28	2.1	0.50	2430	3.68	1173.2
40-015	NORTHERN HOG SUCKER	I	M	S	R	271	20.1	4.87	3607	5.46	179.8
40-023	SMALLMOUTH REDHORSE	I	M	S	R	606	44.8	10.89	9050	13.69	201.8
43-001	COMMON CARP	O	T	M	G	48	3.6	0.86	3215	4.86	905.2
43-006	SILVER CHUB	I		M	N	2	0.2	0.04	1	0.00	7.5
43-009	GRAVEL CHUB	I	M	S	N	73	5.4	1.31	23	0.04	4.4
43-015	SUCKERMOUTH MINNOW	I		S	N	5	0.4	0.09	1	0.00	4.0
43-020	EMERALD SHINER	I		M	N	1436	106.3	25.80	108	0.16	1.0
43-022	ROSYFACE SHINER	I	I	S	N	35	2.6	0.63	2	0.00	1.0
43-025	STRIPED SHINER	I		S	N	1	0.1	0.02	0	0.00	2.0
43-031	STEELCOLOR SHINER	I	P	M	N	40	3.0	0.72	18	0.03	6.3
43-032	SPOTFIN SHINER	I		M	N	76	5.6	1.37	19	0.03	3.4
43-034	SAND SHINER	I	M	M	N	44	3.3	0.79	6	0.01	1.9
43-035	MIMIC SHINER	I	I	M	N	147	10.9	2.64	11	0.02	1.1
43-041	BULLHEAD MINNOW	O		C	N	1	0.1	0.02	0	0.00	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	23	1.7	0.41	4	0.01	2.3
43-044	CENTRAL STONEROLLER	H		N	N	71	5.3	1.28	32	0.05	6.1
43-047	GRASS CARP			M	E	2	0.2	0.04	1383	2.09	9350.0
43-063	CHANNEL SHINER	I	I	M	N	66	4.9	1.19	236	0.36	48.4
47-002	CHANNEL CATFISH			C	F	151	11.2	2.71	6423	9.71	574.8
47-007	FLATHEAD CATFISH	P		C	F	32	2.4	0.58	916	1.39	386.9
47-008	STONECAT MADTOM	I	I	C		63	4.7	1.13	22	0.03	4.8
47-009	MOUNTAIN MADTOM	I	R	C		145	10.7	2.61	10	0.02	0.9
74-005	Striped X White Bass				E	33	2.4	0.59	1687	2.55	690.9
77-001	WHITE CRAPPIE	I		C	S	4	0.3	0.07	18	0.03	62.5
77-002	BLACK CRAPPIE	I		C	S	2	0.2	0.04	40	0.06	275.0
77-003	ROCK BASS	C		C	S	2	0.2	0.04	8	0.01	57.5
77-004	SMALLMOUTH BASS	C	M	C	F	88	6.5	1.58	691	1.05	106.2

Appendix A-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Little Miami River*

Years: 2022

Number of Samples: 27 Data Sources: 99 Data Types: P

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
77-005	SPOTTED BASS	C		C	F	64	4.7	1.15	176	0.27	37.3
77-006	LARGEMOUTH BASS	C		C	F	34	2.5	0.61	62	0.09	24.7
77-008	GREEN SUNFISH	I	T	C	S	24	1.8	0.43	24	0.04	13.5
77-009	BLUEGILL SUNFISH	I	P	C	S	49	3.6	0.88	70	0.11	19.3
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	0.1	0.02	0	0.00	5.0
77-011	LONGEAR SUNFISH	I	M	C	S	100	7.4	1.80	66	0.10	8.9
77-012	REDEAR SUNFISH	I		C	E	1	0.1	0.02	2	0.00	30.0
77-015	GREEN SF X BLUEGILL SF					1	0.1	0.02	1	0.00	15.0
77-017	LONGEAR SF X BLUEGILL SF					1	0.1	0.02	2	0.00	30.0
80-001	SAUGER	P		S	F	6	0.4	0.11	114	0.17	258.3
80-002	WALLEYE	P		S	F	1	0.1	0.02	29	0.04	400.0
80-007	SLENDERHEAD DARTER	I	R	S	D	28	2.1	0.50	6	0.01	2.9
80-011	LOGPERCH	I	M	S	D	118	8.7	2.12	120	0.18	13.7
80-014	JOHNNY DARTER	I		C	D	1	0.1	0.02	0	0.00	1.0
80-015	GREENSIDE DARTER	I	M	S	D	81	6.0	1.46	27	0.04	4.6
80-016	BANDED DARTER	I	I	S	D	102	7.6	1.83	8	0.01	1.1
80-017	VARIEGATE DARTER	I	I	S	D	78	5.8	1.40	27	0.04	4.7
80-022	RAINBOW DARTER	I	M	S	D	37	2.7	0.66	4	0.01	1.5
80-024	FANTAIL DARTER	I		C	D	5	0.4	0.09	0	0.00	2.6
80-026	SAUGER X WALLEYE	P			E	6	0.4	0.11	325	0.49	733.3
85-001	FRESHWATER DRUM		P	M		172	12.7	3.09	3831	5.79	301.0
99-040	UNSPECIFIED SUCKER					1	0.1	0.02	74	0.11	1000.0

No Species: 62 **Nat. Species:** 55 **Hybrids:** 4 **Total Counted:** 5565 **Total Rel. Wt. :** 66126

Appendix A-3: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Duck Creek; East Fork Duck Creek; Trib to Duck Creek @ RM 4.8; Little Duck Creek; Trib to Little Duck Cr. @ RM 4.42*

Years: 2022

Number of Samples: 18 Data Sources: 99 Data Types: E; F

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	28	3.1	0.95	0	***.**	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	1114	123.7	37.89	0	***.**	0.0
43-013	CREEK CHUB	G	T	N	N	751	83.4	25.54	0	***.**	0.0
43-032	SPOTFIN SHINER	I		M	N	6	0.7	0.20	0	***.**	0.0
43-034	SAND SHINER	I	M	M	N	3	0.3	0.10	0	***.**	0.0
43-039	SILVERJAW MINNOW	I		M	N	46	5.1	1.56	0	***.**	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	38	4.2	1.29	0	***.**	0.0
43-044	CENTRAL STONEROLLER	H		N	N	428	47.5	14.56	0	***.**	0.0
47-004	YELLOW BULLHEAD	I	T	C		27	3.0	0.92	0	***.**	0.0
77-006	LARGEMOUTH BASS	C		C	F	1	0.1	0.03	0	***.**	0.0
77-008	GREEN SUNFISH	I	T	C	S	461	51.2	15.68	0	***.**	0.0
77-009	BLUEGILL SUNFISH	I	P	C	S	7	0.8	0.24	0	***.**	0.0
77-011	LONGEAR SUNFISH	I	M	C	S	25	2.8	0.85	0	***.**	0.0
80-022	RAINBOW DARTER	I	M	S	D	3	0.3	0.10	0	***.**	0.0
80-023	ORANGETHROAT DARTER	I		S	D	1	0.1	0.03	0	***.**	0.0
80-024	FANTAIL DARTER	I		C	D	1	0.1	0.03	0	***.**	0.0
99-997	Dry Site					0	0.0	0.00	0	***.**	*****.*
99-999	NO FISH					0	0.0	0.00	0	***.**	*****.*

No Species: 18 **Nat. Species:** 18 **Hybrids:** 0 **Total Counted:** 2940 **Total Rel. Wt. :** 0

Appendix A-4: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Clough Creek; Sycamore Creek; Polk Run; Trib. to Sycamore Creek (RM 1.12); Trib 1.82 to Trib to Sycamore Cr RM1.12*

Years: 2022

Number of Samples: 11 **Data Sources:** 99 **Data Types:** D; E; F

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		7	1.3	0.21	100	2.57	78.5
40-005	QUILLBACK CARPSUCKER	O		M	C	2	0.4	0.06	336	8.65	925.0
40-006	RIVER CARPSUCKER	O		M	C	2	0.4	0.06	354	9.11	975.0
40-008	SILVER REDHORSE	I	M	S	R	1	0.2	0.03	245	6.31	1350.0
40-009	BLACK REDHORSE	I	I	S	R	3	0.6	0.09	218	5.61	400.0
40-010	GOLDEN REDHORSE	I	M	S	R	1	0.2	0.03	1	0.05	10.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	4	0.7	0.12	263	6.78	362.5
40-016	WHITE SUCKER	O	T	S	W	29	5.3	0.86	473	12.15	89.6
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	432	78.6	12.86	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	459	83.5	13.66	0	0.00	0.0
43-015	SUCKERMOUTH MINNOW	I		S	N	2	0.4	0.06	0	0.02	2.5
43-020	EMERALD SHINER	I		M	N	519	94.5	15.45	35	0.91	0.3
43-021	SILVER SHINER	I	I	S	N	5	0.9	0.15	1	0.04	1.8
43-022	ROSYFACE SHINER	I	I	S	N	33	6.0	0.98	2	0.06	0.3
43-025	STRIPED SHINER	I		S	N	8	1.5	0.24	11	0.30	8.1
43-032	SPOTFIN SHINER	I		M	N	26	4.7	0.77	5	0.14	1.1
43-034	SAND SHINER	I	M	M	N	42	7.6	1.25	3	0.09	0.4
43-035	MIMIC SHINER	I	I	M	N	73	13.3	2.17	11	0.29	0.8
43-039	SILVERJAW MINNOW	I		M	N	36	6.6	1.07	0	0.01	0.0
43-042	FATHEAD MINNOW	O	T	C	N	1	0.2	0.03	0	0.01	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	388	70.6	11.55	17	0.45	0.2
43-044	CENTRAL STONEROLLER	H		N	N	756	137.6	22.51	7	0.19	0.0
47-002	CHANNEL CATFISH			C	F	1	0.2	0.03	327	8.41	1800.0
47-004	YELLOW BULLHEAD	I	T	C		3	0.6	0.09	1	0.05	3.3
47-007	FLATHEAD CATFISH	P		C	F	1	0.2	0.03	0	0.01	3.0
54-003	NORTHERN STUDFISH	I		M		3	0.6	0.09	0	0.02	1.6
77-004	SMALLMOUTH BASS	C	M	C	F	49	8.9	1.46	882	22.67	98.9
77-005	SPOTTED BASS	C		C	F	4	0.7	0.12	49	1.26	67.5
77-006	LARGEMOUTH BASS	C		C	F	14	2.6	0.42	15	0.40	6.0
77-007	WARMOUTH SUNFISH	C		C	S	1	0.2	0.03	5	0.14	30.0
77-008	GREEN SUNFISH	I	T	C	S	82	14.9	2.44	119	3.06	7.9
77-009	BLUEGILL SUNFISH	I	P	C	S	75	13.7	2.23	100	2.57	7.3
77-011	LONGEAR SUNFISH	I	M	C	S	105	19.1	3.13	226	5.82	11.8
77-012	REDEAR SUNFISH	I		C	E	3	0.6	0.09	33	0.86	61.6
77-015	GREEN SF X BLUEGILL SF					4	0.7	0.12	10	0.28	15.0
80-015	GREENSIDE DARTER	I	M	S	D	24	4.4	0.71	11	0.29	2.5
80-016	BANDED DARTER	I	I	S	D	7	1.3	0.21	1	0.04	1.2
80-022	RAINBOW DARTER	I	M	S	D	76	13.8	2.26	12	0.32	0.9
80-023	ORANGETHROAT DARTER	I		S	D	5	0.9	0.15	0	0.00	0.0
80-024	FANTAIL DARTER	I		C	D	73	13.3	2.17	1	0.03	0.1

Appendix A-4: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Clough Creek; Sycamore Creek; Polk Run; Trib. to Sycamore Creek (RM 1.12); Trib 1.82 to Trib to Sycamore Cr RM1.12*

Years: 2022

Number of Samples: 11 Data Sources: 99 Data Types: D; E; F

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-997	Dry Site					0	0.0	0.00	0	0.00	*****.*

No Species: 41 **Nat. Species:** 39 **Hybrids:** 1 **Total Counted:** 3359 **Total Rel. Wt. :** 3893

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM01 River: 11-001 Little Miami River RM: 27.90 Date: 08/01/2022

Time Fished: 2064 Distance: 0.500 Drainge (sq mi): 1070.0 Depth: 0

Location: dst. SR 23/3 Little Miami State Park Lat: 39.31667 Long: -84.25168

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
18-002	MOONEYE	I	R	M		3	6.0	0.70	820	0.72	136.6
20-003	GIZZARD SHAD	O		M		21	42.0	4.92	5880	5.13	140.0
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.23	7600	6.63	3800.0
40-004	SMALLMOUTH BUFFALO	I		M	C	3	6.0	0.70	9800	8.55	1633.3
40-009	BLACK REDHORSE	I	I	S	R	12	24.0	2.81	12500	10.90	520.8
40-010	GOLDEN REDHORSE	I	M	S	R	4	8.0	0.94	4200	3.66	525.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	15	30.0	3.51	6840	5.97	228.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	54	108.0	12.65	39760	34.68	368.1
43-020	EMERALD SHINER	I		M	N	132	264.0	30.91	240	0.21	0.9
43-022	ROSYFACE SHINER	I	I	S	N	8	16.0	1.87	24	0.02	1.5
43-031	STEELCOLOR SHINER	I	P	M	N	2	4.0	0.47	12	0.01	3.0
43-032	SPOTFIN SHINER	I		M	N	2	4.0	0.47	12	0.01	3.0
43-035	MIMIC SHINER	I	I	M	N	78	156.0	18.27	180	0.16	1.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	3	6.0	0.70	20	0.02	3.3
43-044	CENTRAL STONEROLLER	H		N	N	11	22.0	2.58	100	0.09	4.5
47-002	CHANNEL CATFISH			C	F	3	6.0	0.70	1400	1.22	233.3
47-008	STONECAT MADTOM	I	I	C		3	6.0	0.70	20	0.02	3.3
47-009	MOUNTAIN MADTOM	I	R	C		15	30.0	3.51	62	0.05	2.0
77-004	SMALLMOUTH BASS	C	M	C	F	4	8.0	0.94	1080	0.94	135.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.23	10	0.01	5.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	0.47	100	0.09	25.0
80-011	LOGPERCH	I	M	S	D	2	4.0	0.47	60	0.05	15.0
80-015	GREENSIDE DARTER	I	M	S	D	6	12.0	1.41	50	0.04	4.1
80-016	BANDED DARTER	I	I	S	D	10	20.0	2.34	10	0.01	0.5
80-017	VARIEGATE DARTER	I	I	S	D	11	22.0	2.58	106	0.09	4.8
80-022	RAINBOW DARTER	I	M	S	D	2	4.0	0.47	6	0.01	1.5
80-026	SAUGER X WALLEYE	P			E	3	6.0	0.70	4400	3.84	733.3
85-001	FRESHWATER DRUM		P	M		16	32.0	3.75	19340	16.87	604.3

No Species: 27 **Nat. Species:** 27 **Hybrids:** 1 **Total Counted:** 427 **Total Rel. Wt. :** 114632

IBI: 48.0 **MIwb:** 10.0

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM01 River: 11-001 Little Miami River RM: 27.90 Date: 09/19/2022

Time Fished: 2856 Distance: 0.500 Drainge (sq mi): 1070.0 Depth: 0

Location: dst. SR 23/3 Little Miami State Park Lat: 39.31667 Long: -84.25168

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	0.59	2200	1.85	550.0
20-003	GIZZARD SHAD	O		M		22	44.0	6.47	8200	6.88	186.3
40-004	SMALLMOUTH BUFFALO	I		M	C	4	8.0	1.18	11200	9.40	1400.0
40-005	QUILLBACK CARPSUCKER	O		M	C	4	8.0	1.18	6800	5.70	850.0
40-006	RIVER CARPSUCKER	O		M	C	5	10.0	1.47	9100	7.63	910.0
40-009	BLACK REDHORSE	I	I	S	R	6	12.0	1.76	8040	6.74	670.0
40-010	GOLDEN REDHORSE	I	M	S	R	5	10.0	1.47	4800	4.03	480.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	32	64.0	9.41	15500	13.00	242.1
40-023	SMALLMOUTH REDHORSE	I	M	S	R	52	104.0	15.29	40780	34.21	392.1
43-009	GRAVEL CHUB	I	M	S	N	1	2.0	0.29	10	0.01	5.0
43-015	SUCKERMOUTH MINNOW	I		S	N	1	2.0	0.29	10	0.01	5.0
43-020	EMERALD SHINER	I		M	N	89	178.0	26.18	220	0.18	1.2
43-022	ROSYFACE SHINER	I	I	S	N	10	20.0	2.94	22	0.02	1.1
43-031	STEELCOLOR SHINER	I	P	M	N	10	20.0	2.94	130	0.11	6.5
43-032	SPOTFIN SHINER	I		M	N	2	4.0	0.59	8	0.01	2.0
43-035	MIMIC SHINER	I	I	M	N	2	4.0	0.59	6	0.01	1.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	2	4.0	0.59	20	0.02	5.0
43-044	CENTRAL STONEROLLER	H		N	N	2	4.0	0.59	30	0.03	7.5
47-002	CHANNEL CATFISH			C	F	3	6.0	0.88	3410	2.86	568.3
47-008	STONECAT MADTOM	I	I	C		13	26.0	3.82	200	0.17	7.6
47-009	MOUNTAIN MADTOM	I	R	C		15	30.0	4.41	40	0.03	1.3
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.29	400	0.34	200.0
77-003	ROCK BASS	C		C	S	1	2.0	0.29	200	0.17	100.0
77-004	SMALLMOUTH BASS	C	M	C	F	5	10.0	1.47	680	0.57	68.0
77-011	LONGEAR SUNFISH	I	M	C	S	1	2.0	0.29	60	0.05	30.0
80-007	SLENDERHEAD DARTER	I	R	S	D	3	6.0	0.88	30	0.03	5.0
80-011	LOGPERCH	I	M	S	D	10	20.0	2.94	420	0.35	21.0
80-015	GREENSIDE DARTER	I	M	S	D	14	28.0	4.12	160	0.13	5.7
80-016	BANDED DARTER	I	I	S	D	5	10.0	1.47	10	0.01	1.0
80-017	VARIEGATE DARTER	I	I	S	D	14	28.0	4.12	200	0.17	7.1
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.29	6	0.01	3.0
85-001	FRESHWATER DRUM		P	M		3	6.0	0.88	6320	5.30	1053.3

No Species: 32 **Nat. Species:** 32 **Hybrids:** 0 **Total Counted:** 340 **Total Rel. Wt. :** 119212

IBI: 52.0 **MIwb:** 10.5

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM02 River: 11-001 Little Miami River RM: 24.10 Date: 08/01/2022

Time Fished: 3226 Distance: 0.500 Drainge (sq mi): 1090.0 Depth: 0

Location: ust. O'Bannon Creek Lat: 39.27409 Long: -84.25833

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		6	12.0	2.45	8100	5.32	675.0
20-001	SKIPJACK HERRING	P		M		1	2.0	0.41	40	0.03	20.0
20-003	GIZZARD SHAD	O		M		26	52.0	10.61	6320	4.15	121.5
40-004	SMALLMOUTH BUFFALO	I		M	C	12	24.0	4.90	46100	30.28	1920.8
40-006	RIVER CARPSUCKER	O		M	C	2	4.0	0.82	2600	1.71	650.0
40-009	BLACK REDHORSE	I	I	S	R	5	10.0	2.04	7100	4.66	710.0
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	1.22	3000	1.97	500.0
40-013	RIVER REDHORSE	I	I	S	R	5	10.0	2.04	34300	22.53	3430.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	19	38.0	7.76	6900	4.53	181.5
40-023	SMALLMOUTH REDHORSE	I	M	S	R	28	56.0	11.43	17100	11.23	305.3
43-001	COMMON CARP	O	T	M	G	1	2.0	0.41	3900	2.56	1950.0
43-020	EMERALD SHINER	I		M	N	24	48.0	9.80	40	0.03	0.8
43-022	ROSYFACE SHINER	I	I	S	N	5	10.0	2.04	16	0.01	1.6
43-031	STEELCOLOR SHINER	I	P	M	N	3	6.0	1.22	40	0.03	6.6
43-032	SPOTFIN SHINER	I		M	N	6	12.0	2.45	60	0.04	5.0
43-035	MIMIC SHINER	I	I	M	N	14	28.0	5.71	50	0.03	1.7
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.41	2	0.00	1.0
43-044	CENTRAL STONEROLLER	H		N	N	7	14.0	2.86	40	0.03	2.8
47-002	CHANNEL CATFISH			C	F	2	4.0	0.82	5400	3.55	1350.0
47-007	FLATHEAD CATFISH	P		C	F	6	12.0	2.45	3300	2.17	275.0
47-008	STONECAT MADTOM	I	I	C		3	6.0	1.22	10	0.01	1.6
47-009	MOUNTAIN MADTOM	I	R	C		8	16.0	3.27	20	0.01	1.2
77-004	SMALLMOUTH BASS	C	M	C	F	5	10.0	2.04	1110	0.73	111.0
77-006	LARGEMOUTH BASS	C		C	F	10	20.0	4.08	240	0.16	12.0
77-009	BLUEGILL SUNFISH	I	P	C	S	7	14.0	2.86	400	0.26	28.5
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	0.82	100	0.07	25.0
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.41	30	0.02	15.0
77-017	LONGEAR SF X BLUEGILL SF					1	2.0	0.41	60	0.04	30.0
80-001	SAUGER	P		S	F	1	2.0	0.41	1000	0.66	500.0
80-007	SLENDERHEAD DARTER	I	R	S	D	2	4.0	0.82	10	0.01	2.5
80-011	LOGPERCH	I	M	S	D	4	8.0	1.63	70	0.05	8.7
80-015	GREENSIDE DARTER	I	M	S	D	3	6.0	1.22	40	0.03	6.6
80-016	BANDED DARTER	I	I	S	D	9	18.0	3.67	20	0.01	1.1
80-017	VARIEGATE DARTER	I	I	S	D	1	2.0	0.41	20	0.01	10.0
80-022	RAINBOW DARTER	I	M	S	D	4	8.0	1.63	20	0.01	2.5
80-024	FANTAIL DARTER	I		C	D	1	2.0	0.41	4	0.00	2.0
80-026	SAUGER X WALLEYE	P			E	1	2.0	0.41	1300	0.85	650.0
85-001	FRESHWATER DRUM		P	M		6	12.0	2.45	3400	2.23	283.3

No Species:	35	**Nat. Species:**	34	**Hybrids:**	3	**Total Counted:**	245	**Total Rel. Wt. :**	152262
IBI:	52.0	**MIwb:**	10.9						

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM02 River: 11-001 Little Miami River RM: 24.10 Date: 09/19/2022

Time Fished: 2995 Distance: 0.500 Drainge (sq mi): 1090.0 Depth: 0

Location: ust. O'Bannon Creek Lat: 39.27409 Long: -84.25833

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	0.78	2200	1.07	550.0
20-003	GIZZARD SHAD	O		M		6	12.0	2.34	3100	1.50	258.3
40-004	SMALLMOUTH BUFFALO	I		M	C	11	22.0	4.30	50300	24.38	2286.3
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.39	1500	0.73	750.0
40-006	RIVER CARPSUCKER	O		M	C	8	16.0	3.13	13300	6.45	831.2
40-007	HIGHFIN CARPSUCKER	O		M	C	1	2.0	0.39	1000	0.48	500.0
40-008	SILVER REDHORSE	I	M	S	R	2	4.0	0.78	6700	3.25	1675.0
40-009	BLACK REDHORSE	I	I	S	R	4	8.0	1.56	3500	1.70	437.5
40-010	GOLDEN REDHORSE	I	M	S	R	12	24.0	4.69	15000	7.27	625.0
40-013	RIVER REDHORSE	I	I	S	R	3	6.0	1.17	13700	6.64	2283.3
40-015	NORTHERN HOG SUCKER	I	M	S	R	18	36.0	7.03	7260	3.52	201.6
40-023	SMALLMOUTH REDHORSE	I	M	S	R	61	122.0	23.83	49860	24.16	408.6
43-001	COMMON CARP	O	T	M	G	2	4.0	0.78	9200	4.46	2300.0
43-009	GRAVEL CHUB	I	M	S	N	1	2.0	0.39	10	0.00	5.0
43-020	EMERALD SHINER	I		M	N	26	52.0	10.16	90	0.04	1.7
43-022	ROSYFACE SHINER	I	I	S	N	10	20.0	3.91	30	0.01	1.5
43-031	STEELCOLOR SHINER	I	P	M	N	2	4.0	0.78	16	0.01	4.0
43-032	SPOTFIN SHINER	I		M	N	2	4.0	0.78	12	0.01	3.0
43-034	SAND SHINER	I	M	M	N	1	2.0	0.39	4	0.00	2.0
43-035	MIMIC SHINER	I	I	M	N	7	14.0	2.73	40	0.02	2.8
43-044	CENTRAL STONEROLLER	H		N	N	1	2.0	0.39	20	0.01	10.0
47-002	CHANNEL CATFISH			C	F	6	12.0	2.34	14200	6.88	1183.3
47-007	FLATHEAD CATFISH	P		C	F	2	4.0	0.78	440	0.21	110.0
47-008	STONECAT MADTOM	I	I	C		2	4.0	0.78	20	0.01	5.0
47-009	MOUNTAIN MADTOM	I	R	C		10	20.0	3.91	20	0.01	1.0
74-005	Striped X White Bass				E	2	4.0	0.78	1200	0.58	300.0
77-004	SMALLMOUTH BASS	C	M	C	F	6	12.0	2.34	120	0.06	10.0
77-005	SPOTTED BASS	C		C	F	1	2.0	0.39	240	0.12	120.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	0.39	120	0.06	60.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	0.78	40	0.02	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	3	6.0	1.17	30	0.01	5.0
80-001	SAUGER	P		S	F	1	2.0	0.39	500	0.24	250.0
80-007	SLENDERHEAD DARTER	I	R	S	D	1	2.0	0.39	4	0.00	2.0
80-011	LOGPERCH	I	M	S	D	7	14.0	2.73	40	0.02	2.8
80-015	GREENSIDE DARTER	I	M	S	D	6	12.0	2.34	60	0.03	5.0
80-016	BANDED DARTER	I	I	S	D	4	8.0	1.56	10	0.00	1.2
80-017	VARIEGATE DARTER	I	I	S	D	6	12.0	2.34	70	0.03	5.8
80-022	RAINBOW DARTER	I	M	S	D	6	12.0	2.34	20	0.01	1.6
85-001	FRESHWATER DRUM		P	M		9	18.0	3.52	12380	6.00	687.7

No Species: 38	**Nat. Species:**	37	**Hybrids:** 1	**Total Counted:**	256	**Total Rel. Wt. :**	206356
IBI: 52.0	**MIwb:**	11.0					

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM03 River: 11-001 Little Miami River RM: 22.30 Date: 08/02/2022

Time Fished: 2872 Distance: 0.500 Drainge (sq mi): 1150.0 Depth: 0

Location: ust. Polk Run Lat: 39.25309 Long: -84.28187

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		3	6.0	1.50	3800	5.30	633.3
20-003	GIZZARD SHAD	O		M		7	14.0	3.50	3280	4.57	234.2
40-004	SMALLMOUTH BUFFALO	I		M	C	5	10.0	2.50	12800	17.85	1280.0
40-006	RIVER CARPSUCKER	O		M	C	1	2.0	0.50	1400	1.95	700.0
40-009	BLACK REDHORSE	I	I	S	R	5	10.0	2.50	5100	7.11	510.0
40-010	GOLDEN REDHORSE	I	M	S	R	9	18.0	4.50	11400	15.89	633.3
40-015	NORTHERN HOG SUCKER	I	M	S	R	10	20.0	5.00	1700	2.37	85.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	21	42.0	10.50	13490	18.81	321.1
43-020	EMERALD SHINER	I		M	N	57	114.0	28.50	100	0.14	0.8
43-025	STRIPED SHINER	I		S	N	1	2.0	0.50	4	0.01	2.0
43-032	SPOTFIN SHINER	I		M	N	5	10.0	2.50	40	0.06	4.0
43-034	SAND SHINER	I	M	M	N	13	26.0	6.50	40	0.06	1.5
43-035	MIMIC SHINER	I	I	M	N	10	20.0	5.00	30	0.04	1.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	10	20.0	5.00	34	0.05	1.7
43-044	CENTRAL STONEROLLER	H		N	N	1	2.0	0.50	4	0.01	2.0
47-002	CHANNEL CATFISH			C	F	4	8.0	2.00	9920	13.83	1240.0
47-007	FLATHEAD CATFISH	P		C	F	2	4.0	1.00	500	0.70	125.0
47-009	MOUNTAIN MADTOM	I	R	C		1	2.0	0.50	2	0.00	1.0
77-004	SMALLMOUTH BASS	C	M	C	F	3	6.0	1.50	860	1.20	143.3
77-006	LARGEMOUTH BASS	C		C	F	2	4.0	1.00	30	0.04	7.5
77-008	GREEN SUNFISH	I	T	C	S	4	8.0	2.00	80	0.11	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	8	16.0	4.00	220	0.31	13.7
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	1.00	180	0.25	45.0
80-007	SLENDERHEAD DARTER	I	R	S	D	2	4.0	1.00	30	0.04	7.5
80-011	LOGPERCH	I	M	S	D	7	14.0	3.50	280	0.39	20.0
80-016	BANDED DARTER	I	I	S	D	3	6.0	1.50	2	0.00	0.3
85-001	FRESHWATER DRUM		P	M		4	8.0	2.00	6400	8.92	800.0

No Species: 27 **Nat. Species:** 27 **Hybrids:** 0 **Total Counted:** 200 **Total Rel. Wt. :** 71726

IBI: 50.0 **MIwb:** 10.0

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM03 River: 11-001 Little Miami River RM: 22.30 Date: 09/20/2022

Time Fished: 3128 Distance: 0.500 Drainge (sq mi): 1150.0 Depth: 0

Location: ust. Polk Run Lat: 39.25309 Long: -84.28187

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-004	SMALLMOUTH BUFFALO	I		M	C	1	2.0	0.51	2900	4.50	1450.0
40-006	RIVER CARPSUCKER	O		M	C	11	22.0	5.56	20100	31.17	913.6
40-010	GOLDEN REDHORSE	I	M	S	R	24	48.0	12.12	27500	42.65	572.9
40-015	NORTHERN HOG SUCKER	I	M	S	R	3	6.0	1.52	1200	1.86	200.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	9	18.0	4.55	10400	16.13	577.7
43-020	EMERALD SHINER	I		M	N	53	106.0	26.77	130	0.20	1.2
43-031	STEELCOLOR SHINER	I	P	M	N	1	2.0	0.51	4	0.01	2.0
43-035	MIMIC SHINER	I	I	M	N	2	4.0	1.01	6	0.01	1.5
47-008	STONECAT MADTOM	I	I	C		7	14.0	3.54	40	0.06	2.8
47-009	MOUNTAIN MADTOM	I	R	C		7	14.0	3.54	30	0.05	2.1
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.51	500	0.78	250.0
77-005	SPOTTED BASS	C		C	F	2	4.0	1.01	20	0.03	5.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.51	10	0.02	5.0
77-008	GREEN SUNFISH	I	T	C	S	4	8.0	2.02	80	0.12	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	1.01	160	0.25	40.0
77-011	LONGEAR SUNFISH	I	M	C	S	15	30.0	7.58	100	0.16	3.3
80-001	SAUGER	P		S	F	1	2.0	0.51	600	0.93	300.0
80-007	SLENDERHEAD DARTER	I	R	S	D	6	12.0	3.03	34	0.05	2.8
80-011	LOGPERCH	I	M	S	D	19	38.0	9.60	380	0.59	10.0
80-015	GREENSIDE DARTER	I	M	S	D	18	36.0	9.09	120	0.19	3.3
80-016	BANDED DARTER	I	I	S	D	9	18.0	4.55	16	0.02	0.8
80-024	FANTAIL DARTER	I		C	D	1	2.0	0.51	4	0.01	2.0
85-001	FRESHWATER DRUM		P	M		1	2.0	0.51	150	0.23	75.0

No Species: 23 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 198 **Total Rel. Wt. :** 64484

IBI: 44.0 **MIwb:** 9.0

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM05 River: 11-001 Little Miami River RM: 21.50 Date: 08/02/2022

Time Fished: 3120 Distance: 0.500 Drainge (sq mi): 1160.0 Depth: 0

Location: dst. Polk Run Lat: 39.24452 Long: -84.29638

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.39	1200	0.83	600.0
20-001	SKIPJACK HERRING	P		M		1	2.0	0.39	40	0.03	20.0
20-003	GIZZARD SHAD	O		M		7	14.0	2.75	1720	1.18	122.8
40-003	BLACK BUFFALO	I		M	C	5	10.0	1.96	27600	19.00	2760.0
40-004	SMALLMOUTH BUFFALO	I		M	C	14	28.0	5.49	46600	32.08	1664.2
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.39	1200	0.83	600.0
40-006	RIVER CARPSUCKER	O		M	C	4	8.0	1.57	6000	4.13	750.0
40-008	SILVER REDHORSE	I	M	S	R	2	4.0	0.78	6000	4.13	1500.0
40-009	BLACK REDHORSE	I	I	S	R	1	2.0	0.39	16	0.01	8.0
40-010	GOLDEN REDHORSE	I	M	S	R	8	16.0	3.14	8700	5.99	543.7
40-013	RIVER REDHORSE	I	I	S	R	2	4.0	0.78	11000	7.57	2750.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	19	38.0	7.45	5300	3.65	139.4
40-023	SMALLMOUTH REDHORSE	I	M	S	R	13	26.0	5.10	10500	7.23	403.8
43-009	GRAVEL CHUB	I	M	S	N	9	18.0	3.53	102	0.07	5.6
43-020	EMERALD SHINER	I		M	N	83	166.0	32.55	120	0.08	0.7
43-032	SPOTFIN SHINER	I		M	N	17	34.0	6.67	126	0.09	3.7
43-034	SAND SHINER	I	M	M	N	9	18.0	3.53	40	0.03	2.2
43-035	MIMIC SHINER	I	I	M	N	9	18.0	3.53	20	0.01	1.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.39	4	0.00	2.0
43-044	CENTRAL STONEROLLER	H		N	N	2	4.0	0.78	10	0.01	2.5
47-002	CHANNEL CATFISH			C	F	8	16.0	3.14	10600	7.30	662.5
47-007	FLATHEAD CATFISH	P		C	F	3	6.0	1.18	1002	0.69	167.0
47-008	STONECAT MADTOM	I	I	C		2	4.0	0.78	10	0.01	2.5
47-009	MOUNTAIN MADTOM	I	R	C		8	16.0	3.14	10	0.01	0.6
77-004	SMALLMOUTH BASS	C	M	C	F	5	10.0	1.96	1200	0.83	120.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.39	200	0.14	100.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	0.39	20	0.01	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.39	20	0.01	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	1	2.0	0.39	20	0.01	10.0
77-012	REDEAR SUNFISH	I		C	E	1	2.0	0.39	60	0.04	30.0
80-001	SAUGER	P		S	F	1	2.0	0.39	300	0.21	150.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.39	20	0.01	10.0
80-015	GREENSIDE DARTER	I	M	S	D	3	6.0	1.18	20	0.01	3.3
80-016	BANDED DARTER	I	I	S	D	5	10.0	1.96	20	0.01	2.0
80-017	VARIEGATE DARTER	I	I	S	D	3	6.0	1.18	20	0.01	3.3
85-001	FRESHWATER DRUM		P	M		3	6.0	1.18	5460	3.76	910.0

No Species: 36 **Nat. Species:** 35 **Hybrids:** 0 **Total Counted:** 255 **Total Rel. Wt. :** 145280

IBI: 46.0 **MIwb:** 10.5

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM05 River: 11-001 Little Miami River RM: 21.50 Date: 09/20/2022

Time Fished: 2700 Distance: 0.500 Drainge (sq mi): 1160.0 Depth: 0

Location: dst. Polk Run Lat: 39.24452 Long: -84.29638

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	0.93	2100	1.21	525.0
20-001	SKIPJACK HERRING	P		M		1	2.0	0.47	60	0.03	30.0
20-003	GIZZARD SHAD	O		M		4	8.0	1.87	1400	0.81	175.0
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.47	5400	3.11	2700.0
40-004	SMALLMOUTH BUFFALO	I		M	C	30	60.0	14.02	103800	59.81	1730.0
40-005	QUILLBACK CARPSUCKER	O		M	C	6	12.0	2.80	9700	5.59	808.3
40-006	RIVER CARPSUCKER	O		M	C	3	6.0	1.40	5400	3.11	900.0
40-009	BLACK REDHORSE	I	I	S	R	2	4.0	0.93	2900	1.67	725.0
40-010	GOLDEN REDHORSE	I	M	S	R	5	10.0	2.34	4800	2.77	480.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	6	12.0	2.80	3500	2.02	291.6
40-023	SMALLMOUTH REDHORSE	I	M	S	R	17	34.0	7.94	14920	8.60	438.8
43-009	GRAVEL CHUB	I	M	S	N	9	18.0	4.21	120	0.07	6.6
43-020	EMERALD SHINER	I		M	N	50	100.0	23.36	140	0.08	1.4
43-022	ROSYFACE SHINER	I	I	S	N	2	4.0	0.93	2	0.00	0.5
43-031	STEELCOLOR SHINER	I	P	M	N	1	2.0	0.47	6	0.00	3.0
43-032	SPOTFIN SHINER	I		M	N	3	6.0	1.40	10	0.01	1.6
43-034	SAND SHINER	I	M	M	N	1	2.0	0.47	2	0.00	1.0
43-044	CENTRAL STONEROLLER	H		N	N	5	10.0	2.34	100	0.06	10.0
43-063	CHANNEL SHINER	I	I	M	N	2	4.0	0.93	6	0.00	1.5
47-002	CHANNEL CATFISH			C	F	3	6.0	1.40	1900	1.09	316.6
47-008	STONECAT MADTOM	I	I	C		2	4.0	0.93	20	0.01	5.0
47-009	MOUNTAIN MADTOM	I	R	C		9	18.0	4.21	20	0.01	1.1
77-005	SPOTTED BASS	C		C	F	2	4.0	0.93	40	0.02	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.47	50	0.03	25.0
77-011	LONGEAR SUNFISH	I	M	C	S	5	10.0	2.34	70	0.04	7.0
80-002	WALLEYE	P		S	F	1	2.0	0.47	800	0.46	400.0
80-007	SLENDERHEAD DARTER	I	R	S	D	1	2.0	0.47	20	0.01	10.0
80-011	LOGPERCH	I	M	S	D	13	26.0	6.07	540	0.31	20.7
80-015	GREENSIDE DARTER	I	M	S	D	7	14.0	3.27	60	0.03	4.2
80-016	BANDED DARTER	I	I	S	D	7	14.0	3.27	20	0.01	1.4
80-017	VARIEGATE DARTER	I	I	S	D	4	8.0	1.87	30	0.02	3.7
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.47	2	0.00	1.0
85-001	FRESHWATER DRUM		P	M		8	16.0	3.74	15600	8.99	975.0

No Species: 33 **Nat. Species:** 33 **Hybrids:** 0 **Total Counted:** 214 **Total Rel. Wt. :** 173538

IBI: 48.0 **MIwb:** 10.0

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM07 River: 11-001 Little Miami River RM: 18.50 Date: 08/02/2022

Time Fished: 2363 Distance: 0.500 Drainge (sq mi): 1190.0 Depth: 0

Location: Camargo Rd. Lat: 39.21684 Long: -84.31488

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	1.15	1900	1.05	475.0
20-003	GIZZARD SHAD	O		M		10	20.0	5.75	4300	2.37	215.0
40-003	BLACK BUFFALO	I		M	C	7	14.0	4.02	40000	22.05	2857.1
40-004	SMALLMOUTH BUFFALO	I		M	C	10	20.0	5.75	38000	20.95	1900.0
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.57	1800	0.99	900.0
40-006	RIVER CARPSUCKER	O		M	C	3	6.0	1.72	5300	2.92	883.3
40-009	BLACK REDHORSE	I	I	S	R	1	2.0	0.57	1000	0.55	500.0
40-010	GOLDEN REDHORSE	I	M	S	R	12	24.0	6.90	10660	5.88	444.1
40-015	NORTHERN HOG SUCKER	I	M	S	R	12	24.0	6.90	6100	3.36	254.1
40-023	SMALLMOUTH REDHORSE	I	M	S	R	28	56.0	16.09	29100	16.04	519.6
43-020	EMERALD SHINER	I		M	N	23	46.0	13.22	80	0.04	1.7
43-031	STEELCOLOR SHINER	I	P	M	N	2	4.0	1.15	50	0.03	12.5
43-032	SPOTFIN SHINER	I		M	N	4	8.0	2.30	30	0.02	3.7
43-035	MIMIC SHINER	I	I	M	N	1	2.0	0.57	4	0.00	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	3	6.0	1.72	16	0.01	2.6
47-002	CHANNEL CATFISH			C	F	12	24.0	6.90	25400	14.00	1058.3
47-007	FLATHEAD CATFISH	P		C	F	2	4.0	1.15	2480	1.37	620.0
47-008	STONECAT MADTOM	I	I	C		3	6.0	1.72	30	0.02	5.0
47-009	MOUNTAIN MADTOM	I	R	C		8	16.0	4.60	4	0.00	0.2
77-004	SMALLMOUTH BASS	C	M	C	F	8	16.0	4.60	1580	0.87	98.7
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	1.72	40	0.02	6.6
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	1.15	30	0.02	7.5
80-007	SLENDERHEAD DARTER	I	R	S	D	1	2.0	0.57	6	0.00	3.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.57	10	0.01	5.0
80-015	GREENSIDE DARTER	I	M	S	D	5	10.0	2.87	40	0.02	4.0
80-016	BANDED DARTER	I	I	S	D	3	6.0	1.72	6	0.00	1.0
80-017	VARIEGATE DARTER	I	I	S	D	2	4.0	1.15	16	0.01	4.0
85-001	FRESHWATER DRUM		P	M		5	10.0	2.87	13400	7.39	1340.0

No Species: 28 **Nat. Species:** 28 **Hybrids:** 0 **Total Counted:** 174 **Total Rel. Wt. :** 181382

IBI: 50.0 **MIwb:** 10.5

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM07 River: 11-001 Little Miami River RM: 18.50 Date: 09/20/2022

Time Fished: 2351 Distance: 0.500 Drainge (sq mi): 1190.0 Depth: 0

Location: Camargo Rd. Lat: 39.21684 Long: -84.31488

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.64	800	0.70	400.0
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.64	6600	5.78	3300.0
40-004	SMALLMOUTH BUFFALO	I		M	C	12	24.0	7.64	41200	36.09	1716.6
40-005	QUILLBACK CARPSUCKER	O		M	C	2	4.0	1.27	3700	3.24	925.0
40-006	RIVER CARPSUCKER	O		M	C	2	4.0	1.27	3000	2.63	750.0
40-009	BLACK REDHORSE	I	I	S	R	1	2.0	0.64	1000	0.88	500.0
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	1.91	3100	2.72	516.6
40-015	NORTHERN HOG SUCKER	I	M	S	R	23	46.0	14.65	9900	8.67	215.2
40-023	SMALLMOUTH REDHORSE	I	M	S	R	19	38.0	12.10	14330	12.55	377.1
43-009	GRAVEL CHUB	I	M	S	N	2	4.0	1.27	6	0.01	1.5
43-020	EMERALD SHINER	I		M	N	14	28.0	8.92	60	0.05	2.1
43-032	SPOTFIN SHINER	I		M	N	4	8.0	2.55	40	0.04	5.0
47-002	CHANNEL CATFISH			C	F	4	8.0	2.55	15700	13.75	1962.5
47-008	STONECAT MADTOM	I	I	C		5	10.0	3.18	40	0.04	4.0
47-009	MOUNTAIN MADTOM	I	R	C		5	10.0	3.18	6	0.01	0.6
77-004	SMALLMOUTH BASS	C	M	C	F	8	16.0	5.10	1280	1.12	80.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.64	60	0.05	30.0
77-011	LONGEAR SUNFISH	I	M	C	S	1	2.0	0.64	20	0.02	10.0
80-007	SLENDERHEAD DARTER	I	R	S	D	6	12.0	3.82	10	0.01	0.8
80-011	LOGPERCH	I	M	S	D	10	20.0	6.37	340	0.30	17.0
80-015	GREENSIDE DARTER	I	M	S	D	4	8.0	2.55	30	0.03	3.7
80-016	BANDED DARTER	I	I	S	D	13	26.0	8.28	20	0.02	0.7
80-017	VARIEGATE DARTER	I	I	S	D	10	20.0	6.37	120	0.11	6.0
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.64	2	0.00	1.0
85-001	FRESHWATER DRUM		P	M		5	10.0	3.18	12800	11.21	1280.0

No Species: 25 **Nat. Species:** 25 **Hybrids:** 0 **Total Counted:** 157 **Total Rel. Wt. :** 114164

IBI: 52.0 **MIwb:** 10.1

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM08 River: 11-001 Little Miami River RM: 17.70 Date: 08/02/2022

Time Fished: 1959 Distance: 0.500 Drainge (sq mi): 1190.0 Depth: 0

Location: canoe access dst. SR126 Lat: 39.20921 Long: -84.30232

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		4	8.0	3.48	9300	6.30	1162.5
18-002	MOONEYE	I	R	M		1	2.0	0.87	300	0.20	150.0
20-003	GIZZARD SHAD	O		M		6	12.0	5.22	2300	1.56	191.6
40-003	BLACK BUFFALO	I		M	C	4	8.0	3.48	28300	19.16	3537.5
40-004	SMALLMOUTH BUFFALO	I		M	C	3	6.0	2.61	9100	6.16	1516.6
40-006	RIVER CARPSUCKER	O		M	C	2	4.0	1.74	3800	2.57	950.0
40-009	BLACK REDHORSE	I	I	S	R	2	4.0	1.74	1400	0.95	350.0
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	2.61	3600	2.44	600.0
40-013	RIVER REDHORSE	I	I	S	R	5	10.0	4.35	33600	22.75	3360.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	12	24.0	10.43	12100	8.19	504.1
40-023	SMALLMOUTH REDHORSE	I	M	S	R	16	32.0	13.91	12400	8.40	387.5
43-020	EMERALD SHINER	I		M	N	2	4.0	1.74	12	0.01	3.0
43-031	STEELCOLOR SHINER	I	P	M	N	2	4.0	1.74	12	0.01	3.0
43-032	SPOTFIN SHINER	I		M	N	6	12.0	5.22	50	0.03	4.1
47-002	CHANNEL CATFISH			C	F	5	10.0	4.35	10300	6.97	1030.0
47-007	FLATHEAD CATFISH	P		C	F	3	6.0	2.61	6000	4.06	1000.0
47-008	STONECAT MADTOM	I	I	C		3	6.0	2.61	10	0.01	1.6
47-009	MOUNTAIN MADTOM	I	R	C		3	6.0	2.61	8	0.01	1.3
74-005	Striped X White Bass				E	1	2.0	0.87	1800	1.22	900.0
77-004	SMALLMOUTH BASS	C	M	C	F	6	12.0	5.22	1400	0.95	116.6
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	1.74	40	0.03	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	1.74	100	0.07	25.0
80-007	SLENDERHEAD DARTER	I	R	S	D	1	2.0	0.87	10	0.01	5.0
80-011	LOGPERCH	I	M	S	D	3	6.0	2.61	160	0.11	26.6
80-015	GREENSIDE DARTER	I	M	S	D	3	6.0	2.61	50	0.03	8.3
80-016	BANDED DARTER	I	I	S	D	3	6.0	2.61	6	0.00	1.0
80-017	VARIEGATE DARTER	I	I	S	D	6	12.0	5.22	20	0.01	1.6
85-001	FRESHWATER DRUM		P	M		6	12.0	5.22	11500	7.79	958.3

No Species: 27 **Nat. Species:** 27 **Hybrids:** 1 **Total Counted:** 115 **Total Rel. Wt. :** 147678

IBI: 54.0 **MIwb:** 10.6

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM08 River: 11-001 Little Miami River RM: 17.70 Date: 09/20/2022

Time Fished: 1659 Distance: 0.500 Drainge (sq mi): 1190.0 Depth: 0

Location: canoe access dst. SR126 Lat: 39.20921 Long: -84.30232

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	1.35	7700	5.26	1925.0
20-003	GIZZARD SHAD	O		M		9	18.0	6.08	3800	2.60	211.1
40-004	SMALLMOUTH BUFFALO	I		M	C	10	20.0	6.76	41000	28.01	2050.0
40-006	RIVER CARPSUCKER	O		M	C	5	10.0	3.38	10200	6.97	1020.0
40-009	BLACK REDHORSE	I	I	S	R	2	4.0	1.35	1800	1.23	450.0
40-010	GOLDEN REDHORSE	I	M	S	R	10	20.0	6.76	10200	6.97	510.0
40-013	RIVER REDHORSE	I	I	S	R	2	4.0	1.35	12300	8.40	3075.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	6	12.0	4.05	2000	1.37	166.6
40-023	SMALLMOUTH REDHORSE	I	M	S	R	48	96.0	32.43	39200	26.78	408.3
43-020	EMERALD SHINER	I		M	N	11	22.0	7.43	40	0.03	1.8
43-031	STEELCOLOR SHINER	I	P	M	N	5	10.0	3.38	110	0.08	11.0
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.68	4	0.00	2.0
47-002	CHANNEL CATFISH			C	F	4	8.0	2.70	200	0.14	25.0
47-007	FLATHEAD CATFISH	P		C	F	2	4.0	1.35	1600	1.09	400.0
47-008	STONECAT MADTOM	I	I	C		4	8.0	2.70	70	0.05	8.7
47-009	MOUNTAIN MADTOM	I	R	C		2	4.0	1.35	24	0.02	6.0
77-004	SMALLMOUTH BASS	C	M	C	F	4	8.0	2.70	4040	2.76	505.0
77-011	LONGEAR SUNFISH	I	M	C	S	1	2.0	0.68	20	0.01	10.0
80-011	LOGPERCH	I	M	S	D	7	14.0	4.73	220	0.15	15.7
80-015	GREENSIDE DARTER	I	M	S	D	1	2.0	0.68	4	0.00	2.0
80-017	VARIEGATE DARTER	I	I	S	D	2	4.0	1.35	30	0.02	7.5
80-022	RAINBOW DARTER	I	M	S	D	2	4.0	1.35	4	0.00	1.0
85-001	FRESHWATER DRUM		P	M		8	16.0	5.41	11800	8.06	737.5

No Species: 23 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 148 **Total Rel. Wt. :** 146366

IBI: 50.0 **MIwb:** 9.9

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM09 River: 11-001 Little Miami River RM: 13.10 Date: 08/03/2022

Time Fished: 2979 Distance: 0.500 Drainge (sq mi): 1200.0 Depth: 0

Location: Wooster Pike- Milford Lat: 39.16896 Long: -84.29664

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.31	900	0.58	450.0
18-002	MOONEYE	I	R	M		1	2.0	0.31	300	0.19	150.0
20-003	GIZZARD SHAD	O		M		6	12.0	1.88	2500	1.62	208.3
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.31	7600	4.93	3800.0
40-004	SMALLMOUTH BUFFALO	I		M	C	13	26.0	4.06	43100	27.94	1657.6
40-006	RIVER CARPSUCKER	O		M	C	3	6.0	0.94	5400	3.50	900.0
40-008	SILVER REDHORSE	I	M	S	R	2	4.0	0.63	7700	4.99	1925.0
40-009	BLACK REDHORSE	I	I	S	R	1	2.0	0.31	1900	1.23	950.0
40-010	GOLDEN REDHORSE	I	M	S	R	7	14.0	2.19	6600	4.28	471.4
40-013	RIVER REDHORSE	I	I	S	R	1	2.0	0.31	5600	3.63	2800.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	11	22.0	3.44	4300	2.79	195.4
40-023	SMALLMOUTH REDHORSE	I	M	S	R	65	130.0	20.31	44200	28.66	340.0
43-009	GRAVEL CHUB	I	M	S	N	1	2.0	0.31	10	0.01	5.0
43-020	EMERALD SHINER	I		M	N	135	270.0	42.19	270	0.18	1.0
43-031	STEELCOLOR SHINER	I	P	M	N	5	10.0	1.56	60	0.04	6.0
43-032	SPOTFIN SHINER	I		M	N	7	14.0	2.19	60	0.04	4.2
43-034	SAND SHINER	I	M	M	N	1	2.0	0.31	4	0.00	2.0
43-035	MIMIC SHINER	I	I	M	N	4	8.0	1.25	20	0.01	2.5
43-044	CENTRAL STONEROLLER	H		N	N	2	4.0	0.63	20	0.01	5.0
47-002	CHANNEL CATFISH			C	F	9	18.0	2.81	13350	8.66	741.6
47-007	FLATHEAD CATFISH	P		C	F	2	4.0	0.63	10	0.01	2.5
47-008	STONECAT MADTOM	I	I	C		5	10.0	1.56	36	0.02	3.6
47-009	MOUNTAIN MADTOM	I	R	C		8	16.0	2.50	20	0.01	1.2
77-004	SMALLMOUTH BASS	C	M	C	F	5	10.0	1.56	3800	2.46	380.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	0.31	20	0.01	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.31	30	0.02	15.0
77-011	LONGEAR SUNFISH	I	M	C	S	6	12.0	1.88	260	0.17	21.6
80-007	SLENDERHEAD DARTER	I	R	S	D	1	2.0	0.31	10	0.01	5.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.31	20	0.01	10.0
80-015	GREENSIDE DARTER	I	M	S	D	1	2.0	0.31	10	0.01	5.0
80-016	BANDED DARTER	I	I	S	D	4	8.0	1.25	20	0.01	2.5
80-022	RAINBOW DARTER	I	M	S	D	2	4.0	0.63	10	0.01	2.5
85-001	FRESHWATER DRUM		P	M		6	12.0	1.88	4100	2.66	341.6
99-040	UNSPECIFIED SUCKER					1	2.0	0.31	2000	1.30	1000.0

No Species: 34 **Nat. Species:** 34 **Hybrids:** 0 **Total Counted:** 320 **Total Rel. Wt. :** 154240

IBI: 50.0 **MIwb:** 10.1

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM09 River: 11-001 Little Miami River RM: 13.10 Date: 09/22/2022

Time Fished: 2463 Distance: 0.500 Drainge (sq mi): 1200.0 Depth: 0

Location: Wooster Pike- Milford Lat: 39.16896 Long: -84.29664

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.50	1400	0.87	700.0
20-003	GIZZARD SHAD	O		M		11	22.0	5.45	5800	3.61	263.6
40-004	SMALLMOUTH BUFFALO	I		M	C	37	74.0	18.32	65300	40.68	882.4
40-006	RIVER CARPSUCKER	O		M	C	5	10.0	2.48	9000	5.61	900.0
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	1.49	3900	2.43	650.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	14	28.0	6.93	4600	2.87	164.2
40-023	SMALLMOUTH REDHORSE	I	M	S	R	34	68.0	16.83	29580	18.43	435.0
43-020	EMERALD SHINER	I		M	N	28	56.0	13.86	120	0.07	2.1
43-031	STEELCOLOR SHINER	I	P	M	N	1	2.0	0.50	8	0.00	4.0
43-041	BULLHEAD MINNOW	O		C	N	1	2.0	0.50	4	0.00	2.0
43-044	CENTRAL STONEROLLER	H		N	N	2	4.0	0.99	60	0.04	15.0
43-047	GRASS CARP			M	E	1	2.0	0.50	20000	12.46	10000.0
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.50	30	0.02	15.0
47-008	STONECAT MADTOM	I	I	C		6	12.0	2.97	66	0.04	5.5
47-009	MOUNTAIN MADTOM	I	R	C		9	18.0	4.46	14	0.01	0.7
77-004	SMALLMOUTH BASS	C	M	C	F	13	26.0	6.44	4000	2.49	153.8
77-005	SPOTTED BASS	C		C	F	1	2.0	0.50	20	0.01	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	3	6.0	1.49	20	0.01	3.3
80-007	SLENDERHEAD DARTER	I	R	S	D	3	6.0	1.49	10	0.01	1.6
80-011	LOGPERCH	I	M	S	D	8	16.0	3.96	220	0.14	13.7
80-015	GREENSIDE DARTER	I	M	S	D	5	10.0	2.48	70	0.04	7.0
80-016	BANDED DARTER	I	I	S	D	1	2.0	0.50	8	0.00	4.0
80-017	VARIEGATE DARTER	I	I	S	D	6	12.0	2.97	80	0.05	6.6
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.50	4	0.00	2.0
80-024	FANTAIL DARTER	I		C	D	1	2.0	0.50	4	0.00	2.0
85-001	FRESHWATER DRUM		P	M		6	12.0	2.97	16200	10.09	1350.0

No Species: 26 **Nat. Species:** 25 **Hybrids:** 0 **Total Counted:** 202 **Total Rel. Wt. :** 160518

IBI: 46.0 **MIwb:** 9.9

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM11 River: 11-001 Little Miami River RM: 10.90 Date: 08/03/2022

Time Fished: 2464 Distance: 0.500 Drainge (sq mi): 1710.0 Depth: 0

Location: intersection of Mt. Carmel and Round Bottom Rd. Lat: 39.14930 Long: -84.31542

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	1.18	1700	1.52	425.0
20-001	SKIPJACK HERRING	P		M		2	4.0	1.18	30	0.03	7.5
20-003	GIZZARD SHAD	O		M		11	22.0	6.51	3000	2.69	136.3
40-003	BLACK BUFFALO	I		M	C	5	10.0	2.96	28200	25.28	2820.0
40-004	SMALLMOUTH BUFFALO	I		M	C	7	14.0	4.14	15500	13.89	1107.1
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.59	1600	1.43	800.0
40-006	RIVER CARPSUCKER	O		M	C	4	8.0	2.37	6700	6.01	837.5
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	1.78	3000	2.69	500.0
40-013	RIVER REDHORSE	I	I	S	R	2	4.0	1.18	8000	7.17	2000.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	9	18.0	5.33	3800	3.41	211.1
40-023	SMALLMOUTH REDHORSE	I	M	S	R	38	76.0	22.49	29700	26.62	390.7
43-020	EMERALD SHINER	I		M	N	36	72.0	21.30	80	0.07	1.1
43-032	SPOTFIN SHINER	I		M	N	2	4.0	1.18	8	0.01	2.0
43-035	MIMIC SHINER	I	I	M	N	2	4.0	1.18	6	0.01	1.5
43-044	CENTRAL STONEROLLER	H		N	N	2	4.0	1.18	20	0.02	5.0
47-002	CHANNEL CATFISH			C	F	2	4.0	1.18	5100	4.57	1275.0
47-009	MOUNTAIN MADTOM	I	R	C		7	14.0	4.14	10	0.01	0.7
77-001	WHITE CRAPPIE	I		C	S	4	8.0	2.37	1400	1.25	175.0
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.59	700	0.63	350.0
77-004	SMALLMOUTH BASS	C	M	C	F	2	4.0	1.18	700	0.63	175.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.59	20	0.02	10.0
77-008	GREEN SUNFISH	I	T	C	S	4	8.0	2.37	60	0.05	7.5
77-009	BLUEGILL SUNFISH	I	P	C	S	7	14.0	4.14	240	0.22	17.1
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	2.0	0.59	10	0.01	5.0
77-011	LONGEAR SUNFISH	I	M	C	S	10	20.0	5.92	140	0.13	7.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.59	40	0.04	20.0
80-016	BANDED DARTER	I	I	S	D	2	4.0	1.18	6	0.01	1.5
85-001	FRESHWATER DRUM		P	M		1	2.0	0.59	1800	1.61	900.0

No Species: 28 **Nat. Species:** 28 **Hybrids:** 0 **Total Counted:** 169 **Total Rel. Wt. :** 111570

IBI: 48.0 **MIwb:** 10.0

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM11 River: 11-001 Little Miami River RM: 10.90 Date: 09/02/2022

Time Fished: 2683 Distance: 0.500 Drainge (sq mi): 1710.0 Depth: 0

Location: intersection of Mt. Carmel and Round Bottom Rd. Lat: 39.14930 Long: -84.31542

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.61	800	1.12	400.0
20-001	SKIPJACK HERRING	P		M		1	2.0	0.61	50	0.07	25.0
20-003	GIZZARD SHAD	O		M		9	18.0	5.52	2500	3.51	138.8
40-004	SMALLMOUTH BUFFALO	I		M	C	8	16.0	4.91	27400	38.47	1712.5
40-006	RIVER CARPSUCKER	O		M	C	1	2.0	0.61	2000	2.81	1000.0
40-010	GOLDEN REDHORSE	I	M	S	R	5	10.0	3.07	6000	8.42	600.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	11	22.0	6.75	4700	6.60	213.6
40-023	SMALLMOUTH REDHORSE	I	M	S	R	11	22.0	6.75	8000	11.23	363.6
43-009	GRAVEL CHUB	I	M	S	N	7	14.0	4.29	28	0.04	2.0
43-020	EMERALD SHINER	I		M	N	50	100.0	30.67	230	0.32	2.3
43-032	SPOTFIN SHINER	I		M	N	2	4.0	1.23	8	0.01	2.0
43-044	CENTRAL STONEROLLER	H		N	N	10	20.0	6.13	120	0.17	6.0
47-002	CHANNEL CATFISH			C	F	5	10.0	3.07	10000	14.04	1000.0
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.61	6000	8.42	3000.0
47-008	STONECAT MADTOM	I	I	C		2	4.0	1.23	20	0.03	5.0
47-009	MOUNTAIN MADTOM	I	R	C		19	38.0	11.66	30	0.04	0.7
74-005	Striped X White Bass				E	1	2.0	0.61	900	1.26	450.0
77-004	SMALLMOUTH BASS	C	M	C	F	2	4.0	1.23	300	0.42	75.0
77-005	SPOTTED BASS	C		C	F	2	4.0	1.23	200	0.28	50.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.61	30	0.04	15.0
80-011	LOGPERCH	I	M	S	D	2	4.0	1.23	80	0.11	20.0
80-014	JOHNNY DARTER	I		C	D	1	2.0	0.61	2	0.00	1.0
80-016	BANDED DARTER	I	I	S	D	7	14.0	4.29	20	0.03	1.4
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.61	4	0.01	2.0
80-024	FANTAIL DARTER	I		C	D	1	2.0	0.61	10	0.01	5.0
85-001	FRESHWATER DRUM		P	M		2	4.0	1.23	1800	2.53	450.0

No Species: 25 **Nat. Species:** 25 **Hybrids:** 1 **Total Counted:** 163 **Total Rel. Wt. :** 71232

IBI: 40.0 **MIwb:** 9.5

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM12 River: 11-001 Little Miami River RM: 8.10 Date: 08/03/2022

Time Fished: 2739 Distance: 0.500 Drainge (sq mi): 1710.0 Depth: 0

Location: Newtown Rd. Lat: 39.13730 Long: -84.35377

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		3	6.0	1.06	2400	3.09	400.0
20-001	SKIPJACK HERRING	P		M		3	6.0	1.06	120	0.15	20.0
20-003	GIZZARD SHAD	O		M		43	86.0	15.25	6980	8.99	81.1
40-003	BLACK BUFFALO	I		M	C	5	10.0	1.77	22500	28.96	2250.0
40-004	SMALLMOUTH BUFFALO	I		M	C	4	8.0	1.42	8500	10.94	1062.5
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.35	1700	2.19	850.0
40-008	SILVER REDHORSE	I	M	S	R	2	4.0	0.71	1200	1.54	300.0
40-010	GOLDEN REDHORSE	I	M	S	R	1	2.0	0.35	1300	1.67	650.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	11	22.0	3.90	5120	6.59	232.7
40-023	SMALLMOUTH REDHORSE	I	M	S	R	6	12.0	2.13	5500	7.08	458.3
43-001	COMMON CARP	O	T	M	G	1	2.0	0.35	6000	7.72	3000.0
43-009	GRAVEL CHUB	I	M	S	N	3	6.0	1.06	66	0.08	11.0
43-020	EMERALD SHINER	I		M	N	150	300.0	53.19	400	0.51	1.3
43-032	SPOTFIN SHINER	I		M	N	2	4.0	0.71	10	0.01	2.5
43-034	SAND SHINER	I	M	M	N	6	12.0	2.13	20	0.03	1.6
43-044	CENTRAL STONEROLLER	H		N	N	3	6.0	1.06	24	0.03	4.0
47-002	CHANNEL CATFISH			C	F	2	4.0	0.71	3200	4.12	800.0
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.35	4	0.01	2.0
47-008	STONECAT MADTOM	I	I	C		1	2.0	0.35	6	0.01	3.0
47-009	MOUNTAIN MADTOM	I	R	C		4	8.0	1.42	6	0.01	0.7
74-005	Striped X White Bass				E	2	4.0	0.71	7000	9.01	1750.0
77-004	SMALLMOUTH BASS	C	M	C	F	3	6.0	1.06	600	0.77	100.0
77-006	LARGEMOUTH BASS	C		C	F	5	10.0	1.77	100	0.13	10.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	0.35	50	0.06	25.0
77-009	BLUEGILL SUNFISH	I	P	C	S	4	8.0	1.42	200	0.26	25.0
77-011	LONGEAR SUNFISH	I	M	C	S	4	8.0	1.42	110	0.14	13.7
80-011	LOGPERCH	I	M	S	D	1	2.0	0.35	30	0.04	15.0
80-015	GREENSIDE DARTER	I	M	S	D	1	2.0	0.35	4	0.01	2.0
80-016	BANDED DARTER	I	I	S	D	1	2.0	0.35	4	0.01	2.0
80-017	VARIEGATE DARTER	I	I	S	D	1	2.0	0.35	6	0.01	3.0
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.35	4	0.01	2.0
85-001	FRESHWATER DRUM		P	M		6	12.0	2.13	4520	5.82	376.6

No Species: 31 **Nat. Species:** 30 **Hybrids:** 1 **Total Counted:** 282 **Total Rel. Wt. :** 77684

IBI: 46.0 **MIwb:** 9.3

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM12 River: 11-001 Little Miami River RM: 8.10 Date: 09/22/2022

Time Fished: 2491 Distance: 0.500 Drainge (sq mi): 1710.0 Depth: 0

Location: Newtown Rd. Lat: 39.13730 Long: -84.35377

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.54	1300	2.10	650.0
20-003	GIZZARD SHAD	O		M		9	18.0	4.86	2900	4.67	161.1
40-004	SMALLMOUTH BUFFALO	I		M	C	6	12.0	3.24	29400	47.39	2450.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	11	22.0	5.95	5340	8.61	242.7
40-023	SMALLMOUTH REDHORSE	I	M	S	R	12	24.0	6.49	8440	13.60	351.6
43-009	GRAVEL CHUB	I	M	S	N	9	18.0	4.86	60	0.10	3.3
43-020	EMERALD SHINER	I		M	N	57	114.0	30.81	160	0.26	1.4
43-035	MIMIC SHINER	I	I	M	N	2	4.0	1.08	2	0.00	0.5
43-063	CHANNEL SHINER	I	I	M	N	8	16.0	4.32	40	0.06	2.5
47-002	CHANNEL CATFISH			C	F	4	8.0	2.16	9800	15.80	1225.0
47-008	STONECAT MADTOM	I	I	C		1	2.0	0.54	6	0.01	3.0
47-009	MOUNTAIN MADTOM	I	R	C		5	10.0	2.70	10	0.02	1.0
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.54	10	0.02	5.0
77-005	SPOTTED BASS	C		C	F	6	12.0	3.24	40	0.06	3.3
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.54	50	0.08	25.0
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	1.62	100	0.16	16.6
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.54	20	0.03	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	18	36.0	9.73	140	0.23	3.8
80-011	LOGPERCH	I	M	S	D	4	8.0	2.16	70	0.11	8.7
80-016	BANDED DARTER	I	I	S	D	13	26.0	7.03	20	0.03	0.7
80-017	VARIEGATE DARTER	I	I	S	D	2	4.0	1.08	10	0.02	2.5
80-022	RAINBOW DARTER	I	M	S	D	8	16.0	4.32	20	0.03	1.2
85-001	FRESHWATER DRUM		P	M		3	6.0	1.62	4100	6.61	683.3

No Species: 23 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 185 **Total Rel. Wt. :** 62038

IBI: 42.0 **MIwb:** 9.2

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM13 River: 11-001 Little Miami River RM: 6.83 Date: 08/03/2022

Time Fished: 2683 Distance: 0.500 Drainge (sq mi): 1720.0 Depth: 0

Location: RR Trestle-Mariemont Lat: 39.14088 Long: -84.36737

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		6	12.0	3.33	5000	5.02	416.6
20-003	GIZZARD SHAD	O		M		25	50.0	13.89	5970	6.00	119.4
40-003	BLACK BUFFALO	I		M	C	3	6.0	1.67	15200	15.27	2533.3
40-004	SMALLMOUTH BUFFALO	I		M	C	5	10.0	2.78	12700	12.76	1270.0
40-005	QUILLBACK CARPSUCKER	O		M	C	3	6.0	1.67	6000	6.03	1000.0
40-006	RIVER CARPSUCKER	O		M	C	4	8.0	2.22	6400	6.43	800.0
40-008	SILVER REDHORSE	I	M	S	R	1	2.0	0.56	2800	2.81	1400.0
40-009	BLACK REDHORSE	I	I	S	R	1	2.0	0.56	10	0.01	5.0
40-010	GOLDEN REDHORSE	I	M	S	R	2	4.0	1.11	1800	1.81	450.0
40-013	RIVER REDHORSE	I	I	S	R	3	6.0	1.67	12800	12.86	2133.3
40-015	NORTHERN HOG SUCKER	I	M	S	R	4	8.0	2.22	1800	1.81	225.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	13	26.0	7.22	11400	11.45	438.4
43-020	EMERALD SHINER	I		M	N	50	100.0	27.78	170	0.17	1.7
43-032	SPOTFIN SHINER	I		M	N	2	4.0	1.11	20	0.02	5.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.56	2	0.00	1.0
43-063	CHANNEL SHINER	I	I	M	N	2	4.0	1.11	6	0.01	1.5
47-002	CHANNEL CATFISH			C	F	9	18.0	5.00	13300	13.36	738.8
47-009	MOUNTAIN MADTOM	I	R	C		2	4.0	1.11	2	0.00	0.5
77-003	ROCK BASS	C		C	S	1	2.0	0.56	30	0.03	15.0
77-004	SMALLMOUTH BASS	C	M	C	F	3	6.0	1.67	20	0.02	3.3
77-005	SPOTTED BASS	C		C	F	4	8.0	2.22	706	0.71	88.2
77-006	LARGEMOUTH BASS	C		C	F	6	12.0	3.33	120	0.12	10.0
77-008	GREEN SUNFISH	I	T	C	S	2	4.0	1.11	80	0.08	20.0
77-009	BLUEGILL SUNFISH	I	P	C	S	4	8.0	2.22	60	0.06	7.5
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	1.11	20	0.02	5.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.56	10	0.01	5.0
80-017	VARIEGATE DARTER	I	I	S	D	1	2.0	0.56	6	0.01	3.0
85-001	FRESHWATER DRUM		P	M		20	40.0	11.11	3120	3.13	78.0

No Species: 28 **Nat. Species:** 28 **Hybrids:** 0 **Total Counted:** 180 **Total Rel. Wt. :** 99552

IBI: 48.0 **MIwb:** 10.3

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM13 River: 11-001 Little Miami River RM: 6.83 Date: 09/22/2022

Time Fished: 2065 Distance: 0.500 Drainge (sq mi): 1720.0 Depth: 0

Location: RR Trestle-Mariemont Lat: 39.14088 Long: -84.36737

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		4	8.0	3.70	3400	2.33	425.0
20-003	GIZZARD SHAD	O		M		5	10.0	4.63	1650	1.13	165.0
40-003	BLACK BUFFALO	I		M	C	2	4.0	1.85	20200	13.87	5050.0
40-004	SMALLMOUTH BUFFALO	I		M	C	22	44.0	20.37	82800	56.86	1881.8
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.93	1800	1.24	900.0
40-006	RIVER CARPSUCKER	O		M	C	1	2.0	0.93	1700	1.17	850.0
40-008	SILVER REDHORSE	I	M	S	R	1	2.0	0.93	1000	0.69	500.0
40-010	GOLDEN REDHORSE	I	M	S	R	1	2.0	0.93	1700	1.17	850.0
40-013	RIVER REDHORSE	I	I	S	R	3	6.0	2.78	17900	12.29	2983.3
40-015	NORTHERN HOG SUCKER	I	M	S	R	2	4.0	1.85	1400	0.96	350.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	3	6.0	2.78	3400	2.33	566.6
43-020	EMERALD SHINER	I		M	N	13	26.0	12.04	60	0.04	2.3
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.93	4	0.00	2.0
43-063	CHANNEL SHINER	I	I	M	N	11	22.0	10.19	60	0.04	2.7
47-002	CHANNEL CATFISH			C	F	1	2.0	0.93	2600	1.79	1300.0
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.93	3400	2.33	1700.0
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.93	10	0.01	5.0
77-005	SPOTTED BASS	C		C	F	16	32.0	14.81	590	0.41	18.4
77-011	LONGEAR SUNFISH	I	M	C	S	8	16.0	7.41	160	0.11	10.0
80-011	LOGPERCH	I	M	S	D	5	10.0	4.63	60	0.04	6.0
80-015	GREENSIDE DARTER	I	M	S	D	1	2.0	0.93	16	0.01	8.0
80-016	BANDED DARTER	I	I	S	D	1	2.0	0.93	2	0.00	1.0
80-017	VARIEGATE DARTER	I	I	S	D	1	2.0	0.93	8	0.01	4.0
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.93	2	0.00	1.0
85-001	FRESHWATER DRUM		P	M		2	4.0	1.85	1700	1.17	425.0

No Species: 25 **Nat. Species:** 25 **Hybrids:** 0 **Total Counted:** 108 **Total Rel. Wt. :** 145622

IBI: 44.0 **MIwb:** 9.4

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM15 River: 11-001 Little Miami River RM: 4.10 Date: 08/03/2022

Time Fished: 2731 Distance: 0.500 Drainge (sq mi): 1730.0 Depth: 0

Location: Ust. Duck Creek Lat: 39.11782 Long: -84.39946

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		2	4.0	0.67	1400	0.88	350.0
18-002	MOONEYE	I	R	M		2	4.0	0.67	400	0.25	100.0
20-001	SKIPJACK HERRING	P		M		1	2.0	0.34	20	0.01	10.0
20-003	GIZZARD SHAD	O		M		41	82.0	13.80	7240	4.56	88.2
40-003	BLACK BUFFALO	I		M	C	8	16.0	2.69	46400	29.23	2900.0
40-004	SMALLMOUTH BUFFALO	I		M	C	10	20.0	3.37	24100	15.18	1205.0
40-006	RIVER CARPSUCKER	O		M	C	7	14.0	2.36	11600	7.31	828.5
40-010	GOLDEN REDHORSE	I	M	S	R	2	4.0	0.67	1016	0.64	254.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	8	16.0	2.69	5130	3.23	320.6
40-023	SMALLMOUTH REDHORSE	I	M	S	R	10	20.0	3.37	10600	6.68	530.0
43-001	COMMON CARP	O	T	M	G	6	12.0	2.02	21400	13.48	1783.3
43-009	GRAVEL CHUB	I	M	S	N	10	20.0	3.37	124	0.08	6.2
43-015	SUCKERMOUTH MINNOW	I		S	N	4	8.0	1.35	30	0.02	3.7
43-020	EMERALD SHINER	I		M	N	90	180.0	30.30	180	0.11	1.0
43-031	STEELCOLOR SHINER	I	P	M	N	2	4.0	0.67	12	0.01	3.0
43-032	SPOTFIN SHINER	I		M	N	4	8.0	1.35	20	0.01	2.5
43-034	SAND SHINER	I	M	M	N	13	26.0	4.38	60	0.04	2.3
43-035	MIMIC SHINER	I	I	M	N	10	20.0	3.37	40	0.03	2.0
43-044	CENTRAL STONEROLLER	H		N	N	6	12.0	2.02	38	0.02	3.1
43-063	CHANNEL SHINER	I	I	M	N	7	14.0	2.36	34	0.02	2.4
47-002	CHANNEL CATFISH			C	F	21	42.0	7.07	19574	12.33	466.0
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.34	400	0.25	200.0
74-005	Striped X White Bass				E	10	20.0	3.37	6700	4.22	335.0
77-004	SMALLMOUTH BASS	C	M	C	F	1	2.0	0.34	200	0.13	100.0
77-005	SPOTTED BASS	C		C	F	2	4.0	0.67	202	0.13	50.5
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.34	20	0.01	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	0.67	180	0.11	45.0
77-011	LONGEAR SUNFISH	I	M	C	S	3	6.0	1.01	40	0.03	6.6
80-017	VARIEGATE DARTER	I	I	S	D	6	12.0	2.02	20	0.01	1.6
85-001	FRESHWATER DRUM		P	M		7	14.0	2.36	1570	0.99	112.1

No Species: 29 **Nat. Species:** 28 **Hybrids:** 1 **Total Counted:** 297 **Total Rel. Wt. :** 158750

IBI: 42.0 **MIwb:** 10.2

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM15 River: 11-001 Little Miami River RM: 4.10 Date: 09/21/2022

Time Fished: 2409 Distance: 0.500 Drainge (sq mi): 1730.0 Depth: 0

Location: Ust. Duck Creek Lat: 39.11782 Long: -84.39946

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.58	7000	4.65	3500.0
20-003	GIZZARD SHAD	O		M		11	22.0	6.36	3400	2.26	154.5
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.58	6800	4.52	3400.0
40-004	SMALLMOUTH BUFFALO	I		M	C	24	48.0	13.87	66600	44.27	1387.5
40-005	QUILLBACK CARPSUCKER	O		M	C	3	6.0	1.73	5200	3.46	866.6
40-006	RIVER CARPSUCKER	O		M	C	5	10.0	2.89	9000	5.98	900.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	15	30.0	8.67	8450	5.62	281.6
40-023	SMALLMOUTH REDHORSE	I	M	S	R	7	14.0	4.05	5900	3.92	421.4
43-001	COMMON CARP	O	T	M	G	1	2.0	0.58	12800	8.51	6400.0
43-009	GRAVEL CHUB	I	M	S	N	14	28.0	8.09	100	0.07	3.5
43-020	EMERALD SHINER	I		M	N	20	40.0	11.56	80	0.05	2.0
43-031	STEELCOLOR SHINER	I	P	M	N	4	8.0	2.31	50	0.03	6.2
43-044	CENTRAL STONEROLLER	H		N	N	17	34.0	9.83	300	0.20	8.8
47-002	CHANNEL CATFISH			C	F	13	26.0	7.51	11106	7.38	427.1
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.58	1000	0.66	500.0
77-004	SMALLMOUTH BASS	C	M	C	F	2	4.0	1.16	400	0.27	100.0
77-005	SPOTTED BASS	C		C	F	11	22.0	6.36	2560	1.70	116.3
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.58	50	0.03	25.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.58	20	0.01	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	6	12.0	3.47	110	0.07	9.1
80-007	SLENDERHEAD DARTER	I	R	S	D	1	2.0	0.58	4	0.00	2.0
80-017	VARIEGATE DARTER	I	I	S	D	1	2.0	0.58	6	0.00	3.0
80-022	RAINBOW DARTER	I	M	S	D	5	10.0	2.89	10	0.01	1.0
80-026	SAUGER X WALLEYE	P			E	1	2.0	0.58	3000	1.99	1500.0
85-001	FRESHWATER DRUM		P	M		7	14.0	4.05	6500	4.32	464.2

No Species: 24 **Nat. Species:** 23 **Hybrids:** 1 **Total Counted:** 173 **Total Rel. Wt. :** 150446

IBI: 46.0 **MIwb:** 10.1

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM16A River: 11-001 Little Miami River RM: 3.70 Date: 08/04/2022

Time Fished: 2619 Distance: 0.500 Drainge (sq mi): 1740.0 Depth: 0

Location: Dst. Duck Creek Lat: 39.11173 Long: -84.40057

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
18-002	MOONEYE	I	R	M		3	6.0	1.60	80	0.09	13.3
20-001	SKIPJACK HERRING	P		M		2	4.0	1.07	20	0.02	5.0
20-003	GIZZARD SHAD	O		M		30	60.0	16.04	4360	5.07	72.6
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.53	6400	7.45	3200.0
40-004	SMALLMOUTH BUFFALO	I		M	C	8	16.0	4.28	14700	17.11	918.7
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.53	500	0.58	250.0
40-006	RIVER CARPSUCKER	O		M	C	7	14.0	3.74	12200	14.20	871.4
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	1.60	30	0.03	5.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	2	4.0	1.07	1800	2.09	450.0
43-001	COMMON CARP	O	T	M	G	19	38.0	10.16	23200	27.00	610.5
43-006	SILVER CHUB	I		M	N	2	4.0	1.07	30	0.03	7.5
43-020	EMERALD SHINER	I		M	N	63	126.0	33.69	120	0.14	0.9
43-032	SPOTFIN SHINER	I		M	N	2	4.0	1.07	10	0.01	2.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.53	6	0.01	3.0
43-063	CHANNEL SHINER	I	I	M	N	1	2.0	0.53	4	0.00	2.0
47-002	CHANNEL CATFISH			C	F	13	26.0	6.95	19800	23.04	761.5
74-005	Striped X White Bass				E	1	2.0	0.53	400	0.47	200.0
77-005	SPOTTED BASS	C		C	F	3	6.0	1.60	304	0.35	50.6
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.53	20	0.02	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	1.07	40	0.05	10.0
80-011	LOGPERCH	I	M	S	D	1	2.0	0.53	16	0.02	8.0
85-001	FRESHWATER DRUM		P	M		21	42.0	11.23	1880	2.19	44.7

No Species: 21 **Nat. Species:** 20 **Hybrids:** 1 **Total Counted:** 187 **Total Rel. Wt. :** 85920

IBI: 32.0 **MIwb:** 8.6

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM16A River: 11-001 Little Miami River RM: 3.70 Date: 09/21/2022

Time Fished: 2166 Distance: 0.500 Drainge (sq mi): 1740.0 Depth: 0

Location: Dst. Duck Creek Lat: 39.11173 Long: -84.40057

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		10	20.0	8.55	17500	10.33	875.0
20-003	GIZZARD SHAD	O		M		14	28.0	11.97	3300	1.95	117.8
40-004	SMALLMOUTH BUFFALO	I		M	C	20	40.0	17.09	65900	38.90	1647.5
40-005	QUILLBACK CARPSUCKER	O		M	C	2	4.0	1.71	1000	0.59	250.0
40-006	RIVER CARPSUCKER	O		M	C	12	24.0	10.26	20600	12.16	858.3
40-008	SILVER REDHORSE	I	M	S	R	1	2.0	0.85	1500	0.89	750.0
43-001	COMMON CARP	O	T	M	G	15	30.0	12.82	25600	15.11	853.3
43-020	EMERALD SHINER	I		M	N	5	10.0	4.27	20	0.01	2.0
43-063	CHANNEL SHINER	I	I	M	N	23	46.0	19.66	29300	17.30	636.9
47-007	FLATHEAD CATFISH	P		C	F	3	6.0	2.56	904	0.53	150.6
77-005	SPOTTED BASS	C		C	F	6	12.0	5.13	760	0.45	63.3
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.85	800	0.47	400.0
77-011	LONGEAR SUNFISH	I	M	C	S	1	2.0	0.85	6	0.00	3.0
80-001	SAUGER	P		S	F	1	2.0	0.85	400	0.24	200.0
85-001	FRESHWATER DRUM		P	M		3	6.0	2.56	1800	1.06	300.0

No Species: 15 **Nat. Species:** 14 **Hybrids:** 0 **Total Counted:** 117 **Total Rel. Wt. :** 169390

IBI: 28.0 **MIwb:** 9.1

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM16 River: 11-001 Little Miami River RM: 3.50 Date: 08/04/2022

Time Fished: 2561 Distance: 0.500 Drainge (sq mi): 1750.0 Depth: 0

Location: dst. Beechmont Ave. Lat: 39.10781 Long: -84.40455

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		6	12.0	3.28	10400	9.67	866.6
18-002	MOONEYE	I	R	M		6	12.0	3.28	1100	1.02	91.6
20-001	SKIPJACK HERRING	P		M		5	10.0	2.73	170	0.16	17.0
20-003	GIZZARD SHAD	O		M		20	40.0	10.93	2450	2.28	61.2
40-003	BLACK BUFFALO	I		M	C	2	4.0	1.09	9200	8.56	2300.0
40-004	SMALLMOUTH BUFFALO	I		M	C	2	4.0	1.09	3300	3.07	825.0
40-005	QUILLBACK CARPSUCKER	O		M	C	2	4.0	1.09	3100	2.88	775.0
40-006	RIVER CARPSUCKER	O		M	C	5	10.0	2.73	7200	6.70	720.0
40-010	GOLDEN REDHORSE	I	M	S	R	3	6.0	1.64	3300	3.07	550.0
40-013	RIVER REDHORSE	I	I	S	R	2	4.0	1.09	9500	8.84	2375.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	23	46.0	12.57	24300	22.60	528.2
43-001	COMMON CARP	O	T	M	G	1	2.0	0.55	5000	4.65	2500.0
43-020	EMERALD SHINER	I		M	N	72	144.0	39.34	120	0.11	0.8
43-035	MIMIC SHINER	I	I	M	N	6	12.0	3.28	20	0.02	1.6
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.55	4	0.00	2.0
47-002	CHANNEL CATFISH			C	F	3	6.0	1.64	3902	3.63	650.3
74-005	Striped X White Bass				E	9	18.0	4.92	22490	20.92	1249.4
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.55	10	0.01	5.0
80-015	GREENSIDE DARTER	I	M	S	D	1	2.0	0.55	6	0.01	3.0
85-001	FRESHWATER DRUM		P	M		13	26.0	7.10	1950	1.81	75.0

No Species: 19 **Nat. Species:** 18 **Hybrids:** 1 **Total Counted:** 183 **Total Rel. Wt. :** 107522

IBI: 40.0 **MIwb:** 9.1

05/21/2023

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM16 River: 11-001 Little Miami River RM: 3.50 Date: 09/21/2022

Time Fished: 2976 Distance: 0.500 Drainge (sq mi): 1750.0 Depth: 0

Location: dst. Beechmont Ave. Lat: 39.10781 Long: -84.40455

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		3	6.0	1.80	3000	2.08	500.0
20-003	GIZZARD SHAD	O		M		26	52.0	15.57	3200	2.22	61.5
40-003	BLACK BUFFALO	I		M	C	2	4.0	1.20	17000	11.78	4250.0
40-004	SMALLMOUTH BUFFALO	I		M	C	12	24.0	7.19	52500	36.37	2187.5
40-005	QUILLBACK CARPSUCKER	O		M	C	1	2.0	0.60	2000	1.39	1000.0
40-006	RIVER CARPSUCKER	O		M	C	2	4.0	1.20	2600	1.80	650.0
40-010	GOLDEN REDHORSE	I	M	S	R	1	2.0	0.60	1000	0.69	500.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	14	28.0	8.38	14000	9.70	500.0
43-001	COMMON CARP	O	T	M	G	1	2.0	0.60	1900	1.32	950.0
43-009	GRAVEL CHUB	I	M	S	N	7	14.0	4.19	20	0.01	1.4
43-020	EMERALD SHINER	I		M	N	39	78.0	23.35	130	0.09	1.6
43-063	CHANNEL SHINER	I	I	M	N	11	22.0	6.59	40	0.03	1.8
47-002	CHANNEL CATFISH			C	F	13	26.0	7.78	22810	15.80	877.3
47-007	FLATHEAD CATFISH	P		C	F	1	2.0	0.60	20	0.01	10.0
47-008	STONECAT MADTOM	I	I	C		1	2.0	0.60	20	0.01	10.0
74-005	Striped X White Bass				E	6	12.0	3.59	19600	13.58	1633.3
77-005	SPOTTED BASS	C		C	F	6	12.0	3.59	70	0.05	5.8
77-011	LONGEAR SUNFISH	I	M	C	S	2	4.0	1.20	20	0.01	5.0
80-011	LOGPERCH	I	M	S	D	10	20.0	5.99	180	0.12	9.0
80-015	GREENSIDE DARTER	I	M	S	D	2	4.0	1.20	10	0.01	2.5
80-016	BANDED DARTER	I	I	S	D	2	4.0	1.20	6	0.00	1.5
80-017	VARIEGATE DARTER	I	I	S	D	1	2.0	0.60	10	0.01	5.0
80-022	RAINBOW DARTER	I	M	S	D	1	2.0	0.60	4	0.00	2.0
80-024	FANTAIL DARTER	I		C	D	1	2.0	0.60	4	0.00	2.0
80-026	SAUGER X WALLEYE	P			E	1	2.0	0.60	3000	2.08	1500.0
85-001	FRESHWATER DRUM		P	M		1	2.0	0.60	1200	0.83	600.0

No Species: 24 **Nat. Species:** 23 **Hybrids:** 2 **Total Counted:** 167 **Total Rel. Wt. :** 144344

IBI: 42.0 **MIwb:** 9.3

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM17 River: 11-001 Little Miami River RM: 1.60 Date: 08/04/2022

Time Fished: 2410 Distance: 0.500 Drainge (sq mi): 1760.0 Depth: 0

Location: dst. US-52 Lat: 39.08358 Long: -84.42356

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
10-004	LONGNOSE GAR	P		M		1	2.0	0.97	900	1.75	450.0
20-001	SKIPJACK HERRING	P		M		4	8.0	3.88	180	0.35	22.5
20-003	GIZZARD SHAD	O		M		10	20.0	9.71	1400	2.73	70.0
40-003	BLACK BUFFALO	I		M	C	1	2.0	0.97	5400	10.53	2700.0
40-004	SMALLMOUTH BUFFALO	I		M	C	5	10.0	4.85	12400	24.18	1240.0
40-006	RIVER CARPSUCKER	O		M	C	1	2.0	0.97	1500	2.92	750.0
40-010	GOLDEN REDHORSE	I	M	S	R	1	2.0	0.97	900	1.75	450.0
40-023	SMALLMOUTH REDHORSE	I	M	S	R	2	4.0	1.94	2500	4.87	625.0
43-001	COMMON CARP	O	T	M	G	1	2.0	0.97	4300	8.38	2150.0
43-020	EMERALD SHINER	I		M	N	64	128.0	62.14	160	0.31	1.2
43-032	SPOTFIN SHINER	I		M	N	2	4.0	1.94	8	0.02	2.0
43-047	GRASS CARP			M	E	1	2.0	0.97	17400	33.93	8700.0
43-063	CHANNEL SHINER	I	I	M	N	1	2.0	0.97	4	0.01	2.0
47-002	CHANNEL CATFISH			C	F	2	4.0	1.94	3200	6.24	800.0
74-005	Striped X White Bass				E	1	2.0	0.97	500	0.97	250.0
77-005	SPOTTED BASS	C		C	F	2	4.0	1.94	210	0.41	52.5
77-006	LARGEMOUTH BASS	C		C	F	2	4.0	1.94	20	0.04	5.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.97	4	0.01	2.0
80-001	SAUGER	P		S	F	1	2.0	0.97	300	0.58	150.0

No Species: 18 **Nat. Species:** 16 **Hybrids:** 1 **Total Counted:** 103 **Total Rel. Wt. :** 51286

IBI: 36.0 **MIwb:** 7.8

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM95 River: 11-002 Clough Creek RM: 3.20 Date: 07/21/2022

Time Fished: 1802 Distance: 0.150 Drainge (sq mi): 1.9 Depth: 0

Location: adj. Clough PIke Lat: 39.09324 Long: -84.36315

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	2	4.0	0.57	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	148	296.0	42.05	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	109	218.0	30.97	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	89	178.0	25.28	0	0.00	0.0
80-023	ORANGETHROAT DARTER	I		S	D	4	8.0	1.14	0	0.00	0.0

No Species: 5 **Nat. Species:** 5 **Hybrids:** 0 **Total Counted:** 352 **Total Rel. Wt. :** 0

IBI: 30.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM98 River: 11-002 Clough Creek RM: 0.60 Date: 07/21/2022

Time Fished: 1576 Distance: 0.150 Drainge (sq mi): 7.8 Depth: 0

Location: Beechmont Ave. and Elstun Rd. Lat: 39.10620 Long: -84.39419

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	6	12.0	1.29	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	171	342.0	36.70	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	21	42.0	4.51	0	0.00	0.0
43-039	SILVERJAW MINNOW	I		M	N	15	30.0	3.22	0	0.00	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	23	46.0	4.94	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	181	362.0	38.84	0	0.00	0.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.21	0	0.00	0.0
80-022	RAINBOW DARTER	I	M	S	D	19	38.0	4.08	0	0.00	0.0
80-023	ORANGETHROAT DARTER	I		S	D	1	2.0	0.21	0	0.00	0.0
80-024	FANTAIL DARTER	I		C	D	28	56.0	6.01	0	0.00	0.0

No Species: 10 **Nat. Species:** 10 **Hybrids:** 0 **Total Counted:** 466 **Total Rel. Wt. :** 0

IBI: 38.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM71 River: 11-004 Duck Creek RM: 6.10 Date: 07/14/2022

Time Fished: 458 Distance: 0.150 Drainge (sq mi): 2.2 Depth: 0

Location: Norwood/Harris Ave. Lat: 39.16073 Long: -84.43835

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-999	NO FISH					0	0.0	***.**	0	0.00	*****.*

No Species: 0 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM72 River: 11-004 Duck Creek RM: 5.14 Date: 07/13/2022

Time Fished: 795 Distance: 0.150 Drainge (sq mi): 5.0 Depth: 0

Location: Duck Creek Rd. Lat: 39.16525 Long: -84.41881

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	3	6.0	4.17	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	2	4.0	2.78	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	67	134.0	93.06	0	0.00	0.0

No Species: 3 **Nat. Species:** 3 **Hybrids:** 0 **Total Counted:** 72 **Total Rel. Wt. :** 0

IBI: 24.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM73 River: 11-004 Duck Creek RM: 4.58 Date: 07/22/2022

Time Fished: 481 Distance: 0.150 Drainge (sq mi): 5.8 Depth: 0

Location: adj. Steel Place Lat: 39.15963 Long: -84.41639

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	100.00	0	0.00	0.0

No Species: 1 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 3 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM74 River: 11-004 Duck Creek RM: 3.90 Date: 07/21/2022

Time Fished: 2320 Distance: 0.150 Drainge (sq mi): 9.5 Depth: 0

Location: dst. East Fork Duck Creek Lat: 39.15838 Long: -84.40724

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	4	8.0	0.79	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	56	112.0	11.00	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	125	250.0	24.56	0	0.00	0.0
43-039	SILVERJAW MINNOW	I		M	N	41	82.0	8.06	0	0.00	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	15	30.0	2.95	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	33	66.0	6.48	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	232	464.0	45.58	0	0.00	0.0
77-009	BLUEGILL SUNFISH	I	P	C	S	3	6.0	0.59	0	0.00	0.0

No Species: 8 **Nat. Species:** 8 **Hybrids:** 0 **Total Counted:** 509 **Total Rel. Wt. :** 0

IBI: 28.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM75 River: 11-004 Duck Creek RM: 3.40 Date: 07/13/2022

Time Fished: 417 Distance: 0.150 Drainge (sq mi): 11.5 Depth: 0

Location: ust. Erie Ave. Lat: 39.14867 Long: -84.40693

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	4	8.0	100.00	0	0.00	0.0

No Species: 1 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 4 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM76 River: 11-004 Duck Creek RM: 2.80 Date: 07/13/2022

Time Fished: 1213 Distance: 0.150 Drainge (sq mi): 11.7 Depth: 0

Location: dst. Erie Ave. Lat: 39.14484 Long: -84.40615

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.65	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	16	32.0	10.32	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	11	22.0	7.10	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	4	8.0	2.58	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	123	246.0	79.35	0	0.00	0.0

No Species: 5 **Nat. Species:** 5 **Hybrids:** 0 **Total Counted:** 155 **Total Rel. Wt. :** 0

IBI: 24.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute Fish Species List

Site ID: LM77 River: 11-004 Duck Creek RM: 2.00 Date: 07/22/2022

Time Fished: 1313 Distance: 0.150 Drainge (sq mi): 14.3 Depth: 0

Location: at Wooster Ave. and Power St. Lat: 39.13261 Long: -84.40476

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.49	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	40	80.0	19.70	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	31	62.0	15.27	0	0.00	0.0
43-032	SPOTFIN SHINER	I		M	N	2	4.0	0.99	0	0.00	0.0
43-034	SAND SHINER	I	M	M	N	3	6.0	1.48	0	0.00	0.0
43-039	SILVERJAW MINNOW	I		M	N	5	10.0	2.46	0	0.00	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	23	46.0	11.33	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	41	82.0	20.20	0	0.00	0.0
47-004	YELLOW BULLHEAD	I	T	C		12	24.0	5.91	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	20	40.0	9.85	0	0.00	0.0
77-011	LONGEAR SUNFISH	I	M	C	S	20	40.0	9.85	0	0.00	0.0
80-022	RAINBOW DARTER	I	M	S	D	3	6.0	1.48	0	0.00	0.0
80-023	ORANGETHROAT DARTER	I		S	D	1	2.0	0.49	0	0.00	0.0
80-024	FANTAIL DARTER	I		C	D	1	2.0	0.49	0	0.00	0.0

No Species: 14 **Nat. Species:** 14 **Hybrids:** 0 **Total Counted:** 203 **Total Rel. Wt. :** 0

IBI: 36.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM79 River: 11-004 Duck Creek RM: 0.50 Date: 07/22/2022

Time Fished: 1253 Distance: 0.150 Drainge (sq mi): 14.6 Depth: 0

Location: ust. Wooster Pike Lat: 39.12245 Long: -84.41169

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-032	SPOTFIN SHINER	I		M	N	4	8.0	8.89	0	0.00	0.0
47-004	YELLOW BULLHEAD	I	T	C		15	30.0	33.33	0	0.00	0.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	2.22	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	16	32.0	35.56	0	0.00	0.0
77-009	BLUEGILL SUNFISH	I	P	C	S	4	8.0	8.89	0	0.00	0.0
77-011	LONGEAR SUNFISH	I	M	C	S	5	10.0	11.11	0	0.00	0.0

No Species: 6 **Nat. Species:** 6 **Hybrids:** 0 **Total Counted:** 45 **Total Rel. Wt. :** 0

IBI: 26.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM50 River: 11-007 Sycamore Creek RM: 1.10 Date: 09/09/2022

Time Fished: 2158 Distance: 0.150 Drainge (sq mi): 12.5 Depth: 0

Location: Loveland Rd. Lat: 39.21719 Long: -84.33174

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	13	26.0	2.19	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	42	84.0	7.08	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	107	214.0	18.04	0	0.00	0.0
43-039	SILVERJAW MINNOW	I		M	N	14	28.0	2.36	0	0.00	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	198	396.0	33.39	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	194	388.0	32.72	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	17	34.0	2.87	0	0.00	0.0
77-009	BLUEGILL SUNFISH	I	P	C	S	3	6.0	0.51	0	0.00	0.0
80-024	FANTAIL DARTER	I		C	D	5	10.0	0.84	0	0.00	0.0

No Species: 9 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 593 **Total Rel. Wt. :** 0

IBI: 24.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM51 River: 11-007 Sycamore Creek RM: 0.50 Date: 08/11/2022

Time Fished: 1382 Distance: 0.200 Drainge (sq mi): 22.8 Depth: 0

Location: ust. Sycamore Creek WWTP Lat: 39.22390 Long: -84.32472

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-008	SILVER REDHORSE	I	M	S	R	1	1.5	0.27	2025	18.91	1350.0
40-009	BLACK REDHORSE	I	I	S	R	1	1.5	0.27	225	2.10	150.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	2	3.0	0.55	1050	9.80	350.0
40-016	WHITE SUCKER	O	T	S	W	4	6.0	1.10	2850	26.61	475.0
43-020	EMERALD SHINER	I		M	N	220	330.0	60.27	330	3.08	1.0
43-021	SILVER SHINER	I	I	S	N	2	3.0	0.55	4	0.04	1.5
43-025	STRIPED SHINER	I		S	N	7	10.5	1.92	97	0.91	9.2
43-032	SPOTFIN SHINER	I		M	N	3	4.5	0.82	7	0.07	1.6
43-034	SAND SHINER	I	M	M	N	2	3.0	0.55	4	0.04	1.5
43-035	MIMIC SHINER	I	I	M	N	13	19.5	3.56	37	0.35	1.9
43-043	BLUNTNOSE MINNOW	O	T	C	N	18	27.0	4.93	45	0.42	1.6
43-044	CENTRAL STONEROLLER	H		N	N	1	1.5	0.27	3	0.03	2.0
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.27	7	0.07	5.0
77-004	SMALLMOUTH BASS	C	M	C	F	8	12.0	2.19	1695	15.83	141.2
77-006	LARGEMOUTH BASS	C		C	F	5	7.5	1.37	60	0.56	8.0
77-007	WARMOUTH SUNFISH	C		C	S	1	1.5	0.27	45	0.42	30.0
77-008	GREEN SUNFISH	I	T	C	S	14	21.0	3.84	465	4.34	22.1
77-009	BLUEGILL SUNFISH	I	P	C	S	15	22.5	4.11	390	3.64	17.3
77-011	LONGEAR SUNFISH	I	M	C	S	29	43.5	7.95	1110	10.36	25.5
77-012	REDEAR SUNFISH	I		C	E	1	1.5	0.27	187	1.75	125.0
77-015	GREEN SF X BLUEGILL SF					1	1.5	0.27	30	0.28	20.0
80-015	GREENSIDE DARTER	I	M	S	D	1	1.5	0.27	1	0.01	1.0
80-016	BANDED DARTER	I	I	S	D	1	1.5	0.27	1	0.01	1.0
80-022	RAINBOW DARTER	I	M	S	D	10	15.0	2.74	30	0.28	2.0
80-024	FANTAIL DARTER	I		C	D	4	6.0	1.10	7	0.07	1.2

No Species: 24 **Nat. Species:** 23 **Hybrids:** 1 **Total Counted:** 365 **Total Rel. Wt. :** 10710

IBI: 52.0 **MIwb:** 7.9

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM51 River: 11-007 Sycamore Creek RM: 0.50 Date: 09/23/2022

Time Fished: 915 Distance: 0.200 Drainge (sq mi): 22.8 Depth: 0

Location: ust. Sycamore Creek WWTP Lat: 39.22390 Long: -84.32472

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-010	GOLDEN REDHORSE	I	M	S	R	1	1.5	0.95	15	0.22	10.0
40-015	NORTHERN HOG SUCKER	I	M	S	R	2	3.0	1.90	1125	16.35	375.0
40-016	WHITE SUCKER	O	T	S	W	1	1.5	0.95	1050	15.26	700.0
43-020	EMERALD SHINER	I		M	N	21	31.5	20.00	37	0.54	1.1
43-021	SILVER SHINER	I	I	S	N	2	3.0	1.90	6	0.09	2.0
43-034	SAND SHINER	I	M	M	N	2	3.0	1.90	3	0.04	1.0
43-035	MIMIC SHINER	I	I	M	N	2	3.0	1.90	4	0.07	1.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	6	9.0	5.71	22	0.33	2.5
43-044	CENTRAL STONEROLLER	H		N	N	1	1.5	0.95	4	0.07	3.0
47-002	CHANNEL CATFISH			C	F	1	1.5	0.95	2700	39.23	1800.0
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.95	7	0.11	5.0
54-003	NORTHERN STUDFISH	I		M		1	1.5	0.95	7	0.11	5.0
77-004	SMALLMOUTH BASS	C	M	C	F	11	16.5	10.48	930	13.51	56.3
77-005	SPOTTED BASS	C		C	F	3	4.5	2.86	30	0.44	6.6
77-006	LARGEMOUTH BASS	C		C	F	3	4.5	2.86	45	0.65	10.0
77-008	GREEN SUNFISH	I	T	C	S	3	4.5	2.86	180	2.62	40.0
77-009	BLUEGILL SUNFISH	I	P	C	S	7	10.5	6.67	105	1.53	10.0
77-011	LONGEAR SUNFISH	I	M	C	S	32	48.0	30.48	555	8.06	11.5
77-012	REDEAR SUNFISH	I		C	E	1	1.5	0.95	45	0.65	30.0
80-016	BANDED DARTER	I	I	S	D	2	3.0	1.90	3	0.04	1.0
80-022	RAINBOW DARTER	I	M	S	D	2	3.0	1.90	6	0.09	2.0

No Species: 21 **Nat. Species:** 20 **Hybrids:** 0 **Total Counted:** 105 **Total Rel. Wt. :** 6882

IBI: 46.0 **MIwb:** 7.4

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM52 River: 11-007 Sycamore Creek RM: 0.10 Date: 08/17/2022

Time Fished: 1785 Distance: 0.200 Drainge (sq mi): 23.3 Depth: 0

Location: dst. Sycamore Creek WWTP Lat: 39.22607 Long: -84.32209

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		7	10.5	2.73	825	11.81	78.5
40-005	QUILLBACK CARPSUCKER	O		M	C	1	1.5	0.39	1425	20.40	950.0
40-009	BLACK REDHORSE	I	I	S	R	1	1.5	0.39	750	10.74	500.0
43-015	SUCKERMOUTH MINNOW	I		S	N	1	1.5	0.39	3	0.04	2.0
43-020	EMERALD SHINER	I		M	N	140	210.0	54.69	210	3.01	1.0
43-021	SILVER SHINER	I	I	S	N	1	1.5	0.39	3	0.04	2.0
43-022	ROSYFACE SHINER	I	I	S	N	13	19.5	5.08	12	0.17	0.6
43-032	SPOTFIN SHINER	I		M	N	4	6.0	1.56	15	0.21	2.5
43-034	SAND SHINER	I	M	M	N	5	7.5	1.95	7	0.11	1.0
43-035	MIMIC SHINER	I	I	M	N	9	13.5	3.52	22	0.32	1.6
43-042	FATHEAD MINNOW	O	T	C	N	1	1.5	0.39	3	0.04	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	2	3.0	0.78	1	0.02	0.5
43-044	CENTRAL STONEROLLER	H		N	N	9	13.5	3.52	37	0.54	2.7
47-007	FLATHEAD CATFISH	P		C	F	1	1.5	0.39	4	0.06	3.0
77-004	SMALLMOUTH BASS	C	M	C	F	12	18.0	4.69	3045	43.59	169.1
77-006	LARGEMOUTH BASS	C		C	F	1	1.5	0.39	15	0.21	10.0
77-008	GREEN SUNFISH	I	T	C	S	11	16.5	4.30	315	4.51	19.0
77-009	BLUEGILL SUNFISH	I	P	C	S	4	6.0	1.56	135	1.93	22.5
77-011	LONGEAR SUNFISH	I	M	C	S	4	6.0	1.56	75	1.07	12.5
80-015	GREENSIDE DARTER	I	M	S	D	7	10.5	2.73	30	0.43	2.8
80-016	BANDED DARTER	I	I	S	D	1	1.5	0.39	3	0.04	2.0
80-022	RAINBOW DARTER	I	M	S	D	20	30.0	7.81	45	0.64	1.5
80-024	FANTAIL DARTER	I		C	D	1	1.5	0.39	3	0.04	2.0

No Species: 23 **Nat. Species:** 23 **Hybrids:** 0 **Total Counted:** 256 **Total Rel. Wt. :** 6985

IBI: 50.0 **MIwb:** 7.5

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM52 River: 11-007 Sycamore Creek RM: 0.10 Date: 09/23/2022

Time Fished: 1447 Distance: 0.200 Drainge (sq mi): 23.3 Depth: 0

Location: dst. Sycamore Creek WWTP Lat: 39.22607 Long: -84.32209

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-005	QUILLBACK CARPSUCKER	O		M	C	1	1.5	0.28	1350	15.25	900.0
40-006	RIVER CARPSUCKER	O		M	C	2	3.0	0.56	2925	33.04	975.0
40-009	BLACK REDHORSE	I	I	S	R	1	1.5	0.28	825	9.32	550.0
43-015	SUCKERMOUTH MINNOW	I		S	N	1	1.5	0.28	4	0.05	3.0
43-020	EMERALD SHINER	I		M	N	136	204.0	38.31	165	1.86	0.8
43-022	ROSYFACE SHINER	I	I	S	N	9	13.5	2.54	7	0.08	0.5
43-032	SPOTFIN SHINER	I		M	N	14	21.0	3.94	22	0.25	1.0
43-034	SAND SHINER	I	M	M	N	18	27.0	5.07	15	0.17	0.5
43-035	MIMIC SHINER	I	I	M	N	20	30.0	5.63	34	0.39	1.1
43-039	SILVERJAW MINNOW	I		M	N	4	6.0	1.13	12	0.14	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	64	96.0	18.03	97	1.10	1.0
43-044	CENTRAL STONEROLLER	H		N	N	2	3.0	0.56	15	0.17	5.0
77-004	SMALLMOUTH BASS	C	M	C	F	14	21.0	3.94	2265	25.58	107.8
77-005	SPOTTED BASS	C		C	F	1	1.5	0.28	375	4.24	250.0
77-006	LARGEMOUTH BASS	C		C	F	1	1.5	0.28	7	0.08	5.0
77-008	GREEN SUNFISH	I	T	C	S	5	7.5	1.41	142	1.61	19.0
77-009	BLUEGILL SUNFISH	I	P	C	S	4	6.0	1.13	247	2.80	41.2
77-011	LONGEAR SUNFISH	I	M	C	S	28	42.0	7.89	142	1.61	3.3
77-012	REDEAR SUNFISH	I		C	E	1	1.5	0.28	45	0.51	30.0
77-015	GREEN SF X BLUEGILL SF					1	1.5	0.28	60	0.68	40.0
80-015	GREENSIDE DARTER	I	M	S	D	12	18.0	3.38	64	0.73	3.5
80-016	BANDED DARTER	I	I	S	D	3	4.5	0.85	7	0.08	1.6
80-022	RAINBOW DARTER	I	M	S	D	13	19.5	3.66	22	0.25	1.1

No Species: 22 **Nat. Species:** 21 **Hybrids:** 1 **Total Counted:** 355 **Total Rel. Wt. :** 8853

IBI: 44.0 **MIwb:** 8.1

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM40 River: 11-009 Polk Run RM: 0.30 Date: 09/09/2022

Time Fished: 1802 Distance: 0.150 Drainge (sq mi): 9.9 Depth: 0

Location: East Kemper Rd. Lat: 39.25100 Long: -84.29890

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	1	2.0	0.34	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	1	2.0	0.34	0	0.00	0.0
43-020	EMERALD SHINER	I		M	N	2	4.0	0.68	0	0.00	0.0
43-022	ROSYFACE SHINER	I	I	S	N	11	22.0	3.74	0	0.00	0.0
43-025	STRIPED SHINER	I		S	N	1	2.0	0.34	0	0.00	0.0
43-032	SPOTFIN SHINER	I		M	N	5	10.0	1.70	0	0.00	0.0
43-034	SAND SHINER	I	M	M	N	15	30.0	5.10	0	0.00	0.0
43-035	MIMIC SHINER	I	I	M	N	29	58.0	9.86	0	0.00	0.0
43-039	SILVERJAW MINNOW	I		M	N	1	2.0	0.34	0	0.00	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	29	58.0	9.86	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	66	132.0	22.45	0	0.00	0.0
54-003	NORTHERN STUDFISH	I		M		2	4.0	0.68	0	0.00	0.0
77-004	SMALLMOUTH BASS	C	M	C	F	4	8.0	1.36	0	0.00	0.0
77-006	LARGEMOUTH BASS	C		C	F	4	8.0	1.36	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	19	38.0	6.46	0	0.00	0.0
77-009	BLUEGILL SUNFISH	I	P	C	S	42	84.0	14.29	0	0.00	0.0
77-011	LONGEAR SUNFISH	I	M	C	S	12	24.0	4.08	0	0.00	0.0
77-015	GREEN SF X BLUEGILL SF					2	4.0	0.68	0	0.00	0.0
80-015	GREENSIDE DARTER	I	M	S	D	4	8.0	1.36	0	0.00	0.0
80-022	RAINBOW DARTER	I	M	S	D	12	24.0	4.08	0	0.00	0.0
80-024	FANTAIL DARTER	I		C	D	32	64.0	10.88	0	0.00	0.0

No Species: 20 **Nat. Species:** 20 **Hybrids:** 1 **Total Counted:** 294 **Total Rel. Wt. :** 0

IBI: 52.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM55 River: 11-049 Trib. to Sycamore Creek (RM 1.12) RM: 1.20 Date: 07/22/2022

Time Fished: 1408 Distance: 0.100 Drainge (sq mi): 5.3 Depth: 0

Location: ust. Blome Rd. bridge Lat: 39.21713 Long: -84.34732

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-013	CREEK CHUB	G	T	N	N	103	309.0	47.69	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	112	336.0	51.85	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	1	3.0	0.46	0	0.00	0.0

No Species: 3 **Nat. Species:** 3 **Hybrids:** 0 **Total Counted:** 216 **Total Rel. Wt. :** 0

IBI: 26.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM56 River: 11-049 Trib. to Sycamore Creek (RM 1.12) RM: 0.20 Date: 09/09/2022

Time Fished: 2173 Distance: 0.150 Drainge (sq mi): 5.6 Depth: 0

Location: ust. Loveland-Maderia Rd. Lat: 39.21663 Long: -84.33716

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	2	4.0	0.56	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	70	140.0	19.61	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	119	238.0	33.33	0	0.00	0.0
43-039	SILVERJAW MINNOW	I		M	N	2	4.0	0.56	0	0.00	0.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	48	96.0	13.45	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	101	202.0	28.29	0	0.00	0.0
77-008	GREEN SUNFISH	I	T	C	S	12	24.0	3.36	0	0.00	0.0
80-024	FANTAIL DARTER	I		C	D	3	6.0	0.84	0	0.00	0.0

No Species: 8 **Nat. Species:** 8 **Hybrids:** 0 **Total Counted:** 357 **Total Rel. Wt. :** 0

IBI: 28.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM81 River: 11-051 East Fork Duck Creek RM: 2.30 Date: 07/13/2022

Time Fished: 0 Distance: 0.150 Drainge (sq mi): 0.5 Depth: 0

Location: end of Tamworth Dr. Lat: 39.18297 Long: -84.39883

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-997	Dry Site					0	0.0	***.**	0	0.00	*****.*

No Species: 1 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM85 River: 11-051 East Fork Duck Creek RM: 2.00 Date: 07/13/2022

Time Fished: 674 Distance: 0.150 Drainge (sq mi): 1.3 Depth: 0

Location: at Stewart Ave. Lat: 39.17956 Long: -84.39516

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	10	20.0	33.33	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	17	34.0	56.67	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	3	6.0	10.00	0	0.00	0.0

No Species: 3 **Nat. Species:** 3 **Hybrids:** 0 **Total Counted:** 30 **Total Rel. Wt. :** 0

IBI: 22.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM84 River: 11-051 East Fork Duck Creek RM: 0.50 Date: 07/14/2022

Time Fished: 1361 Distance: 0.150 Drainge (sq mi): 1.9 Depth: 0

Location: behind JP Parkers School Lat: 39.16515 Long: -84.40055

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	205	410.0	62.50	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	25	50.0	7.62	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	98	196.0	29.88	0	0.00	0.0

No Species: 3 **Nat. Species:** 3 **Hybrids:** 0 **Total Counted:** 328 **Total Rel. Wt. :** 0

IBI: 28.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM83 River: 11-075 Trib to Duck Creek @ RM 4.8 RM: 0.80 Date: 07/13/2022

Time Fished: 0 Distance: 0.150 Drainge (sq mi): 1.2 Depth: 0

Location: behind Home Depot Lat: 39.17355 Long: -84.42361

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-997	Dry Site					0	0.0	***.**	0	0.00	*****.*

No Species: 1 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM80 River: 11-075 Trib to Duck Creek @ RM 4.8 RM: 0.10 Date: 07/13/2022

Time Fished: 448 Distance: 0.150 Drainge (sq mi): 1.4 Depth: 0

Location: Kennedy Ave. Lat: 39.16681 Long: -84.41926

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-999	NO FISH					0	0.0	***.**	0	0.00	*****.*

No Species: 0 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0

IBI: 0.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM86 River: 11-076 Little Duck Creek RM: 2.40 Date: 07/14/2022

Time Fished: 791 Distance: 0.150 Drainge (sq mi): 0.2 Depth: 0

Location: adj. Camargo Rd. Lat: 39.16058 Long: -84.38092

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	282	564.0	56.29	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	106	212.0	21.16	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	113	226.0	22.55	0	0.00	0.0

No Species: 3 **Nat. Species:** 3 **Hybrids:** 0 **Total Counted:** 501 **Total Rel. Wt. :** 0

IBI: 32.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM87 River: 11-076 Little Duck Creek RM: 1.90 Date: 07/14/2022

Time Fished: 1022 Distance: 0.150 Drainge (sq mi): 0.4 Depth: 0

Location: adj. Plainville Rd. Lat: 39.15863 Long: -84.38086

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	11	22.0	2.95	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	172	344.0	46.11	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	147	294.0	39.41	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	43	86.0	11.53	0	0.00	0.0

No Species: 4 **Nat. Species:** 4 **Hybrids:** 0 **Total Counted:** 373 **Total Rel. Wt. :** 0

IBI: 32.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM90 River: 11-076 Little Duck Creek RM: 1.00 Date: 07/22/2022

Time Fished: 924 Distance: 0.150 Drainge (sq mi): 0.5 Depth: 0

Location: Settle St. Lat: 39.15694 Long: -84.38426

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	11	22.0	2.08	0	0.00	0.0
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	187	374.0	35.35	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	238	476.0	44.99	0	0.00	0.0
43-044	CENTRAL STONEROLLER	H		N	N	93	186.0	17.58	0	0.00	0.0

No Species: 4 **Nat. Species:** 4 **Hybrids:** 0 **Total Counted:** 529 **Total Rel. Wt. :** 0

IBI: 32.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM92 River: 11-076 Little Duck Creek RM: 0.49 Date: 07/21/2022

Time Fished: 625 Distance: 0.150 Drainge (sq mi): 1.6 Depth: 0

Location: Wooster and Red Bank Rd. Lat: 39.13566 Long: -84.40127

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-999	NO FISH					0	0.0	***.**	0	0.00	*****.*

No Species: 0 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM82 River: 11-077 Trib to Little Duck Cr. @ RM 4.42 RM: 0.20 Date: 07/13/2022

Time Fished: 660 Distance: 0.150 Drainge (sq mi): 0.5 Depth: 0

Location: at baseball field Lat: 39.18245 Long: -84.36992

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-011	WESTERN BLACKNOSE DACE	G	T	S	N	139	278.0	73.94	0	0.00	0.0
43-013	CREEK CHUB	G	T	N	N	49	98.0	26.06	0	0.00	0.0

No Species: 2 **Nat. Species:** 2 **Hybrids:** 0 **Total Counted:** 188 **Total Rel. Wt. :** 0

IBI: 28.0 **MIwb:** N/A

Appendix Table A-5. Midwest Biodiversity Institute
Fish Species List

Site ID: LM54 River: 11-086 Trib 1.82 to Trib to Sycamore Cr RM1.12 RM: 2.40 Date: 07/14/2022

Time Fished: 0 Distance: 0.000 Drainge (sq mi): 1.6 Depth: 0

Location: Glenover Dr. and Raiders Run Lat: 39.21561 Long: -84.36545

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-997	Dry Site					0	0.0	***.**	0	0.00	*****.*

No Species: 1 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 0 **Total Rel. Wt. :** 0

IBI: 12.0 **MIwb:** N/A

Appendix B

Little Miami River 2022 Macroinvertebrate Assemblage Data
B-1: ICI Metrics & Scores
B-2: Macroinvertebrate Taxa by Site

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of Mayfly Taxa	Number of Caddisfly Taxa	Number of Dipteran Taxa	Percent: Mayflies	Percent: Caddis-flies	Percent: Tany-tarsini	Percent: Other Dipt/NI	Percent: Tolerant Organisms	Qual. EPT	ICI or Narrative
Little Miami River (11-001)													
Year: 2022													
LM01	27.90	1069.0	26(4)	7(4)	6(4)	7(2)	21.6(4)	54.7(6)	5.3(2)	16.8(4)	0.1(6)	33(6)	42
LM02	24.10	1085.0	32(4)	8(6)	9(6)	11(4)	21.3(4)	40.0(6)	15.5(4)	21.7(4)	0.0(6)	30(6)	50
LM03	22.30	1148.0	32(4)	9(6)	6(4)	13(6)	29.6(6)	45.8(6)	8.2(2)	15.6(6)	0.2(6)	28(6)	52
LM05	21.50	1160.0	45(6)	10(6)	7(6)	17(6)	47.1(6)	28.9(4)	3.1(2)	19.9(4)	1.1(6)	27(6)	52
LM07	18.50	1187.0	37(6)	7(4)	9(6)	15(6)	12.0(4)	46.7(6)	10.0(2)	30.7(2)	0.4(6)	30(6)	48
LM08	17.70	1190.0	31(4)	8(6)	9(6)	11(4)	8.1(2)	46.2(6)	25.7(6)	19.6(4)	1.1(6)	25(6)	50
LM09	13.10	1203.0	33(4)	8(6)	9(6)	11(4)	14.8(4)	52.5(6)	16.0(4)	15.2(6)	0.9(6)	27(6)	52
LM11	10.90	1707.0	28(4)	7(4)	5(4)	10(4)	14.2(4)	43.8(6)	10.2(4)	31.4(0)	0.0(6)	26(6)	42
LM12	8.10	1710.0	39(6)	9(6)	11(6)	11(6)	15.3(4)	44.9(6)	23.3(6)	15.4(4)	0.0(6)	24(6)	56
LM13	6.83	1720.0	35(6)	8(6)	9(6)	12(6)	35.9(6)	30.2(4)	10.3(4)	22.6(4)	0.3(6)	29(6)	54
LM15	4.10	1730.0	35(6)	9(6)	9(6)	12(6)	23.7(6)	50.8(6)	14.9(4)	10.3(6)	0.0(6)	24(6)	58
LM16A	3.70	1752.0	44(6)	5(4)	10(6)	18(6)	4.8(2)	7.0(2)	38.5(6)	48.5(0)	2.2(4)	15(4)	40
LM16	3.50	1752.0	31(4)	6(4)	6(4)	10(4)	8.6(2)	29.8(4)	31.3(6)	28.7(2)	1.1(6)	25(6)	42
Clough Creek (11-002)													
Year: 2022													
LM95	3.20	2.1										7	MG
LM98	0.60	7.8										11	G
Duck Creek (11-004)													
Year: 2022													
LM71	6.10	2.2										0	VP
LM72	5.14	5.1										3	P
LM73	4.58	5.8										5	F
LM74	3.90	9.6										6	F
LM75	3.40	7.3										5	F
LM76	2.80	11.8	22(2)	1(0)	3(6)	12(2)	27.6(6)	1.3(4)	5.7(2)	65.3(0)	42.8(0)	7(4)	26
LM77	2.00	14.3	26(4)	2(0)	4(6)	16(4)	22.2(4)	6.6(6)	5.9(2)	65.3(0)	18.7(2)	7(4)	32
LM79	0.50	14.6	21(2)	2(0)	4(6)	12(2)	55.9(6)	11.4(6)	0.3(2)	32.4(4)	4.8(6)	10(4)	38
Sycamore Creek (11-007)													
Year: 2022													
LM50	1.10	14.7	29(4)	5(4)	3(6)	17(4)	21.6(4)	7.6(6)	14.9(4)	55.9(2)	2.3(6)	11(6)	46
LM51	0.50	24.0	32(4)	5(4)	6(6)	14(4)	36.8(6)	25.9(6)	4.3(2)	32.5(4)	0.0(6)	15(6)	48
LM52	0.10	24.0	27(4)	3(2)	6(6)	12(2)	6.1(2)	32.7(6)	11.4(2)	49.4(2)	1.6(6)	13(6)	38
Unnamed Tributary to Sycamore Cr. at RM 1.12 (11-049)													

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of: Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	ICI or Narrative
Year: 2022													
LM55	1.20	5.3										8	G
LM56	0.20	5.6	24(2)	0(0)	3(6)	15(4)	0.0(0)	0.5(4)	53.7(6)	45.3(4)	11.0(4)	10(6)	36
East Fork Duck Creek (11-051)													
Year: 2022													
LM85	2.00	1.3										5	F
LM84	0.50	2.4										5	F
Unnamed Tributary to Duck Creek at RM 4.8 (11-075)													
Year: 2022													
LM80	0.10	1.4										2	P
Little Duck Creek (11-076)													
Year: 2022													
LM86	2.40	0.5										7	MG
LM87	1.90	0.5										9	G
LM90	1.00	1.1										8	G
Unnamed Tributary to Little Duck Creek at RM 4.42 (11-077)													
Year: 2022													
LM82	0.20	0.3										4	F
Unnamed Tributary (1.82) to Tributary to Sycamore Creek (1.1) (11-086)													
Year: 2022													
LM54	2.40	1.6										0	
Little Miami River (11-001)													
Year: 2020													
	24.10	1085.0	33(4)	7(4)	7(6)	13(6)	21.1(4)	59.9(6)	6.1(2)	12.5(6)	0.0(6)	29(6)	50
	13.07	1203.0	28(4)	7(4)	8(6)	9(4)	19.9(4)	25.7(4)	9.1(2)	44.6(0)	0.0(6)	23(6)	40
600580	3.50	1752.0	41(6)	9(6)	10(6)	15(6)	3.0(2)	16.3(2)	60.5(6)	20.1(4)	3.1(2)	20(6)	46
Year: 2019													
LM16a	3.50	1752.0	45(6)	4(2)	6(4)	23(6)	1.8(2)	2.2(0)	5.6(2)	87.8(0)	62.2(0)	11(4)	26
LM16	3.35	1750.0	25(4)	8(6)	6(4)	4(2)	0.7(2)	78.7(6)	18.7(4)	1.9(6)	0.1(6)	15(4)	44
Year: 2017													
LM01	27.90	1069.0	50(6)	12(6)	8(6)	20(6)	33.2(6)	33.9(6)	19.3(4)	12.3(6)	0.8(6)	19(6)	58
LM02	24.10	1085.0	46(6)	11(6)	7(6)	16(6)	29.0(6)	26.2(4)	28.1(6)	16.5(6)	1.3(4)	23(6)	56
LM03	22.30	1148.0										23	E
LM05	21.50	1160.0										19	E
LM07	18.50	1187.0	39(6)	7(4)	9(6)	15(6)	18.8(4)	59.1(6)	13.5(4)	7.4(6)	0.0(6)	19(6)	54
LM08	17.70	1190.0	42(6)	11(6)	8(6)	14(6)	29.5(6)	43.6(6)	13.4(4)	8.2(6)	0.0(6)	20(6)	58

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of Mayfly Taxa	Number of Caddisfly Taxa	Number of Dipteran Taxa	Percent: Mayflies	Percent: Caddis-flies	Percent: Tany-tarsini	Percent: Other Dipt/NI	Percent: Tolerant Organisms	Qual. EPT	ICI or Narrative
LM09	13.10	1203.0	31(4)	8(6)	8(6)	9(4)	19.5(4)	55.4(6)	14.1(4)	10.4(6)	0.0(6)	20(6)	52
LM11	10.90	1707.0	38(6)	10(6)	7(6)	14(6)	21.7(6)	27.9(4)	31.6(6)	17.9(4)	1.1(6)	20(6)	56
LM12	8.10	1710.0										26	E
LM13	6.83	1720.0	40(6)	11(6)	9(6)	12(6)	20.3(4)	52.7(6)	10.4(4)	15.8(4)	0.0(6)	20(6)	54
LM15	4.10	1730.0	36(6)	9(6)	8(6)	12(6)	16.8(4)	42.8(6)	22.1(6)	17.2(4)	0.3(6)	19(6)	56
LM16	3.40	1752.0	50(6)	8(6)	9(6)	24(6)	40.0(6)	6.8(2)	10.0(4)	42.1(0)	11.4(0)	19(6)	42
Duck Creek (11-004)													
Year: 2017													
LM71	6.10	2.2										0	VP
LM72	5.14	5.1										2	P
LM73	4.58	5.8										3	P
LM74	3.90	9.6										4	F
LM75	3.40	7.3										4	F
LM76	2.80	11.8	24(2)	2(0)	4(6)	15(4)	25.1(6)	5.8(6)	12.6(4)	56.5(2)	32.5(0)	3(0)	30
LM77	2.00	14.3	33(4)	3(2)	3(6)	21(6)	39.7(6)	21.8(6)	5.3(2)	33.2(4)	14.2(4)	6(2)	42
LM79	0.50	14.6	27(4)	3(2)	3(6)	17(4)	31.8(6)	4.8(6)	6.4(2)	57.0(2)	26.2(0)	6(2)	34
Sycamore Creek (11-007)													
Year: 2017													
LM50	1.10	14.7	32(4)	3(2)	6(6)	19(4)	4.9(2)	29.3(6)	23.6(6)	41.6(4)	5.4(6)	8(4)	44
LM51	0.50	24.0	36(4)	4(2)	4(6)	18(4)	12.9(2)	18.3(6)	18.5(4)	49.4(2)	0.9(6)	7(2)	38
LM52	0.10	24.0	27(4)	3(2)	5(6)	13(2)	4.4(2)	33.1(6)	5.9(2)	56.6(2)	14.8(4)	12(6)	36
Unnamed Tributary to Sycamore Cr. at RM 1.12 (11-049)													
Year: 2017													
LM55	1.20	5.3										8	G
LM56	0.20	5.6	38(6)	4(2)	4(6)	24(6)	35.2(6)	2.2(6)	20.3(6)	41.8(4)	3.3(6)	8(4)	52
East Fork Duck Creek (11-051)													
Year: 2017													
LM85	2.00	1.3										1	VP
LM84	0.50	2.4										6	F
Unnamed Tributary to Duck Creek at RM 4.8 (11-075)													
Year: 2017													
LM80	0.10	1.4										1	VP
Little Duck Creek (11-076)													
Year: 2017													
LM86	2.40	0.5										8	G

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Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of: Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	ICI or Narrative
LM87	1.90	0.5										8	G
LM90	1.00	1.1										7	G
Unnamed Tributary to Little Duck Creek at RM 4.42 (11-077)													
Year: 2017													
LM82	0.20	0.6										3	P
Little Miami River (11-001)													
Year: 2016													
	14.05	1200.0										22	
Year: 2012													
LM01	27.80	1070.0	31(4)	8(6)	6(4)	10(4)	16.6(4)	18.6(4)	27.0(6)	37.5(0)	0.3(6)	19(6)	44
LM02	24.10	1085.0	44(6)	10(6)	8(6)	18(6)	10.0(2)	41.4(6)	14.7(4)	31.4(2)	0.5(6)	12(4)	48
LM03	22.80	1150.0	30(4)	6(4)	7(6)	10(4)	11.5(2)	43.6(6)	30.2(6)	13.7(6)	0.0(6)	17(6)	50
LM04	21.80	1150.0	35(6)	5(2)	5(4)	18(6)	2.6(2)	16.6(4)	14.8(4)	65.8(0)	2.9(2)	8(2)	32
LM05	21.40	1160.0	35(6)	5(2)	7(6)	15(6)	2.8(2)	32.4(4)	27.1(6)	36.9(0)	0.0(6)	14(4)	42
LM06	20.60	1161.0	23(4)	5(2)	6(4)	9(4)	9.1(2)	57.8(6)	21.7(4)	9.4(6)	0.0(6)	12(4)	42
LM07	18.60	1190.0	33(4)	5(2)	8(6)	15(6)	21.6(4)	47.9(6)	11.3(2)	19.1(4)	0.0(6)	15(4)	44
LM08	17.60	1190.0	38(6)	6(4)	7(6)	20(6)	6.0(2)	30.5(4)	21.5(4)	38.6(0)	1.2(6)	13(4)	42
LM09	13.10	1203.0	43(6)	9(6)	10(6)	15(6)	3.9(2)	57.8(6)	13.9(4)	23.4(4)	0.0(6)	15(4)	50
LM10	12.40	1210.0	33(4)	6(4)	8(6)	12(6)	7.8(2)	43.7(6)	14.4(4)	33.6(2)	0.0(6)	14(4)	44
LM11	10.90	1707.0	40(6)	7(4)	8(6)	18(6)	10.2(2)	23.2(4)	35.3(6)	30.9(2)	1.4(4)	18(6)	46
LM12	8.00	1714.0										16	
LM13	7.30	1720.0	33(6)	8(6)	7(6)	11(6)	13.2(4)	56.0(6)	5.6(2)	24.8(2)	0.0(6)	15(4)	48
LM14	5.30	1720.0	33(6)	6(4)	7(6)	13(6)	1.9(2)	16.3(2)	21.8(6)	59.5(0)	1.1(6)	13(4)	42
LM15	4.10	1730.0	44(6)	7(4)	10(6)	19(6)	3.8(2)	13.2(2)	20.8(6)	61.9(0)	0.4(6)	22(6)	44
LM16	3.40	1752.0	42(6)	6(4)	12(6)	14(6)	6.8(2)	16.4(2)	28.5(6)	47.9(0)	1.1(6)	14(4)	42
LM17	1.40	1760.0	22(4)	2(0)	3(2)	8(4)	0.1(2)	0.9(0)	0.0(0)	98.4(0)	0.6(6)	0(0)	18
Clough Creek (11-002)													
Year: 2012													
LM99	4.60	0.9										3	F
LM95	3.20	2.1										3	F
LM96	3.10	5.4										6	G
LM97	1.20	7.5	19(2)	2(0)	5(6)	10(2)	6.5(2)	53.3(6)	7.5(2)	32.3(4)	1.0(6)	7(4)	34
LM98	0.40	8.0										8	G
Duck Creek (11-004)													
Year: 2012													

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of Mayfly Taxa	Number of Caddisfly Taxa	Number of Dipteran Taxa	Percent: Mayflies	Percent: Caddis-flies	Percent: Tany-tarsini	Percent: Other Dipt/NI	Percent: Tolerant Organisms	Qual. EPT	ICI or Narrative
LM71	6.00	2.2										0	VP
LM78	5.20	3.5										1	VP
LM72	4.60	5.1										2	P
LM73	4.40	5.8										2	P
LM75	3.30	11.4										4	F
LM76	2.90	11.8	14(2)	0(0)	0(0)	10(2)	0.0(0)	0.0(0)	22.4(6)	77.6(0)	4.6(6)	5(2)	F
LM77	1.80	14.3										4	F
LM79	0.90	14.7										0	VP
Sycamore Creek (11-007)													
Year: 2012													
LM47	3.60	3.4										3	F
LM48	2.40	4.8										5	MG
LM49	1.50	6.6	10(0)	2(0)	1(4)	5(0)	3.0(2)	3.0(6)	3.0(2)	90.9(0)	0.0(6)	9(4)	G
LM50	1.10	14.7	16(2)	2(0)	2(4)	8(2)	3.6(2)	5.5(6)	0.0(0)	89.2(0)	0.0(6)	7(2)	MG
LM51	0.30	22.7	14(2)	3(2)	1(2)	7(2)	3.7(2)	0.6(2)	1.3(2)	94.4(0)	5.0(6)	11(4)	G
LM52	0.20	24.0										8	MG
Unnamed Tributary to Sycamore Cr. at RM 1.12 (11-049)													
Year: 2012													
LM55	1.00	5.3										7	G
LM56	0.30	5.6										8	G
LM53	0.10	4.9	19(2)	1(0)	0(0)	15(4)	7.4(2)	0.0(0)	11.6(4)	80.6(0)	2.5(6)	8(4)	G
East Fork Duck Creek (11-051)													
Year: 2012													
LM85	1.50	1.3										0	VP
LM84	0.60	2.3										1	VP
LM74	0.15	3.4										3	VP
Unnamed Tributary to Duck Creek at RM 4.8 (11-075)													
Year: 2012													
LM80	0.20	1.4										0	VP
Little Duck Creek (11-076)													
Year: 2012													
LM86	2.70	0.4										7	G
LM87	2.60	0.5										6	G
LM90	2.30	0.5										5	MG
LM89	1.40	1.1										2	P

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of: Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	ICI or Narrative
Unnamed Tributary to Little Duck Creek at RM 4.42 (11-077)													
Year: 2012													
LM82	0.10	1.4										0	
Little Miami River (11-001)													
Year: 2007													
LMRB07	29.00		34(4)	10(6)	8(6)	9(2)	15.0(4)	39.0(6)	29.8(6)	15.8(6)	0.0(6)	16(6)	52
LM01	27.90	1069.0	40(6)	8(6)	9(6)	15(6)	35.9(6)	47.0(6)	3.5(2)	12.5(6)	0.4(6)	16(4)	54
LM02	24.10	1085.0	27(4)	6(4)	5(4)	9(4)	36.1(6)	56.1(6)	2.7(2)	4.2(6)	0.1(6)	19(6)	48
LM03	22.80		40(6)	8(6)	6(6)	17(4)	28.2(6)	50.9(6)	4.8(2)	13.5(6)	0.3(6)	23(6)	54
LM04	21.70	1150.0	26(4)	0(0)	2(2)	14(6)	0.0(0)	0.5(0)	0.9(2)	98.6(0)	77.3(0)	1(0)	14
LM06	20.60	1161.0	43(6)	9(6)	8(6)	18(6)	21.7(4)	35.9(6)	20.9(4)	17.8(4)	1.4(4)	17(6)	52
LM08	16.90											17	
M05P11	13.07	1203.0	31(4)	7(4)	8(6)	10(4)	32.3(6)	31.4(4)	24.2(6)	12.0(6)	0.3(6)	19(6)	52
LM12	8.14		30(4)	8(6)	7(6)	10(2)	25.6(6)	29.1(6)	25.2(6)	20.0(6)	0.0(6)	12(6)	54
LM16	3.50	1752.0	33(6)	10(6)	6(4)	11(6)	32.1(6)	4.7(0)	3.5(2)	59.6(0)	1.9(4)	24(6)	40
Clough Creek (11-002)													
Year: 2007													
LM98	0.42											8	
Duck Creek (11-004)													
Year: 2007													
LM75	3.36											1	
LM79	0.95											3	
Sycamore Creek (11-007)													
Year: 2007													
LM50	1.10											8	
LM51	0.50	24.0	29(4)	3(2)	3(6)	15(4)	15.6(4)	5.0(4)	35.6(6)	40.6(4)	1.1(6)	8(4)	44
LM52	0.10	24.0	40(6)	3(2)	3(6)	30(6)	11.4(2)	1.3(2)	14.8(4)	72.3(0)	23.2(0)	5(2)	30
Little Miami River (11-001)													
Year: 1998													
LMRB08	29.20	1064.0	35(6)	8(6)	7(6)	15(6)	14.8(4)	24.5(4)	21.0(4)	38.1(0)	0.7(6)	17(6)	48
LM01	28.00	1069.0	45(6)	8(6)	6(4)	19(6)	4.6(2)	8.1(2)	18.2(4)	68.7(0)	0.4(6)	19(6)	42
LM02	24.20	1085.0	42(6)	10(6)	6(4)	17(6)	12.0(4)	38.1(6)	19.0(4)	29.3(2)	0.6(6)	14(4)	48
M05S39	21.90	1148.0	53(6)	11(6)	7(6)	23(6)	13.6(4)	19.9(4)	29.7(6)	34.7(2)	2.2(4)	11(4)	48
LM04	21.80	1150.0										7	F
LM04	21.80	1150.0										2	P

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	ICI or Narrative
LM06	20.60	1161.0	38(6)	7(4)	7(6)	18(6)	5.0(2)	17.3(4)	59.2(6)	18.5(4)	0.7(6)	15(4)	48
LMRB06	19.10	1186.0										20	E
LMRB06	13.60	1199.0										17	VG
LMRB03	8.80	1713.0										21	E
600580	3.40	1752.0	41(6)	8(6)	8(6)	13(6)	4.9(2)	10.7(2)	63.1(6)	20.9(4)	0.7(6)	18(6)	50
Sycamore Creek (11-007)													
Year: 1998													
LM51	0.50	24.0										11	G
LM51	0.24	24.0										6	F
LM52	0.10	24.0										7	F
Little Miami River (11-001)													
Year: 1993													
LMRB08	29.20	1064.0	40(6)	11(6)	8(6)	10(4)	23.5(4)	7.3(2)	55.4(6)	9.9(6)	0.3(6)	19(6)	52
LM01	28.00	1069.0										18	E
LM02	23.90	1145.0	47(6)	13(6)	6(4)	18(6)	46.2(6)	14.1(2)	18.2(4)	20.1(4)	0.0(6)	18(6)	50
LM03	22.20	1148.0	46(6)	8(6)	3(2)	17(6)	13.3(4)	8.3(2)	0.5(2)	74.7(0)	45.7(0)	13(4)	VG
LM05	21.40	1160.0	51(6)	10(6)	8(6)	21(6)	35.2(6)	19.4(4)	28.9(6)	15.8(6)	1.1(6)	14(4)	56
LM06	20.60	1161.0	45(6)	9(6)	7(6)	15(6)	35.0(6)	17.5(4)	37.1(6)	9.4(6)	0.3(6)	19(6)	58
LMRB06	18.90	1186.0										15	VG
M05P11	13.10	1203.0	38(6)	10(6)	3(2)	15(6)	24.3(6)	1.6(0)	3.9(2)	68.7(0)	11.2(0)	13(4)	VG
LMRB03	8.80	1713.0	29(4)	7(4)	8(6)	8(4)	26.6(6)	34.7(4)	30.6(6)	7.4(6)	0.5(6)	16(6)	52
600580	3.40	1752.0	48(6)	8(6)	7(6)	16(6)	15.7(4)	7.8(2)	48.2(6)	27.6(2)	4.9(0)	14(4)	42
LM17	1.60	1754.0	21(2)	3(2)	2(2)	10(4)	0.7(2)	3.7(0)	0.0(0)	94.0(0)	11.5(0)	4(0)	F
LMRB01	0.40	1757.0										5	F
Sycamore Creek (11-007)													
Year: 1993													
LM51	0.50	24.0										7	F
LM51	0.24	24.0	38(6)	4(2)	2(4)	24(6)	10.5(2)	4.5(4)	24.0(4)	60.1(2)	17.1(2)	3(0)	32
LM52	0.10	24.0	31(4)	3(2)	1(2)	19(4)	1.0(2)	0.0(2)	11.4(2)	81.4(0)	23.2(0)	7(2)	20
Clough Creek (11-002)													
Year: 1991													
LM95	3.20	2.1										5	F
Sycamore Creek (11-007)													
Year: 1991													
LM50	1.20	9.4										8	G

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

Appendix Table B-1. ICI metrics and values in the Little Miami River study area including historical data also sampled in 2022.

Site_ID	River Mile	Drainage Area (sq mi)	Total Taxa	Number of Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	ICI or Narrative
LM50	1.00	14.7	24(2)	3(2)	1(2)	16(4)	0.5(2)	0.5(2)	18.6(4)	80.4(0)	34.5(0)	7(2)	20
Unnamed Tributary to Sycamore Cr. at RM 1.12 (11-049)													
Year: 1991													
LM53	0.10	4.9										0	VP
Little Miami River (11-001)													
Year: 1983													
LMRB08	29.20	1064.0	30(4)	7(4)	6(4)	10(4)	32.3(6)	15.1(2)	38.7(6)	13.5(6)	0.5(6)	14(4)	46
LM01	28.00	1069.0	36(6)	8(6)	6(4)	16(6)	17.3(4)	27.1(4)	21.8(4)	33.7(2)	0.4(6)	9(2)	44
LM02	23.90	1145.0	38(6)	8(6)	7(6)	15(6)	30.7(6)	21.2(4)	21.7(4)	25.2(4)	0.0(6)	13(4)	52
LM05	20.90	1161.0	26(4)	5(2)	6(4)	12(6)	8.7(2)	28.1(4)	40.1(6)	23.1(4)	0.1(6)	10(2)	40
LM07	18.50	1187.0	30(4)	5(2)	5(4)	12(6)	18.9(4)	61.1(6)	3.1(2)	15.9(6)	0.2(6)	9(2)	42
M05P11	13.10	1203.0	33(4)	7(4)	6(4)	15(6)	34.3(6)	44.9(6)	1.6(2)	19.0(4)	0.3(6)	9(2)	44
LMRB03	8.80	1713.0	25(4)	6(4)	8(6)	7(4)	42.5(6)	32.8(4)	11.5(4)	13.0(6)	0.0(6)	13(4)	48
600580	3.30	1752.0	26(4)	7(4)	1(0)	10(4)	13.0(4)	2.0(0)	0.0(0)	83.6(0)	9.1(0)	12(4)	20
Duck Creek (11-004)													
Year: 1983													
LM79	0.90	14.7										2	P
Sycamore Creek (11-007)													
Year: 1983													
LM51	0.60	24.0										4	F
LM52	0.10	24.0										0	P

Narrative Codes, VP - Very Poor, P - Poor, F - Fair, MG - Marginally Good, G - Good, E - Excellent, PHW3A - Spring Water Type A, PHW2 - Small Drainage Warm Water Stream

***Appendix Table B-2**. Macroinvertebrate taxa collected in the Little Miami River mainstem in 2020 including tolerance assignment, taxa group, abundance, and number if sites collected.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abund-ance	Percent	Qual Sites	Samples Collect-ed in
52200	*Cheumatopsyche sp*	F	C	9608	27.24	13	13
85625	*Rheotanytarsus sp*	F	T	6416	18.19	11	13
11130	*Baetis intercalaris*	F	M	3113	8.82	12	12
52430	*Ceratopsyche morosa group*	MI	C	2899	8.22	12	13
84450	*Polypedilum (Uresipedilum) flavum*	F	D	2499	7.08	12	13
01801	*Turbellaria*	F	N	1126	3.19	12	13
13570	*Maccaffertium terminatum*	MI	M	1012	2.87	12	13
74100	*Simulium sp*	F	D	928	2.63	13	13
12200	*Isonychia sp*	MI	M	795	2.25	12	13
13510	*Maccaffertium exiguum*	MI	M	641	1.82	10	13
51600	*Polycentropus sp*	MI	C	550	1.56	2	2
84700	*Stenochironomus sp*	F	D	542	1.54	1	12
77750	*Hayesomyia senata or Thienemannimyia norena*	F	D	508	1.44	10	12
16700	*Tricorythodes sp*	MI	M	461	1.31	13	13
83040	*Dicrotendipes neomodestus*	F	D	344	0.98	9	9
13561	*Maccaffertium pulchellum*	MI	M	314	0.89	12	12
84540	*Polypedilum (Tripodura) scalaenum group*	F	D	313	0.89	9	10
78450	*Nilotanypus fimbriatus*	F	D	207	0.59	1	12
53800	*Hydroptila sp*	F	C	202	0.57	13	13
78750	*Rheopelopia paramaculipennis*	MI	D	188	0.53	3	6
51300	*Neureclipsis sp*	MI	C	115	0.33	12	13
52510	*Hydropsyche aerata*	MI	C	112	0.32	1	7
50315	*Chimarra obscura*	MI	C	105	0.30	12	12
59970	*Petrophila sp*	MI	O	107	0.30	12	12
82220	*Tvetenia discoloripes group*	MI	D	106	0.30	3	8
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	MI	D	105	0.30	4	8
03600	*Oligochaeta*	T	N	95	0.27	11	12
68901	*Macronychus glabratus*	F	O	97	0.27	10	12
77500	*Conchapelopia sp*	F	D	95	0.27	3	9
81240	*Nanocladius (N.) distinctus*	MT	D	95	0.27	3	7
11119	*Plauditus dubius or P. virilis*	I	M	88	0.25	5	5
53400	*Protoptila sp*	I	C	88	0.25	12	13
69400	*Stenelmis sp*	F	O	88	0.25	13	13
11118	*Plauditus dubius*	MI	M	73	0.21	7	7
13540	*Maccaffertium mediopunctatum*	MI	M	71	0.20	11	11
13550	*Maccaffertium mexicanum integrum*	MI	M	69	0.20	3	6
77120	*Ablabesmyia mallochi*	F	D	72	0.20	12	12
87540	*Hemerodromia sp*	F	D	60	0.17	5	10
84520	*Polypedilum (Tripodura) halterale group*	MT	D	55	0.16	3	4
93900	*Elimia sp*	MI	N	57	0.16	10	10
77100	*Ablabesmyia sp*		D	48	0.14	0	1
80410	*Cricotopus (C.) sp*	F	D	48	0.14	3	4

***Appendix Table B-2**. continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abund-ance	Percent	Qual Sites	Samples Collect-ed in
85840	*Tanytarsus sepp*	F	T	48	0.14	5	6
80310	*Cardiocladius obscurus*	MI	D	44	0.12	8	10
83300	*Glyptotendipes (G.) sp*	MT	D	41	0.12	1	3
82130	*Thienemanniella similis*	MI	D	38	0.11	1	2
52560	*Hydropsyche orris*	MI	C	35	0.10	0	4
52801	*Potamyia flava*	MI	C	35	0.10	2	6
82100	*Thienemanniella sp*		D	36	0.10	2	3
11014	*Acentrella turbida*	I	M	32	0.09	11	11
52570	*Hydropsyche simulans*	MI	C	31	0.09	3	9
83050	*Dicrotendipes lucifer*	MT	D	30	0.09	3	4
85821	*Tanytarsus glabrescens group sp 7*	F	T	30	0.09	3	6
13400	*Stenacron sp*	F	M	25	0.07	13	13
52520	*Hydropsyche bidens*	MI	C	26	0.07	0	4
84960	*Pseudochironomus sp*	F	D	24	0.07	0	1
03000	*Ectoprocta*	F		18	0.05	6	11
51206	*Cyrnellus fraternus*	F	C	16	0.05	2	4
65800	*Berosus sp*	MT	O	16	0.05	10	10
83000	*Dicrotendipes sp*	F	D	16	0.05	0	1
96900	*Ferrissia sp*	F	N	18	0.05	7	7
59100	*Ceraclea sp*	MI	C	14	0.04	4	6
59140	*Ceraclea maculata*	MI	C	13	0.04	5	7
77800	*Helopelopia sp*	F	D	15	0.04	4	4
84300	*Phaenopsectra obediens group*	F	D	15	0.04	1	2
04660	*Helobdella sp*	MT	N	9	0.03	2	3
22300	*Argia sp*	F	O	12	0.03	12	13
48410	*Corydalus cornutus*	MI	O	10	0.03	9	10
54160	*Ochrotrichia sp*	MI	C	10	0.03	5	5
84460	*Polypedilum (P.) fallax group*	F	D	11	0.03	0	2
85615	*Rheotanytarsus pellucidus*	MI	T	9	0.03	0	1
03360	*Plumatella sp*	F	N	6	0.02	4	5
08601	*Hydrachnidia*	F	N	8	0.02	2	3
13521	*Stenonema femoratum*	F	M	7	0.02	9	10
68601	*Ancyronyx variegata*	F	O	6	0.02	11	11
81060	*Lopescladius sp*	MI	D	6	0.02	0	1
83840	*Microtendipes pedellus group*	F	D	6	0.02	2	2
85200	*Cladotanytarsus sp*		T	8	0.02	2	3
95100	*Physella sp*	T	N	8	0.02	6	7
04935	*Erpobdella punctata punctata*	MT	N	3	0.01	3	4
51050	*Cernotina sp*	MI	C	3	0.01	2	4
52530	*Hydropsyche depravata group*	F	C	5	0.01	0	1
59407	*Nectopsyche candida*	MI	C	2	0.01	13	13

Appendix Table B-2. *continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abund-ance	Percent	Qual Sites	Samples Collect-ed in
68130	*Helichus sp*	F	O	2	0.01	8	9
84470	*Polypedilum (P.) illinoense*	T	D	5	0.01	9	10
85800	*Tanytarsus sp*	F	T	3	0.01	4	5
03451	*Urnatella gracilis*	MI	N	0	0.00	1	1
04510	*Hirudinida*	MT	N	0	0.00	1	1
04666	*Helobdella papillata*	MT	N	0	0.00	2	2
04683	*Placobdella multilineata*	F	N	0	0.00	1	1
04901	Erpobdellidae	MT	N	0	0.00	4	4
05800	*Caecidotea sp*	T	N	0	0.00	6	6
05900	*Lirceus sp*	MT	N	0	0.00	6	6
06201	*Hyalella azteca*	F	N	0	0.00	7	7
06700	*Crangonyx sp*	MT	N	0	0.00	7	7
08200	*Orconectes sp*	F	N	0	0.00	10	10
11015	*Acerpenna sp*	MI	M	0	0.00	2	2
11120	*Baetis flavistriga*	F	M	0	0.00	1	1
11620	*Paracloeodes minutus*	MI	M	0	0.00	9	9
11650	*Procloeon sp (w/ hindwing pads)*	MI	M	0	0.00	1	1
11651	*Procloeon sp (w/o hindwing pads)*	MI	M	0	0.00	2	2
11670	*Procloeon viridoculare*	MI	M	0	0.00	6	6
13000	*Leucrocuta sp*	MI	M	0	0.00	13	13
13100	*Nixe sp*	MI	M	0	0.00	9	9
17200	*Caenis sp*	F	M	0	0.00	8	8
18100	*Anthopotamus sp*	MI	M	0	0.00	4	4
18600	*Ephemera sp*	MI	M	0	0.00	10	10
18700	*Hexagenia sp*	F	M	0	0.00	2	2
21001	Calopterygidae	F	O	0	0.00	1	1
21200	*Calopteryx sp*	F	O	0	0.00	2	2
21300	*Hetaerina sp*	F	O	1	0.00	8	8
22001	Coenagrionidae	T	O	0	0.00	13	13
23905	*Boyeria grafiana*	MI	O	0	0.00	3	3
23909	*Boyeria vinosa*	F	O	0	0.00	4	4
24820	*Gomphurus externus*	MI	O	0	0.00	1	1
24900	*Gomphus sp*	F	O	1	0.00	9	10
25010	*Hagenius brevistylus*	F	O	0	0.00	5	5
26700	*Macromia sp*	MI	O	0	0.00	10	10
27400	*Neurocordulia sp*	F	O	0	0.00	4	4
34700	*Agnetina capitata complex*	MI	S	0	0.00	4	4
34715	*Agnetina flavescens*	I	S	0	0.00	5	5
42700	*Belostoma sp*	T	O	0	0.00	3	3
43300	*Ranatra sp*	F	O	0	0.00	1	1
43570	*Neoplea sp*	F	O	0	0.00	2	2

***Appendix Table B-2**. continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abund-ance	Percent	Qual Sites	Samples Collect-ed in
44501	Corixidae	F	O	0	0.00	1	1
50301	*Chimarra aterrima*	MI	C	0	0.00	2	2
54100	*Neotrichia sp*	F	C	0	0.00	4	4
58505	*Helicopsyche borealis*	MI	C	0	0.00	2	2
59300	*Mystacides sp*	MI	C	0	0.00	1	1
59415	*Nectopsyche exquisita*	MI	C	0	0.00	3	3
59570	*Oecetis nocturna*	F	C	0	0.00	2	2
59580	*Oecetis persimilis*	MI	C	1	0.00	5	5
59700	*Triaenodes sp*	MI	C	0	0.00	2	2
59724	*Triaenodes injustus*	MI	C	0	0.00	3	3
60900	*Peltodytes sp*	MT	O	0	0.00	4	4
67800	*Tropisternus sp*	T	O	0	0.00	2	2
67880				0	0.00	1	1
68075	*Psephenus herricki*	MI	O	0	0.00	11	11
68708	*Dubiraphia vittata group*	F	O	0	0.00	10	10
71900	*Tipula sp*	F	D	0	0.00	2	2
72501	Culicidae	MT	D	0	0.00	6	6
77001	*Tanypodinae*		D	0	0.00	1	1
77130	*Ablabesmyia rhamphe group*	MT	D	0	0.00	8	8
77470	*Coelotanypus sp*	T	D	0	0.00	5	5
78100	*Labrundinia sp*	F	D	0	0.00	6	6
78140	*Labrundinia pilosella*	F	D	0	0.00	3	3
78350	*Meropelopia sp*	F	D	0	0.00	1	1
78600	*Pentaneura inconspicua*	F	D	0	0.00	1	1
78655	*Procladius (Holotanypus) sp*	MT	D	0	0.00	11	11
80420	*Cricotopus (C.) bicinctus*	T	D	0	0.00	2	2
80440	*Cricotopus (C.) trifascia*	F	D	0	0.00	1	1
81650	*Parametriocnemus sp*	F	D	0	0.00	1	1
82600	*Axarus sp*	F	D	0	0.00	1	1
82730	*Chironomus (C.) decorus group*	T	D	0	0.00	4	4
82820	*Cryptochironomus sp*	F	D	0	0.00	7	7
82822	*Cryptochironomus eminentia*	F	D	0	0.00	2	2
83051	*Dicrotendipes simpsoni*	T	D	0	0.00	1	1
83400	*Harnischia sp*	F	D	0	0.00	2	2
84020	*Parachironomus carinatus*	F	D	0	0.00	2	2
84040	*Parachironomus frequens*	F	D	0	0.00	1	1
84155	*Paralauterborniella nigrohalteralis*	F	D	0	0.00	4	4
84210	*Paratendipes albimanus or P. duplicatus*	F	D	0	0.00	2	2
84612	*Saetheria tylus*	F	D	0	0.00	2	2
84800	*Tribelos jucundum*	MT	D	0	0.00	1	1
85230	*Cladotanytarsus mancus group*	F	T	0	0.00	2	2

***Appendix Table B-2**. continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abund-ance	Percent	Qual Sites	Samples Collect-ed in
85260	*Cladotanytarsus vanderwulpi group*		T	0	0.00	1	1
85264	*Cladotanytarsus vanderwulpi group sp 4*	MI	T	0	0.00	1	1
85265	*Cladotanytarsus vanderwulpi group sp 5*	MI	T	0	0.00	2	2
85500	*Paratanytarsus sp*	F	T	0	0.00	2	2
93200	Hydrobiidae	F	N	0	0.00	3	3
96120	*Menetus (Micromenetus) dilatatus*	MT	N	0	0.00	1	1
97601	*Corbicula fluminea*	F	N	1	0.00	8	9
97710	*Dreissena polymorpha*	F	N	1	0.00	6	6
98001	Pisidiidae		N	1	0.00	1	2
98600	*Sphaerium sp*	F	N	0	0.00	9	9
99240	*Lasmigona complanata*	MI	N	0	0.00	1	1
99700	*Potamilus alatus*	MI	N	0	0.00	1	1

Appendix Table B-3*. Macroinvertebrate taxa collected in the Duck Creek subwatershed in 2020 including tolerance assignment, taxa group, abundance, and number if sites collected.*

Code	Taxa Name	ance	Group	dance	Percent	Samples	Samples
84470	*Polypedilum (P.) illinoense*	T	D	1340	14.01	14	14
03600	*Oligochaeta*	T	N	710	7.42	14	14
11130	*Baetis intercalaris*	F	M	3191	33.36	12	12
84450	*Polypedilum (Uresipedilum) flavum*	F	D	759	7.94	12	12
74100	*Simulium sp*	F	D	195	2.04	12	12
01801	*Turbellaria*	F	N	154	1.61	12	12
11120	*Baetis flavistriga*	F	M	0	0.00	12	12
52530	*Hydropsyche depravata group*	F	C	268	2.80	11	11
52200	*Cheumatopsyche sp*	F	C	237	2.48	11	11
53800	*Hydroptila sp*	F	C	33	0.35	10	10
77500	*Conchapelopia sp*	F	D	769	8.04	9	9
80420	*Cricotopus (C.) bicinctus*	T	D	156	1.63	8	8
04985	*Barbronia weberi*	MT	N	3	0.03	8	9
82820	*Cryptochironomus sp*	F	D	0	0.00	8	8
80510	*Cricotopus (Isocladius) sylvestris group*	T	D	46	0.48	7	9
95100	*Physella sp*	T	N	1	0.01	7	7
05900	*Lirceus sp*	MT	N	0	0.00	7	7
69400	*Stenelmis sp*	F	O	0	0.00	7	7
77120	*Ablabesmyia mallochi*	F	D	0	0.00	7	7
52430	*Ceratopsyche morosa group*	MI	C	8	0.08	6	7
71900	*Tipula sp*	F	D	1	0.01	6	6
80430	*Cricotopus (C.) tremulus group*	MT	D	0	0.00	6	6
82730	*Chironomus (C.) decorus group*	T	D	0	0.00	6	6
84540	*Polypedilum (Tripodura) scalaenum group*	F	D	687	7.18	5	5
84960	*Pseudochironomus sp*	F	D	147	1.54	5	6
87540	*Hemerodromia sp*	F	D	25	0.26	5	6
72700	*Anopheles sp*	F	D	0	0.00	5	5
84210	*Paratendipes albimanus or P. duplicatus*	F	D	0	0.00	5	5
83040	*Dicrotendipes neomodestus*	F	D	102	1.07	4	5
50315	*Chimarra obscura*	MI	C	20	0.21	4	4
13521	*Stenonema femoratum*	F	M	5	0.05	4	5
04664	*Helobdella stagnalis*	T	N	0	0.00	4	4
21300	*Hetaerina sp*	F	O	0	0.00	4	4
22001	Coenagrionidae	T	O	0	0.00	4	4
50301	*Chimarra aterrima*	MI	C	0	0.00	4	4
80410	*Cricotopus (C.) sp*	F	D	0	0.00	4	4
82710	*Chironomus (C.) sp*	MT	D	0	0.00	4	4
77750	*Hayesomyia senata or Thienemannimyia norena*	F	D	79	0.83	3	4
22300	*Argia sp*	F	O	1	0.01	3	3
06700	*Crangonyx sp*	MT	N	0	0.00	3	3
17200	*Caenis sp*	F	M	0	0.00	3	3
72150	*Pericoma sp*	MT	D	0	0.00	3	3

***Appendix Table B-3**. continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abun-dance	Percent	Qual. Samples	All Samples
78401	*Natarsia species A (sensu Roback, 1978)*	T	D	0	0.00	3	3
78655	*Procladius (Holotanypus) sp*	MT	D	0	0.00	3	3
84300	*Phaenopsectra obediens group*	F	D	0	0.00	3	3
85821	*Tanytarsus glabrescens group sp 7*	F	T	325	3.40	2	3
85500	*Paratanytarsus sp*	F	T	7	0.07	2	3
04660	*Helobdella sp*	MT	N	0	0.00	2	2
04666	*Helobdella papillata*	MT	N	0	0.00	2	2
04901	Erpobdellidae	MT	N	0	0.00	2	2
21604	*Archilestes grandis*	T	O	0	0.00	2	2
51250	*Holocentropus sp*	F	C	0	0.00	2	2
53501	Hydroptilidae	F	C	0	0.00	2	2
67700	*Paracymus sp*	MT	O	0	0.00	2	2
68075	*Psephenus herricki*	MI	O	0	0.00	2	2
74650	*Atrichopogon sp*	F	D	0	0.00	2	2
77800	*Helopelopia sp*	F	D	0	0.00	2	2
78350	*Meropelopia sp*	F	D	0	0.00	2	2
78600	*Pentaneura inconspicua*	F	D	0	0.00	2	2
80411	*Cricotopus (Isocladius) sp nr. absurdus*	MT	D	0	0.00	2	2
81650	*Parametriocnemus sp*	F	D	0	0.00	2	2
82200	*Tvetenia bavarica group*	MI	D	0	0.00	2	2
83840	*Microtendipes pedellus group*	F	D	0	0.00	2	2
85800	*Tanytarsus sp*	F	T	62	0.65	1	3
83051	*Dicrotendipes simpsoni*	T	D	17	0.18	1	1
85840	*Tanytarsus sepp*	F	T	17	0.18	1	2
78450	*Nilotanypus fimbriatus*	F	D	15	0.16	1	2
04935	*Erpobdella punctata punctata*	MT	N	11	0.12	1	1
07800	*Cambarus sp*		N	0	0.00	1	1
11200	*Callibaetis sp*	MT	M	0	0.00	1	1
21001	Calopterygidae	F	O	0	0.00	1	1
23600	*Aeshna sp*	MT	O	0	0.00	1	1
27001	Corduliidae		O	0	0.00	1	1
27400	*Neurocordulia sp*	F	O	0	0.00	1	1
28001	Libellulidae	MT	O	0	0.00	1	1
28705	*Pachydiplax longipennis*	T	O	0	0.00	1	1
44501	Corixidae	F	O	0	0.00	1	1
45400	*Trichocorixa sp*	MT	O	0	0.00	1	1
51050	*Cernotina sp*	MI	C	0	0.00	1	1
60900	*Peltodytes sp*	MT	O	0	0.00	1	1
63900	*Laccophilus sp*	T	O	0	0.00	1	1
67800	*Tropisternus sp*	T	O	0	0.00	1	1
68708	*Dubiraphia vittata group*	F	O	0	0.00	1	1
70600	*Antocha sp*	MI	D	0	0.00	1	1

***Appendix Table B-3**. continued*.

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abun-dance	Percent	Qual. Samples	All Samples
71910	*Tipula abdominalis*	F	D	0	0.00	1	1
72160	*Psychoda sp*	T	D	0	0.00	1	1
72501	Culicidae	MT	D	0	0.00	1	1
72900	*Culex sp*	T	D	0	0.00	1	1
77001	*Tanypodinae*		D	0	0.00	1	1
78200	*Larsia sp*	MT	D	0	0.00	1	1
78601	*Pentaneura inyoensis*	F	D	0	0.00	1	1
78702	*Psectrotanypus dyari*	VT	D	0	0.00	1	1
80001	*Orthocladiinae*		D	0	0.00	1	1
80440	*Cricotopus (C.) trifascia*	F	D	0	0.00	1	1
80474	*Cricotopus (C.) or Paratrichocladius sp*		D	0	0.00	1	1
80740	*Eukiefferiella claripennis group*	MT	D	0	0.00	1	1
82100	*Thienemanniella sp*		D	0	0.00	1	1
82770	*Chironomus (C.) riparius group*	T	D	0	0.00	1	1
83003	*Dicrotendipes fumidus*	F	D	0	0.00	1	1
84230	*Paratendipes subaequalis*	F	D	0	0.00	1	1
85625	*Rheotanytarsus sp*	F	T	0	0.00	1	1
86501	Stratiomyidae		D	0	0.00	1	1
89001	Sciomyzidae	MT	D	0	0.00	1	1
89700	*Limnophora sp*	F	D	0	0.00	1	1
93200	Hydrobiidae	F	N	0	0.00	1	1
95501	Planorbidae	MT	N	0	0.00	1	1
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	F	D	116	1.21	0	1
81240	*Nanocladius (N.) distinctus*	MT	D	22	0.23	0	1
84520	*Polypedilum (Tripodura) halterale group*	MT	D	17	0.18	0	1
01320	*Hydra sp*	F	N	16	0.17	0	1
04510	*Hirudinida*	MT	N	1	0.01	0	1
65800	*Berosus sp*	MT	O	1	0.01	0	1

Appendix Table B-4*. Macroinvertebrate taxa collected in the Sycamore Creek, Polk Run, and Clough Creek partial subwatersheds in 2020 including tolerance assignment, taxa group, abundance, and number if sites collected.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abun-dance	Percent	Qual Samples	All Samples
01801	*Turbellaria*	F	N	614	5.03	9	9
03600	*Oligochaeta*	T	N	44	0.36	8	8
05900	*Lirceus sp*	MT	N	10	0.08	8	8
11120	*Baetis flavistriga*	F	M	78	0.64	8	8
11130	*Baetis intercalaris*	F	M	2158	17.69	8	8
50301	*Chimarra aterrima*	MI	C	13	0.11	8	8
52200	*Cheumatopsyche sp*	F	C	1010	8.28	8	8
52530	*Hydropsyche depravata group*	F	C	167	1.37	8	8
77120	*Ablabesmyia mallochi*	F	D	0	0.00	8	8
95100	*Physella sp*	T	N	5	0.04	8	8
17200	*Caenis sp*	F	M	4	0.03	7	7
68075	*Psephenus herricki*	MI	O	0	0.00	7	7
69400	*Stenelmis sp*	F	O	8	0.07	7	7
74100	*Simulium sp*	F	D	108	0.89	7	7
83040	*Dicrotendipes neomodestus*	F	D	130	1.07	7	7
13521	*Stenonema femoratum*	F	M	84	0.69	6	6
22001	Coenagrionidae	T	O	0	0.00	6	6
50315	*Chimarra obscura*	MI	C	94	0.77	6	6
52430	*Ceratopsyche morosa group*	MI	C	875	7.17	6	6
53800	*Hydroptila sp*	F	C	82	0.67	6	6
71900	*Tipula sp*	F	D	2	0.02	6	7
77500	*Conchapelopia sp*	F	D	201	1.65	6	6
77800	*Helopelopia sp*	F	D	219	1.80	6	6
84450	*Polypedilum (Uresipedilum) flavum*	F	D	2573	21.10	6	6
22300	*Argia sp*	F	O	22	0.18	5	6
51250	*Holocentropus sp*	F	C	0	0.00	5	5
59970	*Petrophila sp*	MI	O	9	0.07	5	5
82820	*Cryptochironomus sp*	F	D	0	0.00	5	5
84210	*Paratendipes albimanus or P. duplicatus*	F	D	16	0.13	5	5
84470	*Polypedilum (P.) illinoense*	T	D	279	2.29	5	6
21001	Calopterygidae	F	O	3	0.02	4	4
72900	*Culex sp*	T	D	0	0.00	4	4
78655	*Procladius (Holotanypus) sp*	MT	D	0	0.00	4	4
83820	*Microtendipes "caelum" (sensu Simpson & E*	MI	D	0	0.00	4	4
84300	*Phaenopsectra obediens group*	F	D	0	0.00	4	4
85625	*Rheotanytarsus sp*	F	T	948	7.77	4	6
85840	*Tanytarsus sepp*	F	T	42	0.34	4	4
04935	*Erpobdella punctata punctata*	MT	N	0	0.00	3	3
04985	*Barbronia weberi*	MT	N	0	0.00	3	3
06700	*Crangonyx sp*	MT	N	0	0.00	3	3
84540	*Polypedilum (Tripodura) scalaenum group*	F	D	76	0.62	3	5
85800	*Tanytarsus sp*	F	T	48	0.39	3	3

***Appendix Table B-4**. continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abun-dance	Percent	Qual Samples	All Samples
85821	*Tanytarsus glabrescens group sp 7*	F	T	1462	11.99	3	5
87540	*Hemerodromia sp*	F	D	26	0.21	3	3
06201	*Hyalella azteca*	F	N	11	0.09	2	2
21200	*Calopteryx sp*	F	O	9	0.07	2	2
51300	*Neureclipsis sp*	MI	C	11	0.09	2	2
54160	*Ochrotrichia sp*	MI	C	0	0.00	2	2
60900	*Peltodytes sp*	MT	O	0	0.00	2	2
68601	*Ancyronyx variegata*	F	O	1	0.01	2	3
68708	*Dubiraphia vittata group*	F	O	0	0.00	2	2
71300	*Limonia sp*	F	D	0	0.00	2	2
72700	*Anopheles sp*	F	D	0	0.00	2	2
74650	*Atrichopogon sp*	F	D	0	0.00	2	2
77750	*Hayesomyia senata or Thienemannimyia nc*	F	D	33	0.27	2	3
78601	*Pentaneura inyoensis*	F	D	0	0.00	2	2
80310	*Cardiocladius obscurus*	MI	D	0	0.00	2	2
80410	*Cricotopus (C.) sp*	F	D	0	0.00	2	2
80420	*Cricotopus (C.) bicinctus*	T	D	15	0.12	2	3
81650	*Parametriocnemus sp*	F	D	10	0.08	2	3
82730	*Chironomus (C.) decorus group*	T	D	0	0.00	2	2
83840	*Microtendipes pedellus group*	F	D	0	0.00	2	2
84700	*Stenochironomus sp*	F	D	0	0.00	2	2
85500	*Paratanytarsus sp*	F	T	86	0.71	2	2
97601	*Corbicula fluminea*	F	N	1	0.01	2	2
03000	*Ectoprocta*	F		0	0.00	1	1
04666	*Helobdella papillata*	MT	N	0	0.00	1	1
04901	Erpobdellidae	MT	N	0	0.00	1	1
06501	Gammaridae		N	0	0.00	1	1
11014	*Acentrella turbida*	I	M	0	0.00	1	1
11670	*Procloeon viridoculare*	MI	M	0	0.00	1	1
13100	*Nixe sp*	MI	M	0	0.00	1	1
16700	*Tricorythodes sp*	MI	M	0	0.00	1	1
21604	*Archilestes grandis*	T	O	0	0.00	1	1
23909	*Boyeria vinosa*	F	O	0	0.00	1	1
26600	*Didymops transversa*	MT	O	0	0.00	1	1
26700	*Macromia sp*	MI	O	0	0.00	1	1
27000	Corduliidae or Libellulidae		O	0	0.00	1	1
27307	*Epitheca (Epicordulia) princeps*	MT	O	0	0.00	1	1
27400	*Neurocordulia sp*	F	O	0	0.00	1	1
43570	*Neoplea sp*	F	O	0	0.00	1	1
51050	*Cernotina sp*	MI	C	0	0.00	1	1
53201	*Glossosomatidae*	MI	C	0	0.00	1	1
53501	*Hydroptilidae*	F	C	0	0.00	1	1

Appendix Table B-4. *continued.*

Taxa Code	Taxa Name	Toler-ance	Taxa Group	Abun-dance	Percent	Qual Samples	All Samples
59300	*Mystacides sp*	MI	C	0	0.00	1	1
59580	*Oecetis persimilis*	MI	C	1	0.01	1	1
65800	*Berosus sp*	MT	O	0	0.00	1	1
68025	*Ectopria sp*	F	O	0	0.00	1	1
70501	Tipulidae		D	0	0.00	1	1
70600	*Antocha sp*	MI	D	0	0.00	1	1
72501	Culicidae	MT	D	0	0.00	1	1
77130	*Ablabesmyia rhamphe group*	MT	D	0	0.00	1	1
78350	*Meropelopia sp*	F	D	0	0.00	1	1
78650	*Procladius sp*	MT	D	0	0.00	1	1
78750	*Rheopelopia paramaculipennis*	MI	D	21	0.17	1	2
79720	*Diamesa sp*	F	D	0	0.00	1	1
79760	*Pagastia sp*	F	D	0	0.00	1	1
80440	*Cricotopus (C.) trifascia*	F	D	0	0.00	1	1
81690	*Paratrichocladius sp*	MI	D	0	0.00	1	1
81825	*Rheocricotopus (Psilocricotopus) robacki*	F	D	0	0.00	1	1
82141	*Thienemanniella xena*	F	D	12	0.10	1	2
82710	*Chironomus (C.) sp*	MT	D	0	0.00	1	1
82822	*Cryptochironomus eminentia*	F	D	0	0.00	1	1
83003	*Dicrotendipes fumidus*	F	D	42	0.34	1	1
83900	*Nilothauma sp*	F	D	0	0.00	1	1
85210	*Cladotanytarsus species group B*	MI	T	0	0.00	1	1
85260	*Cladotanytarsus vanderwulpi group*		T	0	0.00	1	1
93200	*Hydrobiidae*	F	N	1	0.01	1	2
96900	*Ferrissia sp*	F	N	43	0.35	1	3
01900	*Nemertea*	F	N	16	0.13	0	1
08601	*Hydrachnidia*	F	N	24	0.20	0	1
12200	*Isonychia sp*	MI	M	10	0.08	0	2
13400	*Stenacron sp*	F	M	134	1.10	0	2
13500	*Maccaffertium sp*	MI	M	12	0.10	0	2
13561	*Maccaffertium pulchellum*	MI	M	1	0.01	0	1
51206	*Cyrnellus fraternus*	F	C	8	0.07	0	1
52570	*Hydropsyche simulans*	MI	C	1	0.01	0	1
71910	*Tipula abdominalis*	F	D	5	0.04	0	1
74673	*Atrichopogon websteri*	F	D	2	0.02	0	1
77001	Tanypodinae		D	10	0.08	0	1
78450	*Nilotanypus fimbriatus*	F	D	42	0.34	0	3
80350	*Corynoneura sp*		D	16	0.13	0	2
80370	*Corynoneura lobata*	F	D	40	0.33	0	3
80411	*Cricotopus (Isocladius) sp nr. absurdus*	MT	D	15	0.12	0	1
80430	*Cricotopus (C.) tremulus group*	MT	D	29	0.24	0	1
82100	*Thienemanniella sp*		D	16	0.13	0	2
84960	*Pseudochironomus sp*	F	D	85	0.70	0	2
85615	*Rheotanytarsus pellucidus*	MI	T	20	0.16	0	1
96120	*Menetus (Micromenetus) dilatatus*	MT	N	4	0.03	0	1

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/12/2022* RM: **27.90**

Site ID: **LM01** Location: *dst. SR 23/3 Little Miami State Park* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	213 +
03000	Ectoprocta		F	1
03360	Plumatella sp		F	+
03600	Oligochaeta		T	+
04666	Helobdella papillata		MT	+
04901	Erpobdellidae		MT	+
05800	Caecidotea sp		T	+
05900	Lirceus sp		MT	+
06201	Hyalella azteca		F	+
08200	Orconectes sp		F	+
08601	Hydrachnidia		F	+
11014	Acentrella turbida		I	+
11119	Plauditus dubius or P. virilis		I	+
11130	Baetis intercalaris		F	119 +
11651	Procloeon sp (w/o hindwing pads)		MI	+
11670	Procloeon viridoculare		MI	+
12200	Isonychia sp		MI	20 +
13000	Leucrocuta sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	61 +
13521	Stenonema femoratum		F	+
13540	Maccaffertium mediopunctatum		MI	17 +
13561	Maccaffertium pulchellum		MI	9 +
13570	Maccaffertium terminatum		MI	128 +
16700	Tricorythodes sp		MI	8 +
17200	Caenis sp		F	+
18600	Ephemera sp		MI	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
23905	Boyeria grafiana	X	MI	+
23909	Boyeria vinosa		F	+
24900	Gomphus sp		F	+
25010	Hagenius brevistylus		F	+
26700	Macromia sp		MI	+
34700	Agnetina capitata complex		MI	+
42700	Belostoma sp		T	+
43570	Neoplea sp		F	+
48410	Corydalus cornutus		MI	+
50301	Chimarra aterrima		MI	+
50315	Chimarra obscura		MI	+
51050	Cernotina sp		MI	+
51300	Neureclipsis sp		MI	12 +
52200	Cheumatopsyche sp		F	589 +
52430	Ceratopsyche morosa group		MI	286 +
52510	Hydropsyche aerata		MI	18
52530	Hydropsyche depravata group		F	5
52570	Hydropsyche simulans		MI	+
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	6 +
54100	Neotrichia sp		F	+
54160	Ochrotrichia sp		MI	+
58505	Helicopsyche borealis		MI	+
59140	Ceraclea maculata		MI	+
59300	Mystacides sp		MI	+
59407	Nectopsyche candida		MI	+
59580	Oecetis persimilis		MI	+
59970	Petrophila sp		MI	20 +
60900	Peltodytes sp		MT	+
65800	Berosus sp		MT	+
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	+
68601	Ancyronyx variegata		F	1 +
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	5 +
69400	Stenelmis sp		F	+
71900	Tipula sp		F	+
74100	Simulium sp		F	+
77001	Tanypodinae			+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	2
77750	Hayesomyia senata or Thienemannimyia norena		F	2 +
77800	Helopelopia sp		F	+
78450	Nilotanypus fimbriatus		F	9
78600	Pentaneura inconspicua		F	+
78655	Procladius (Holotanypus) sp		MT	+
80310	Cardiocladius obscurus		MI	+
81240	Nanocladius (N.) distinctus		MT	+
82220	Tvetenia discoloripes group		MI	14
82730	Chironomus (C.) decorus group		T	+
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	+
83400	Harnischia sp		F	+
83840	Microtendipes pedellus group		F	+
84040	Parachironomus frequens		F	+

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/12/2022* RM: **27.90**

Site ID: **LM01** Location: *dst. SR 23/3 Little Miami State Park* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
84450	Polypedilum (Uresipedilum) flavum		F	38 +
84470	Polypedilum (P.) illinoense		T	2 +
84520	Polypedilum (Tripodura) halterale group		MT	+
84540	Polypedilum (Tripodura) scalaenum group		F	+
85260	Cladotanytarsus vanderwulpi group			+
85625	Rheotanytarsus sp		F	89 +
85800	Tanytarsus sp		F	+
87540	Hemerodromia sp		F	+
93900	Elimia sp		MI	+
97601	Corbicula fluminea		F	+
97710	Dreissena polymorpha		F	1 +
98600	Sphaerium sp		F	+

No. Quantitative Taxa:	26	Total Taxa;	97
No. Qualitative Taxa:	91	ICI:	42
Number of Organisms:	1675	Qual EPT:	33

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/12/2022* RM: **24.10**

Site ID: **LM02** Location: *ust. O'Bannon Creek* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	22 +
03000	Ectoprocta		F	1
03600	Oligochaeta		T	+
05800	Caecidotea sp		T	+
05900	Lirceus sp		MT	+
06700	Crangonyx sp		MT	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	+
11118	Plauditus dubius		MI	7 +
11130	Baetis intercalaris		F	81 +
11620	Paracloeodes minutus		MI	+
11670	Procloeon viridoculare		MI	+
12200	Isonychia sp		MI	18 +
13000	Leucrocuta sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	43
13521	Stenonema femoratum		F	+
13540	Maccaffertium mediopunctatum		MI	2 +
13561	Maccaffertium pulchellum		MI	2 +
13570	Maccaffertium terminatum		MI	38 +
16700	Tricorythodes sp		MI	78 +
17200	Caenis sp		F	+
18600	Ephemera sp		MI	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
23909	Boyeria vinosa		F	+
24900	Gomphus sp		F	+
25010	Hagenius brevistylus		F	+
26700	Macromia sp		MI	+
34700	Agnetina capitata complex		MI	+
48410	Corydalus cornutus		MI	+
50315	Chimarra obscura		MI	+
51050	Cernotina sp		MI	1
51300	Neureclipsis sp		MI	24 +
52200	Cheumatopsyche sp		F	212 +
52430	Ceratopsyche morosa group		MI	192 +
52510	Hydropsyche aerata		MI	65
52570	Hydropsyche simulans		MI	1
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	5 +
54100	Neotrichia sp		F	+
58505	Helicopsyche borealis		MI	+
59100	Ceraclea sp		MI	4
59140	Ceraclea maculata		MI	+
59407	Nectopsyche candida		MI	+
59415	Nectopsyche exquisita		MI	+
59570	Oecetis nocturna		F	+
59580	Oecetis persimilis		MI	1 +
59700	Triaenodes sp		MI	+
59970	Petrophila sp		MI	17 +
60900	Peltodytes sp		MT	+
65800	Berosus sp		MT	+
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	1 +
69400	Stenelmis sp		F	+
74100	Simulium sp		F	3 +
77120	Ablabesmyia mallochi		F	+
77470	Coelotanypus sp		T	+
77500	Conchapelopia sp		F	4 +
77750	Hayesomyia senata or Thienemannimyia norena		F	4
78100	Labrundinia sp		F	+
78450	Nilotanypus fimbriatus		F	8
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	13
80310	Cardiocladius obscurus		MI	4
82220	Tvetenia discoloripes group		MI	34
82820	Cryptochironomus sp		F	+
84450	Polypedilum (Uresipedilum) flavum		F	161 +
84470	Polypedilum (P.) illinoense		T	+
84700	Stenochironomus sp		F	17
85500	Paratanytarsus sp		F	+
85625	Rheotanytarsus sp		F	195 +
85800	Tanytarsus sp		F	+
85821	Tanytarsus glabrescens group sp 7		F	+
85840	Tanytarsus sepp		F	+
87540	Hemerodromia sp		F	4
93200	Hydrobiidae		F	+
93900	Elimia sp		MI	+
96900	Ferrissia sp		F	+
97601	Corbicula fluminea		F	+
97710	Dreissena polymorpha		F	+
98600	Sphaerium sp		F	+
99700	Potamilus alatus		MI	+

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/12/2022* RM: **24.10**

Site ID: **LM02** Location: *ust. O'Bannon Creek* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.

No. Quantitative Taxa:	32	Total Taxa;	85
No. Qualitative Taxa:	72	ICI:	50
Number of Organisms:	1262	Qual EPT:	30

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/12/2022* RM: **22.30**

Site ID: **LM03** Location: *ust. Polk Run* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	76 +
03360	Plumatella sp		F	+
03600	Oligochaeta		T	+
04935	Erpobdella punctata punctata		MT	+
05900	Lirceus sp		MT	+
06201	Hyalella azteca		F	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	+
11118	Plauditus dubius		MI	21 +
11130	Baetis intercalaris		F	243 +
11620	Paracloeodes minutus		MI	+
11650	Procloeon sp (w/ hindwing pads)		MI	+
11670	Procloeon viridoculare		MI	+
12200	Isonychia sp		MI	32 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	48 +
13540	Maccaffertium mediopunctatum		MI	13 +
13550	Maccaffertium mexicanum integrum		MI	2
13561	Maccaffertium pulchellum		MI	57 +
13570	Maccaffertium terminatum		MI	43 +
16700	Tricorythodes sp		MI	36 +
18600	Ephemera sp		MI	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
24900	Gomphus sp		F	+
25010	Hagenius brevistylus		F	+
26700	Macromia sp		MI	+
43300	Ranatra sp		F	+
48410	Corydalus cornutus		MI	+
50315	Chimarra obscura		MI	+
51300	Neureclipsis sp		MI	24 +
52200	Cheumatopsyche sp		F	536 +
52430	Ceratopsyche morosa group		MI	180 +
52510	Hydropsyche aerata		MI	7
52570	Hydropsyche simulans		MI	+
53400	Protoptila sp		I	15 +
53800	Hydroptila sp		F	5 +
54100	Neotrichia sp		F	+
59100	Ceraclea sp		MI	+
59407	Nectopsyche candida		MI	+
59580	Oecetis persimilis		MI	+
59700	Triaenodes sp		MI	+
59970	Petrophila sp		MI	9 +
60900	Peltodytes sp		MT	+
67880				+
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	+
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	4 +
69400	Stenelmis sp		F	+
72501	Culicidae		MT	+
74100	Simulium sp		F	35 +
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77500	Conchapelopia sp		F	+
77750	Hayesomyia senata or Thienemannimyia norena		F	6 +
78450	Nilotanypus fimbriatus		F	11
78655	Procladius (Holotanypus) sp		MT	+
80310	Cardiocladius obscurus		MI	3 +
81650	Parametriocnemus sp	X	F	+
82130	Thienemanniella similis		MI	6
82220	Tvetenia discoloripes group		MI	17 +
83840	Microtendipes pedellus group		F	6 +
84450	Polypedilum (Uresipedilum) flavum		F	74 +
84470	Polypedilum (P.) illinoense		T	3
84540	Polypedilum (Tripodura) scalaenum group		F	3 +
84700	Stenochironomus sp		F	17
85625	Rheotanytarsus sp		F	135
85800	Tanytarsus sp		F	3
87540	Hemerodromia sp		F	+
93900	Elimia sp		MI	4 +
96900	Ferrissia sp		F	+
97601	Corbicula fluminea		F	+
97710	Dreissena polymorpha		F	+
98600	Sphaerium sp		F	+

No. Quantitative Taxa:	32	Total Taxa;	78
No. Qualitative Taxa:	70	ICI:	52
Number of Organisms:	1674	Qual EPT:	28

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/15/2022* RM: **21.50**

Site ID: **LM05** Location: *dst. Polk Run* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	102 +
03000	Ectoprocta		F	3
03360	Plumatella sp		F	+
03600	Oligochaeta		T	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	2 +
11119	Plauditus dubius or P. virilis		I	+
11130	Baetis intercalaris		F	1168 +
11620	Paracloeodes minutus		MI	+
12200	Isonychia sp		MI	30 +
13000	Leucrocuta sp		MI	+
13400	Stenacron sp		F	24 +
13510	Maccaffertium exiguum		MI	16 +
13521	Stenonema femoratum		F	5 +
13540	Maccaffertium mediopunctatum		MI	8 +
13561	Maccaffertium pulchellum		MI	5 +
13570	Maccaffertium terminatum		MI	69 +
16700	Tricorythodes sp		MI	28 +
17200	Caenis sp		F	+
18100	Anthopotamus sp		MI	+
21200	Calopteryx sp		F	+
21300	Hetaerina sp		F	1 +
22001	Coenagrionidae		T	+
22300	Argia sp		F	3 +
24900	Gomphus sp		F	+
25010	Hagenius brevistylus		F	+
26700	Macromia sp		MI	+
34715	Agnetina flavescens		I	+
48410	Corydalus cornutus		MI	1 +
50315	Chimarra obscura		MI	13 +
51206	Cyrnellus fraternus		F	1
51300	Neureclipsis sp		MI	4 +
52200	Cheumatopsyche sp		F	547 +
52430	Ceratopsyche morosa group		MI	255 +
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	+
54160	Ochrotrichia sp		MI	10 +
59407	Nectopsyche candida		MI	1 +
59415	Nectopsyche exquisita		MI	+
59570	Oecetis nocturna		F	+
59580	Oecetis persimilis		MI	+
59970	Petrophila sp		MI	1 +
65800	Berosus sp		MT	+
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	1 +
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	20 +
69400	Stenelmis sp		F	+
74100	Simulium sp		F	129 +
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77500	Conchapelopia sp		F	5
77750	Hayesomyia senata or Thienemannimyia norena		F	20
77800	Helopelopia sp		F	15 +
78140	Labrundinia pilosella		F	+
78450	Nilotanypus fimbriatus		F	10 +
78750	Rheopelopia paramaculipennis		MI	15
80310	Cardiocladius obscurus		MI	+
81240	Nanocladius (N.) distinctus		MT	10
82220	Tvetenia discoloripes group		MI	15 +
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	+
83300	Glyptotendipes (G.) sp		MT	5
83400	Harnischia sp		F	+
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	5 +
84450	Polypedilum (Uresipedilum) flavum		F	156 +
84460	Polypedilum (P.) fallax group		F	5
84470	Polypedilum (P.) illinoense		T	+
84540	Polypedilum (Tripodura) scalaenum group		F	5 +
84700	Stenochironomus sp		F	34
85230	Cladotanytarsus mancus group		F	+
85625	Rheotanytarsus sp		F	83 +
85821	Tanytarsus glabrescens group sp 7		F	5 +
85840	Tanytarsus sepp		F	+
87540	Hemerodromia sp		F	10 +
93900	Elimia sp		MI	11 +
96900	Ferrissia sp		F	18 +
97601	Corbicula fluminea		F	+
98001	Pisidiidae			1
99240	Lasmigona complanata		MI	+

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/15/2022* RM: **21.50**

Site ID: **LM05** Location: *dst. Polk Run* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.

No. Quantitative Taxa:	45	Total Taxa;	81
No. Qualitative Taxa:	71	ICI:	52
Number of Organisms:	2875	Qual EPT:	27

River Code: **11-001** River: *Little Miami River* Coll. Date *08/15/2022* RM: **18.50**

Site ID: **LM07** Location: *Camargo Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	33 +
03000	Ectoprocta		F	1 +
03600	Oligochaeta		T	1 +
04660	Helobdella sp		MT	+
04666	Helobdella papillata		MT	+
04901	Erpobdellidae		MT	+
05900	Lirceus sp		MT	+
06201	Hyalella azteca		F	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	+
11015	Acerpenna sp		MI	+
11118	Plauditus dubius		MI	+
11130	Baetis intercalaris		F	158 +
11620	Paracloeodes minutus		MI	+
11670	Procloeon viridoculare		MI	+
12200	Isonychia sp		MI	42 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	1 +
13521	Stenonema femoratum		F	+
13540	Maccaffertium mediopunctatum		MI	1 +
13561	Maccaffertium pulchellum		MI	5 +
13570	Maccaffertium terminatum		MI	55 +
16700	Tricorythodes sp		MI	12 +
17200	Caenis sp		F	+
18600	Ephemera sp		MI	+
21001	Calopterygidae		F	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
23905	Boyeria grafiana	X	MI	+
24900	Gomphus sp		F	+
25010	Hagenius brevistylus		F	+
34700	Agnetina capitata complex		MI	+
48410	Corydalus cornutus		MI	2 +
50315	Chimarra obscura		MI	10 +
51300	Neureclipsis sp		MI	10 +
52200	Cheumatopsyche sp		F	606 +
52430	Ceratopsyche morosa group		MI	361 +
52510	Hydropsyche aerata		MI	13
52570	Hydropsyche simulans		MI	2
53400	Protoptila sp		I	50 +
53800	Hydroptila sp		F	18 +
54160	Ochrotrichia sp		MI	+
59100	Ceraclea sp		MI	1 +
59407	Nectopsyche candida		MI	+
59580	Oecetis persimilis		MI	+
59724	Triaenodes injustus		MI	+
59970	Petrophila sp		MI	+
65800	Berosus sp		MT	+
67800	Tropisternus sp		T	+
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	+
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	10 +
69400	Stenelmis sp		F	+
74100	Simulium sp		F	130 +
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	8
77750	Hayesomyia senata or Thienemannimyia norena		F	16 +
78140	Labrundinia pilosella		F	+
78350	Meropelopia sp	X	F	+
78450	Nilotanypus fimbriatus		F	32
80310	Cardiocladius obscurus		MI	+
80420	Cricotopus (C.) bicinctus		T	+
81240	Nanocladius (N.) distinctus		MT	8
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	24 +
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	8
84155	Paralauterborniella nigrohalteralis		F	+
84450	Polypedilum (Uresipedilum) flavum		F	331 +
84470	Polypedilum (P.) illinoense		T	+
84520	Polypedilum (Tripodura) halterale group		MT	55
84540	Polypedilum (Tripodura) scalaenum group		F	16 +
84700	Stenochironomus sp		F	39
85200	Cladotanytarsus sp			8
85230	Cladotanytarsus mancus group		F	+
85625	Rheotanytarsus sp		F	213 +
85821	Tanytarsus glabrescens group sp 7		F	8
85840	Tanytarsus sepp		F	+
87540	Hemerodromia sp		F	2

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/15/2022* RM: **18.50**

Site ID: **LM07** Location: *Camargo Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
93200	Hydrobiidae		**F**	+					
93900	Elimia sp		**MI**	+					
95100	Physella sp		**T**	+					
96900	Ferrissia sp		**F**	+					
97601	Corbicula fluminea		**F**	1					
97710	Dreissena polymorpha		**F**	+					
98600	Sphaerium sp		**F**	+					

No. Quantitative Taxa:	37	Total Taxa;	90
No. Qualitative Taxa:	78	ICI:	48
Number of Organisms:	2291	Qual EPT:	30

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/15/2022* RM: **17.70**

Site ID: **LM08** Location: *canoe access dst. SR126* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	64 +
03000	Ectoprocta		F	3
04901	Erpobdellidae		MT	+
05800	Caecidotea sp		T	+
05900	Lirceus sp		MT	+
06201	Hyalella azteca		F	+
06700	Crangonyx sp		MT	+
08200	Orconectes sp		F	+
11118	Plauditus dubius		MI	4 +
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	14 +
11620	Paracloeodes minutus		MI	+
12200	Isonychia sp		MI	54 +
13000	Leucrocuta sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	28 +
13521	Stenonema femoratum		F	+
13540	Maccaffertium mediopunctatum		MI	3 +
13561	Maccaffertium pulchellum		MI	5 +
13570	Maccaffertium terminatum		MI	36 +
16700	Tricorythodes sp		MI	19 +
18600	Ephemera sp		MI	+
21200	Calopteryx sp		F	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
23905	Boyeria grafiana	X	MI	+
23909	Boyeria vinosa		F	+
24900	Gomphus sp		F	+
26700	Macromia sp		MI	+
48410	Corydalus cornutus		MI	+
50315	Chimarra obscura		MI	+
51206	Cyrnellus fraternus		F	5 +
51300	Neureclipsis sp		MI	9 +
51600	Polycentropus sp		MI	+
52200	Cheumatopsyche sp		F	589 +
52430	Ceratopsyche morosa group		MI	299 +
52510	Hydropsyche aerata		MI	7
52510	Hydropsyche aerata		MI	+
52570	Hydropsyche simulans		MI	6
52801	Potamyia flava		MI	1
53400	Protoptila sp		I	13 +
53800	Hydroptila sp		F	4 +
59407	Nectopsyche candida		MI	+
59415	Nectopsyche exquisita		MI	+
59970	Petrophila sp		MI	+
65800	Berosus sp		MT	+
68075	Psephenus herricki		MI	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	5 +
69400	Stenelmis sp		F	+
74100	Simulium sp		F	1 +
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77470	Coelotanypus sp		T	+
77500	Conchapelopia sp		F	8
77750	Hayesomyia senata or Thienemannimyia norena		F	8 +
77800	Helopelopia sp		F	+
78450	Nilotanypus fimbriatus		F	4
78655	Procladius (Holotanypus) sp		MT	+
80310	Cardiocladius obscurus		MI	8
81240	Nanocladius (N.) distinctus		MT	23
82730	Chironomus (C.) decorus group		T	+
82822	Cryptochironomus eminentia		F	+
83000	Dicrotendipes sp		F	16
83040	Dicrotendipes neomodestus		F	31 +
83050	Dicrotendipes lucifer		MT	+
84020	Parachironomus carinatus		F	+
84155	Paralauterborniella nigrohalteralis		F	+
84450	Polypedilum (Uresipedilum) flavum		F	194 +
84470	Polypedilum (P.) illinoense		T	+
84520	Polypedilum (Tripodura) halterale group		MT	+
84700	Stenochironomus sp		F	39
85200	Cladotanytarsus sp			+
85625	Rheotanytarsus sp		F	520 +
85800	Tanytarsus sp		F	+
85840	Tanytarsus sepp		F	+
93900	Elimia sp		MI	+
95100	Physella sp		T	+
97710	Dreissena polymorpha		F	+
98600	Sphaerium sp		F	+

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/15/2022* RM: **17.70**

Site ID: **LM08** Location: *canoe access dst. SR126* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.

No. Quantitative Taxa:	31	Total Taxa;	81
No. Qualitative Taxa:	71	ICI:	50
Number of Organisms:	2020	Qual EPT:	25

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/16/2022* RM: **13.10**

Site ID: **LM09** Location: *Wooster Pike- Milford* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	61 +
03000	Ectoprocta		F	1 +
03600	Oligochaeta		T	+
04510	Hirudinida		MT	+
06201	Hyalella azteca		F	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	+
11118	Plauditus dubius		MI	40 +
11130	Baetis intercalaris		F	190 +
11670	Procloeon viridoculare		MI	+
12200	Isonychia sp		MI	18 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	11 +
13521	Stenonema femoratum		F	+
13540	Maccaffertium mediopunctatum		MI	18 +
13550	Maccaffertium mexicanum integrum		MI	+
13561	Maccaffertium pulchellum		MI	79 +
13570	Maccaffertium terminatum		MI	77 +
16700	Tricorythodes sp		MI	29 +
17200	Caenis sp		F	+
18100	Anthopotamus sp		MI	+
18600	Ephemera sp		MI	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
26700	Macromia sp		MI	+
34715	Agnetina flavescens		I	+
44501	Corixidae		F	+
48410	Corydalus cornutus		MI	+
50315	Chimarra obscura		MI	1 +
51050	Cernotina sp		MI	+
51300	Neureclipsis sp		MI	2 +
52200	Cheumatopsyche sp		F	1080 +
52430	Ceratopsyche morosa group		MI	513 +
52510	Hydropsyche aerata		MI	1
52560	Hydropsyche orris		MI	1
52801	Potamyia flava		MI	1
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	25 +
59100	Ceraclea sp		MI	9
59407	Nectopsyche candida		MI	+
59970	Petrophila sp		MI	35 +
60900	Peltodytes sp		MT	+
65800	Berosus sp		MT	+
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	8 +
69400	Stenelmis sp		F	2 +
71900	Tipula sp		F	+
72501	Culicidae		MT	+
74100	Simulium sp		F	1 +
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77470	Coelotanypus sp		T	+
77500	Conchapelopia sp		F	7 +
77750	Hayesomyia senata or Thienemannimyia norena		F	7 +
77800	Helopelopia sp		F	+
78450	Nilotanypus fimbriatus		F	17
78655	Procladius (Holotanypus) sp		MT	+
80310	Cardiocladius obscurus		MI	29 +
80410	Cricotopus (C.) sp		F	+
81240	Nanocladius (N.) distinctus		MT	29
82100	Thienemanniella sp			+
82220	Tvetenia discoloripes group		MI	+
83040	Dicrotendipes neomodestus		F	+
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	29 +
84450	Polypedilum (Uresipedilum) flavum		F	271 +
84700	Stenochironomus sp		F	15
85200	Cladotanytarsus sp			+
85625	Rheotanytarsus sp		F	498 +
85821	Tanytarsus glabrescens group sp 7		F	+
87540	Hemerodromia sp		F	8
93900	Elimia sp		MI	+
95100	Physella sp		T	+
96900	Ferrissia sp		F	+
97601	Corbicula fluminea		F	+
98600	Sphaerium sp		F	+

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/16/2022* RM: **13.10**

Site ID: **LM09** Location: *Wooster Pike- Milford* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.

No. Quantitative Taxa:	33	Total Taxa;	79
No. Qualitative Taxa:	71	ICI:	52
Number of Organisms:	3113	Qual EPT:	27

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/16/2022* RM: **10.90**

Site ID: **LM11** Location: *intersection of Mt. Carmel and Round Bottom Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	102 +
03000	Ectoprocta		**F**	1 +
03360	Plumatella sp		**F**	+
03600	Oligochaeta		**T**	+
04683	Placobdella multilineata		**F**	+
04935	Erpobdella punctata punctata		**MT**	+
05800	Caecidotea sp		**T**	+
06201	Hyalella azteca		**F**	+
06700	Crangonyx sp		**MT**	+
08200	Orconectes sp		**F**	+
11014	Acentrella turbida		**I**	+
11015	Acerpenna sp		**MI**	+
11118	Plauditus dubius		**MI**	+
11130	Baetis intercalaris		**F**	72 +
11651	Procloeon sp (w/o hindwing pads)		**MI**	+
12200	Isonychia sp		**MI**	89 +
13000	Leucrocuta sp		**MI**	+
13100	Nixe sp		**MI**	+
13400	Stenacron sp		**F**	+
13510	Maccaffertium exiguum		**MI**	14 +
13521	Stenonema femoratum		**F**	+
13540	Maccaffertium mediopunctatum		**MI**	3 +
13561	Maccaffertium pulchellum		**MI**	49 +
13570	Maccaffertium terminatum		**MI**	62 +
16700	Tricorythodes sp		**MI**	20 +
17200	Caenis sp		**F**	+
18600	Ephemera sp		**MI**	+
21300	Hetaerina sp		**F**	+
22001	Coenagrionidae		**T**	+
22300	Argia sp		**F**	+
24820	Gomphurus externus		**MI**	+
26700	Macromia sp		**MI**	+
48410	Corydalus cornutus		**MI**	4 +
50315	Chimarra obscura		**MI**	3 +
51300	Neureclipsis sp		**MI**	3 +
52200	Cheumatopsyche sp		**F**	893 +
52430	Ceratopsyche morosa group		**MI**	52 +
52510	Hydropsyche aerata		**MI**	1
53400	Protoptila sp		**I**	+
53800	Hydroptila sp		**F**	+
59140	Ceraclea maculata		**MI**	+
59407	Nectopsyche candida		**MI**	+
59724	Triaenodes injustus		**MI**	+
59970	Petrophila sp		**MI**	+
65800	Berosus sp		**MT**	+
68075	Psephenus herricki		**MI**	+
68130	Helichus sp		**F**	+
68601	Ancyronyx variegata		**F**	3 +
68708	Dubiraphia vittata group		**F**	+
68901	Macronychus glabratus		**F**	1 +
69400	Stenelmis sp		**F**	+
72501	Culicidae		**MT**	+
74100	Simulium sp		**F**	1 +
77120	Ablabesmyia mallochi		**F**	+
77130	Ablabesmyia rhamphe group		**MT**	+
77470	Coelotanypus sp		**T**	+
77750	Hayesomyia senata or Thienemannimyia norena		**F**	15 +
78100	Labrundinia sp		**F**	+
78655	Procladius (Holotanypus) sp		**MT**	+
80310	Cardiocladius obscurus		**MI**	+
81240	Nanocladius (N.) distinctus		**MT**	+
82220	Tvetenia discoloripes group		**MI**	5
82730	Chironomus (C.) decorus group		**T**	+
82820	Cryptochironomus sp		**F**	+
83040	Dicrotendipes neomodestus		**F**	+
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		**MI**	+
84450	Polypedilum (Uresipedilum) flavum		**F**	167 +
84470	Polypedilum (P.) illinoense		**T**	+
84540	Polypedilum (Tripodura) scalaenum group		**F**	5
84700	Stenochironomus sp		**F**	20
85625	Rheotanytarsus sp		**F**	218 +
85821	Tanytarsus glabrescens group sp 7		**F**	5
85840	Tanytarsus sepp		**F**	+
93200	Hydrobiidae		**F**	+
93900	Elimia sp		**MI**	34 +
97601	Corbicula fluminea		**F**	+
98001	Pisidiidae			+

No. Quantitative Taxa:	26	Total Taxa;	77
No. Qualitative Taxa:	72	ICI:	42
Number of Organisms:	1842	Qual EPT:	26

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/16/2022* RM: **8.10**

Site ID: **LM12** Location: *Newtown Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	33
03000	Ectoprocta		F	2 +
03600	Oligochaeta		T	1
04935	Erpobdella punctata punctata		MT	+
05900	Lirceus sp		MT	+
06700	Crangonyx sp		MT	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	+
11118	Plauditus dubius		MI	1 +
11130	Baetis intercalaris		F	127 +
11620	Paracloeodes minutus		MI	+
12200	Isonychia sp		MI	90 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	1 +
13510	Maccaffertium exiguum		MI	6
13521	Stenonema femoratum		F	+
13540	Maccaffertium mediopunctatum		MI	2 +
13550	Maccaffertium mexicanum integrum		MI	+
13561	Maccaffertium pulchellum		MI	58 +
13570	Maccaffertium terminatum		MI	195 +
16700	Tricorythodes sp		MI	43 +
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	1
24900	Gomphus sp		F	+
26700	Macromia sp		MI	+
27400	Neurocordulia sp		F	+
34700	Agnetina capitata complex		MI	+
42700	Belostoma sp		T	+
48410	Corydalus cornutus		MI	1
50315	Chimarra obscura		MI	2 +
51206	Cyrnellus fraternus		F	2
51300	Neureclipsis sp		MI	20 +
52200	Cheumatopsyche sp		F	1408 +
52430	Ceratopsyche morosa group		MI	75 +
52520	Hydropsyche bidens		MI	3
52560	Hydropsyche orris		MI	1
52570	Hydropsyche simulans		MI	1
52801	Potamyia flava		MI	1
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	16 +
54160	Ochrotrichia sp		MI	+
59140	Ceraclea maculata		MI	2 +
59407	Nectopsyche candida		MI	+
59970	Petrophila sp		MI	18 +
65800	Berosus sp		MT	16 +
68075	Psephenus herricki		MI	+
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
69400	Stenelmis sp		F	1 +
72501	Culicidae		MT	+
74100	Simulium sp		F	+
77500	Conchapelopia sp		F	37
78100	Labrundinia sp		F	+
78450	Nilotanypus fimbriatus		F	28
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	12 +
80310	Cardiocladius obscurus		MI	+
82100	Thienemanniella sp			12 +
82220	Tvetenia discoloripes group		MI	12
83050	Dicrotendipes lucifer		MT	24 +
83300	Glyptotendipes (G.) sp		MT	12 +
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	+
84450	Polypedilum (Uresipedilum) flavum		F	330 +
84540	Polypedilum (Tripodura) scalaenum group		F	+
84700	Stenochironomus sp		F	24
85265	Cladotanytarsus vanderwulpi group sp 5		MI	+
85625	Rheotanytarsus sp		F	783 +
85821	Tanytarsus glabrescens group sp 7		F	12
93900	Elimia sp		MI	+
95100	Physella sp		T	+
97601	Corbicula fluminea		F	+
97710	Dreissena polymorpha		F	+
98600	Sphaerium sp		F	+

No. Quantitative Taxa:	39	Total Taxa;	75
No. Qualitative Taxa:	60	ICI:	56
Number of Organisms:	3413	Qual EPT:	24

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/17/2022* RM: **6.83**

Site ID: **LM13** Location: *RR Trestle-Mariemont* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	265 +
03000	Ectoprocta		F	1 +
03451	Urnatella gracilis		MI	+
03600	Oligochaeta		T	+
05800	Caecidotea sp		T	+
06700	Crangonyx sp		MT	+
08200	Orconectes sp		F	+
11014	Acentrella turbida		I	+
11119	Plauditus dubius or P. virilis		I	+
11130	Baetis intercalaris		F	343 +
11670	Procloeon viridoculare		MI	+
12200	Isonychia sp		MI	154 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	111 +
13540	Maccaffertium mediopunctatum		MI	4 +
13550	Maccaffertium mexicanum integrum		MI	29
13561	Maccaffertium pulchellum		MI	36 +
13570	Maccaffertium terminatum		MI	145 +
16700	Tricorythodes sp		MI	25 +
18600	Ephemera sp		MI	+
18700	Hexagenia sp		F	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
26700	Macromia sp		MI	+
27400	Neurocordulia sp		F	+
34715	Agnetina flavescens		I	+
48410	Corydalus cornutus		MI	2 +
50315	Chimarra obscura		MI	1 +
51050	Cernotina sp		MI	2
51300	Neureclipsis sp		MI	3 +
51600	Polycentropus sp		MI	550 +
52200	Cheumatopsyche sp		F	116 +
52430	Ceratopsyche morosa group		MI	+
52520	Hydropsyche bidens		MI	2
52560	Hydropsyche orris		MI	4
52570	Hydropsyche simulans		MI	2 +
52801	Potamyia flava		MI	+
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	34 +

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
54160	Ochrotrichia sp		MI	+
59100	Ceraclea sp		MI	+
59407	Nectopsyche candida		MI	+
59724	Triaenodes injustus		MI	+
59970	Petrophila sp		MI	+
65800	Berosus sp		MT	+
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	+
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
68901	Macronychus glabratus		F	11
69400	Stenelmis sp		F	9 +
74100	Simulium sp		F	9 +
77120	Ablabesmyia mallochi		F	+
77750	Hayesomyia senata or Thienemannimyia norena		F	40 +
78100	Labrundinia sp		F	+
78450	Nilotanypus fimbriatus		F	40
78655	Procladius (Holotanypus) sp		MT	+
80310	Cardiocladius obscurus		MI	+
80420	Cricotopus (C.) bicinctus		T	+
81060	Lopescladius sp		MI	6
82820	Cryptochironomus sp		F	+
83050	Dicrotendipes lucifer		MT	6
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	6
84155	Paralauterborniella nigrohalteralis		F	+
84300	Phaenopsectra obediens group		F	6
84450	Polypedilum (Uresipedilum) flavum		F	68 +
84460	Polypedilum (P.) fallax group		F	6
84470	Polypedilum (P.) illinoense		T	+
84540	Polypedilum (Tripodura) scalaenum group		F	62 +
84700	Stenochironomus sp		F	11
85625	Rheotanytarsus sp		F	244 +
87540	Hemerodromia sp		F	+
93900	Elimia sp		MI	8 +
96900	Ferrissia sp		F	+
97601	Corbicula fluminea		F	+
98600	Sphaerium sp		F	+

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/17/2022* RM: **6.83**

Site ID: **LM13** Location: *RR Trestle-Mariemont* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.

No. Quantitative Taxa:	35	Total Taxa;	79
No. Qualitative Taxa:	67	ICI:	54
Number of Organisms:	2361	Qual EPT:	29

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/17/2022* RM: **4.10**

Site ID: **LM15** Location: *Ust. Duck Creek* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	13 +
03360	Plumatella sp		F	6
03600	Oligochaeta		T	+
05800	Caecidotea sp		T	+
11014	Acentrella turbida		I	30 +
11119	Plauditus dubius or P. virilis		I	88 +
11130	Baetis intercalaris		F	405 +
11620	Paracloeodes minutus		MI	+
12200	Isonychia sp		MI	152 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	290 +
13521	Stenonema femoratum		F	2
13540	Maccaffertium mediopunctatum		MI	+
13550	Maccaffertium mexicanum integrum		MI	38
13570	Maccaffertium terminatum		MI	2 +
16700	Tricorythodes sp		MI	30 +
18100	Anthopotamus sp		MI	+
18600	Ephemera sp		MI	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
24900	Gomphus sp		F	+
27400	Neurocordulia sp		F	+
34715	Agnetina flavescens		I	+
50315	Chimarra obscura		MI	25 +
51300	Neureclipsis sp		MI	2 +
52200	Cheumatopsyche sp		F	1596 +
52430	Ceratopsyche morosa group		MI	496 +
52520	Hydropsyche bidens		MI	19
52570	Hydropsyche simulans		MI	16
52801	Potamyia flava		MI	5 +
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	56 +
59100	Ceraclea sp		MI	+
59140	Ceraclea maculata		MI	3
59407	Nectopsyche candida		MI	+
59970	Petrophila sp		MI	6 +
68075	Psephenus herricki		MI	+
68130	Helichus sp		F	+
68601	Ancyronyx variegata		F	+
68901	Macronychus glabratus		F	1 +
69400	Stenelmis sp		F	3 +
74100	Simulium sp		F	266 +
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77750	Hayesomyia senata or Thienemannimyia norena		F	19 +
78140	Labrundinia pilosella		F	+
78450	Nilotanypus fimbriatus		F	16
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	+
80410	Cricotopus (C.) sp		F	+
80440	Cricotopus (C.) trifascia		F	+
82130	Thienemanniella similis		MI	32 +
82220	Tvetenia discoloripes group		MI	9
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	+
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	9
84300	Phaenopsectra obediens group		F	9 +
84450	Polypedilum (Uresipedilum) flavum		F	37 +
84470	Polypedilum (P.) illinoense		T	+
84540	Polypedilum (Tripodura) scalaenum group		F	+
84612	Saetheria tylus		F	+
84700	Stenochironomus sp		F	9
84800	Tribelos jucundum		MT	+
85264	Cladotanytarsus vanderwulpi group sp 4		MI	+
85500	Paratanytarsus sp		F	+
85615	Rheotanytarsus pellucidus		MI	9
85625	Rheotanytarsus sp		F	642 +
87540	Hemerodromia sp		F	26 +
95100	Physella sp		T	+

No. Quantitative Taxa:	35	Total Taxa;	71
No. Qualitative Taxa:	60	ICI:	58
Number of Organisms:	4367	Qual EPT:	24

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/18/2022* RM: **3.70**

Site ID: **LM16A** Location: *Dst. Duck Creek* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	42 +
03000	Ectoprocta		F	4
03600	Oligochaeta		T	59 +
04660	Helobdella sp		MT	8
04935	Erpobdella punctata punctata		MT	3
06700	Crangonyx sp		MT	+
08601	Hydrachnidia		F	+
11620	Paracloeodes minutus		MI	+
12200	Isonychia sp		MI	6
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	4
13550	Maccaffertium mexicanum integrum		MI	+
13561	Maccaffertium pulchellum		MI	8 +
13570	Maccaffertium terminatum		MI	68
16700	Tricorythodes sp		MI	60 +
17200	Caenis sp		F	+
18100	Anthopotamus sp		MI	+
18600	Ephemera sp		MI	+
18700	Hexagenia sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	8 +
24900	Gomphus sp		F	+
26700	Macromia sp		MI	+
43570	Neoplea sp		F	+
51206	Cyrnellus fraternus		F	8 +
51300	Neureclipsis sp		MI	2
52200	Cheumatopsyche sp		F	146 +
52430	Ceratopsyche morosa group		MI	17
52520	Hydropsyche bidens		MI	2
52570	Hydropsyche simulans		MI	3
53400	Protoptila sp		I	10
53800	Hydroptila sp		F	17 +
59140	Ceraclea maculata		MI	8
59407	Nectopsyche candida		MI	1 +
68130	Helichus sp		F	1
68601	Ancyronyx variegata		F	1 +
68901	Macronychus glabratus		F	15
69400	Stenelmis sp		F	8 +
72501	Culicidae		MT	+
74100	Simulium sp		F	+
77100	Ablabesmyia sp			48
77120	Ablabesmyia mallochi		F	72 +
77130	Ablabesmyia rhamphe group		MT	+
77500	Conchapelopia sp		F	24
77750	Hayesomyia senata or Thienemannimyia norena		F	144 +
78100	Labrundinia sp		F	+
78450	Nilotanypus fimbriatus		F	16
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	72 +
80410	Cricotopus (C.) sp		F	48
82100	Thienemanniella sp			24
82822	Cryptochironomus eminentia		F	+
83040	Dicrotendipes neomodestus		F	289 +
83300	Glyptotendipes (G.) sp		MT	24
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	48
84155	Paralauterborniella nigrohalteralis		F	+
84210	Paratendipes albimanus or P. duplicatus		F	+
84450	Polypedilum (Uresipedilum) flavum		F	193
84470	Polypedilum (P.) illinoense		T	+
84520	Polypedilum (Tripodura) halterale group		MT	+
84540	Polypedilum (Tripodura) scalaenum group		F	96 +
84700	Stenochironomus sp		F	241 +
84960	Pseudochironomus sp		F	24
85265	Cladotanytarsus vanderwulpi group sp 5		MI	+
85625	Rheotanytarsus sp		F	1132
85800	Tanytarsus sp		F	+
85840	Tanytarsus sepp		F	48
87540	Hemerodromia sp		F	2
95100	Physella sp		T	8
96900	Ferrissia sp		F	+

No. Quantitative Taxa: 44 Total Taxa; 72

No. Qualitative Taxa: 45 ICI: 40

Number of Organisms: 3062 Qual EPT: 15

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-001** River: ***Little Miami River*** Coll. Date *08/18/2022* RM: **3.50**

Site ID: **LM16** Location: *dst. Beechmont Ave.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	100 +
03000	Ectoprocta		F	+
03600	Oligochaeta		T	34 +
04660	Helobdella sp		MT	1 +
04901	Erpobdellidae		MT	+
06201	Hyalella azteca		F	+
06700	Crangonyx sp		MT	+
08601	Hydrachnidia		F	8
11014	Acentrella turbida		I	+
11119	Plauditus dubius or P. virilis		I	+
11130	Baetis intercalaris		F	193 +
11620	Paracloeodes minutus		MI	+
12200	Isonychia sp		MI	90 +
13000	Leucrocuta sp		MI	+
13100	Nixe sp		MI	+
13400	Stenacron sp		F	+
13510	Maccaffertium exiguum		MI	8 +
13521	Stenonema femoratum		F	+
13561	Maccaffertium pulchellum		MI	1 +
13570	Maccaffertium terminatum		MI	94 +
16700	Tricorythodes sp		MI	73 +
17200	Caenis sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
23909	Boyeria vinosa		F	+
24900	Gomphus sp		F	1
27400	Neurocordulia sp		F	+
34715	Agnetina flavescens		I	+
42700	Belostoma sp		T	+
50301	Chimarra aterrima		MI	+
50315	Chimarra obscura		MI	50 +
51300	Neureclipsis sp		MI	+
52200	Cheumatopsyche sp		F	1290 +
52430	Ceratopsyche morosa group		MI	173 +
52560	Hydropsyche orris		MI	29
52801	Potamyia flava		MI	27
53400	Protoptila sp		I	+
53800	Hydroptila sp		F	16 +
54100	Neotrichia sp		F	+
59140	Ceraclea maculata		MI	+
59407	Nectopsyche candida		MI	+
59970	Petrophila sp		MI	1 +
65800	Berosus sp		MT	+
67800	Tropisternus sp		T	+
68075	Psephenus herricki		MI	+
68601	Ancyronyx variegata		F	1 +
68901	Macronychus glabratus		F	16 +
69400	Stenelmis sp		F	65 +
72501	Culicidae		MT	+
74100	Simulium sp		F	353 +
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77470	Coelotanypus sp		T	+
77750	Hayesomyia senata or Thienemannimyia norena		F	227 +
78100	Labrundinia sp		F	+
78450	Nilotanypus fimbriatus		F	16
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	76
80410	Cricotopus (C.) sp		F	+
81240	Nanocladius (N.) distinctus		MT	25 +
82600	Axarus sp		F	+
82730	Chironomus (C.) decorus group		T	+
83040	Dicrotendipes neomodestus		F	+
83050	Dicrotendipes lucifer		MT	+
83051	Dicrotendipes simpsoni		T	+
84020	Parachironomus carinatus		F	+
84210	Paratendipes albimanus or P. duplicatus		F	+
84450	Polypedilum (Uresipedilum) flavum		F	479 +
84540	Polypedilum (Tripodura) scalaenum group		F	126 +
84612	Saetheria tylus		F	+
84700	Stenochironomus sp		F	76
85625	Rheotanytarsus sp		F	1664 +
87540	Hemerodromia sp		F	8
95100	Physella sp		T	+
96120	Menetus (Micromenetus) dilatatus		MT	+
98600	Sphaerium sp		F	+

No. Quantitative Taxa:	31	Total Taxa;	76
No. Qualitative Taxa:	68	ICI:	42
Number of Organisms:	5321	Qual EPT:	25

River Code: **11-002** River: ***Clough Creek*** Coll. Date *08/09/2020* RM: **0.60**

Site ID: **LM98** Location: *Beechmont Ave. and Elstun Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.	Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
11130	Baetis intercalaris		**F**	+					

No. Quantitative Taxa:	0	Total Taxa;	1
No. Qualitative Taxa:	1	ICI:	G
Number of Organisms:	0	Qual EPT:	11

River Code: **11-002** River: ***Clough Creek*** Coll. Date *08/09/2022* RM: **3.20**

Site ID: **LM95** Location: *adj. Clough PIke* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
05900	Lirceus sp		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
21001	Calopterygidae		F	+
50301	Chimarra aterrima		MI	+
51250	Holocentropus sp		F	+
52200	Cheumatopsyche sp		F	+
52430	Ceratopsyche morosa group		MI	+
52530	Hydropsyche depravata group		F	+
68075	Psephenus herricki		MI	+
71900	Tipula sp		F	+
74100	Simulium sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	+
83840	Microtendipes pedellus group		F	+
93200	Hydrobiidae		F	+
95100	Physella sp		T	+

No. Quantitative Taxa:	0	Total Taxa;	19
No. Qualitative Taxa:	19	ICI:	MG
Number of Organisms:	0	Qual EPT:	7

River Code: **11-002** River: ***Clough Creek*** Coll. Date *08/09/2022* RM: **0.60**

Site ID: **LM98** Location: *Beechmont Ave. and Elstun Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
04666	Helobdella papillata		MT	+
11120	Baetis flavistriga		F	+
13521	Stenonema femoratum		F	+
17200	Caenis sp		F	+
22001	Coenagrionidae		T	+
26600	Didymops transversa		MT	+
27307	Epitheca (Epicordulia) princeps		MT	+
50301	Chimarra aterrima		MI	+
50315	Chimarra obscura		MI	+
51250	Holocentropus sp		F	+
52200	Cheumatopsyche sp		F	+
52430	Ceratopsyche morosa group		MI	+
52530	Hydropsyche depravata group		F	+
53501	Hydroptilidae		F	+
59970	Petrophila sp		MI	+
60900	Peltodytes sp		MT	+
68075	Psephenus herricki		MI	+
68708	Dubiraphia vittata group		F	+
69400	Stenelmis sp		F	+
70501	Tipulidae			+
71300	Limonia sp		F	+
71900	Tipula sp		F	+
74100	Simulium sp		F	+
77120	Ablabesmyia mallochi		F	+
77800	Helopelopia sp		F	+
82820	Cryptochironomus sp		F	+
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	+
84300	Phaenopsectra obediens group		F	+
84450	Polypedilum (Uresipedilum) flavum		F	+
84470	Polypedilum (P.) illinoense		T	+
85260	Cladotanytarsus vanderwulpi group			+
85625	Rheotanytarsus sp		F	+
95100	Physella sp		T	+

No. Quantitative Taxa:	0	Total Taxa;	35
No. Qualitative Taxa:	35	ICI:	G
Number of Organisms:	0	Qual EPT:	11

River Code: **11-004** River: ***Duck Creek*** Coll. Date *06/29/2022* RM: **6.10**

Site ID: **LM71** Location: *Norwood/Harris Ave.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
04664	Helobdella stagnalis		**T**	+
04985	Barbronia weberi		**MT**	+
77001	Tanypodinae			+
78655	Procladius (Holotanypus) sp		**MT**	+
80410	Cricotopus (C.) sp		**F**	+
80430	Cricotopus (C.) tremulus group		**MT**	+
80510	Cricotopus (Isocladius) sylvestris group		**T**	+
82710	Chironomus (C.) sp		**MT**	+
82820	Cryptochironomus sp		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+
84540	Polypedilum (Tripodura) scalaenum group		**F**	+

No. Quantitative Taxa:	0	Total Taxa;	11
No. Qualitative Taxa:	11	ICI:	VP
Number of Organisms:	0	Qual EPT:	0

River Code: **11-004** River: ***Duck Creek*** Coll. Date *06/29/2022* RM: **5.14**

Site ID: **LM72** Location: *Duck Creek Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	+
03600	Oligochaeta		**T**	+
04664	Helobdella stagnalis		**T**	+
04985	Barbronia weberi		**MT**	+
05900	Lirceus sp		**MT**	+
11120	Baetis flavistriga		**F**	+
11130	Baetis intercalaris		**F**	+
23600	Aeshna sp		**MT**	+
53501	Hydroptilidae		**F**	+
69400	Stenelmis sp		**F**	+
74650	Atrichopogon sp		**F**	+
77500	Conchapelopia sp		**F**	+
80420	Cricotopus (C.) bicinctus		**T**	+
80430	Cricotopus (C.) tremulus group		**MT**	+
80510	Cricotopus (Isocladius) sylvestris group		**T**	+
82710	Chironomus (C.) sp		**MT**	+
84450	Polypedilum (Uresipedilum) flavum		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+

No. Quantitative Taxa:	0	Total Taxa;	18
No. Qualitative Taxa:	18	ICI:	P
Number of Organisms:	0	Qual EPT:	3

River Code: **11-004** River: ***Duck Creek*** Coll. Date *06/30/2022* RM: **4.58**

Site ID: **LM73** Location: *adj. Steel Place* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	+
03600	Oligochaeta		**T**	+
05900	Lirceus sp		**MT**	+
11120	Baetis flavistriga		**F**	+
11130	Baetis intercalaris		**F**	+
45400	Trichocorixa sp		**MT**	+
52200	Cheumatopsyche sp		**F**	+
52530	Hydropsyche depravata group		**F**	+
53800	Hydroptila sp		**F**	+
74100	Simulium sp		**F**	+
77500	Conchapelopia sp		**F**	+
80420	Cricotopus (C.) bicinctus		**T**	+
80430	Cricotopus (C.) tremulus group		**MT**	+
80440	Cricotopus (C.) trifascia		**F**	+
84450	Polypedilum (Uresipedilum) flavum		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+
84960	Pseudochironomus sp		**F**	+

No. Quantitative Taxa:	0	Total Taxa;	17
No. Qualitative Taxa:	17	ICI:	F
Number of Organisms:	0	Qual EPT:	5

River Code: **11-004** River: ***Duck Creek*** Coll. Date *06/30/2022* RM: **3.90**

Site ID: **LM74** Location: *dst. East Fork Duck Creek* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
04985	Barbronia weberi		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
50315	Chimarra obscura		MI	+
52200	Cheumatopsyche sp		F	+
52530	Hydropsyche depravata group		F	+
53501	Hydroptilidae		F	+
72700	Anopheles sp		F	+
74100	Simulium sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	+
80420	Cricotopus (C.) bicinctus		T	+
80510	Cricotopus (Isocladius) sylvestris group		T	+
82710	Chironomus (C.) sp		MT	+
84450	Polypedilum (Uresipedilum) flavum		F	+
84470	Polypedilum (P.) illinoense		T	+
84960	Pseudochironomus sp		F	+
85840	Tanytarsus sepp		F	+

No. Quantitative Taxa:	0	Total Taxa;	20
No. Qualitative Taxa:	20	ICI:	F
Number of Organisms:	0	Qual EPT:	6

River Code: **11-004** River: ***Duck Creek*** Coll. Date *06/30/2022* RM: **3.40**

Site ID: **LM75** Location: *ust. Erie Ave.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	+
03600	Oligochaeta		**T**	+
04664	Helobdella stagnalis		**T**	+
04985	Barbronia weberi		**MT**	+
05900	Lirceus sp		**MT**	+
11120	Baetis flavistriga		**F**	+
11130	Baetis intercalaris		**F**	+
21300	Hetaerina sp		**F**	+
21604	Archilestes grandis		**T**	+
22001	Coenagrionidae		**T**	+
52200	Cheumatopsyche sp		**F**	+
52530	Hydropsyche depravata group		**F**	+
53800	Hydroptila sp		**F**	+
69400	Stenelmis sp		**F**	+
74100	Simulium sp		**F**	+
78401	Natarsia species A (sensu Roback, 1978)		**T**	+
80410	Cricotopus (C.) sp		**F**	+
80411	Cricotopus (Isocladius) sp nr. absurdus		**MT**	+
80420	Cricotopus (C.) bicinctus		**T**	+
80510	Cricotopus (Isocladius) sylvestris group		**T**	+
82100	Thienemanniella sp			+
82730	Chironomus (C.) decorus group		**T**	+
82820	Cryptochironomus sp		**F**	+
84450	Polypedilum (Uresipedilum) flavum		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+

No. Quantitative Taxa: 0 Total Taxa; 25

No. Qualitative Taxa: 25 ICI: F

Number of Organisms: 0 Qual EPT: 5

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-004** River: ***Duck Creek*** Coll. Date *08/08/2022* RM: **2.80**

Site ID: **LM76** Location: *dst. Erie Ave.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	3 +
03600	Oligochaeta		T	213 +
04510	Hirudinida		MT	1
04666	Helobdella papillata		MT	+
04901	Erpobdellidae		MT	+
04985	Barbronia weberi		MT	2 +
11130	Baetis intercalaris		F	990 +
17200	Caenis sp		F	+
21001	Calopterygidae		F	+
21300	Hetaerina sp		F	+
22300	Argia sp		F	1 +
27001	Corduliidae			+
28001	Libellulidae		MT	+
50315	Chimarra obscura		MI	+
52200	Cheumatopsyche sp		F	26 +
52430	Ceratopsyche morosa group		MI	+
52530	Hydropsyche depravata group		F	6 +
53800	Hydroptila sp		F	16 +
71900	Tipula sp		F	+
72150	Pericoma sp		MT	+
74100	Simulium sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	352 +
77750	Hayesomyia senata or Thienemannimyia norena		F	29 +
80410	Cricotopus (C.) sp		F	+
80411	Cricotopus (Isocladius) sp nr. absurdus		MT	+
80420	Cricotopus (C.) bicinctus		T	117 +
80510	Cricotopus (Isocladius) sylvestris group		T	29
82730	Chironomus (C.) decorus group		T	+
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	29 +
84450	Polypedilum (Uresipedilum) flavum		F	117 +
84470	Polypedilum (P.) illinoense		T	1175 +
84540	Polypedilum (Tripodura) scalaenum group		F	206 +
84960	Pseudochironomus sp		F	59 +
85800	Tanytarsus sp		F	29
85821	Tanytarsus glabrescens group sp 7		F	176
87540	Hemerodromia sp		F	8
95100	Physella sp		T	1 +

No. Quantitative Taxa:	22	Total Taxa;	39
No. Qualitative Taxa:	34	ICI:	26
Number of Organisms:	3585	Qual EPT:	7

River Code: **11-004** River: ***Duck Creek*** Coll. Date *08/08/2022* RM: **2.00**

Site ID: **LM77** Location: *at Wooster Ave. and Power St.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	135 +
03600	Oligochaeta		T	497 +
04660	Helobdella sp		MT	+
04935	Erpobdella punctata punctata		MT	11 +
04985	Barbronia weberi		MT	1
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	747 +
13521	Stenonema femoratum		F	1
17200	Caenis sp		F	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
50315	Chimarra obscura		MI	+
52200	Cheumatopsyche sp		F	113 +
52430	Ceratopsyche morosa group		MI	1
52530	Hydropsyche depravata group		F	91 +
53800	Hydroptila sp		F	17 +
68708	Dubiraphia vittata group		F	+
69400	Stenelmis sp		F	+
71900	Tipula sp		F	+
74100	Simulium sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	298 +
77750	Hayesomyia senata or Thienemannimyia norena		F	50
80420	Cricotopus (C.) bicinctus		T	17 +
80510	Cricotopus (Isocladius) sylvestris group		T	17
81231	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"		F	116
82730	Chironomus (C.) decorus group		T	+
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	66
83051	Dicrotendipes simpsoni		T	17 +
84210	Paratendipes albimanus or P. duplicatus		F	+
84450	Polypedilum (Uresipedilum) flavum		F	315 +
84470	Polypedilum (P.) illinoense		T	83 +
84520	Polypedilum (Tripodura) halterale group		MT	17
84540	Polypedilum (Tripodura) scalaenum group		F	481 +
84960	Pseudochironomus sp		F	66
85800	Tanytarsus sp		F	33
85821	Tanytarsus glabrescens group sp 7		F	149 +
85840	Tanytarsus sepp		F	17
87540	Hemerodromia sp		F	16 +
95100	Physella sp		T	+

No. Quantitative Taxa: 26 Total Taxa; 42

No. Qualitative Taxa: 31 ICI: 32

Number of Organisms: 3372 Qual EPT: 7

River Code: **11-004** River: ***Duck Creek*** Coll. Date *08/08/2022* RM: **0.50**

Site ID: **LM79** Location: *ust. Wooster Pike* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01320	Hydra sp		F	16
01801	Turbellaria		F	16 +
03600	Oligochaeta		T	+
04666	Helobdella papillata		MT	+
04901	Erpobdellidae		MT	+
04985	Barbronia weberi		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	1454 +
13521	Stenonema femoratum		F	4 +
17200	Caenis sp		F	+
21300	Hetaerina sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
27400	Neurocordulia sp		F	+
28705	Pachydiplax longipennis		T	+
50315	Chimarra obscura		MI	20 +
51250	Holocentropus sp		F	+
52200	Cheumatopsyche sp		F	98 +
52430	Ceratopsyche morosa group		MI	7 +
52530	Hydropsyche depravata group		F	171 +
53800	Hydroptila sp		F	+
60900	Peltodytes sp		MT	+
65800	Berosus sp		MT	1
69400	Stenelmis sp		F	+
71900	Tipula sp		F	1 +
74100	Simulium sp		F	195 +
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	119 +
77750	Hayesomyia senata or Thienemannimyia norena		F	+
78401	Natarsia species A (sensu Roback, 1978)		T	+
78450	Nilotanypus fimbriatus		F	15
78600	Pentaneura inconspicua		F	+
78655	Procladius (Holotanypus) sp		MT	+
80420	Cricotopus (C.) bicinctus		T	22 +
80474	Cricotopus (C.) or Paratrichocladius sp			+
80510	Cricotopus (Isocladius) sylvestris group		T	+
81240	Nanocladius (N.) distinctus		MT	22
82730	Chironomus (C.) decorus group		T	+
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	7 +
84450	Polypedilum (Uresipedilum) flavum		F	327 +
84470	Polypedilum (P.) illinoense		T	82 +
84540	Polypedilum (Tripodura) scalaenum group		F	+
84960	Pseudochironomus sp		F	22 +
85500	Paratanytarsus sp		F	7
85800	Tanytarsus sp		F	+
85821	Tanytarsus glabrescens group sp 7		F	+
87540	Hemerodromia sp		F	1 +
95100	Physella sp		T	+

No. Quantitative Taxa:	21	Total Taxa;	49
No. Qualitative Taxa:	44	ICI:	38
Number of Organisms:	2607	Qual EPT:	10

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-007** River: ***Sycamore Creek*** Coll. Date *08/04/2022* RM: **1.10**

Site ID: **LM50** Location: *Loveland Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	42 +
03600	Oligochaeta		T	4 +
04985	Barbronia weberi		MT	+
05900	Lirceus sp		MT	+
11120	Baetis flavistriga		F	67 +
11130	Baetis intercalaris		F	50 +
13400	Stenacron sp		F	132
13500	Maccaffertium sp		MI	1
13521	Stenonema femoratum		F	+
17200	Caenis sp		F	4 +
21200	Calopteryx sp		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
27000	Corduliidae or Libellulidae			+
43570	Neoplea sp		F	+
50301	Chimarra aterrima		MI	+
50315	Chimarra obscura		MI	+
51250	Holocentropus sp		F	+
52200	Cheumatopsyche sp		F	+
52430	Ceratopsyche morosa group		MI	15 +
52530	Hydropsyche depravata group		F	3 +
53800	Hydroptila sp		F	72 +
68075	Psephenus herricki		MI	+
69400	Stenelmis sp		F	+
71300	Limonia sp		F	+
71900	Tipula sp		F	+
72700	Anopheles sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	36 +
77800	Helopelopia sp		F	29 +
78450	Nilotanypus fimbriatus		F	10
78601	Pentaneura inyoensis		F	+
78650	Procladius sp		MT	+
80370	Corynoneura lobata		F	8
80410	Cricotopus (C.) sp		F	+
80411	Cricotopus (Isocladius) sp nr. absurdus		MT	15
80420	Cricotopus (C.) bicinctus		T	15
80430	Cricotopus (C.) tremulus group		MT	29
81650	Parametriocnemus sp	X	F	+
81825	Rheocricotopus (Psilocricotopus) robacki		F	+
82141	Thienemanniella xena		F	12
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	29 +
83900	Nilothauma sp		F	+
84210	Paratendipes albimanus or P. duplicatus		F	+
84300	Phaenopsectra obediens group		F	+
84450	Polypedilum (Uresipedilum) flavum		F	379 +
84470	Polypedilum (P.) illinoense		T	7 +
84540	Polypedilum (Tripodura) scalaenum group		F	7 +
84960	Pseudochironomus sp		F	22
85500	Paratanytarsus sp		F	44 +
85625	Rheotanytarsus sp		F	15 +
85821	Tanytarsus glabrescens group sp 7		F	117 +
85840	Tanytarsus sepp		F	+
87540	Hemerodromia sp		F	9 +
95100	Physella sp		T	+
96120	Menetus (Micromenetus) dilatatus		MT	4
96900	Ferrissia sp		F	1

No. Quantitative Taxa:	29	Total Taxa;	58
No. Qualitative Taxa:	47	ICI:	46
Number of Organisms:	1178	Qual EPT:	11

River Code: **11-007** River: ***Sycamore Creek*** Coll. Date *08/04/2022* RM: **0.50**

Site ID: **LM51** Location: *ust. Sycamore Creek WWTP* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	155 +
03600	Oligochaeta		T	+
04935	Erpobdella punctata punctata		MT	+
05900	Lirceus sp		MT	9 +
06201	Hyalella azteca		F	+
06700	Crangonyx sp		MT	+
11014	Acentrella turbida		I	+
11120	Baetis flavistriga		F	6 +
11130	Baetis intercalaris		F	1204 +
11670	Procloeon viridoculare		MI	+
13400	Stenacron sp		F	2
13521	Stenonema femoratum		F	2 +
13561	Maccaffertium pulchellum		MI	1
16700	Tricorythodes sp		MI	+
17200	Caenis sp		F	+
21001	Calopterygidae		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	+
23909	Boyeria vinosa		F	+
26700	Macromia sp		MI	+
50301	Chimarra aterrima		MI	2 +
50315	Chimarra obscura		MI	91 +
51250	Holocentropus sp		F	+
51300	Neureclipsis sp		MI	+
52200	Cheumatopsyche sp		F	293 +
52430	Ceratopsyche morosa group		MI	309 +
52530	Hydropsyche depravata group		F	161 +
53800	Hydroptila sp		F	1 +
59970	Petrophila sp		MI	9 +
60900	Peltodytes sp		MT	+
68075	Psephenus herricki		MI	+
68601	Ancyronyx variegata		F	1
69400	Stenelmis sp		F	8 +
71900	Tipula sp		F	1
72900	Culex sp		T	+
74100	Simulium sp		F	33 +
74650	Atrichopogon sp		F	+
77001	Tanypodinae			10
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	+
77750	Hayesomyia senata or Thienemannimyia norena		F	+
77800	Helopelopia sp		F	31 +
78450	Nilotanypus fimbriatus		F	24
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	10
79760	Pagastia sp		F	+
80310	Cardiocladius obscurus		MI	+
80350	Corynoneura sp			8
80410	Cricotopus (C.) sp		F	+
80420	Cricotopus (C.) bicinctus		T	+
81650	Parametriocnemus sp	X	F	10
81690	Paratrichocladius sp		MI	+
82100	Thienemanniella sp			8
82822	Cryptochironomus eminentia		F	+
83040	Dicrotendipes neomodestus		F	10 +
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	+
84450	Polypedilum (Uresipedilum) flavum		F	763 +
84540	Polypedilum (Tripodura) scalaenum group		F	+
85615	Rheotanytarsus pellucidus		MI	20
85625	Rheotanytarsus sp		F	112
85800	Tanytarsus sp		F	10 +
85821	Tanytarsus glabrescens group sp 7		F	+
85840	Tanytarsus sepp		F	+
95100	Physella sp		T	1 +
97601	Corbicula fluminea		F	1 +

No. Quantitative Taxa: 32 Total Taxa; 65

No. Qualitative Taxa: 53 ICI: 48

Number of Organisms: 3306 Qual EPT: 15

Appendix Table B-5. Macroinvertebrate taxa list for the Little Miami River study area including historical data.

River Code: **11-007** River: ***Sycamore Creek*** Coll. Date *08/04/2022* RM: **0.10**

Site ID: **LM52** Location: *dst. Sycamore Creek WWTP* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	1 +
03600	Oligochaeta		T	+
04901	Erpobdellidae		MT	+
04935	Erpobdella punctata punctata		MT	+
04985	Barbronia weberi		MT	+
05900	Lirceus sp		MT	1 +
06201	Hyalella azteca		F	11 +
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	82 +
12200	Isonychia sp		MI	2
13521	Stenonema femoratum		F	82 +
17200	Caenis sp		F	+
21001	Calopterygidae		F	+
22001	Coenagrionidae		T	+
22300	Argia sp		F	10
27400	Neurocordulia sp		F	+
50301	Chimarra aterrima		MI	+
50315	Chimarra obscura		MI	+
51206	Cyrnellus fraternus		F	8
51300	Neureclipsis sp		MI	11 +
52200	Cheumatopsyche sp		F	507 +
52430	Ceratopsyche morosa group		MI	363 +
52530	Hydropsyche depravata group		F	+
52570	Hydropsyche simulans		MI	1
53800	Hydroptila sp		F	+
54160	Ochrotrichia sp		MI	+
59580	Oecetis persimilis		MI	1 +
59970	Petrophila sp		MI	+
65800	Berosus sp		MT	+
68075	Psephenus herricki		MI	+
68601	Ancyronyx variegata		F	+
69400	Stenelmis sp		F	+
71900	Tipula sp		F	1 +
72501	Culicidae		MT	+
72900	Culex sp		T	+
74100	Simulium sp		F	64 +
74650	Atrichopogon sp		F	+
77120	Ablabesmyia mallochi		F	+
77130	Ablabesmyia rhamphe group		MT	+
77500	Conchapelopia sp		F	66 +
77800	Helopelopia sp		F	33 +
78655	Procladius (Holotanypus) sp		MT	+
80310	Cardiocladius obscurus		MI	+
80350	Corynoneura sp			8
80420	Cricotopus (C.) bicinctus		T	+
81650	Parametriocnemus sp	X	F	+
82141	Thienemanniella xena		F	+
82730	Chironomus (C.) decorus group		T	+
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	49 +
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	+
84210	Paratendipes albimanus or P. duplicatus		F	16 +
84450	Polypedilum (Uresipedilum) flavum		F	1035 +
84470	Polypedilum (P.) illinoense		T	+
84540	Polypedilum (Tripodura) scalaenum group		F	16
85625	Rheotanytarsus sp		F	279 +
85800	Tanytarsus sp		F	16 +
85821	Tanytarsus glabrescens group sp 7		F	16 +
87540	Hemerodromia sp		F	+
95100	Physella sp		T	3 +
96900	Ferrissia sp		F	41
97601	Corbicula fluminea		F	+

No. Quantitative Taxa:	27	Total Taxa;	62
No. Qualitative Taxa:	55	ICI:	38
Number of Organisms:	2723	Qual EPT:	13

River Code: **11-009** River: ***Polk Run*** Coll. Date *08/08/2022* RM: **0.30**

Site ID: **LM40** Location: *East Kemper Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
04935	Erpobdella punctata punctata		MT	+
05900	Lirceus sp		MT	+
06700	Crangonyx sp		MT	+
08601	Hydrachnidia		F	24
11120	Baetis flavistriga		F	5 +
11130	Baetis intercalaris		F	822 +
12200	Isonychia sp		MI	8
13100	Nixe sp		MI	+
13500	Maccaffertium sp		MI	11
13521	Stenonema femoratum		F	+
17200	Caenis sp		F	+
21001	Calopterygidae		F	3 +
22001	Coenagrionidae		T	+
22300	Argia sp		F	9 +
50301	Chimarra aterrima		MI	+
50315	Chimarra obscura		MI	+
52200	Cheumatopsyche sp		F	210 +
52430	Ceratopsyche morosa group		MI	188 +
52530	Hydropsyche depravata group		F	3 +
53201	Glossosomatidae		MI	+
53800	Hydroptila sp		F	8 +
54160	Ochrotrichia sp		MI	+
59300	Mystacides sp		MI	+
59970	Petrophila sp		MI	+
68025	Ectopria sp		F	+
68075	Psephenus herricki		MI	+
68601	Ancyronyx variegata		F	+
68708	Dubiraphia vittata group		F	+
69400	Stenelmis sp		F	+
70600	Antocha sp		MI	+
71900	Tipula sp		F	+
74100	Simulium sp		F	11 +
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	99 +
77750	Hayesomyia senata or Thienemannimyia norena		F	33
77800	Helopelopia sp		F	22 +
78450	Nilotanypus fimbriatus		F	8
78655	Procladius (Holotanypus) sp		MT	+
78750	Rheopelopia paramaculipennis		MI	11 +
80370	Corynoneura lobata		F	16
80440	Cricotopus (C.) trifascia		F	+
82100	Thienemanniella sp			8
82820	Cryptochironomus sp		F	+
83040	Dicrotendipes neomodestus		F	+
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		MI	+
84300	Phaenopsectra obediens group		F	+
84450	Polypedilum (Uresipedilum) flavum		F	187 +
84470	Polypedilum (P.) illinoense		T	+
84540	Polypedilum (Tripodura) scalaenum group		F	11
84700	Stenochironomus sp		F	+
85625	Rheotanytarsus sp		F	375 +
85800	Tanytarsus sp		F	22 +
85821	Tanytarsus glabrescens group sp 7		F	55
95100	Physella sp		T	1 +
96900	Ferrissia sp		F	1 +

No. Quantitative Taxa:	26	Total Taxa;	57
No. Qualitative Taxa:	48	ICI:	50
Number of Organisms:	2151	Qual EPT:	14

River Code: **11-049** River: ***Unnamed Tributary to Sycamore Cr. at RM 1.12*** Coll. Date *06/29/2022* RM: **1.20**

Site ID: **LM55** Location: *ust. Blome Rd. bridge* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
05900	Lirceus sp		MT	+
06700	Crangonyx sp		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
17200	Caenis sp		F	+
50301	Chimarra aterrima		MI	+
51050	Cernotina sp		MI	+
52200	Cheumatopsyche sp		F	+
52530	Hydropsyche depravata group		F	+
53800	Hydroptila sp		F	+
59970	Petrophila sp		MI	+
72900	Culex sp		T	+
74100	Simulium sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	+
77750	Hayesomyia senata or Thienemannimyia norena		F	+
78350	Meropelopia sp	X	F	+
79720	Diamesa sp	X	F	+
83040	Dicrotendipes neomodestus		F	+
84210	Paratendipes albimanus or P. duplicatus		F	+
84470	Polypedilum (P.) illinoense		T	+
85840	Tanytarsus sepp		F	+

No. Quantitative Taxa:	0	Total Taxa;	24
No. Qualitative Taxa:	24	ICI:	G
Number of Organisms:	0	Qual EPT:	8

River Code: **11-049** River: ***Unnamed Tributary to Sycamore Cr. at RM 1.12*** Coll. Date *08/04/2020* RM: **0.20**

Site ID: **LM56** Location: *ust. Loveland-Maderia Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	416 +
01900	Nemertea		F	16
03000	Ectoprocta		F	+
03600	Oligochaeta		T	40 +
04985	Barbronia weberi		MT	+
05900	Lirceus sp		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
13521	Stenonema femoratum		F	+
17200	Caenis sp		F	+
21200	Calopteryx sp		F	9 +
22300	Argia sp		F	3 +
50301	Chimarra aterrima		MI	11 +
50315	Chimarra obscura		MI	3 +
51250	Holocentropus sp		F	+
52200	Cheumatopsyche sp		F	+
52530	Hydropsyche depravata group		F	+
53800	Hydroptila sp		F	1 +
68075	Psephenus herricki		MI	+
69400	Stenelmis sp		F	+
71900	Tipula sp		F	+
71910	Tipula abdominalis		F	5
74100	Simulium sp		F	+
74673	Atrichopogon websteri		F	2
77120	Ablabesmyia mallochi		F	+
77800	Helopelopia sp		F	104 +
78601	Pentaneura inyoensis		F	+
80370	Corynoneura lobata		F	16
82730	Chironomus (C.) decorus group		T	+
83003	Dicrotendipes fumidus		F	42 +
83040	Dicrotendipes neomodestus		F	42 +
84210	Paratendipes albimanus or P. duplicatus		F	+
84450	Polypedilum (Uresipedilum) flavum		F	209 +
84470	Polypedilum (P.) illinoense		T	272
84540	Polypedilum (Tripodura) scalaenum group		F	42 +
84700	Stenochironomus sp		F	+
84960	Pseudochironomus sp		F	63
85210	Cladotanytarsus species group B		MI	+
85500	Paratanytarsus sp		F	42 +
85625	Rheotanytarsus sp		F	167
85821	Tanytarsus glabrescens group sp 7		F	1274
85840	Tanytarsus sepp		F	42 +
87540	Hemerodromia sp		F	17 +
93200	Hydrobiidae		F	1
95100	Physella sp		T	+

No. Quantitative Taxa: 24 Total Taxa; 45

No. Qualitative Taxa: 36 ICI: 36

Number of Organisms: 2839 Qual EPT: 10

River Code: **11-051** River: ***East Fork Duck Creek*** Coll. Date *07/01/2022* RM: **2.00**

Site ID: **LM85** Location: *at Stewart Ave.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
06700	Crangonyx sp		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
21604	Archilestes grandis		T	+
52200	Cheumatopsyche sp		F	+
52530	Hydropsyche depravata group		F	+
53800	Hydroptila sp		F	+
72150	Pericoma sp		MT	+
72160	Psychoda sp		T	+
72501	Culicidae		MT	+
72700	Anopheles sp		F	+
74100	Simulium sp		F	+
78702	Psectrotanypus dyari		VT	+
80410	Cricotopus (C.) sp		F	+
80430	Cricotopus (C.) tremulus group		MT	+
80510	Cricotopus (Isocladius) sylvestris group		T	+
81650	Parametriocnemus sp	X	F	+
82710	Chironomus (C.) sp		MT	+
84450	Polypedilum (Uresipedilum) flavum		F	+
84470	Polypedilum (P.) illinoense		T	+
85625	Rheotanytarsus sp		F	+
87540	Hemerodromia sp		F	+
89700	Limnophora sp		F	+
95100	Physella sp		T	+

No. Quantitative Taxa:	0	Total Taxa;	26
No. Qualitative Taxa:	26	ICI:	F
Number of Organisms:	0	Qual EPT:	5

River Code: **11-051** River: ***East Fork Duck Creek*** Coll. Date *07/01/2022* RM: **0.50**

Site ID: **LM84** Location: *behind JP Parkers School* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
05900	Lirceus sp		MT	+
06700	Crangonyx sp		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
44501	Corixidae		F	+
52200	Cheumatopsyche sp		F	+
52530	Hydropsyche depravata group		F	+
53800	Hydroptila sp		F	+
71900	Tipula sp		F	+
72150	Pericoma sp		MT	+
72700	Anopheles sp		F	+
74100	Simulium sp		F	+
74650	Atrichopogon sp		F	+
77120	Ablabesmyia mallochi		F	+
77500	Conchapelopia sp		F	+
77750	Hayesomyia senata or Thienemannimyia norena		F	+
78655	Procladius (Holotanypus) sp		MT	+
80420	Cricotopus (C.) bicinctus		T	+
80510	Cricotopus (Isocladius) sylvestris group		T	+
80740	Eukiefferiella claripennis group		MT	+
82730	Chironomus (C.) decorus group		T	+
82820	Cryptochironomus sp		F	+
84450	Polypedilum (Uresipedilum) flavum		F	+
84470	Polypedilum (P.) illinoense		T	+
85500	Paratanytarsus sp		F	+
87540	Hemerodromia sp		F	+
95501	Planorbidae		MT	+

No. Quantitative Taxa:	0	Total Taxa;	29
No. Qualitative Taxa:	29	ICI:	F
Number of Organisms:	0	Qual EPT:	5

River Code: **11-075** River: ***Unnamed Tributary to Duck Creek at RM 4.8*** Coll. Date *06/29/2022* RM: **0.10**

Site ID: **LM80** Location: *Kennedy Ave.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
03600	Oligochaeta		**T**	+
04985	Barbronia weberi		**MT**	+
11200	Callibaetis sp		**MT**	+
53800	Hydroptila sp		**F**	+
63900	Laccophilus sp		**T**	+
67700	Paracymus sp		**MT**	+
67800	Tropisternus sp		**T**	+
72700	Anopheles sp		**F**	+
72900	Culex sp		**T**	+
74100	Simulium sp		**F**	+
77500	Conchapelopia sp		**F**	+
80430	Cricotopus (C.) tremulus group		**MT**	+
82730	Chironomus (C.) decorus group		**T**	+
82770	Chironomus (C.) riparius group		**T**	+
83040	Dicrotendipes neomodestus		**F**	+
83840	Microtendipes pedellus group		**F**	+
84210	Paratendipes albimanus or P. duplicatus		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+
84960	Pseudochironomus sp		**F**	+
86501	Stratiomyidae			+
95100	Physella sp		**T**	+

No. Quantitative Taxa:	0	Total Taxa;	21
No. Qualitative Taxa:	21	ICI:	P
Number of Organisms:	0	Qual EPT:	2

River Code: **11-076** River: ***Little Duck Creek*** Coll. Date *07/01/2022* RM: **2.40**

Site ID: **LM86** Location: *adj. Camargo Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	+
03600	Oligochaeta		**T**	+
05900	Lirceus sp		**MT**	+
11120	Baetis flavistriga		**F**	+
11130	Baetis intercalaris		**F**	+
13521	Stenonema femoratum		**F**	+
22001	Coenagrionidae		**T**	+
50301	Chimarra aterrima		**MI**	+
52200	Cheumatopsyche sp		**F**	+
52430	Ceratopsyche morosa group		**MI**	+
53800	Hydroptila sp		**F**	+
67700	Paracymus sp		**MT**	+
68075	Psephenus herricki		**MI**	+
69400	Stenelmis sp		**F**	+
74100	Simulium sp		**F**	+
77120	Ablabesmyia mallochi		**F**	+
77800	Helopelopia sp		**F**	+
82820	Cryptochironomus sp		**F**	+
83040	Dicrotendipes neomodestus		**F**	+
84210	Paratendipes albimanus or P. duplicatus		**F**	+
84450	Polypedilum (Uresipedilum) flavum		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+
85500	Paratanytarsus sp		**F**	+
87540	Hemerodromia sp		**F**	+

No. Quantitative Taxa:	0	Total Taxa;	24
No. Qualitative Taxa:	24	ICI:	MG
Number of Organisms:	0	Qual EPT:	7

River Code: **11-076** River: ***Little Duck Creek*** Coll. Date *07/01/2022* RM: **1.90**

Site ID: **LM87** Location: *adj. Plainville Rd.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		F	+
03600	Oligochaeta		T	+
04664	Helobdella stagnalis		T	+
06700	Crangonyx sp		MT	+
11120	Baetis flavistriga		F	+
11130	Baetis intercalaris		F	+
13521	Stenonema femoratum		F	+
50301	Chimarra aterrima		MI	+
51250	Holocentropus sp		F	+
52200	Cheumatopsyche sp		F	+
52430	Ceratopsyche morosa group		MI	+
52530	Hydropsyche depravata group		F	+
53800	Hydroptila sp		F	+
69400	Stenelmis sp		F	+
70600	Antocha sp		MI	+
72700	Anopheles sp		F	+
74100	Simulium sp		F	+
77800	Helopelopia sp		F	+
78350	Meropelopia sp	X	F	+
78600	Pentaneura inconspicua		F	+
81650	Parametriocnemus sp	X	F	+
82200	Tvetenia bavarica group		MI	+
82820	Cryptochironomus sp		F	+
84230	Paratendipes subaequalis		F	+
84300	Phaenopsectra obediens group		F	+
84450	Polypedilum (Uresipedilum) flavum		F	+
84470	Polypedilum (P.) illinoense		T	+
95100	Physella sp		T	+

No. Quantitative Taxa: 0 Total Taxa; 28

No. Qualitative Taxa: 28 ICI: G

Number of Organisms: 0 Qual EPT: 9

River Code: **11-076** River: ***Little Duck Creek*** Coll. Date *07/01/2022* RM: **1.00**

Site ID: **LM90** Location: *Settle St.* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	+
03600	Oligochaeta		**T**	+
04985	Barbronia weberi		**MT**	+
05900	Lirceus sp		**MT**	+
07800	Cambarus sp			+
11120	Baetis flavistriga		**F**	+
11130	Baetis intercalaris		**F**	+
13521	Stenonema femoratum		**F**	+
50301	Chimarra aterrima		**MI**	+
51050	Cernotina sp		**MI**	+
52200	Cheumatopsyche sp		**F**	+
52430	Ceratopsyche morosa group		**MI**	+
52530	Hydropsyche depravata group		**F**	+
68075	Psephenus herricki		**MI**	+
69400	Stenelmis sp		**F**	+
71900	Tipula sp		**F**	+
74100	Simulium sp		**F**	+
77120	Ablabesmyia mallochi		**F**	+
77500	Conchapelopia sp		**F**	+
78401	Natarsia species A (sensu Roback, 1978)		**T**	+
78450	Nilotanypus fimbriatus		**F**	+
78601	Pentaneura inyoensis		**F**	+
83003	Dicrotendipes fumidus		**F**	+
83840	Microtendipes pedellus group		**F**	+
84210	Paratendipes albimanus or P. duplicatus		**F**	+
84300	Phaenopsectra obediens group		**F**	+
84450	Polypedilum (Uresipedilum) flavum		**F**	+
84470	Polypedilum (P.) illinoense		**T**	+
84540	Polypedilum (Tripodura) scalaenum group		**F**	+

No. Quantitative Taxa:	0	Total Taxa;	29
No. Qualitative Taxa:	29	ICI:	G
Number of Organisms:	0	Qual EPT:	8

River Code: **11-077** River: ***Unnamed Tributary to Little Duck Creek at RM 4.42*** Coll. Date *06/30/2022* RM: **0.20**

Site ID: **LM82** Location: *at baseball field* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
03600	Oligochaeta		**T**	+
04660	Helobdella sp		**MT**	+
05900	Lirceus sp		**MT**	+
11120	Baetis flavistriga		**F**	+
50301	Chimarra aterrima		**MI**	+
52430	Ceratopsyche morosa group		**MI**	+
52530	Hydropsyche depravata group		**F**	+
71900	Tipula sp		**F**	+
71910	Tipula abdominalis		**F**	+
78200	Larsia sp		**MT**	+
78350	Meropelopia sp	**X**	**F**	+
80001	Orthocladiinae			+
80430	Cricotopus (C.) tremulus group		**MT**	+
82200	Tvetenia bavarica group		**MI**	+
84210	Paratendipes albimanus or P. duplicatus		**F**	+
84300	Phaenopsectra obediens group		**F**	+
89001	Sciomyzidae		**MT**	+
93200	Hydrobiidae		**F**	+
95100	Physella sp		**T**	+

No. Quantitative Taxa:	0	Total Taxa;	19
No. Qualitative Taxa:	19	ICI:	F
Number of Organisms:	0	Qual EPT:	4

River Code: **11-086** River: ***Unnamed Tributary (1.82) to Tributary to Sycamore*** Coll. Date *06/29/2022* RM: **2.40**

Site ID: **LM54** Location: *Glenover Dr. and Raiders Run* Sample:

Taxa Code	Taxa	CWH Taxa	Tol.	Qt./Ql.
01801	Turbellaria		**F**	+
05900	Lirceus sp		**MT**	+
06501	Gammaridae			+
21604	Archilestes grandis		**T**	+
22001	Coenagrionidae		**T**	+
22300	Argia sp		**F**	+
69400	Stenelmis sp		**F**	+
72700	Anopheles sp		**F**	+
72900	Culex sp		**T**	+
78655	Procladius (Holotanypus) sp		**MT**	+
82710	Chironomus (C.) sp		**MT**	+
82820	Cryptochironomus sp		**F**	+
83040	Dicrotendipes neomodestus		**F**	+
83840	Microtendipes pedellus group		**F**	+
84210	Paratendipes albimanus or P. duplicatus		**F**	+
84300	Phaenopsectra obediens group		**F**	+
95100	Physella sp		**T**	+

No. Quantitative Taxa:	0	Total Taxa;	17
No. Qualitative Taxa:	17	ICI:	
Number of Organisms:	0	Qual EPT:	0

Appendix C

Little Miami River 2022 Habitat Data
C-1: QHEI Metrics & Scores
C-2: QHEI Field Sheets

Appendix Table C-1. *QHEI scores and metric values at 37 sites in the Little Miami River mainstem and tributary subwatersheds*

Site ID	Collection Date	River Mile	QHEI	Substrate Score	Cover Score	Channel Score	Riparian Score	Pool Score	Riffle Score	Gradient Value	Gradient Score
					Little Miami River						
LM01	01-Aug-22	27.90	**89.50**	18.0	17.0	18.5	6.5	13.0	7.5	6.60	10
LM02	01-Aug-22	24.10	**91.00**	18.0	19.0	18.5	5.5	13.0	8.0	6.51	10
LM03	02-Aug-22	22.30	**84.50**	18.0	17.0	14.5	5.0	12.0	8.0	6.39	10
LM05	02-Aug-22	21.50	**89.50**	18.0	17.0	18.5	6.0	12.0	8.0	6.43	10
LM07	02-Aug-22	18.50	**89.50**	18.0	17.0	18.5	6.0	12.0	8.0	6.35	10
LM08	02-Aug-22	17.70	**85.50**	18.0	16.0	17.5	5.0	11.0	8.0	6.24	10
LM09	03-Aug-22	13.10	**87.75**	18.0	14.0	19.5	6.3	12.0	8.0	6.19	10
LM11	03-Aug-22	10.90	**85.00**	18.0	15.0	18.5	4.5	11.0	8.0	6.14	10
LM12	03-Aug-22	8.10	**89.25**	18.0	17.0	19.0	5.3	13.0	8.0	6.08	10
LM13	03-Aug-22	6.83	**87.00**	18.0	16.0	18.5	5.5	11.0	8.0	6.07	10
LM15	03-Aug-22	4.10	**87.50**	18.0	16.0	18.5	5.0	12.0	8.0	6.18	10
LM16A	04-Aug-22	3.70	**65.00**	14.0	16.0	11.0	7.0	7.0	0.0	6.16	10
LM16	04-Aug-22	3.50	**84.00**	17.0	15.0	17.0	7.0	10.0	8.0	6.16	10
LM16	21-Sep-23	3.50	**88.50**	18.0	15.0	18.5	7.0	13.0	8.0	6.16	10
LM17	04-Aug-22	1.60	**62.00**	14.0	14.0	11.0	6.0	7.0	0.0	6.18	10
					Sycamore Creek						
LM50	09-Sep-22	1.10	**70.00**	20.0	10.0	15.0	7.0	8.0	6.0	53.80	4
LM51	11-Aug-22	0.50	**61.50**	14.0	13.0	10.5	4.5	9.0	4.5	38.00	6
LM52	11-Aug-22	0.10	**68.00**	15.0	13.0	13.0	5.0	11.0	5.0	38.20	6
					Unnamed Tributary to Sycamore Creek @RM 1.12						
LM55	22-Jul-22	1.20	**60.75**	23.0	9.0	11.0	5.3	6.0	5.5	65.00	4
LM56	9-Sep-22	0.20	**63.00**	18.5	9.0	12.0	7.5	6.0	6.0	66.30	4
					Polk Run						
LM40	09-Sep-22	0.30	**63.00**	18.0	13.0	11.0	6.0	5.0	6.0	56.10	4
	Boatable Sites			*Headwater*							
	Excellent		≥75	Excellent		≥70					
	Good		≥60	Good		≥55					
	Fair		≥45	Fair		≥43					
	Poor		≥30	Poor		≥30					
	Very Poor		<30	Very Poor		<30					

***Appendix Table C-1**. continued.*

Site ID	Collection Date	River Mile	QHEI	Substrate Score	Cover Score	Channel Score	Riparian Score	Pool Score	Riffle Score	Gradient Value	Gradient Score
Duck Creek											
LM71	13-Jul-22	6.10	**26.00**	0.5	8.0	6.5	3.0	4.0	0.0	65.30	4
LM72	13-Jul-22	5.14	**54.50**	18.0	10.0	11.0	4.5	4.0	3.0	48.10	4
LM73	22-Jul-22	4.58	**16.00**	-1.0	2.0	6.0	3.0	2.0	0.0	43.70	4
LM74	21-Jul-22	3.90	**63.00**	16.5	14.0	10.5	3.5	10.0	2.5	37.50	6
LM75	13-Jul-22	3.40	**15.00**	-1.0	2.0	6.0	3.0	1.0	0.0	64.80	4
LM76	13-Jul-22	2.80	**66.00**	18.0	14.0	11.5	4.5	8.0	4.0	31.40	6
LM77	22-Jul-22	2.00	**67.00**	18.0	14.0	11.0	5.0	6.0	5.0	29.80	8
LM79	22-Jul-22	0.50	**68.75**	16.0	15.0	12.5	2.3	10.0	5.0	26.00	8
Unnamed Tributary to Duck Creek @RM 4.8											
LM80	13-Jul-22	0.10	**34.50**	6.5	9.0	7.0	4.0	2.0	2.0	114.00	4
Unnamed Tributary to Little Duck Cr. @RM 4.42											
LM82	13-Jul-22	0.20	**50.50**	16.5	8.0	9.0	5.5	5.0	2.5	87.60	4
East Fork Duck Creek											
LM85	13-Jul-22	2.00	**62.50**	19.5	15.0	11.0	4.0	7.0	2.0	132.00	4
LM84	14-Jul-22	0.50	**65.00**	18.5	15.0	10.5	4.0	8.0	5.0	123.00	4
Little Duck Creek											
LM86	14-Jul-22	2.40	**56.50**	18.0	13.0	10.0	4.0	4.0	3.5	333.00	4
LM87	14-Jul-22	1.90	**61.00**	19.5	14.0	11.5	4.0	4.0	4.0	384.00	4
LM90	22-Jul-22	1.00	**61.00**	18.0	13.0	10.5	6.0	5.0	4.5	312.00	4
LM92	21-Jul-22	0.49	**66.50**	20.0	13.0	14.5	4.0	6.0	5.0	133.00	4
Clough Creek											
LM95	21-Jul-22	3.20	**59.00**	19.5	12.0	10.5	4.0	6.0	3.0	85.40	4
LM98	21-Jul-22	0.60	**59.50**	18.0	10.0	10.0	5.5	6.0	6.0	66.60	4
	Boatable Sites			***Headwater***							
	Excellent		≥75	**Excellent**		≥70					
	Good		≥60	**Good**		≥55					
	Fair		≥45	**Fair**		≥43					
	Poor		≥30	**Poor**		≥30					
	Very Poor		<30	**Very Poor**		<30					

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 89.5

Stream & Location: Little Miami River - d.s. SR 23/3 L.Miami State Park *RM:* 27.9 *Date:* 8/01/2022

LM01 *Scorers Full Name & Affiliation:* MAS - MBI

River Code: 11 - 001 - ___ *STORET #:* ______ *Lat./Long.:* (NAD 83 - decimal °) 39.316671 / 84.25162 (mid) Office verified location ☐

1] *SUBSTRATE* Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x		☐ ☐ DETRITUS [3]		
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Substrate 18 Maximum 20

2] *INSTREAM COVER*

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 2 SHALLOWS (IN SLOW WATER) [1]
- 1 ROOTMATS [1]
- 2 POOLS > 70cm [2]
- 1 ROOTWADS [1]
- 3 BOULDERS [1]
- 1 OXBOWS, BACKWATERS [1]
- 3 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 17

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 18.5

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for *EACH BANK* (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐ ☐ NONE / LITTLE [3]
- ☑ ☑ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☑ ☐ WIDE > 50m [4]
- ☐ ☑ MODERATE 10-50m [3]
- ☐ ☐ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW < 5m [1]
- ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☐ ☐ OPEN PASTURE, ROWCROP [0]
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 6.5

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check ONE (*ONLY!*)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☑ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 13

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☑ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☑ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☑ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 7.5

6] *GRADIENT* (6.6 ft/mi)

DRAINAGE AREA (1070 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___

%RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☒ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE
1st-sample pass-2nd

1st		2nd
☐	HIGH	☐
☐	UP	☐
☒	NORMAL	☐
☐	LOW	☐
☐	DRY	☐

DISTANCE
- ☒ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY
1st --sample pass-- 2nd

1st		2nd
☐	< 20 cm	☐
☐	20-<40 cm	☐
☒	40-70 cm	☐
☐	> 70 cm/ CTB	☐
☐	SECCHI DEPTH	☐

pass 1st _______ cm
2nd _______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: *Reach consistency*/ Is reach typical of steam?, *Recreation*/ Observed - Inferred, *Other*/ Sampling observations, Concerns, Access directions, etc.

beg. 39.31889, -84.25162
Mid 39.316671, -84.251687
end 39.31462, -84.25243

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft2 ☐ >3ft

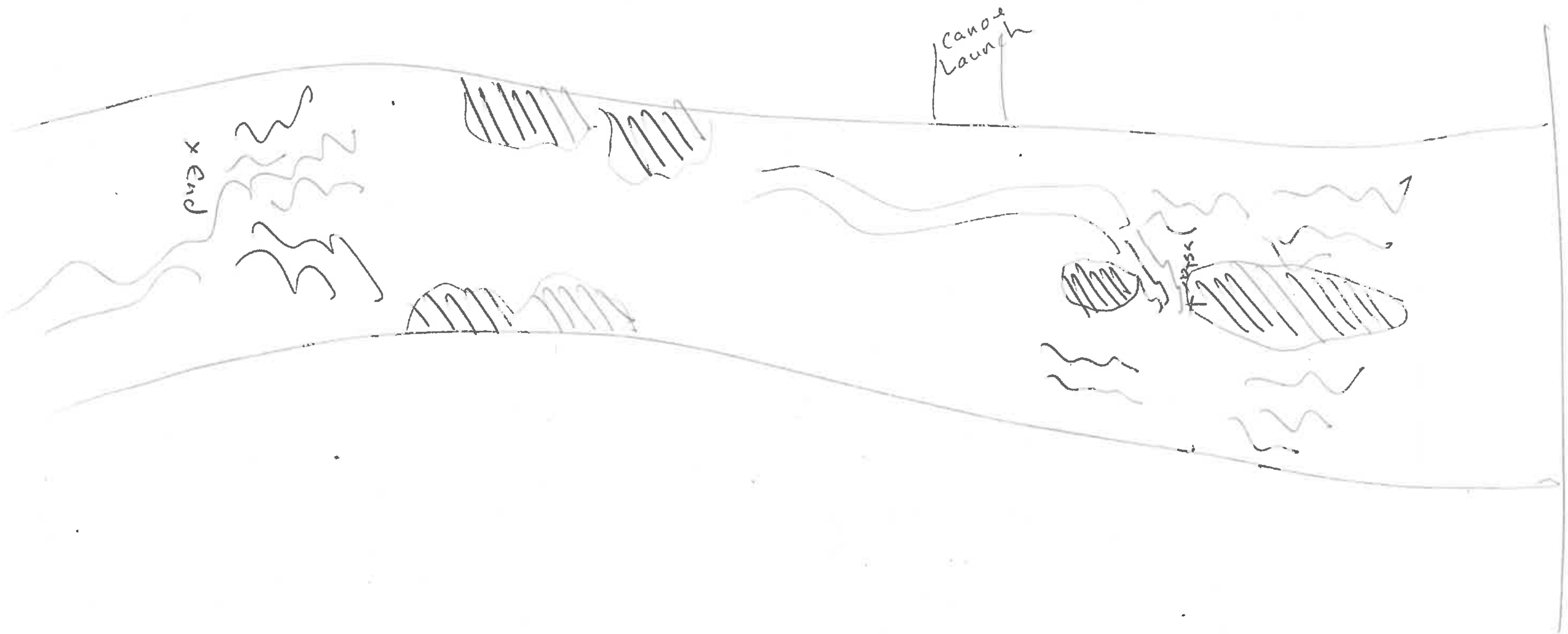
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{\bar{x}}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 91

Stream & Location: Little Miami River - ust. O'Bannon Creek RM: 24.1 Date: 8/01/2022

LM02 Scorers Full Name & Affiliation: MAS -> MBI

River Code: 11 - 001 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.274096 / 84.258334 (Mid) Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]	x	
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 18 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
3 ROOTMATS [1]
3 POOLS > 70cm [2]
3 ROOTWADS [1]
3 BOULDERS [1]
3 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
2 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☑ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 19 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☑ MODERATE [3] ☐ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☑ EXCELLENT [7] ☐ GOOD [5] ☐ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☑ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☑ HIGH [3] ☑ MODERATE [2] ☐ LOW [1]

Comments

Channel: 18.5 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐ ☐ NONE / LITTLE [3] ☑ ☑ MODERATE [2] ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐ ☐ WIDE > 50m [4] ☑ ☐ MODERATE 10-50m [3] ☑ ☑ NARROW 5-10m [2] ☐ ☐ VERY NARROW < 5m [1] ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐ ☐ FOREST, SWAMP [3] ☐ ☐ SHRUB OR OLD FIELD [2] ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1] ☐ ☐ FENCED PASTURE [1] ☐ ☐ OPEN PASTURE, ROWCROP [0] ☐ ☐ CONSERVATION TILLAGE [1] ☐ ☐ URBAN OR INDUSTRIAL [0] ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 5.5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☑ VERY FAST [1] ☑ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 13 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☑ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☑ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☑ NONE [2] ☐ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 Maximum 8

6] GRADIENT (6.51 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (1090 mi²)

%POOL: ? %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient: 10 Maximum 10

EPA 4520 06/16/06

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☒ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE (1st-sample pass-2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☒ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☒ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☒ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass 71 cm
2nd pass _____ cm

CANOPY
- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg. 39.27545, -84.25613
Mid 39.274096, -84.258334
End 39.27217, -84.25923

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

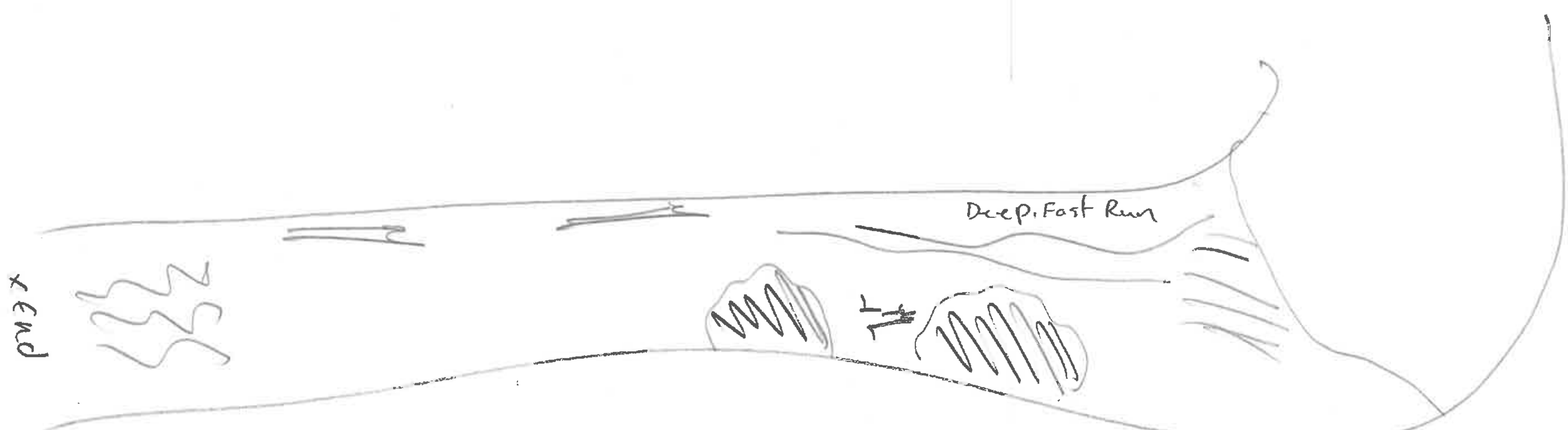
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 84.5

Stream & Location: Little Miami River - ust. Polk Run RM: 22.3 Date: 8/02/2022

LM03 Scorers Full Name & Affiliation:

River Code: 11 - 001 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.25309 / 84.281876 Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]	x	
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY

SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 18 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
3 POOLS > 70cm [2]
2 ROOTWADS [1]
3 BOULDERS [1]
3 OXBOWS, BACKWATERS [1]
2 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 17 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☑ GOOD [5] ☑ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☑ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☑ HIGH [3] ☑ MODERATE [2] ☐ LOW [1]

Comments

Channel: 14.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐ ☐ NONE / LITTLE [3] ☑ ☑ MODERATE [2] ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐ ☐ WIDE > 50m [4] ☐ ☐ MODERATE 10-50m [3] ☑ ☑ NARROW 5-10m [2] ☐ ☐ VERY NARROW < 5m [1] ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐ ☐ FOREST, SWAMP [3] ☐ ☐ SHRUB OR OLD FIELD [2] ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1] ☐ ☐ FENCED PASTURE [1] ☐ ☐ OPEN PASTURE, ROWCROP [0] ☐ ☐ CONSERVATION TILLAGE [1] ☐ ☐ URBAN OR INDUSTRIAL [0] ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☐ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☑ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 12 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☑ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☑ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☑ NONE [2] ☐ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 (Maximum 8)

6] GRADIENT (6.39 ft/mi)

DRAINAGE AREA (1150 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ____ %GLIDE: ____ %RUN: ____ %RIFFLE: ____

Gradient: 10 (Maximum 10)

EPA 4520 06/16/06

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation*/ Observed - Inferred, *Other*/ Sampling observations, Concerns, Access directions, etc.

Beg. 39.25373, -84.27963
Mid 39.25309, -84.281876
End 39.25107, -84.28464

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☒ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE (1st-sample pass-2nd)

1st		2nd
☐	HIGH	☐
☐	UP	☐
☒	NORMAL	☐
☐	LOW	☐
☐	DRY	☐

DISTANCE
- ☒ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)

1st		2nd
☐	< 20 cm	☐
☐	20-<40 cm	☐
☐	40-70 cm	☐
☒	> 70 cm/ CTB	☐
☐	SECCHI DEPTH	☐

SECCHI DEPTH pass 1st _____ cm, 2nd _____ cm

CANOPY
- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

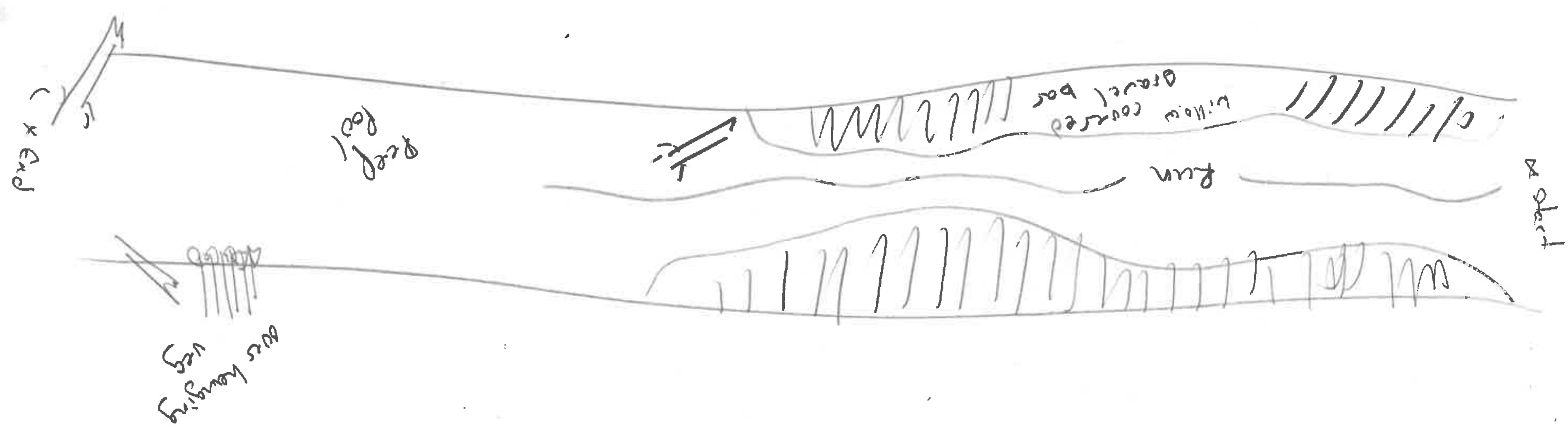
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 89.5

Stream & Location: Dst Polk Run Little Miami River LMO S

RM: 21.5 Date: 8/02/2022

Scorers Full Name & Affiliation: MAS -> MBI

River Code: 11-001-___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.244521 / 84.296381 Mid Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x
☐ ☐ BOULDER [9]	x	x
☑ ☐ COBBLE [8]	x	x
☐ ☑ GRAVEL [7]	x	x
☐ ☐ SAND [6]	x	
☐ ☐ BEDROCK [5]		

OTHER TYPES	POOL	RIFFLE
☐ ☐ HARDPAN [4]		
☐ ☐ DETRITUS [3]	x	
☐ ☐ MUCK [2]		
☐ ☐ SILT [2]	x	
☐ ☐ ARTIFICIAL [0]		

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Substrate Maximum 20: 18

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 2 ROOTMATS [1]
- 3 POOLS > 70cm [2]
- 2 ROOTWADS [1]
- 3 BOULDERS [1]
- 3 OXBOWS, BACKWATERS [1]
- 2 AQUATIC MACROPHYTES [1]
- 2 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 17

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY
- ☐ HIGH [4]
- ☑ MODERATE [3]
- ☐ LOW [2]
- ☐ NONE [1]

DEVELOPMENT
- ☑ EXCELLENT [7]
- ☐ GOOD [5]
- ☐ FAIR [3]
- ☐ POOR [1]

CHANNELIZATION
- ☑ NONE [6]
- ☐ RECOVERED [4]
- ☐ RECOVERING [3]
- ☐ RECENT OR NO RECOVERY [1]

STABILITY
- ☑ HIGH [3]
- ☑ MODERATE [2]
- ☐ LOW [1]

Comments

Channel Maximum 20: 18.5

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐ ☐ NONE / LITTLE [3]
- ☑ ☑ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐ ☐ WIDE > 50m [4]
- ☑ ☑ MODERATE 10-50m [3]
- ☐ ☐ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW < 5m [1]
- ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☐ ☐ OPEN PASTURE, ROWCROP [0]
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 6

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☑ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☑ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☑ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☑ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 8

6] GRADIENT (6.43 ft/ml)
DRAINAGE AREA (1160 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ____ %GLIDE: ____
%RUN: ____ %RIFFLE: ____

Gradient Maximum 10: 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☒ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

DISTANCE
- ☒ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

STAGE

1st -sample pass-		2nd
☐	HIGH	☐
☐	UP	☐
☒	NORMAL	☐
☐	LOW	☐
☐	DRY	☐

CLARITY

1st	--sample pass--	2nd
☐	< 20 cm	☐
☐	20-<40 cm	☐
☐	40-70 cm	☐
☒	> 70 cm/ CTB	☐
☐	SECCHI DEPTH	☐

CANOPY
- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _____ cm
2nd _____ cm

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.24662, -84.29536
Mid 39.244521, -84.296381
end 39.24237, -84.29621

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

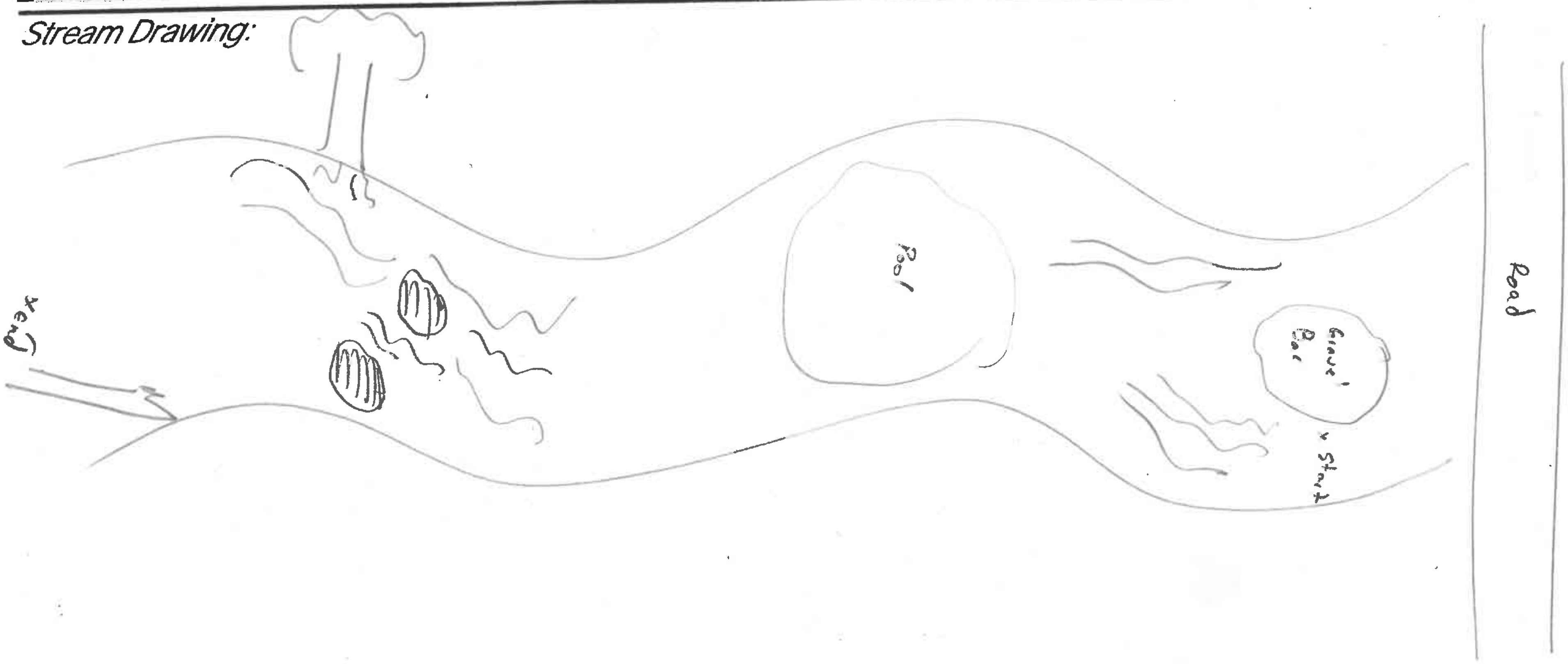
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 89.5

Stream & Location: Little Miami River - Camargo Rd. RM: 18.5 Date: 8/02/2022

LM07

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11-001-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.216841 / 84.314889 Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]	x	
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]	x	
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Substrate: 18 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 1 ROOTMATS [1]
- 3 POOLS > 70cm [2]
- 1 ROOTWADS [1]
- 3 BOULDERS [1]
- 1 OXBOWS, BACKWATERS [1]
- 2 AQUATIC MACROPHYTES [1]
- 2 LOGS OR WOODY DEBRIS [1]

AMOUNT

Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 17 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 18.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☑ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☑☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 6 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☑ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☑ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 12 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☑ BEST AREAS > 10cm [2]	☑ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 (Maximum 8)

6] GRADIENT

GRADIENT (6.35 ft/mi)
DRAINAGE AREA (1190 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient: 10 (Maximum 10)

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.21917 , -84.31583

Mid 39.216841 , -84.314889

End 39.21451 , -84.31430

A] SAMPLED REACH
Check ALL that apply

METHOD
- [x] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

STAGE (1st -sample pass- 2nd)
- [ ] HIGH [ ]
- [ ] UP [ ]
- [x] NORMAL [ ]
- [ ] LOW [ ]
- [ ] DRY [ ]

DISTANCE
- [x] 0.5 Km
- [ ] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

____ meters

CLARITY (1st --sample pass-- 2nd)
- [ ] < 20 cm [ ]
- [ ] 20-<40 cm [ ]
- [ ] 40-70 cm [ ]
- [x] > 70 cm/ CTB [ ]
- [ ] SECCHI DEPTH [ ]

1st pass ______ cm

2nd pass ______ cm

CANOPY
- [x] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION
POOL: AREA [ ] >100ft^2 DEPTH [ ] >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

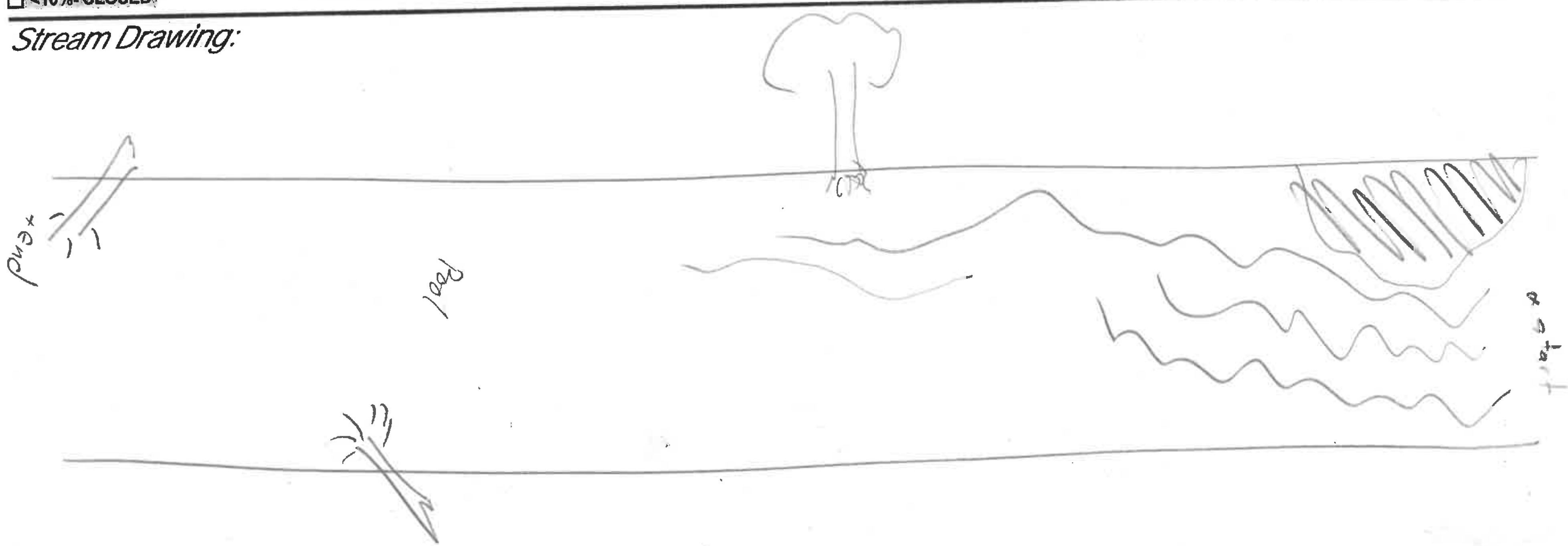
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 85.8

Stream & Location: Little Miami River - canoe access dst. SR126 LM08 RM: 17.7 Date: 8/02/2022

Scorers Full Name & Affiliation: MAS- MBI

River Code: 11 - 001 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.209211 / 84.302324 Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]	x	
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]	x	
☐ ☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

ORIGIN (Check ONE (Or 2 & average)): ☑ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 18 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	3 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	3 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]
2 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]
3 ROOTMATS [1]		

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 14 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☑ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 17.5 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐ ☐ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☑ ☑ MODERATE [2]	☐ ☑ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☑ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	
☑ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☑ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☑ POOL WIDTH < RIFFLE WIDTH [0]	☑ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☑ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 11 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☑ BEST AREAS > 10cm [2]	☑ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 Maximum 8

6] GRADIENT

GRADIENT (6.24 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (1190 mi²)

%POOL: ? %GLIDE: %RUN: %RIFFLE:

Gradient: 10 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _______ cm
2nd _______ cm

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
Circle some & *COMMENT*

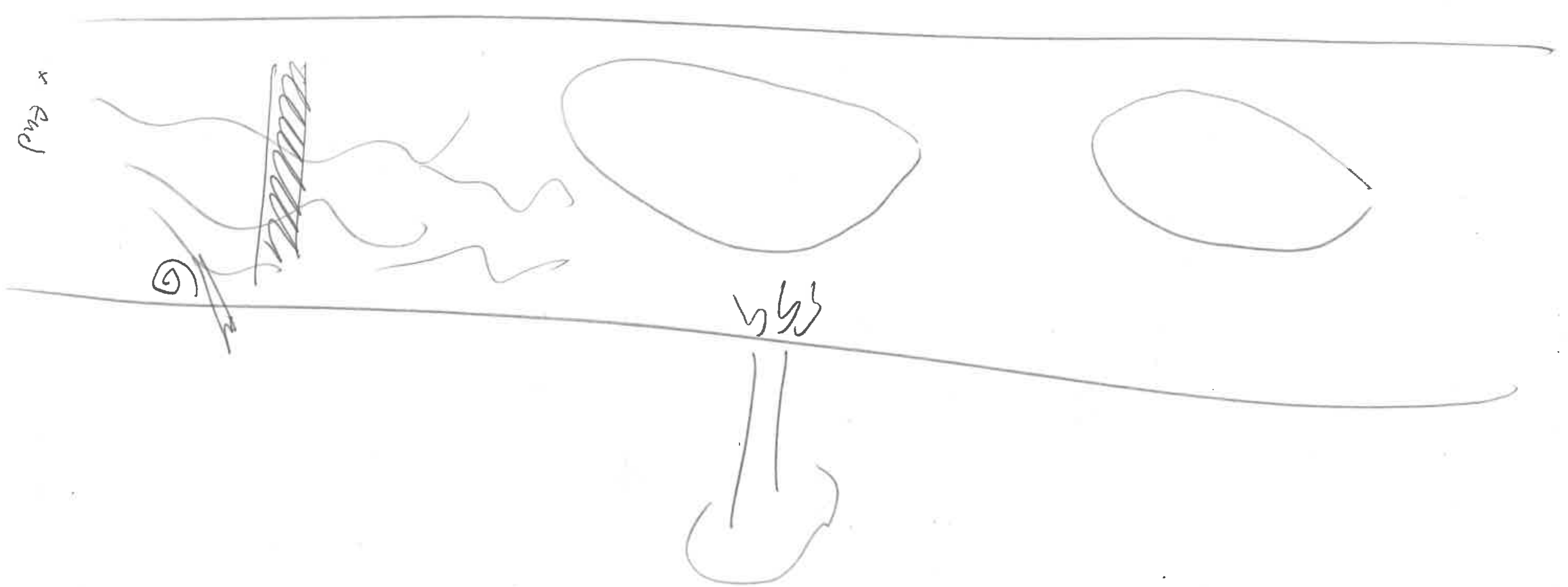
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 87.75

Stream & Location: Little Miami River - Wooster Pike - Milford LM09 RM: 13.1 Date: 8/03/2022

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11-001-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.168967 / 84.296643 Mid Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]	x	
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]	x	
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

(Score natural substrates; ignore sludge from point-sources)

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Substrate: 18 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 2 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 3 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 3 BOULDERS [1]
- 3 OXBOWS, BACKWATERS [1]
- 2 AQUATIC MACROPHYTES [1]
- 2 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 14 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☑ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 19.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐☐ NONE / LITTLE [3]
- ☑☑ MODERATE [2]
- ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐☑ WIDE > 50m [4]
- ☑☑ MODERATE 10-50m [3]
- ☐☐ NARROW 5-10m [2]
- ☐☐ VERY NARROW < 5m [1]
- ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐☐ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☑☑ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☐☐ OPEN PASTURE, ROWCROP [0]
- ☐☐ CONSERVATION TILLAGE [1]
- ☐☐ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 6.25 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 12 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☑ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☑ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 (Maximum 8)

6] GRADIENT (6.19 ft/mi)
DRAINAGE AREA (1200 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___

%RUN: ___ %RIFFLE: ___

Gradient: 10 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- [x] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

DISTANCE
- [x] 0.5 Km
- [ ] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

____ meters

STAGE

1st -sample pass-		2nd
[ ]	HIGH	[ ]
[ ]	UP	[ ]
[x]	NORMAL	[ ]
[ ]	LOW	[ ]
[ ]	DRY	[ ]

CLARITY

1st --sample pass--		2nd
[ ]	< 20 cm	[ ]
[ ]	20-<40 cm	[ ]
[ ]	40-70 cm	[ ]
[x]	> 70 cm/ CTB	[ ]
[ ]	SECCHI DEPTH	[ ]

CANOPY
- [ ] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

pass 1st ______ cm
2nd ______ cm

C] RECREATION AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg. - 39.17078, -84.29798
Mid. - 39.168967, -84.296643
End. - 39.16710, -84.29510

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

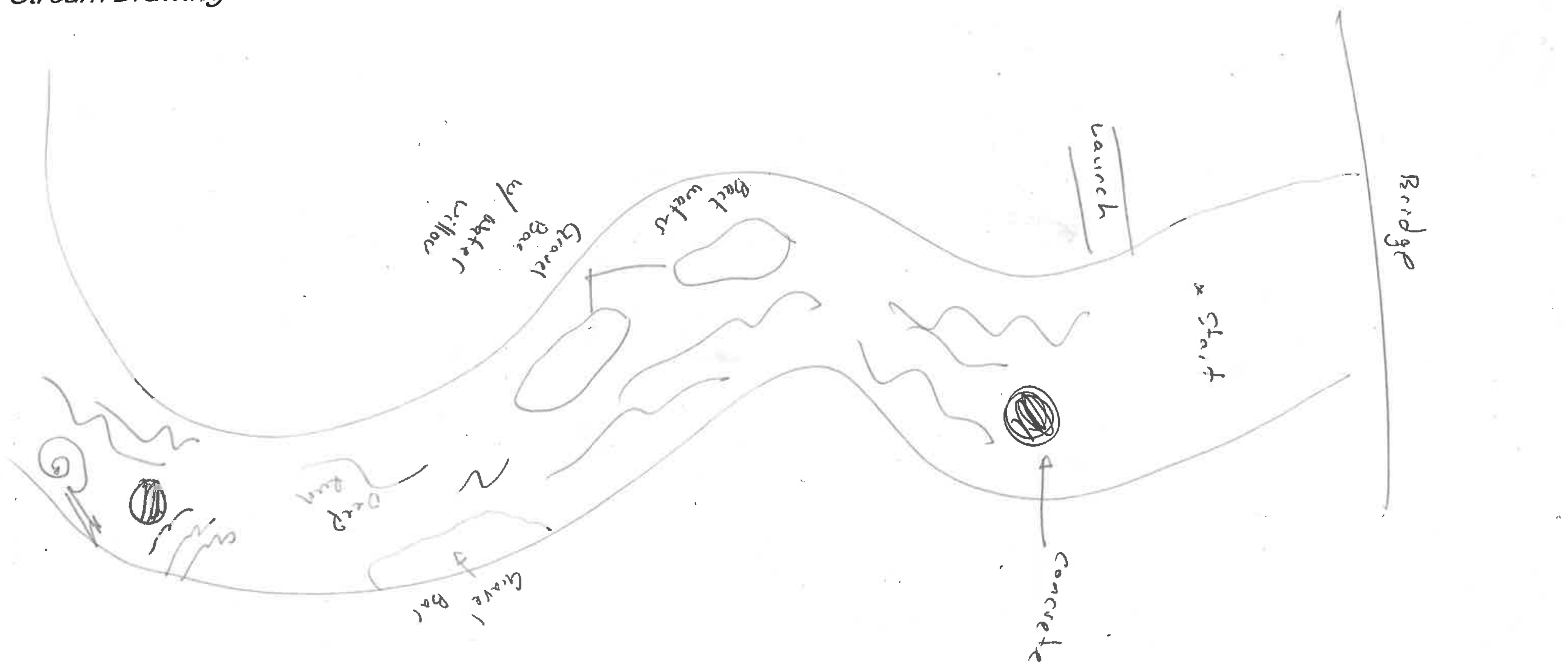
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 85.0

Stream & Location: Little Miami River - Mt. Carmel + Round Bottom Rd. RM: 10.9 Date: 8/03/2022

LM11 Scorers Full Name & Affiliation: MAS-MBI

River Code: 11-001-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.149303 / 84.315429 MID Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]	X	
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 18 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
3 POOLS > 70cm [2]
2 ROOTWADS [1]
3 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
1 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 15 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 18.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐ ☐ NONE / LITTLE [3]; ☑ ☑ MODERATE [2]; ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐ ☐ WIDE > 50m [4]; ☐ ☐ MODERATE 10-50m [3]; ☑ ☐ NARROW 5-10m [2]; ☐ ☑ VERY NARROW < 5m [1]; ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐ ☐ FOREST, SWAMP [3]; ☐ ☐ SHRUB OR OLD FIELD [2]; ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]; ☐ ☐ FENCED PASTURE [1]; ☐ ☐ OPEN PASTURE, ROWCROP [0]; ☐ ☐ CONSERVATION TILLAGE [1]; ☐ ☐ URBAN OR INDUSTRIAL [0]; ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 4.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☐ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☑ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☑ VERY FAST [1] ☑ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 11 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☑ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☑ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☑ NONE [2] ☐ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 (Maximum 8)

6] GRADIENT (6.14 ft/mi)
DRAINAGE AREA (1710 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: %RUN: %RIFFLE:

Gradient: 10 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☑ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)

1st		2nd
☐	HIGH	☐
☐	UP	☐
☑	NORMAL	☐
☐	LOW	☐
☐	DRY	☐

DISTANCE
- ☑ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

____ meters

CLARITY (1st --sample pass-- 2nd)

1st		2nd
☐	< 20 cm	☐
☐	20-<40 cm	☐
☐	40-70 cm	☐
☑	> 70 cm/ CTB	☐
☐	SECCHI DEPTH	☐

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st ______ cm
2nd ______ cm

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation*/ Observed - Inferred, *Other*/ Sampling observations, Concerns, Access directions, etc.

Beg 39.14994 , -84.31258
Mid 39.149303 , -84.315429
end 39.14821 , -84.31778

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

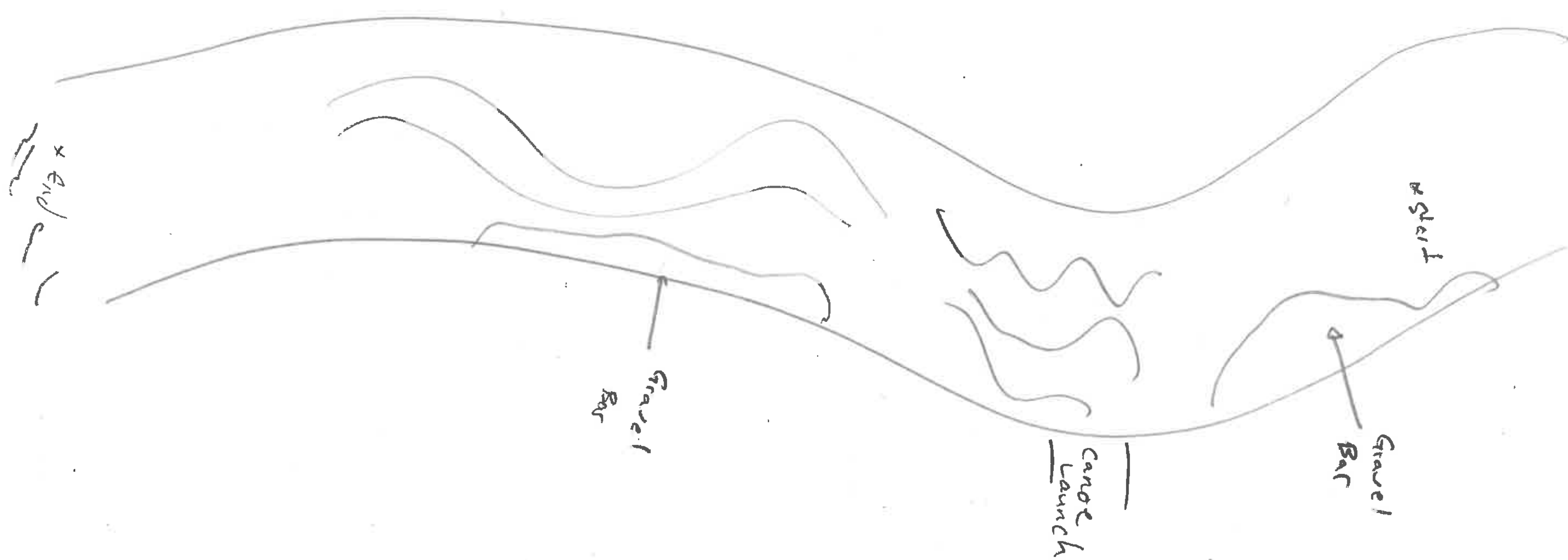
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA
Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 89.25

Stream & Location: Little Miami River Newtown Rd *RM:* 8.1 *Date:* 8/03/2022
LM1.2 *Scorers Full Name & Affiliation:* MAS - MBI
River Code: 11-001-___ *STORET #:* ______ *Lat./Long.: (NAD 83 - decimal °)* 39.137303 / 84.353777 MID *Office verified location* ☐

1] *SUBSTRATE* Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]	x	
☐[x] COBBLE [8]	x	x	☐☐ MUCK [2]		
[x]☐ GRAVEL [7]	x	x	☐☐ SILT [2]	x	
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: [x] 4 or more [2] ☐ 3 or less [0]
Comments

ORIGIN Check ONE (Or 2 & average)
- [x] LIMESTONE [1]
- [x] TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY
SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- [x] NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- [x] NORMAL [0]
- ☐ NONE [1]

Substrate 18 Maximum 20

2] *INSTREAM COVER* Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0	UNDERCUT BANKS [1]	3	POOLS > 70cm [2]	2	OXBOWS, BACKWATERS [1]
2	OVERHANGING VEGETATION [1]	2	ROOTWADS [1]	1	AQUATIC MACROPHYTES [1]
3	SHALLOWS (IN SLOW WATER) [1]	3	BOULDERS [1]	3	LOGS OR WOODY DEBRIS [1]
2	ROOTMATS [1]				

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- [x] MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments
Cover Maximum 20: 17

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	[x] EXCELLENT [7]	[x] NONE [6]	[x] HIGH [3]
[x] MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
[x] LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments
Channel Maximum 20: 19

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for *EACH BANK* (Or 2 per bank & average)
River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	[x]☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
[x][x] MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐[x] URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	[x][x] RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐[x] VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.
Comments
Riparian Maximum 10: 5.25

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check ONE (ONLY!)
- [x] > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- [x] POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- [x] VERY FAST [1]
- [x] FAST [1]
- [x] MODERATE [1]
- [x] SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- [x] EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments
Pool / Current Maximum 12: 13

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
[x] BEST AREAS > 10cm [2]	[x] MAXIMUM > 50cm [2]	[x] STABLE (e.g., Cobble, Boulder) [2]	[x] NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments
Riffle / Run Maximum 8: 8

6] *GRADIENT* (6.08 ft/mi) DRAINAGE AREA (1710 mi²)
- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient Maximum 10: 10

EPA 4520 06/16/06

A] SAMPLED REACH
Check ALL that apply

METHOD
- [x] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

STAGE (1st-sample pass-2nd)
- [ ] HIGH [ ]
- [ ] UP [ ]
- [x] NORMAL [ ]
- [ ] LOW [ ]
- [ ] DRY [ ]

DISTANCE
- [x] 0.5 Km
- [ ] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- [ ] < 20 cm [ ]
- [ ] 20-<40 cm [ ]
- [ ] 40-70 cm [ ]
- [x] > 70 cm/ CTB [ ]
- [ ] SECCHI DEPTH [ ]

CANOPY
- [x] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

1st pass _______ cm
2nd pass _______ cm

Comment RE: *Reach consistency/* Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg - 39.13657, -84.35127
Mid - 39.137303, -84.353777
end 39.13876, -84.35629

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

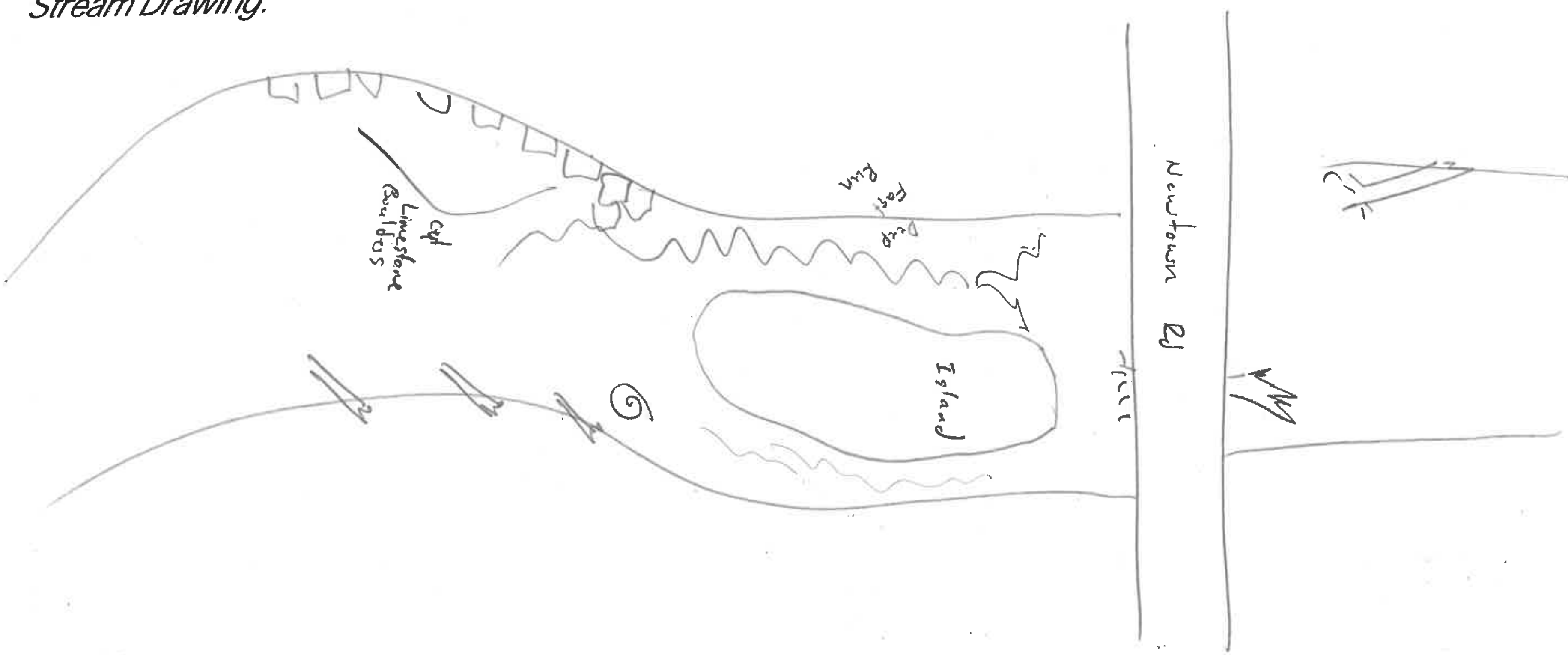
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{\bar{x}}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x² width
entrench. ratio
Legacy Tree:

Stream Drawing:



OhioEPA **Qualitative Habitat Evaluation Index and Use Assessment Field Sheet** QHEI Score: 87.0

Stream & Location: Little Miami River R.R. Trestle - Mariemont RM: 6.83 Date: 8/03/2022

LM 13 Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 001 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.140881 / 84.367376 Mid. Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE	ORIGIN	QUALITY
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]			☑ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]	x		☑ TILLS [1]	☐ MODERATE [-1]
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]			☐ WETLANDS [0]	☑ NORMAL [0]
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]	x		☐ HARDPAN [0]	☐ FREE [1]
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]			☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)			☐ RIP/RAP [0]	☐ MODERATE [-1]
						☐ LACUSTURINE [0]	☑ NORMAL [0]
						☐ SHALE [-1]	☐ NONE [1]
						☐ COAL FINES [-2]	

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Substrate 18 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 2 SHALLOWS (IN SLOW WATER) [1]
- 2 ROOTMATS [1]
- 2 POOLS > 70cm [2]
- 2 ROOTWADS [1]
- 3 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 1 AQUATIC MACROPHYTES [1]
- 3 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover 16 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 18.5 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☐☑ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☑☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian 5.5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	
☑ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☑ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☑ POOL WIDTH < RIFFLE WIDTH [0]	☑ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☑ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current 11 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☑ BEST AREAS > 10cm [2]	☑ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 8 Maximum 8

6] GRADIENT (6.07 ft/mi)

DRAINAGE AREA (1720 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ( ) %GLIDE: ( )
%RUN: ( ) %RIFFLE: ( )

Gradient 10 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☑ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☑ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _____ cm
2nd _____ cm

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.14166, -84.36496
Mid 39.140881, -84.367376
end 39.14025, -84.37040

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

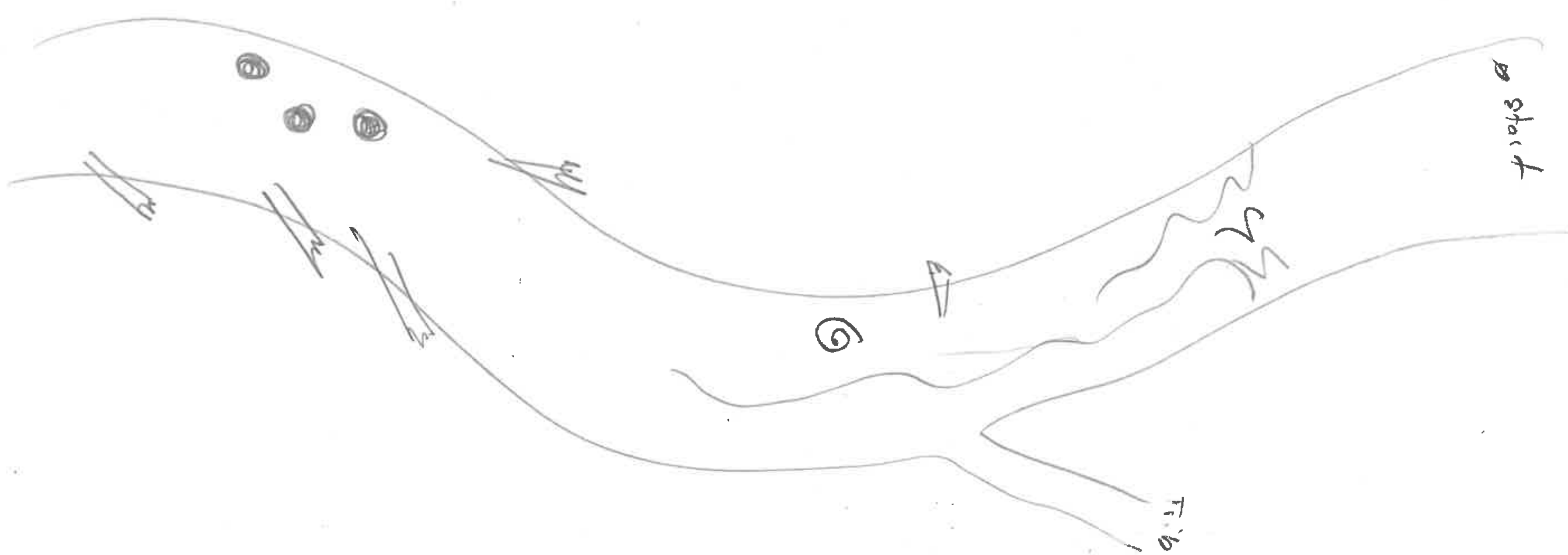
Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 87.5

Stream & Location: Little Miami River ust Duck Creek LMIS *RM:* 4.1 *Date:* 8/03/2022

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 001 - *STORET #:* *Lat./Long.:* (NAD 83 - decimal °) 39.117828 / 84.39946 MID *Office verified location* ☐

1] *SUBSTRATE*

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]	x	
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]	x	
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Substrate 18 Maximum 20

2] *INSTREAM COVER*

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 2 ROOTMATS [1]
- 3 POOLS > 70cm [2]
- 2 ROOTWADS [1]
- 3 BOULDERS [1]
- 3 OXBOWS, BACKWATERS [1]
- 3 AQUATIC MACROPHYTES [1]
- 2 LOGS OR WOODY DEBRIS [1]

AMOUNT

Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover 16 Maximum 20

3] *CHANNEL MORPHOLOGY*

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☑ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 18.5 Maximum 20

4] *BANK EROSION AND RIPARIAN ZONE*

Check **ONE** in each category for *EACH BANK* (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐ ☐ NONE / LITTLE [3]
- ☑ ☑ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐ ☐ WIDE > 50m [4]
- ☐ ☐ MODERATE 10-50m [3]
- ☑ ☑ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW < 5m [1]
- ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☐ ☐ OPEN PASTURE, ROWCROP [0]
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 5 Maximum 10

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH

Check ONE (*ONLY!*)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH

Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☑ POOL WIDTH = RIFFLE WIDTH [1]
- ☑ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY

Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☑ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 12 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☑ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☑ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run 8 Maximum 8

6] *GRADIENT* (6.18 ft/mi)

DRAINAGE AREA (1730 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:

%RUN: %RIFFLE:

Gradient 10 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- [x] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

STAGE
1st-sample pass-2nd
- [ ] HIGH [ ]
- [ ] UP [ ]
- [x] NORMAL [ ]
- [ ] LOW [ ]
- [ ] DRY [ ]

DISTANCE
- [x] 0.5 Km
- [ ] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

______ meters

CLARITY
1st --sample pass-- 2nd
- [ ] < 20 cm [ ]
- [ ] 20-<40 cm [ ]
- [ ] 40-70 cm [ ]
- [x] > 70 cm/ CTB [ ]
- [ ] SECCHI DEPTH [ ]

1st pass ______ cm
2nd ______ cm

CANOPY
- [x] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.11973, -84.39989

Mid 39.117828, -84.39946

End 39.11561, -84.39871

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

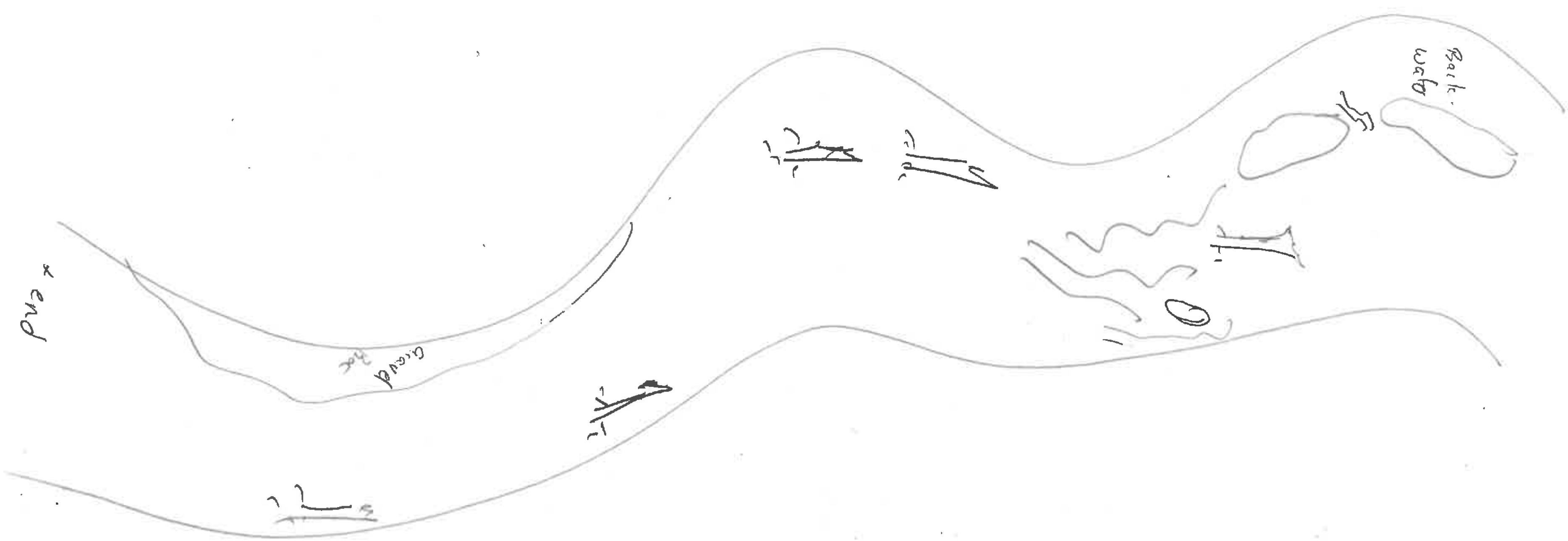
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 65

Stream & Location: Little Miami River Dst Duck Creek RM: 3.7 Date: 8/04/2022
LM16A
Scorers Full Name & Affiliation: MAS - MBI
River Code: 11 - 001 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.11735 / 84.400579 Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x		☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x		☐☐ DETRITUS [3]	x	
☐☐ COBBLE [8]	x		☐☐ MUCK [2]		
☐☑ GRAVEL [7]	x		☐☐ SILT [2]	x	
☑☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]
(Score natural substrates; ignore sludge from point-sources)
Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY
SILT
- ☐ HEAVY [-2]
- ☑ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☑ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate: 14 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	3 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
1 SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
2 ROOTMATS [1]		

AMOUNT
Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 16 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☑ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 11 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)
River right looking downstream

L R EROSION	L R RIPARIAN WIDTH	L R FLOOD PLAIN QUALITY	L R
☐☐ NONE / LITTLE [3]	☐☑ WIDE > 50m [4]	☐☑ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☑☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 7 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH
Check ONE (ONLY!)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH
Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☑ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY
Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☑ SLOW [1]
- ☐ VERY FAST [1]
- ☐ INTERSTITIAL [-1]
- ☐ FAST [1]
- ☐ INTERMITTENT [-2]
- ☐ MODERATE [1]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 7 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:
Check ONE (Or 2 & average).
☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 0 (Maximum 8)

6] GRADIENT (6.16 ft/mi)
DRAINAGE AREA (1740 mi²)
- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient: 10 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- [x] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

STAGE
1st -sample pass- 2nd
- [ ] HIGH [ ]
- [ ] UP [ ]
- [x] NORMAL [ ]
- [ ] LOW [ ]
- [ ] DRY [ ]

DISTANCE
- [x] 0.5 Km
- [ ] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

_____ meters

CLARITY
1st --sample pass-- 2nd
- [ ] < 20 cm [ ]
- [ ] 20-<40 cm [ ]
- [ ] 40-70 cm [ ]
- [x] > 70 cm/ CTB [ ]
- [ ] SECCHI DEPTH [ ]

pass 1st _____ cm
2nd _____ cm

CANOPY
- [ ] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.11351, -84.40003
Mid 39.111735, -84.400579
End 39.10930, -84.40109

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

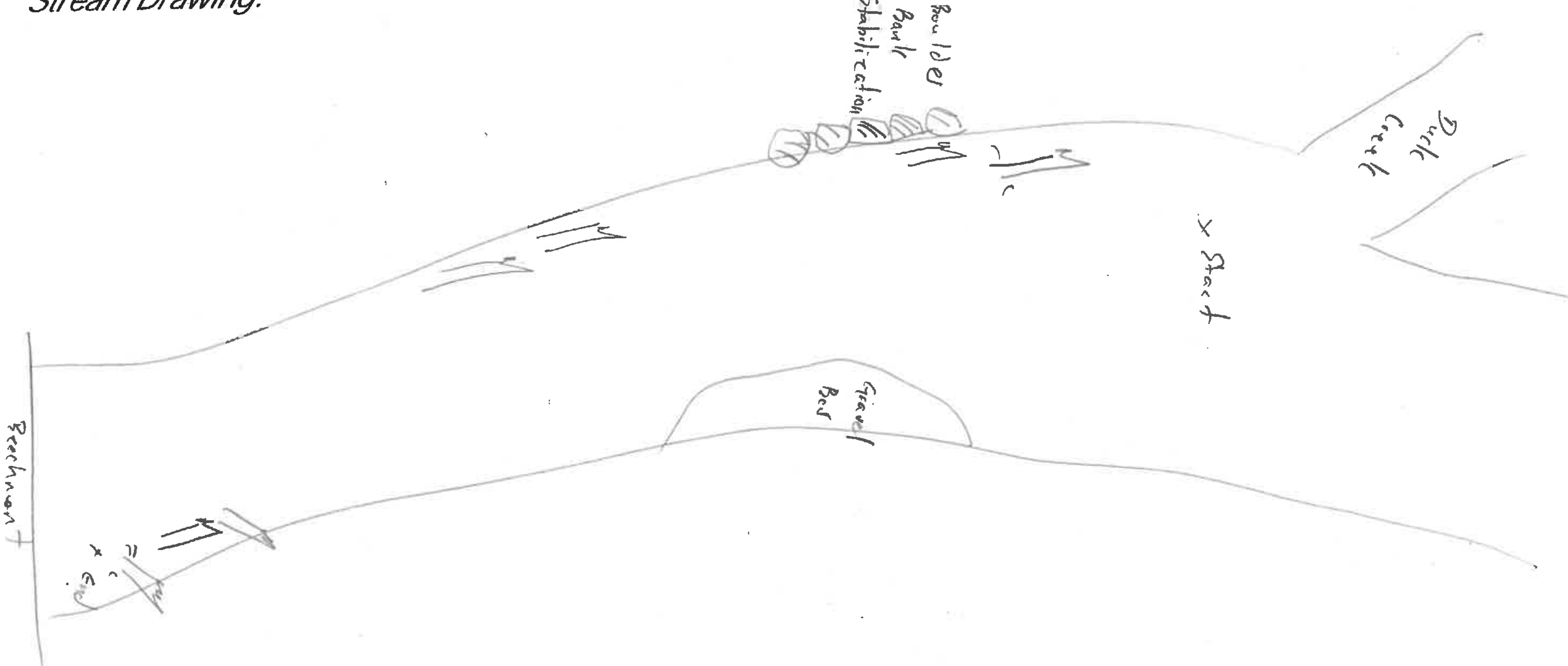
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 84.0

Stream & Location: Little Miami River Dst Beechmont Ave LM16 RM: 3.5 Date: 8/04/2022

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 001 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.107813 / 84.404555 MID Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]	x	
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]	x	
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

(Score natural substrates; ignore sludge from point-sources)

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 17 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
3 POOLS > 70cm [2]
2 ROOTWADS [1]
3 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
3 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 15 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 17 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☑☑ MODERATE [2] ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☑☐ WIDE > 50m [4] ☐☑ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☑☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☐☑ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 7 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☐ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☑ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☑ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☑ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 10 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☑ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☑ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☑ NONE [2] ☐ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 (Maximum 8)

6] GRADIENT (6.16 ft/mi)
DRAINAGE AREA (1750 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient: 10 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☒ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

DISTANCE
- ☒ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

meters

STAGE
1st-sample pass-2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☒ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

CLARITY
1st --sample pass-- 2nd
- ☐ <20 cm ☐
- ☐ 20-<40 cm ☐
- ☒ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm
2nd ______ cm

CANOPY
- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Deep Riffle / Run complex gone during 1st pass after the cofferdam was removed the riffle/run complex returned for 2nd pass
Beg 39.10878, -84.40202 end- 39.10631, -84.40676
Mid 39.107813, -84.404555

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 84.0

Stream & Location: Little Miami River Dst Beechmont Ave RM: 3.5 Date: 8/04/2022

LM16

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 001 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.107813 / 84.404555 MID Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]	x	
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]		x
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY

SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 17 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	3 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
2 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
2 ROOTMATS [1]		

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 15 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☑ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 17 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐ ☐ NONE / LITTLE [3]	☑ ☐ WIDE > 50m [4]	☑ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☑ ☑ MODERATE [2]	☐ ☑ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☑ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian: 7 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)	CHANNEL WIDTH — Check ONE (Or 2 & average)	CURRENT VELOCITY — Check ALL that apply	
☑ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☑ POOL WIDTH < RIFFLE WIDTH [0]	☑ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☑ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 10 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☑ BEST AREAS > 10cm [2]	☑ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 8 Maximum 8

6] GRADIENT (6.16 ft/mi) ☐ VERY LOW - LOW [2-4]

DRAINAGE AREA (1750 mi²) ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ( ) %GLIDE: ( )

%RUN: ( ) %RIFFLE: ( )

Gradient: 10 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- [x] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

STAGE

1st-sample pass		2nd
[ ]	HIGH	[ ]
[ ]	UP	[ ]
[x]	NORMAL	[ ]
[ ]	LOW	[ ]
[ ]	DRY	[ ]

DISTANCE
- [x] 0.5 Km
- [ ] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

_____ meters

CLARITY

1st --sample pass--		2nd
[ ]	<20 cm	[ ]
[ ]	20-<40 cm	[ ]
[x]	40-70 cm	[ ]
[ ]	> 70 cm/ CTB	[ ]
[ ]	SECCHI DEPTH	[ ]

1st pass _______ cm
2nd pass _______ cm

CANOPY
- [x] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Deep Riffle / Run complex gone during 1st pass after the cofferdam was removed the riffle/run complex returned for 2nd pass
Beg 39.10878, -84.40202 end- 39.10631, -84.40676
Mid 39.107813, -84.404555

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

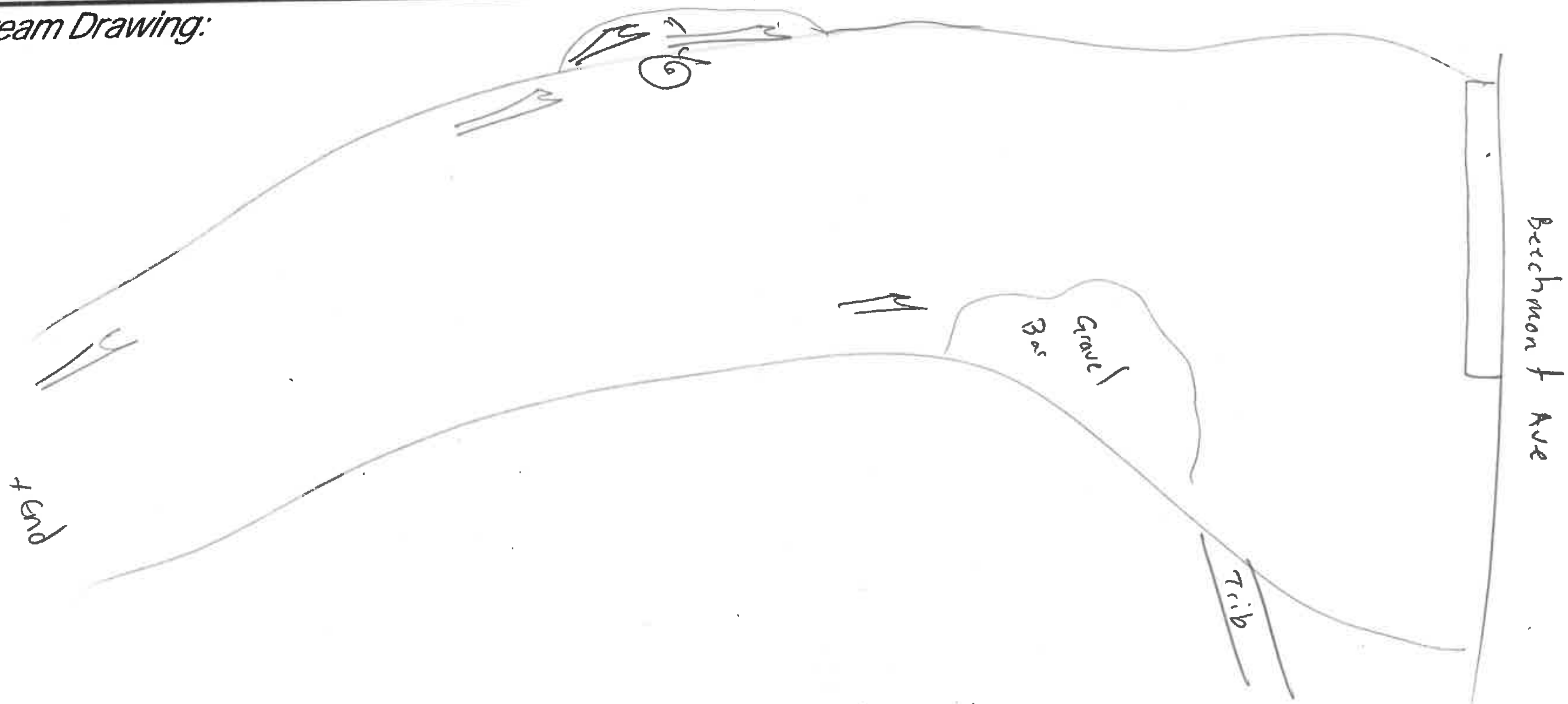
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 62

Stream & Location: Little Miami River Dst US-52 LM17

RM: 1.6 Date: 8/04/2022

Scorers Full Name & Affiliation: MAS-MBI

River Code: 11-001-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.083589 / 84.423565 Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x		☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x		☐☐ DETRITUS [3]		
☐☐ COBBLE [8]	x		☐☐ MUCK [2]		
☐☑ GRAVEL [7]	x		☐☐ SILT [2]		
☑☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1]; ☑ TILLS [1]; ☐ WETLANDS [0]; ☐ HARDPAN [0]; ☐ SANDSTONE [0]; ☐ RIP/RAP [0]; ☐ LACUSTURINE [0]; ☐ SHALE [-1]; ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2]; ☑ MODERATE [-1]; ☐ NORMAL [0]; ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2]; ☑ MODERATE [-1]; ☐ NORMAL [0]; ☐ NONE [1]

Substrate: 14 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]
r OVERHANGING VEGETATION [1]
0 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
3 POOLS > 70cm [2]
2 ROOTWADS [1]
1 BOULDERS [1]
16 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
3 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11]; ☑ MODERATE 25-75% [7]; ☑ SPARSE 5-<25% [3]; ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 14 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4]; ☐ MODERATE [3]; ☑ LOW [2]; ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7]; ☐ GOOD [5]; ☐ FAIR [3]; ☑ POOR [1]

CHANNELIZATION: ☑ NONE [6]; ☐ RECOVERED [4]; ☐ RECOVERING [3]; ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☐ HIGH [3]; ☑ MODERATE [2]; ☐ LOW [1]

Comments

Channel: 11 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3]; ☑☑ MODERATE [2]; ☐☑ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☑ WIDE > 50m [4]; ☑☐ MODERATE 10-50m [3]; ☑☐ NARROW 5-10m [2]; ☐☐ VERY NARROW < 5m [1]; ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☑ FOREST, SWAMP [3]; ☐☐ SHRUB OR OLD FIELD [2]; ☐☑ RESIDENTIAL, PARK, NEW FIELD [1]; ☐☐ FENCED PASTURE [1]; ☐☐ OPEN PASTURE, ROWCROP [0]; ☐☐ CONSERVATION TILLAGE [1]; ☑☐ URBAN OR INDUSTRIAL [0]; ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 6 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6]; ☐ 0.7-<1m [4]; ☐ 0.4-<0.7m [2]; ☐ 0.2-<0.4m [1]; ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☐ POOL WIDTH > RIFFLE WIDTH [2]; ☐ POOL WIDTH = RIFFLE WIDTH [1]; ☑ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1]; ☐ VERY FAST [1]; ☐ FAST [1]; ☐ MODERATE [1]; ☑ SLOW [1]; ☐ INTERSTITIAL [-1]; ☐ INTERMITTENT [-2]; ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 7 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2]; ☐ BEST AREAS 5-10cm [1]; ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2]; ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2]; ☐ MOD. STABLE (e.g., Large Gravel) [1]; ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2]; ☐ LOW [1]; ☐ MODERATE [0]; ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 0 (Maximum 8)

6] GRADIENT (6.18 ft/mi)

DRAINAGE AREA (1760 mi²)

☐ VERY LOW - LOW [2-4]; ☐ MODERATE [6-10]; ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: %RUN: %RIFFLE:

Gradient: 10 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☑ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE

1st -sample pass-		2nd
☐	HIGH	☐
☐	UP	☐
☑	NORMAL	☐
☐	LOW	☐
☐	DRY	☐

DISTANCE
- ☑ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY

1st --sample	pass--	2nd
☐	< 20 cm	☐
☐	20-<40 cm	☐
☑	40-70 cm	☐
☐	> 70 cm/ CTB	☐
☐	SECCHI DEPTH	☐

1st pass _____ cm
2nd pass _____ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: *Reach consistency/* Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

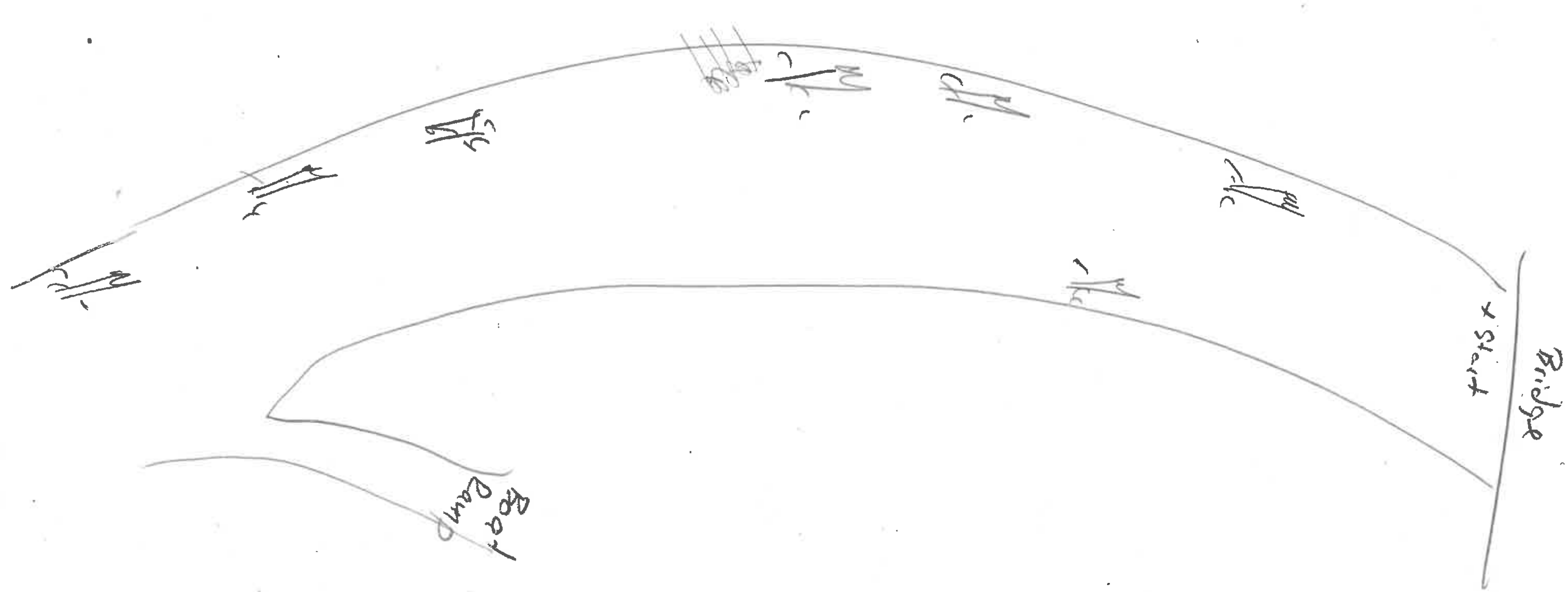
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 63

Stream & Location: Polk Run - East Kemper Rd. *RM:* 0.3 *Date:* 9/09/2022

LM 40 *Scorers Full Name & Affiliation:* MBI - MAS

River Code: 11-009- *STORET #:* *Lat./Long.:* (NAD 83 - decimal °) 39.251004 / 84.298907 *Office verified location* ☐

1] *SUBSTRATE* Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☑ ☐ COBBLE [8]	x		☐ ☐ MUCK [2]		
☐ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]		
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]		
☐ ☑ BEDROCK [5]	x				

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ NONE [1]

Substrate 18 Maximum 20

2] *INSTREAM COVER* Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
2 ROOTMATS [1]		

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover 13 Maximum 20

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 11 Maximum 20

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for *EACH BANK* (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☑ ☑ NONE / LITTLE [3]
- ☑ ☑ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐ ☐ WIDE > 50m [4]
- ☐ ☑ MODERATE 10-50m [3]
- ☑ ☐ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW < 5m [1]
- ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐ ☐ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☐ ☐ OPEN PASTURE, ROWCROP [0]

(L R)
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 6 Maximum 10

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check ONE (*ONLY!*)
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☑ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☑ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 5 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☑ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run 6 Maximum 8

6] *GRADIENT* (56.1 ft/mi)

DRAINAGE AREA (9.97 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:

%RUN: %RIFFLE:

Gradient 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☑ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☑ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass _____ cm
2nd pass _____ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.25068, -84.29797
Mid 39.251004, -84.298907
End 39.25133, -84.29951

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

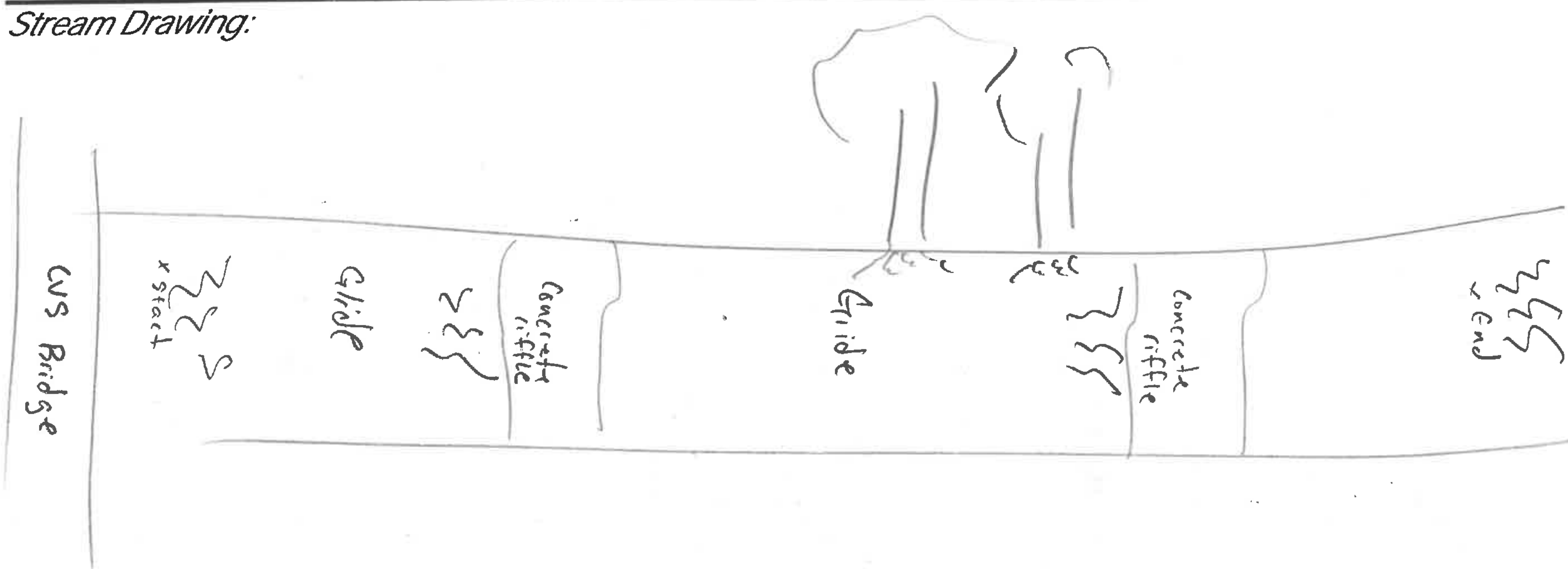
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 70

Stream & Location: Sycamore Creek - Loveland Rd. LM50

RM: 1.1 Date: 9/09/2022

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 007 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.217190 / 84.331749 Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☑ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]	x	x	☐ ☐ DETRITUS [3]		
☐ ☐ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☐ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]		
☐ ☐ SAND [6]	x	x	☐ ☐ ARTIFICIAL [0]		
☑ ☐ BEDROCK [5]	x				

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ NONE [1]

Substrate: 20 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 1 POOLS > 70cm [2]
- 2 ROOTWADS [1]
- 3 BOULDERS [1]
- 1 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☑ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 10

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☑ GOOD [5]	☑ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 15

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☑ ☑ NONE / LITTLE [3]
- ☐ ☐ MODERATE [2]
- ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐ ☐ WIDE > 50m [4]
- ☐ ☐ MODERATE 10-50m [3]
- ☑ ☑ NARROW 5-10m [2]
- ☐ ☐ VERY NARROW < 5m [1]
- ☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☑ ☑ FOREST, SWAMP [3]
- ☐ ☐ SHRUB OR OLD FIELD [2]
- ☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐ ☐ FENCED PASTURE [1]
- ☐ ☐ OPEN PASTURE, ROWCROP [0]
- ☐ ☐ CONSERVATION TILLAGE [1]
- ☐ ☐ URBAN OR INDUSTRIAL [0]
- ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 7

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☑ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 8

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☑ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 6

6] GRADIENT (53.8 ft/mi)
DRAINAGE AREA (12.5 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 4

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☒ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☒ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☒ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☒ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☒ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _____ cm
2nd _____ cm

C] RECREATION AREA DEPTH
POOL: ☐ >100ft2 ☐ >3ft

Comment RE: Reach consistency/ Is reach typical of steam?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Beg 39.21787, -84.33165
Mid 39.217190, -84.331749
End 39.21663, -84.33202

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

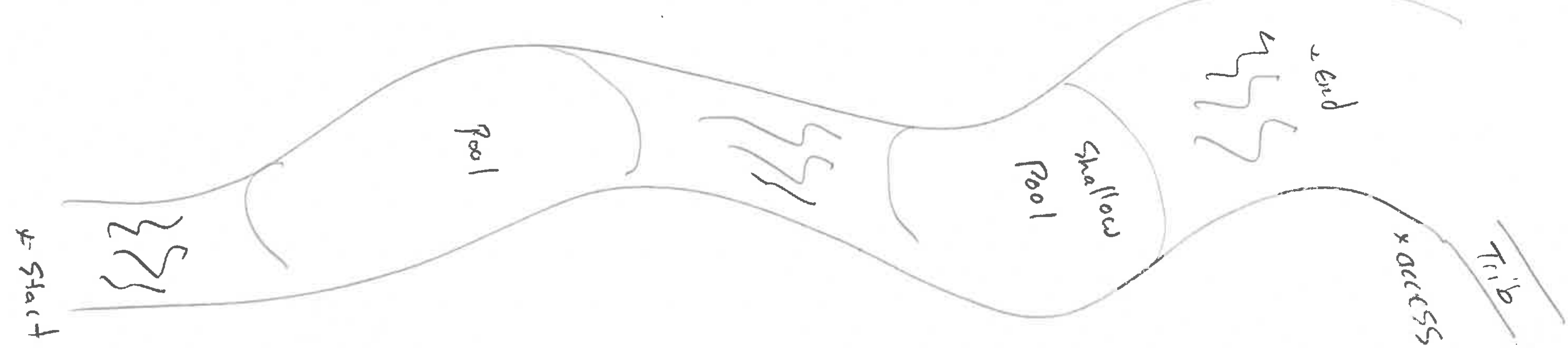
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: **61.5**

Stream & Location: Sycamore Creek Ust Sycamore Cr WWTP *RM:* 0.5 *Date:* 8/11/2022
LMS1 *Scorers Full Name & Affiliation:* MAS-MBI
River Code: 11-007-___ *STORET #:* ______ *Lat./Long.:* (NAD 83 - decimal °) 39.223905 / 84.324723 MID *Office verified location* [ ]

1] *SUBSTRATE* Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
[ ] [ ] BLDR /SLABS [10]	x	x	[ ] [ ] HARDPAN [4]		
[ ] [ ] BOULDER [9]	x	x	[ ] [ ] DETRITUS [3]		
[ ] [ ] COBBLE [8]	x	x	[ ] [ ] MUCK [2]		
[ ] [ ] GRAVEL [7]	x	x	[ ] [ ] SILT [2]		
[ ] [x] SAND [6]	x	x	[ ] [ ] ARTIFICIAL [0]		
[x] [ ] BEDROCK [5]	x		(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: [x] 4 or more [2] [ ] 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- [x] LIMESTONE [1]
- [ ] TILLS [1]
- [ ] WETLANDS [0]
- [ ] HARDPAN [0]
- [ ] SANDSTONE [0]
- [ ] RIP/RAP [0]
- [ ] LACUSTURINE [0]
- [ ] SHALE [-1]
- [ ] COAL FINES [-2]

QUALITY

SILT
- [ ] HEAVY [-2]
- [ ] MODERATE [-1]
- [x] NORMAL [0]
- [ ] FREE [1]

EMBEDDEDNESS
- [ ] EXTENSIVE [-2]
- [ ] MODERATE [-1]
- [x] NORMAL [0]
- [ ] NONE [1]

Substrate **14** Maximum 20

2] *INSTREAM COVER*

Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 3 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 2 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 2 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- [ ] EXTENSIVE >75% [11]
- [x] MODERATE 25-75% [7]
- [ ] SPARSE 5-<25% [3]
- [ ] NEARLY ABSENT <5% [1]

Comments

Cover **13** Maximum 20

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY
- [ ] HIGH [4]
- [ ] MODERATE [3]
- [x] LOW [2]
- [ ] NONE [1]

DEVELOPMENT
- [ ] EXCELLENT [7]
- [ ] GOOD [5]
- [x] FAIR [3]
- [ ] POOR [1]

CHANNELIZATION
- [ ] NONE [6]
- [ ] RECOVERED [4]
- [x] RECOVERING [3]
- [ ] RECENT OR NO RECOVERY [1]

STABILITY
- [x] HIGH [3]
- [x] MODERATE [2]
- [ ] LOW [1]

Comments

Channel **10.5** Maximum 20

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for *EACH BANK* (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- [x] [ ] NONE / LITTLE [3]
- [ ] [ ] MODERATE [2]
- [ ] [x] HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- [ ] [ ] WIDE > 50m [4]
- [ ] [x] MODERATE 10-50m [3]
- [ ] [ ] NARROW 5-10m [2]
- [x] [ ] VERY NARROW < 5m [1]
- [ ] [ ] NONE [0]

FLOOD PLAIN QUALITY (L R)
- [ ] [ ] FOREST, SWAMP [3]
- [ ] [ ] SHRUB OR OLD FIELD [2]
- [ ] [x] RESIDENTIAL, PARK, NEW FIELD [1]
- [ ] [ ] FENCED PASTURE [1]
- [ ] [ ] OPEN PASTURE, ROWCROP [0]
- [ ] [ ] CONSERVATION TILLAGE [1]
- [x] [ ] URBAN OR INDUSTRIAL [0]
- [ ] [ ] MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian **4.5** Maximum 10

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check ONE (ONLY!)
- [x] > 1m [6]
- [ ] 0.7-<1m [4]
- [ ] 0.4-<0.7m [2]
- [ ] 0.2-<0.4m [1]
- [ ] < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- [ ] POOL WIDTH > RIFFLE WIDTH [2]
- [x] POOL WIDTH = RIFFLE WIDTH [1]
- [ ] POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- [ ] TORRENTIAL [-1]
- [ ] VERY FAST [1]
- [ ] FAST [1]
- [x] MODERATE [1]
- [x] SLOW [1]
- [ ] INTERSTITIAL [-1]
- [ ] INTERMITTENT [-2]
- [ ] EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current **9** Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

[ ] NO RIFFLE [metric=0]

RIFFLE DEPTH
- [ ] BEST AREAS > 10cm [2]
- [x] BEST AREAS 5-10cm [1]
- [ ] BEST AREAS < 5cm [metric=0]

RUN DEPTH
- [ ] MAXIMUM > 50cm [2]
- [x] MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- [x] STABLE (e.g., Cobble, Boulder) [2]
- [ ] MOD. STABLE (e.g., Large Gravel) [1]
- [ ] UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- [ ] NONE [2]
- [x] LOW [1]
- [x] MODERATE [0]
- [ ] EXTENSIVE [-1]

Comments

Riffle / Run **4.5** Maximum 8

6] *GRADIENT* (38.0 ft/mi)

DRAINAGE AREA (22.8 mi²)

- [ ] VERY LOW - LOW [2-4]
- [ ] MODERATE [6-10]
- [ ] HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ____
%RUN: ____ %RIFFLE: ____

Gradient **6** Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☑ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☑ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _____ cm
2nd _____ cm

Comment RE: Reach consistency/ Is reach typical of steam?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Beg 39.22456, -84.32378
Mid 39.223905, -84.324723
End 39.22369, -84.32581

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft2 ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

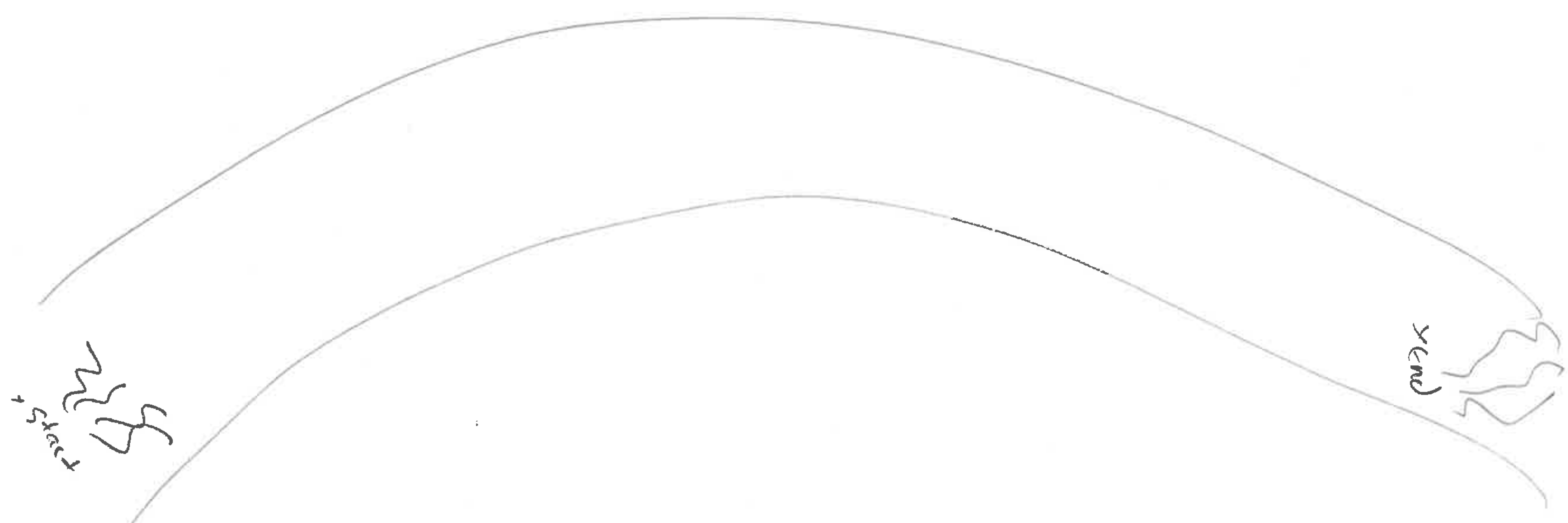
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 68

Stream & Location: Sycamore Creek Dst Sycamore Creek WWTP *RM:* 0.1 *Date:* 8/11/2022

LM52

Scorers Full Name & Affiliation:

River Code: 11-007- *STORET #:* *Lat./Long.:* (NAD 83 - decimal °) 39.226077 / 84.322095 Mid *Office verified location* ☐

1] *SUBSTRATE*

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]		
☐ ☐ BOULDER [9]	x	x
☐ ☑ COBBLE [8]	x	x
☐ ☐ GRAVEL [7]	x	x
☑ ☐ SAND [6]	x	x
☐ ☐ BEDROCK [5]		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

OTHER TYPES	POOL	RIFFLE
☐ ☐ HARDPAN [4]		
☐ ☐ DETRITUS [3]		
☐ ☐ MUCK [2]		
☐ ☐ SILT [2]	x	
☐ ☐ ARTIFICIAL [0]		

(Score natural substrates; ignore sludge from point-sources)

Check ONE (*Or 2 & average*)

ORIGIN

- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☑ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☑ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Comments

Substrate 15 Maximum 20

2] *INSTREAM COVER*

Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 3 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 3 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT

Check ONE (*Or 2 & average*)

- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 13

3] *CHANNEL MORPHOLOGY*

Check ONE in each category (*Or 2 & average*)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☑ MODERATE [3]	☑ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 13

4] *BANK EROSION AND RIPARIAN ZONE*

Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

L R EROSION	L R RIPARIAN WIDTH	L R FLOOD PLAIN QUALITY	L R
☐ ☐ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☑ ☑ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☑ ☑ NARROW 5-10m [2]	☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 5

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH

Check ONE (*ONLY!*)

- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH

Check ONE (*Or 2 & average*)

- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY

Check ALL that apply

- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential

Primary Contact

Secondary Contact

(circle one and comment on back)

Comments

Pool / Current Maximum 12: 11

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☑ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☑ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☑ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 5

6] *GRADIENT* (38.2 ft/mi)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (23.3 mi²)

%POOL: ? %GLIDE:

%RUN: %RIFFLE:

Gradient Maximum 10: 6

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☑ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☑ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ________ cm
2nd pass ________ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.22560, -84.32112
Mid 39.226077, -84.322095
End 39.22555, -84.32304

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

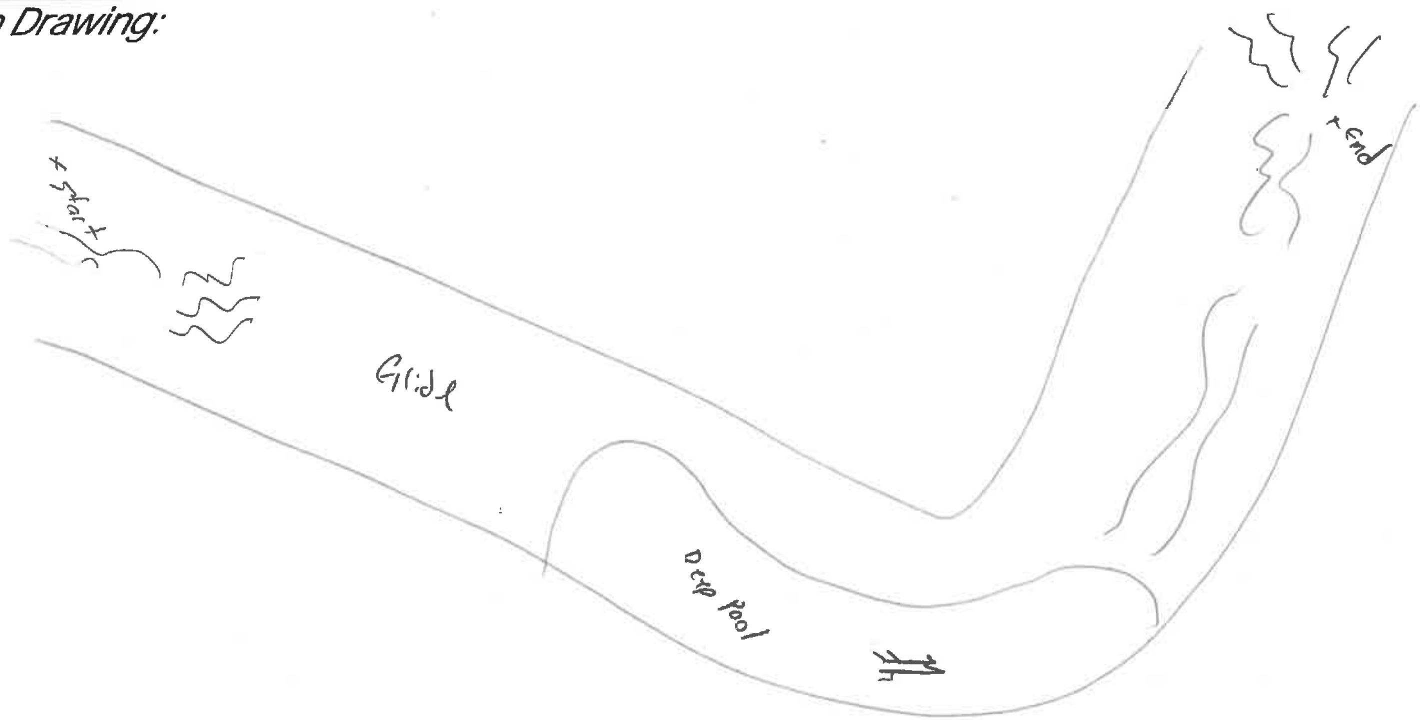
Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 60.75

Stream & Location: Unnamed Tributary to Sycamore Creek RM: 1.2 Date: 7/22/2022

LM55 - Upst. Blome Rd. bridge Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 049 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.217136 / 84.347321 Mid Office verified location ☐

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☑ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☐ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]		
☐ ☐ SAND [6]	x	x	☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]	x	x	(Score natural substrates; ignore sludge from point-sources)		

very little

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☑ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☑ NONE [1]

Substrate: 20 Maximum 20

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 9 Maximum 20

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 11 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐ ☐ NONE / LITTLE [3]	☐ ☑ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☑ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☑ ☑ HEAVY / SEVERE [1]	☑ ☐ NARROW 5-10m [2]	☑ ☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian: 5.25 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☒ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 6 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☑ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 5.5 Maximum 8

6] GRADIENT (65.0 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (5.32 mi²)

%POOL: ____ %GLIDE: ____ %RUN: ____ %RIFFLE: ____

Gradient: 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☑ OTHER

100 meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☑ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

1st pass ________ cm
2nd ________ cm

C] RECREATION AREA DEPTH
POOL: ☐ >100ft2 ☐ >3ft

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Upstream Dam likey blocks fish movement
Beg. 39.21745, -84.3469
Mid 39.217136, -84.347321
End 39.21675, -84.34769

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

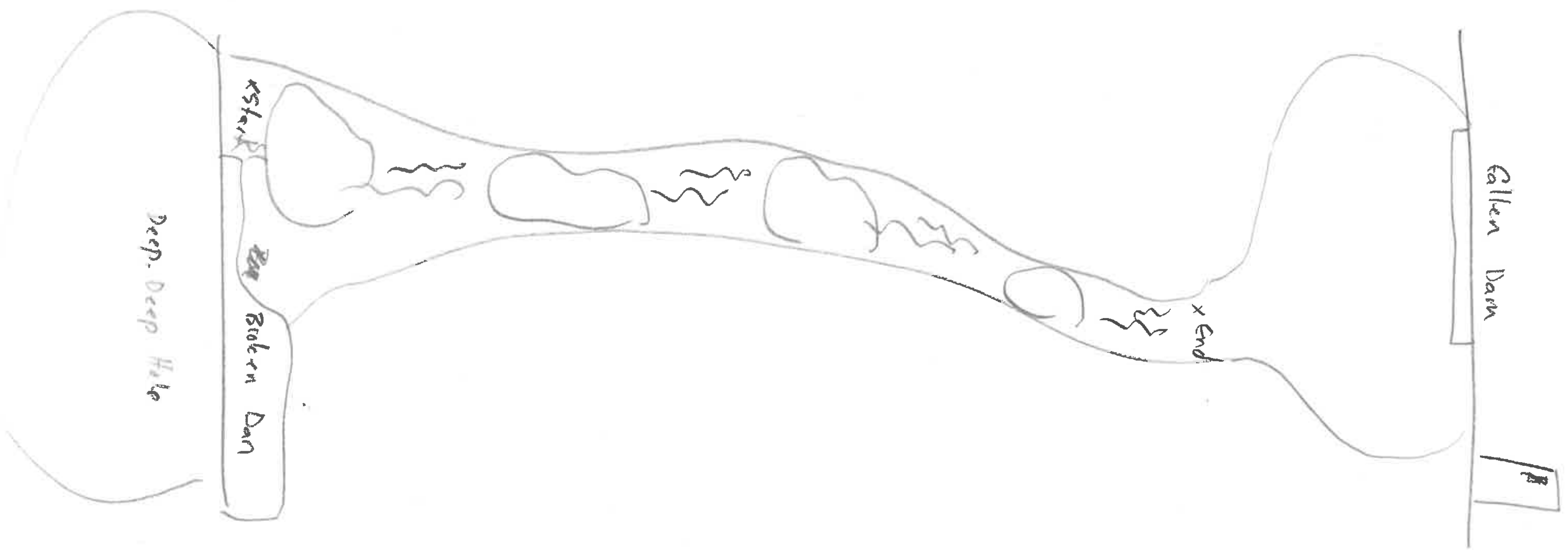
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 63

Stream & Location: Unnamed Trib to Sycamore Creek RM: 0.2 Date: 9/09/2022

LM56 - ust Loveland-Moderia Rd. Scorers Full Name & Affiliation: MAS -> MBI

River Code: 11-049- - - STORET #: Lat./Long. (NAD 83 - decimal °) 39.216632 / 84.337167 MBI Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE	ORIGIN	QUALITY
☐☑ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]			☑ LIMESTONE [1]	☐ HEAVY [-2]
☐☐ BOULDER [9]			☐☐ DETRITUS [3]			☐ TILLS [1]	☐ MODERATE [-1]
☐☐ COBBLE [8]	x	x	☐☐ MUCK [2]			☐ WETLANDS [0]	☑ NORMAL [0] (SILT)
☐☐ GRAVEL [7]	x	x	☐☐ SILT [2]			☐ HARDPAN [0]	☑ FREE [1]
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]			☐ SANDSTONE [0]	☐ EXTENSIVE [-2]
☑☐ BEDROCK [5]						☐ RIP/RAP [0]	☐ MODERATE [-1]
						☐ LACUSTURINE [0]	☐ NORMAL [0] (EMBEDDEDNESS)
						☑ SHALE [-1]	☑ NONE [1]
						☐ COAL FINES [-2]	

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Substrate 18.5 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0	UNDERCUT BANKS [1]	0	POOLS > 70cm [2]	0	OXBOWS, BACKWATERS [1]
0	OVERHANGING VEGETATION [1]	0	ROOTWADS [1]	0	AQUATIC MACROPHYTES [1]
3	SHALLOWS (IN SLOW WATER) [1]	3	BOULDERS [1]	0	LOGS OR WOODY DEBRIS [1]
0	ROOTMATS [1]				

AMOUNT — Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover 9 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 12 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☑ WIDE > 50m [4]	☑☑ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☑☐ MODERATE 10-50m [3]	☐☑ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 7.5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☑ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☑ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 6 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 6 Maximum 8

6] GRADIENT (66.3 ft/mi)
DRAINAGE AREA (5.61 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient 4 Maximum 10

EPA 4520 06/16/06

A] SAMPLED REACH
Check ALL that apply

METHOD
- [ ] BOAT
- [ ] WADE
- [ ] L. LINE
- [x] OTHER

STAGE
1st -sample pass- 2nd
- [ ] HIGH [ ]
- [x] UP [ ]
- [ ] NORMAL [ ]
- [ ] LOW [ ]
- [ ] DRY [ ]

DISTANCE
- [ ] 0.5 Km
- [ ] 0.2 Km
- [x] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER

_____ meters

CLARITY
1st --sample pass-- 2nd
- [ ] < 20 cm [ ]
- [ ] 20-<40 cm [ ]
- [ ] 40-70 cm [ ]
- [x] > 70 cm/ CTB [ ]
- [ ] SECCHI DEPTH [ ]

1st pass _______ cm
2nd pass _______ cm

CANOPY
- [x] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.21625, -84.33639
Mid 39.216632, -84.337167
End 39.21721, -84.33720

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

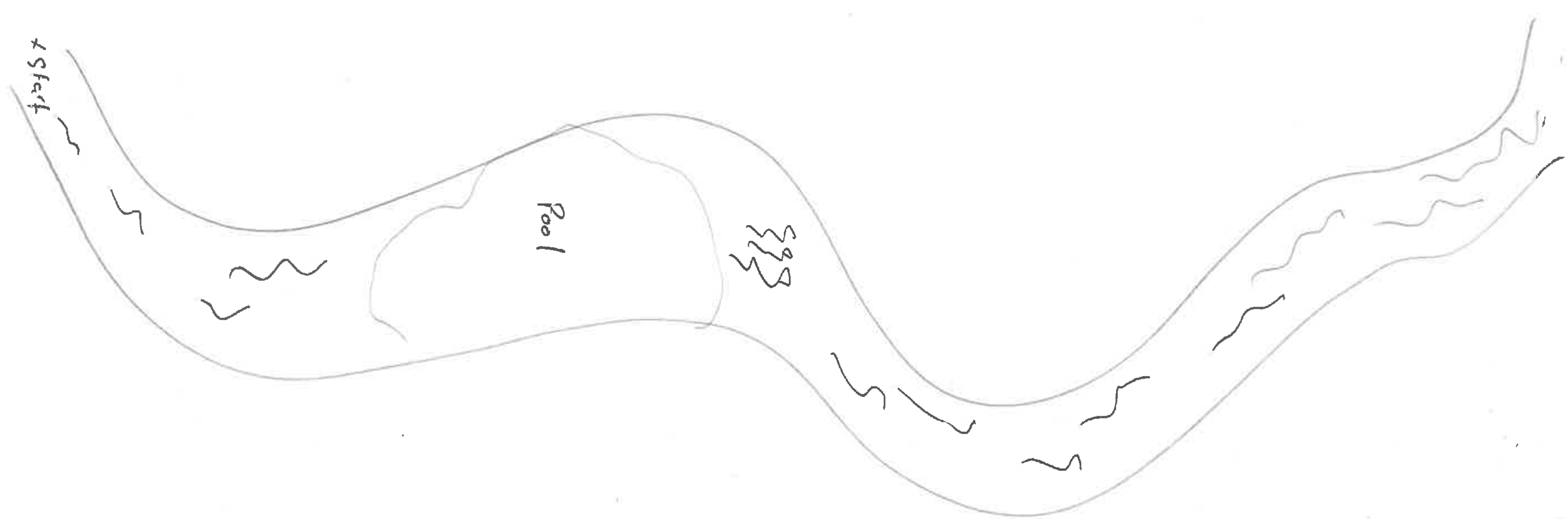
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 26.0

Stream & Location: Duck Creek - Norwood/Harris Ave. RM: 6.1 Date: 7/13/2022

LM71 Scorers Full Name & Affiliation: MAS - MBI

River Code: 11-004-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.16073 / 84.438359 MRD Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☐☐ MUCK [2]		
☐☐ GRAVEL [7]	x		☐☐ SILT [2]		
☐☐ SAND [6]	x		☑☑ ARTIFICIAL [0]	x	
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN	QUALITY
☐ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☐ TILLS [1]	☐ MODERATE [-1]
☐ WETLANDS [0]	☑ NORMAL [0]
☐ HARDPAN [0]	☑ FREE [1]
☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☑ RIP/RAP [0]	☐ MODERATE [-1]
☐ LACUSTURINE [0]	☑ NORMAL [0]
☐ SHALE [-1]	☐ NONE [1]
☐ COAL FINES [-2]	

Substrate: 0.5 (Maximum 20)

Comments

Substrates covered in bacterial colonies from gray water

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]
0 POOLS > 70cm [2]
0 ROOTWADS [1]
1 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
0 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 8 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☑ NONE [1]	☑ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel: 6.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☑☑ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☑☑ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☑☑ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)	CHANNEL WIDTH — Check ONE (Or 2 & average)	CURRENT VELOCITY — Check ALL that apply	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☑ 0.2-<0.4m [1]		☐ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 4 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 0 (Maximum 8)

6] GRADIENT (65.3 ft/mi)

DRAINAGE AREA (2.24 mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient: 4 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st-sample pass-2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

___ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

1st pass ______ cm
2nd pass ______ cm

C] RECREATION
POOL: ☐ >100ft² (AREA) ☐ >3ft (DEPTH)

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

Beg 39.16140, -84.43829
Mid 39.16073, -84.438359
End 39.16011, -84.43814

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☑ CSOs/SSOs/OUTFALLS

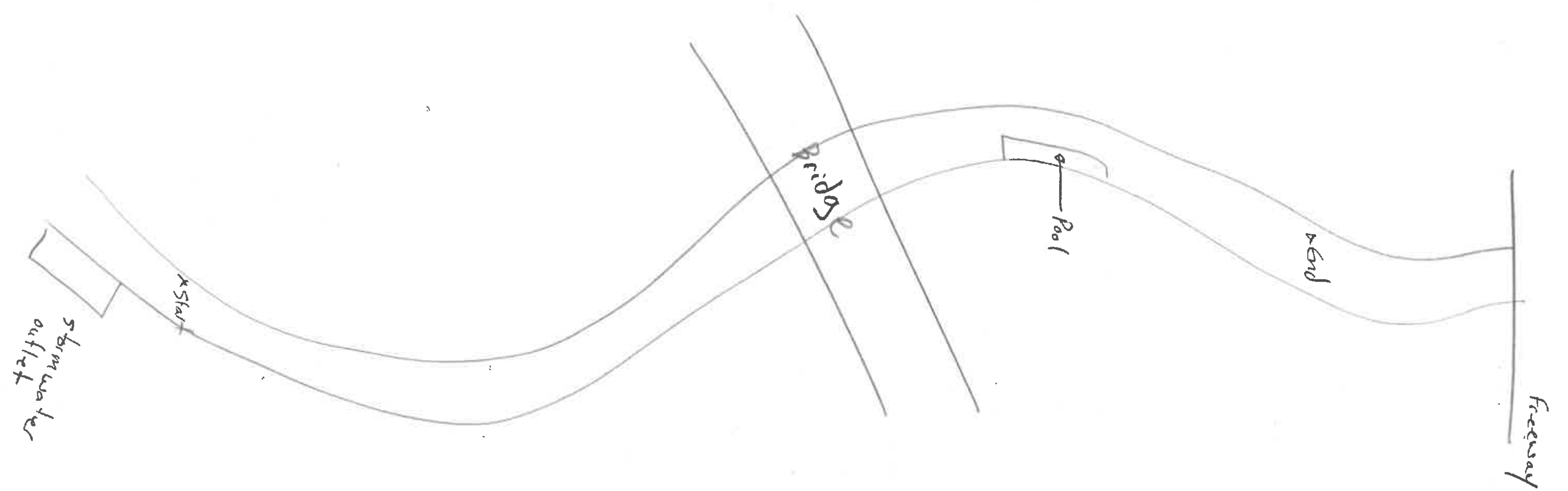
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 54.5

Stream & Location: Duck Creek - @ Duck Creek Rd. RM: 5.14 Date: 7/13/2022

LM72 Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 004 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.165258 / 84.418817 Mid Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]		
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]		
☐☐ SAND [6]			☐☐ ARTIFICIAL [0]	x	x
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Comments: Algae covering surface of Substrates

Substrate: 18 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
0 POOLS > 70cm [2]
0 ROOTWADS [1]
3 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 10 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☐ NONE [1]
DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☑ FAIR [3] ☐ POOR [1]
CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☑ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]
STABILITY: ☑ HIGH [3] ☐ MODERATE [2] ☐ LOW [1]

Comments

Channel: 11 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☑☑ NONE / LITTLE [3] ☐☐ MODERATE [2] ☐☐ HEAVY / SEVERE [1]
RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☐☐ MODERATE 10-50m [3] ☐☑ NARROW 5-10m [2] ☑☐ VERY NARROW < 5m [1] ☐☐ NONE [0]
FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☑☑ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 4.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☐ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☑ 0.2-<0.4m [1] ☐ < 0.2m [0]
CHANNEL WIDTH — Check ONE (Or 2 & average): ☐ POOL WIDTH > RIFFLE WIDTH [2] ☑ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]
CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]
Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 4 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☑ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]
RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☑ MAXIMUM < 50cm [1]
RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ☑ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]
RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ☑ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 3 (Maximum 8)

6] GRADIENT (48.1 ft/mi)
DRAINAGE AREA (5.05 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient: 4 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

pass 1st _____ cm
2nd _____ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Beg 39.16516, -84.41811
Mid 39.165258, -84.418817
End 39.16534, -84.41940

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☑ CSOs/SSOs/OUTFALLS

C] RECREATION
POOL: ☐ >100ft² (AREA) ☐ >3ft (DEPTH)

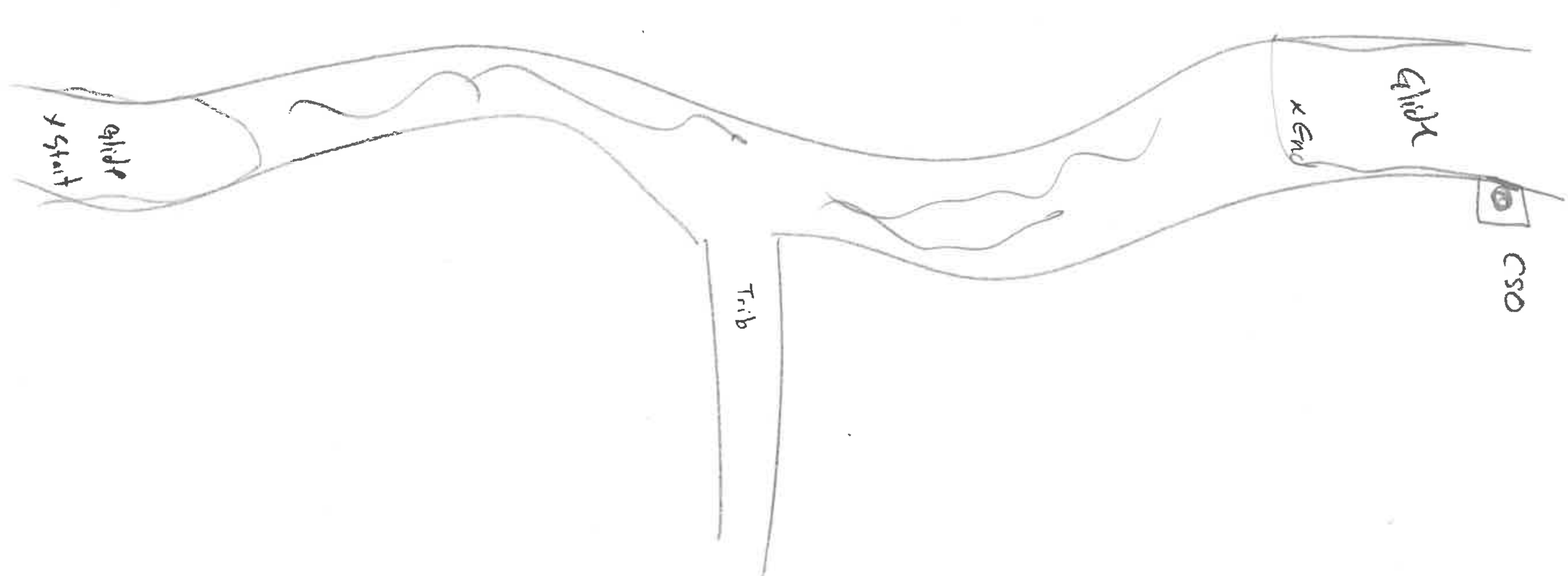
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 16

Stream & Location: Duck Creek - adj. Steel Place LM73

RM: 4.58 Date: 7/22/2022

Scorers Full Name & Affiliation: MAS-MBI

River Code: 11-004-___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.159634 / 84.416392 Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]			☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☐ COBBLE [8]			☐ ☐ MUCK [2]		
☐ ☐ GRAVEL [7]			☐ ☐ SILT [2]		
☐ ☐ SAND [6]			☑ ☑ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☑ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☑ FREE [1]
EMBEDDEDNESS: ☑ EXTENSIVE [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate: -1 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
0 POOLS > 70cm [2]
0 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
0 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☑ NEARLY ABSENT <5% [1]

Comments

Cover: 2 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☑ NONE [1]	☑ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel: 6 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☑ ☑ NONE / LITTLE [3]; ☐ ☐ MODERATE [2]; ☐ ☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐ ☐ WIDE > 50m [4]; ☐ ☐ MODERATE 10-50m [3]; ☐ ☐ NARROW 5-10m [2]; ☐ ☐ VERY NARROW < 5m [1]; ☑ ☑ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐ ☐ FOREST, SWAMP [3]; ☐ ☐ SHRUB OR OLD FIELD [2]; ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]; ☐ ☐ FENCED PASTURE [1]; ☐ ☐ OPEN PASTURE, ROWCROP [0]; ☐ ☐ CONSERVATION TILLAGE [1]; ☑ ☑ URBAN OR INDUSTRIAL [0]; ☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☐ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☑ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☐ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☑ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☑ FAST [1] ☑ MODERATE [1] ☐ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 2 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 0 (Maximum 8)

6] GRADIENT (43.7 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (5.84 mi²)

%POOL: ? %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient: 4 (Maximum 10)

EPA 4520 06/16/06

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

SECCHI DEPTH pass: 1st _____ cm, 2nd _____ cm

Comment RE: *Reach consistency/* Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.15907, -84.41602

Mid 39.159634, -84.416392

end 39.16034, -84.41668

B] AESTHETICS
- ☑ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☑ TRASH / LITTER
- ☑ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☑ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

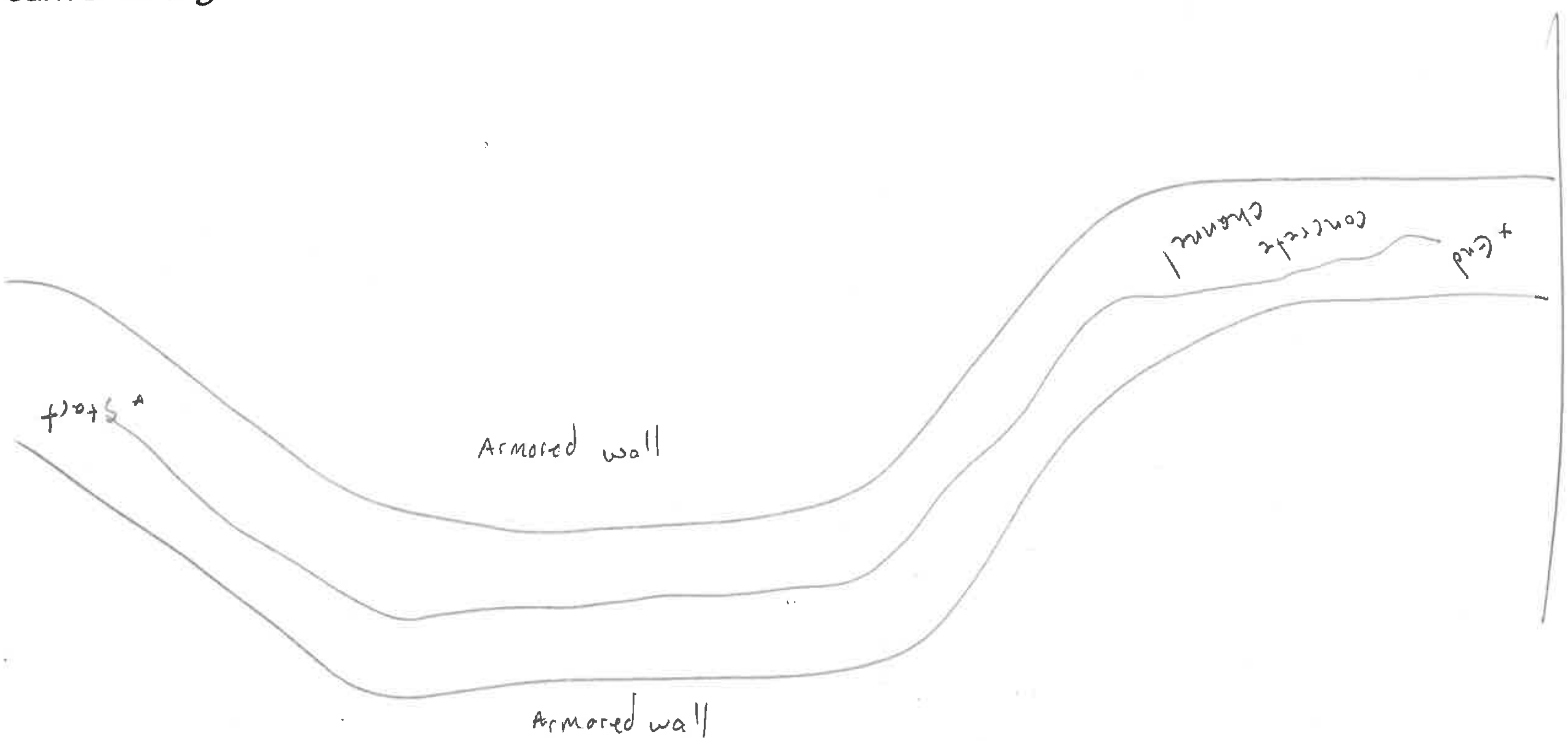
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 63

Stream & Location: Duck Creek Dst EFk Duck Creek LM74

RM: 3.9 Date: 7/21/2022

Scorers Full Name & Affiliation: MAS - MB

River Code: 11-004-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.158383 / 84.407240 mid Office verified location [ ]

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
[ ] [ ] BLDR /SLABS [10]	x	x	[ ] [ ] HARDPAN [4]	x	
[ ] [ ] BOULDER [9]	x	x	[ ] [ ] DETRITUS [3]		
[ ] [x] COBBLE [8]	x	x	[ ] [ ] MUCK [2]		
[x] [ ] GRAVEL [7]	x	x	[ ] [ ] SILT [2]	x	
[ ] [ ] SAND [6]			[ ] [ ] ARTIFICIAL [0]	x	x
[ ] [ ] BEDROCK [5]					

NUMBER OF BEST TYPES: [x] 4 or more [2] [ ] 3 or less [0]

(Score natural substrates; ignore sludge from point-sources)

ORIGIN: [x] LIMESTONE [1] [ ] TILLS [1] [ ] WETLANDS [0] [ ] HARDPAN [0] [ ] SANDSTONE [0] [ ] RIP/RAP [0] [ ] LACUSTURINE [0] [ ] SHALE [-1] [ ] COAL FINES [-2]

QUALITY — SILT: [ ] HEAVY [-2] [x] MODERATE [-1] [ ] NORMAL [0] [ ] FREE [1]

EMBEDDEDNESS: [ ] EXTENSIVE [-2] [x] MODERATE [-1] [x] NORMAL [0] [ ] NONE [1]

Comments

Substrate: 16.5 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	2 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	2 BOULDERS [1]	2 LOGS OR WOODY DEBRIS [1]
1 ROOTMATS [1]		

AMOUNT — Check ONE (Or 2 & average): [ ] EXTENSIVE >75% [11] [x] MODERATE 25-75% [7] [ ] SPARSE 5-<25% [3] [ ] NEARLY ABSENT <5% [1]

Comments

Cover: 14 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
[ ] HIGH [4]	[ ] EXCELLENT [7]	[ ] NONE [6]	[ ] HIGH [3]
[x] MODERATE [3]	[ ] GOOD [5]	[ ] RECOVERED [4]	[x] MODERATE [2]
[x] LOW [2]	[x] FAIR [3]	[x] RECOVERING [3]	[ ] LOW [1]
[ ] NONE [1]	[ ] POOR [1]	[ ] RECENT OR NO RECOVERY [1]	

Comments

Channel: 10.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	
[ ] [ ] NONE / LITTLE [3]	[ ] [ ] WIDE > 50m [4]	[ ] [ ] FOREST, SWAMP [3]	[ ] [ ] CONSERVATION TILLAGE [1]
[x] [ ] MODERATE [2]	[ ] [ ] MODERATE 10-50m [3]	[ ] [ ] SHRUB OR OLD FIELD [2]	[x] [x] URBAN OR INDUSTRIAL [0]
[ ] [x] HEAVY / SEVERE [1]	[ ] [ ] NARROW 5-10m [2]	[x] [x] RESIDENTIAL, PARK, NEW FIELD [1]	[ ] [ ] MINING / CONSTRUCTION [0]
	[x] [x] VERY NARROW < 5m [1]	[ ] [ ] FENCED PASTURE [1]	
	[ ] [ ] NONE [0]	[ ] [ ] OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
[x] > 1m [6]	[x] POOL WIDTH > RIFFLE WIDTH [2]	[ ] TORRENTIAL [-1]	[x] SLOW [1]
[ ] 0.7-<1m [4]	[ ] POOL WIDTH = RIFFLE WIDTH [1]	[ ] VERY FAST [1]	[ ] INTERSTITIAL [-1]
[ ] 0.4-<0.7m [2]	[ ] POOL WIDTH < RIFFLE WIDTH [0]	[ ] FAST [1]	[ ] INTERMITTENT [-2]
[ ] 0.2-<0.4m [1]		[x] MODERATE [1]	[ ] EDDIES [1]
[ ] < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 10 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). [ ] NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
[ ] BEST AREAS > 10cm [2]	[ ] MAXIMUM > 50cm [2]	[ ] STABLE (e.g., Cobble, Boulder) [2]	[ ] NONE [2]
[x] BEST AREAS 5-10cm [1]	[x] MAXIMUM ≤ 50cm [1]	[x] MOD. STABLE (e.g., Large Gravel) [1]	[ ] LOW [1]
[ ] BEST AREAS < 5cm [metric=0]		[ ] UNSTABLE (e.g., Fine Gravel, Sand) [0]	[x] MODERATE [0]
			[x] EXTENSIVE [-1]

Comments

Riffle / Run: 2.5 (Maximum 8)

6] GRADIENT
GRADIENT (37.5 ft/mi) DRAINAGE AREA (19.59 mi²)

[ ] VERY LOW - LOW [2-4] [ ] MODERATE [6-10] [ ] HIGH - VERY HIGH [10-6]

%POOL: ( ) %GLIDE: ( ) %RUN: ( ) %RIFFLE: ( )

Gradient: 6 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☑ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☑ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

pass 1st ______ cm
2nd ______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☑ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: *Reach consistency/* Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.15784, -84.40765
mid 39.158383, -84.407240
end 39.15883, -84.40668

B] AESTHETICS
- ☑ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

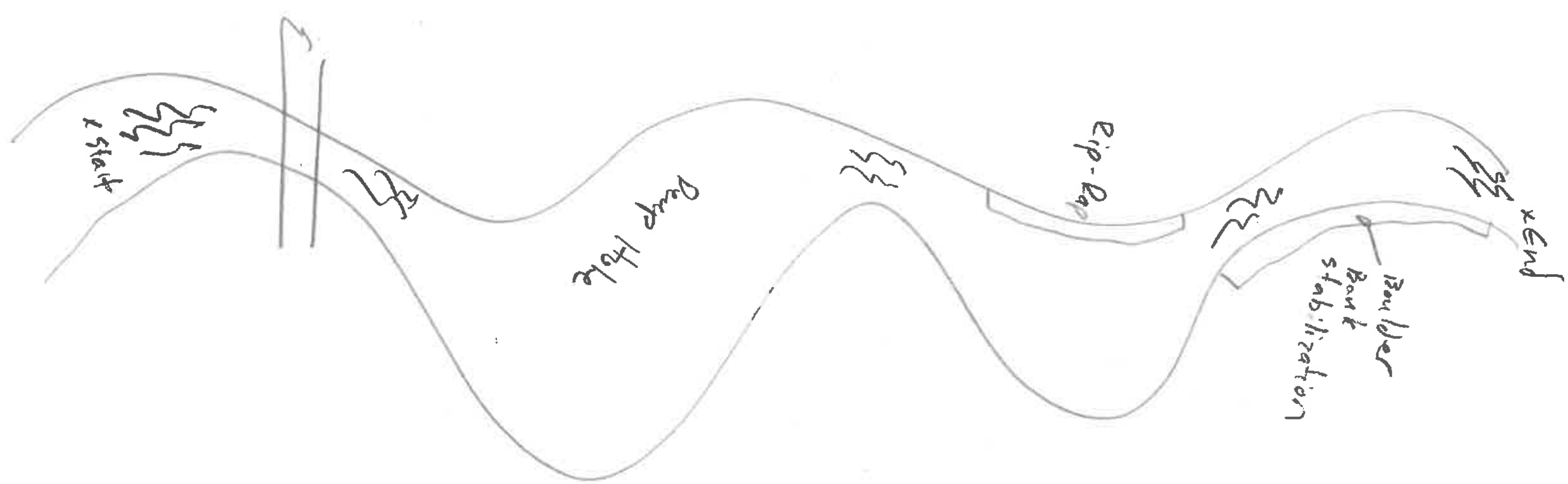
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

Ohio EPA

QHEI Score: 15

Stream & Location: Duck Creek Ust Erie Ave — RM: 3.4 Date: 7/13/2022

LM75 — Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 004 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.148671 / 84.406936 Mid — Office verified location [ ]

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
[ ] [ ] BLDR /SLABS [10]			[ ] [ ] HARDPAN [4]		
[ ] [ ] BOULDER [9]			[ ] [ ] DETRITUS [3]		
[ ] [ ] COBBLE [8]			[ ] [ ] MUCK [2]		
[ ] [ ] GRAVEL [7]			[ ] [ ] SILT [2]		
[ ] [ ] SAND [6]			[x] [x] ARTIFICIAL [0]		
[ ] [ ] BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: [ ] 4 or more [2] [x] 3 or less [0]

Comments

ORIGIN (Check ONE (Or 2 & average)): [ ] LIMESTONE [1] [ ] TILLS [1] [ ] WETLANDS [0] [ ] HARDPAN [0] [ ] SANDSTONE [0] [x] RIP/RAP [0] [ ] LACUSTURINE [0] [ ] SHALE [-1] [ ] COAL FINES [-2]

QUALITY
- SILT: [ ] HEAVY [-2] [ ] MODERATE [-1] [ ] NORMAL [0] [x] FREE [1]
- EMBEDDEDNESS: [x] EXTENSIVE [-2] [ ] MODERATE [-1] [ ] NORMAL [0] [ ] NONE [1]

Substrate: -1 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT Check ONE (Or 2 & average): [ ] EXTENSIVE >75% [11] [ ] MODERATE 25-75% [7] [ ] SPARSE 5-<25% [3] [x] NEARLY ABSENT <5% [1]

Comments

Cover: 2 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
[ ] HIGH [4]	[ ] EXCELLENT [7]	[ ] NONE [6]	[x] HIGH [3]
[ ] MODERATE [3]	[ ] GOOD [5]	[ ] RECOVERED [4]	[ ] MODERATE [2]
[ ] LOW [2]	[ ] FAIR [3]	[ ] RECOVERING [3]	[ ] LOW [1]
[x] NONE [1]	[x] POOR [1]	[x] RECENT OR NO RECOVERY [1]	

Comments

Channel: 6 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
[x] [x] NONE / LITTLE [3]	[ ] [ ] WIDE > 50m [4]	[ ] [ ] FOREST, SWAMP [3]	[ ] [ ] CONSERVATION TILLAGE [1]
[ ] [ ] MODERATE [2]	[ ] [ ] MODERATE 10-50m [3]	[ ] [ ] SHRUB OR OLD FIELD [2]	[x] [x] URBAN OR INDUSTRIAL [0]
[ ] [ ] HEAVY / SEVERE [1]	[ ] [ ] NARROW 5-10m [2]	[ ] [ ] RESIDENTIAL, PARK, NEW FIELD [1]	[ ] [ ] MINING / CONSTRUCTION [0]
	[ ] [ ] VERY NARROW < 5m [1]	[ ] [ ] FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	[x] [x] NONE [0]	[ ] [ ] OPEN PASTURE, ROWCROP [0]	

Comments

Riparian: 3 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
[ ] > 1m [6]	[ ] POOL WIDTH > RIFFLE WIDTH [2]	[ ] TORRENTIAL [-1]	[ ] SLOW [1]
[ ] 0.7-<1m [4]	[ ] POOL WIDTH = RIFFLE WIDTH [1]	[ ] VERY FAST [1]	[ ] INTERSTITIAL [-1]
[ ] 0.4-<0.7m [2]	[x] POOL WIDTH < RIFFLE WIDTH [0]	[ ] FAST [1]	[ ] INTERMITTENT [-2]
[ ] 0.2-<0.4m [1]		[x] MODERATE [1]	[ ] EDDIES [1]
[x] < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 1 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). [ ] NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
[ ] BEST AREAS > 10cm [2]	[ ] MAXIMUM > 50cm [2]	[ ] STABLE (e.g., Cobble, Boulder) [2]	[ ] NONE [2]
[ ] BEST AREAS 5-10cm [1]	[ ] MAXIMUM < 50cm [1]	[ ] MOD. STABLE (e.g., Large Gravel) [1]	[ ] LOW [1]
[x] BEST AREAS < 5cm [metric=0]		[ ] UNSTABLE (e.g., Fine Gravel, Sand) [0]	[ ] MODERATE [0]
			[ ] EXTENSIVE [-1]

Comments

Riffle / Run: 0 (Maximum 8)

6] GRADIENT (64.8 ft/ml)
DRAINAGE AREA (11.5 mi²)

[ ] VERY LOW - LOW [2-4]
[ ] MODERATE [6-10]
[ ] HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient: 4 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☑ L. LINE
- ☐ OTHER

STAGE
1st-sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

______ meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st ______ cm
pass
2nd ______ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

~~m~~ beg - 39.14808 , -84.40695
mid - 39.148671 , -84.406936
end - 39.14919 , -84.40733

B] AESTHETICS
- ☑ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☑ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

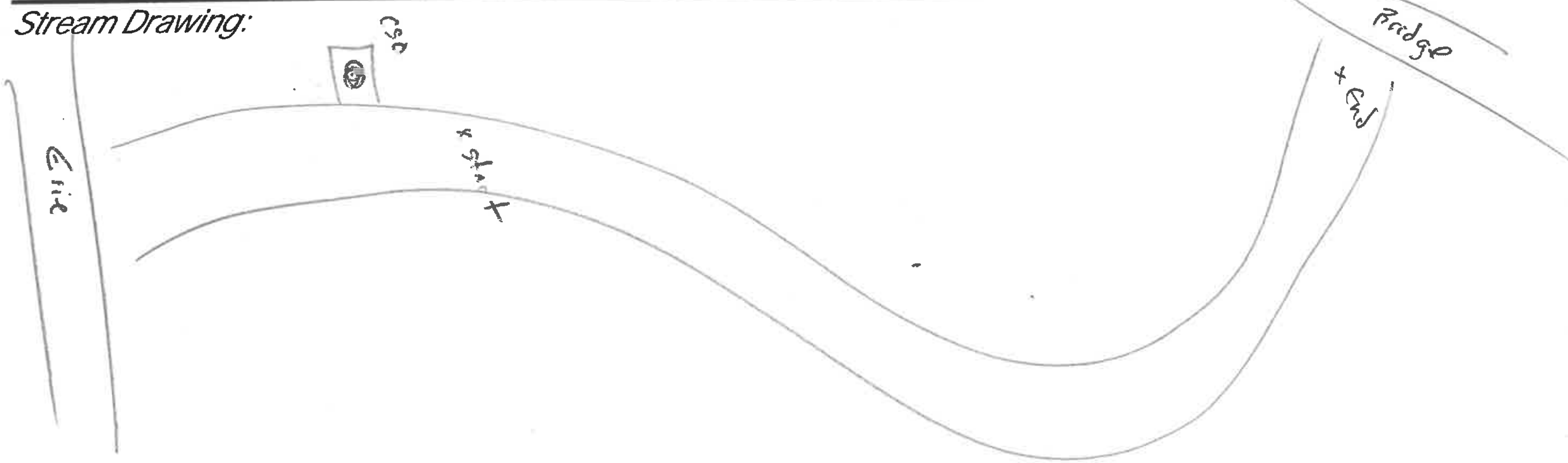
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 66

Stream & Location: Duck Creek Dst Erie Ave *RM:* 2.8 *Date:* 7/13/2022
LM76 *Scorers Full Name & Affiliation:* MAS - MBI
River Code: 11 - 004 - ___ *STORET #:* ______ *Lat./Long.:* (NAD 83 - decimal °) 39.144846 / 84.406158 mid *Office verified location* ☐

1] *SUBSTRATE* Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]	x	
☐☐ BOULDER [9]			☐☐ DETRITUS [3]	x	
☑☐ COBBLE [8]	x	x	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	x	x	☐☐ SILT [2]	x	
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Substrate 18 Maximum 20

2] *INSTREAM COVER* Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
2 ROOTMATS [1]		

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 14

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 11.5

4] *BANK EROSION AND RIPARIAN ZONE* Check **ONE** in each category for *EACH BANK* (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☐☑ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☑☑ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☑☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	*Indicate predominant land use(s) past 100m riparian.*
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian Maximum 10: 4.5

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check **ONE** (*ONLY!*)
- ☐ > 1m [6]
- ☑ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 8

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 4

6] *GRADIENT* (31.4 ft/mi) ☐ VERY LOW - LOW [2-4]
DRAINAGE AREA (11.7 mi²) ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient Maximum 10: 6

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☑ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☑ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st ________ cm
2nd ________ cm

C] RECREATION AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.14429, -84.40590
mid 39.144846, -84.406158
end 39.14555, -84.40621

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

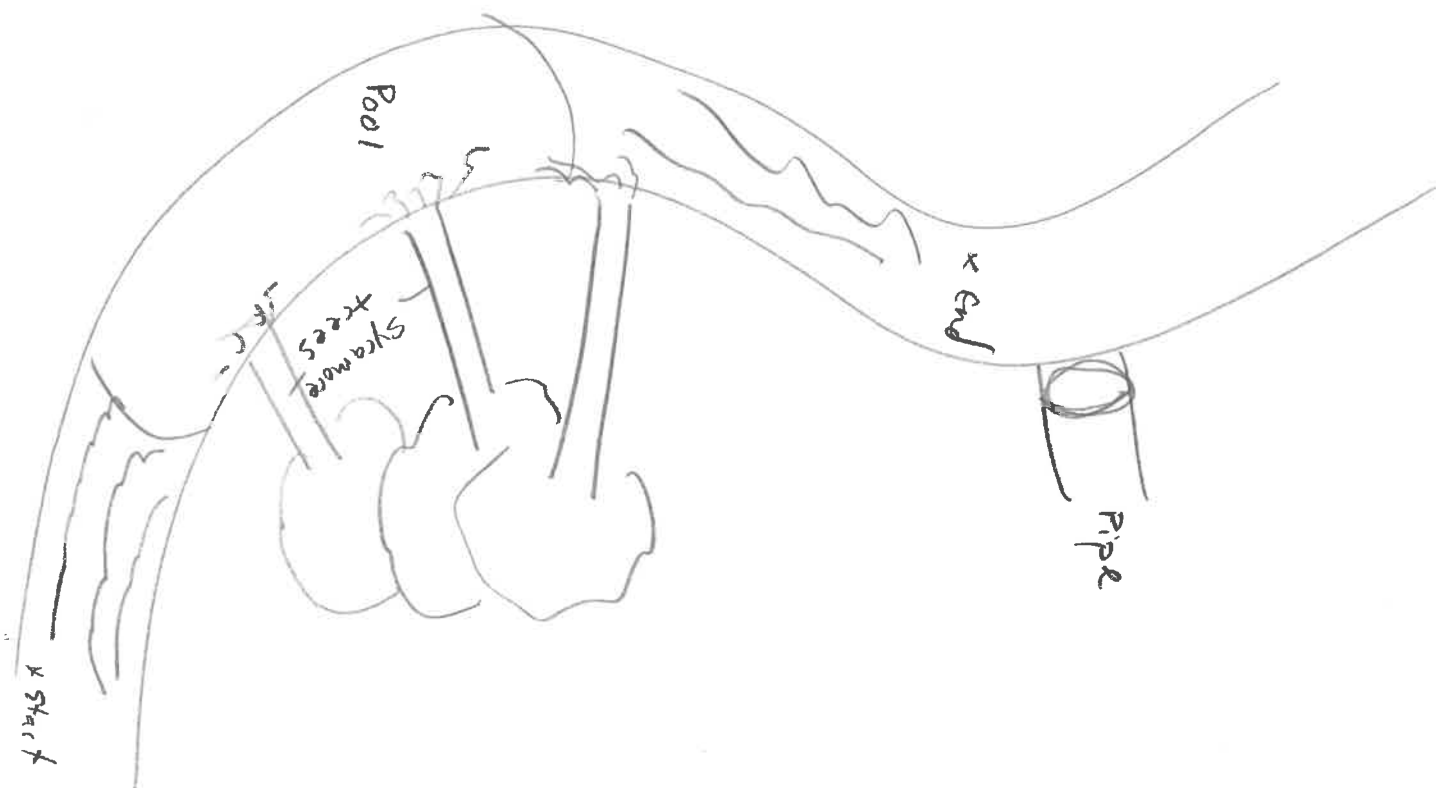
Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 67

Stream & Location: Duck Creek @ Wooster + Power St. RM: 2.0 Date: 7/22/2022

LM77 Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 004 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °) 39.132612 / 84.404768 mid Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]	x	
☐ ☐ BOULDER [9]	x		☐ ☐ DETRITUS [3]		
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]	x	
☐ ☐ SAND [6]	x	x	☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

ORIGIN (Check ONE (Or 2 & average)): ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 18 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1	UNDERCUT BANKS [1]	0	POOLS > 70cm [2]	0	OXBOWS, BACKWATERS [1]
1	OVERHANGING VEGETATION [1]	1	ROOTWADS [1]	0	AQUATIC MACROPHYTES [1]
3	SHALLOWS (IN SLOW WATER) [1]	2	BOULDERS [1]	1	LOGS OR WOODY DEBRIS [1]
2	ROOTMATS [1]				

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 14 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☑ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 11 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐ ☐ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☑ ☑ MODERATE [2]	☑ ☑ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☑ ☑ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☑ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 6 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☑ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 5 (Maximum 8)

6] GRADIENT (29.8 ft/mi)

DRAINAGE AREA (14.3 mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient: 8 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☑ L. LINE
- ☐ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☑ 10%-<30%
- ☐ <10%- CLOSED

SECCHI DEPTH pass 1st _____ cm, 2nd _____ cm

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.13213, -84.40530

Mid 39.132612, -84.404768

end 39.13313, -84.40414

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☑ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

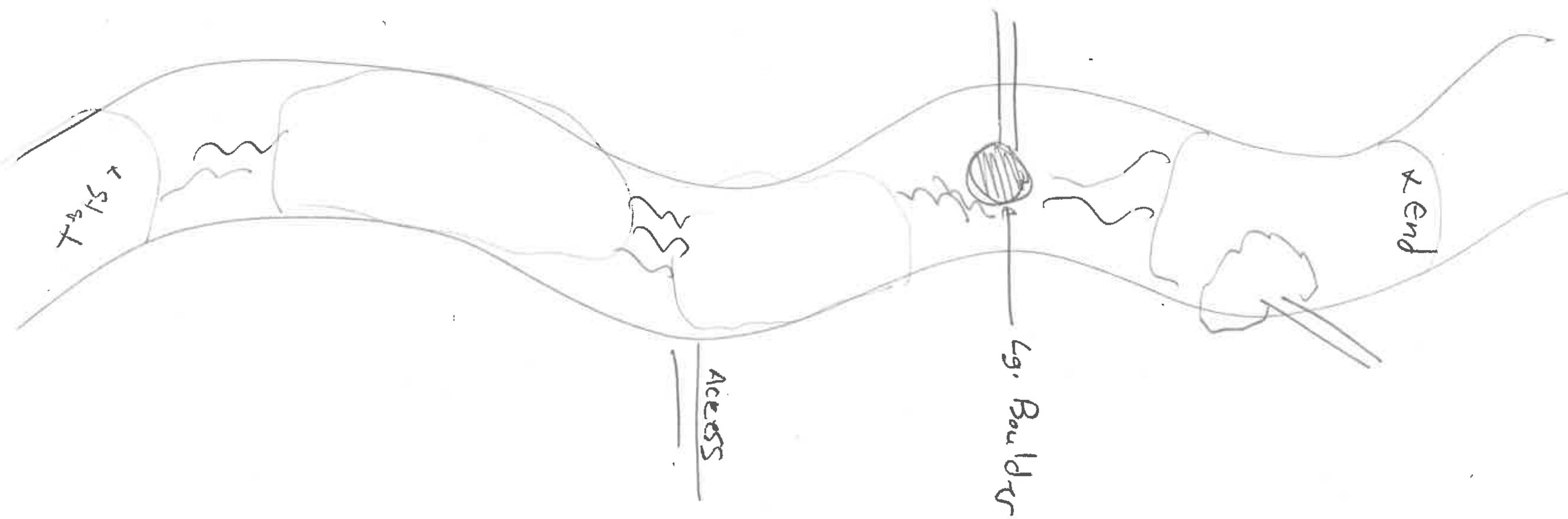
Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 68.75

Stream & Location: Duck Creek ust. Wooster Pike   RM: 0.5   Date: 7/22/2022

LM79   Scorers Full Name & Affiliation: MAS - MBI

River Code: 11-004-___   STORET #: ______   Lat./Long. (NAD 83 - decimal °): 39.122455 / 84.411698 Mid   Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]		
☐☐ COBBLE [8]	x	x	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	x	x	☐☐ SILT [2]		
☑☐ SAND [6]	x		☐☐ ARTIFICIAL [0]	x	x
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 16 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

3 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
3 POOLS > 70cm [2]
3 ROOTWADS [1]
3 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
3 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 15 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☑ MODERATE [3] ☑ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☑ GOOD [5] ☑ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☑ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☑ HIGH [3] ☑ MODERATE [2] ☐ LOW [1]

Comments

Channel: 12.5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☑☐ MODERATE [2] ☑☑ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☐☐ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☑☑ VERY NARROW < 5m [1] ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☑☑ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 2.25 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 10 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☑ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☑ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☑ NONE [2] ☑ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 5 (Maximum 8)

6] GRADIENT (26.0 ft/mi)
DRAINAGE AREA (14.6 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ___ %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient: 8 (Maximum 10)

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.12220, -84.41106

mid 39.122455, -84.411698

end 39.12294, -84.411180

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☑ L. LINE
- ☐ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm

2nd pass ______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☑ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH

POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

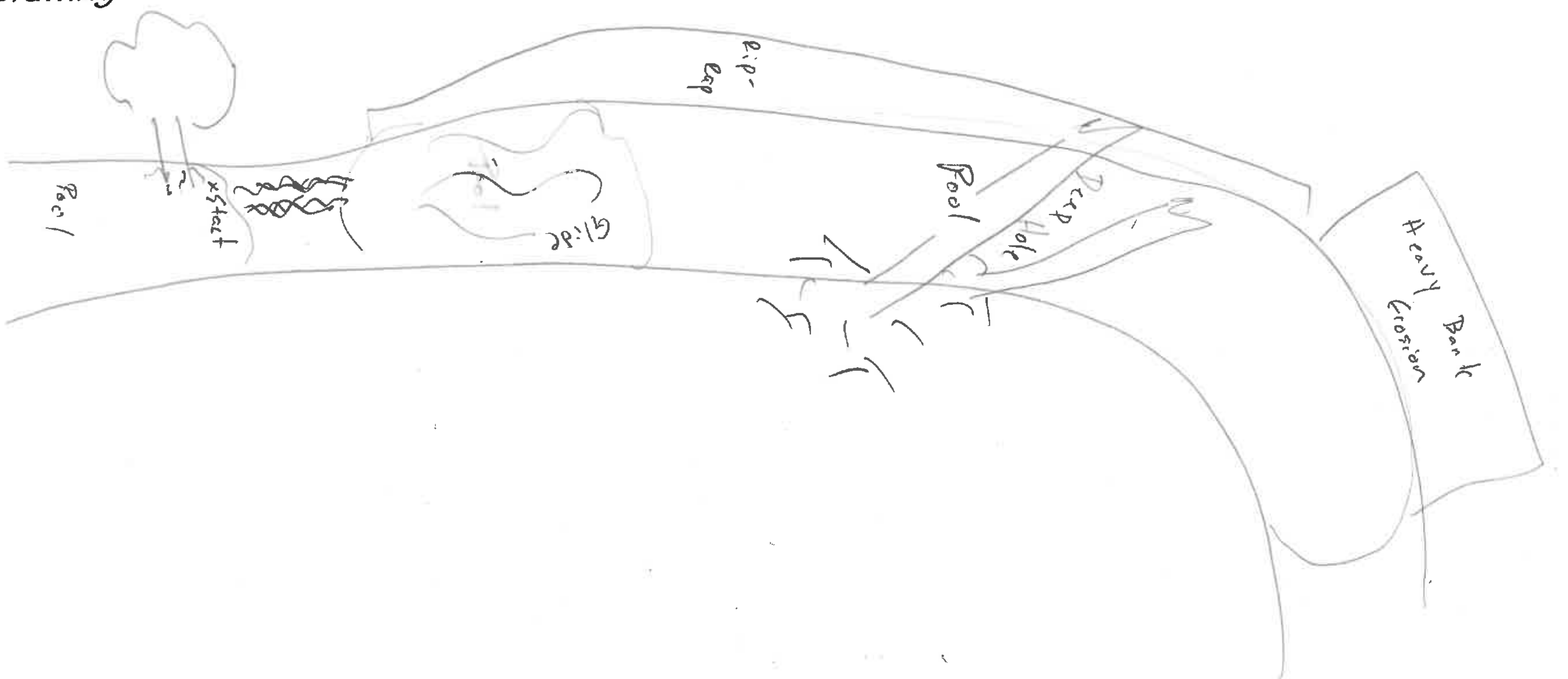
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 34.5

Stream & Location: Unnamed Tributary to Duck Creek LM80 RM: 0.1 Date: 7/13/2022

Scorers Full Name & Affiliation: MAS-MBI

River Code: 11-075-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.166812 / 84.419261 Mid Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]	✓	✓	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	✓	✓	☐☐ SILT [2]		
☐☐ SAND [6]			☑☐ ARTIFICIAL [0]	✓	✓
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☑ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☑ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate: 6.5 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 0 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 3 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 9 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☑ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel: 7 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☑☑ NONE / LITTLE [3]
- ☑☑ MODERATE [2]
- ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐☐ WIDE > 50m [4]
- ☐☐ MODERATE 10-50m [3]
- ☐☑ NARROW 5-10m [2]
- ☑☐ VERY NARROW < 5m [1]
- ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐☐ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☐☐ OPEN PASTURE, ROWCROP [0]
- ☐☐ CONSERVATION TILLAGE [1]
- ☑☑ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 4 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☑ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☑ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 2 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☑ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☑ EXTENSIVE [-1]

Comments

Riffle / Run: 2 Maximum 8

6] GRADIENT (114.0 ft/mi)
DRAINAGE AREA (1.42 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ____ %GLIDE: ____
%RUN: ____ %RIFFLE: ____

Gradient: 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.16639, -84.41880
mid 39.166812, -84.419261
end 39.16711, -84.41973

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st ______ cm
pass
2nd ______ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

C] RECREATION
POOL: AREA ☐ >100ft² DEPTH ☐ >3ft

B] AESTHETICS
- ☑ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☑ CSOs/SSOs/OUTFALLS

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

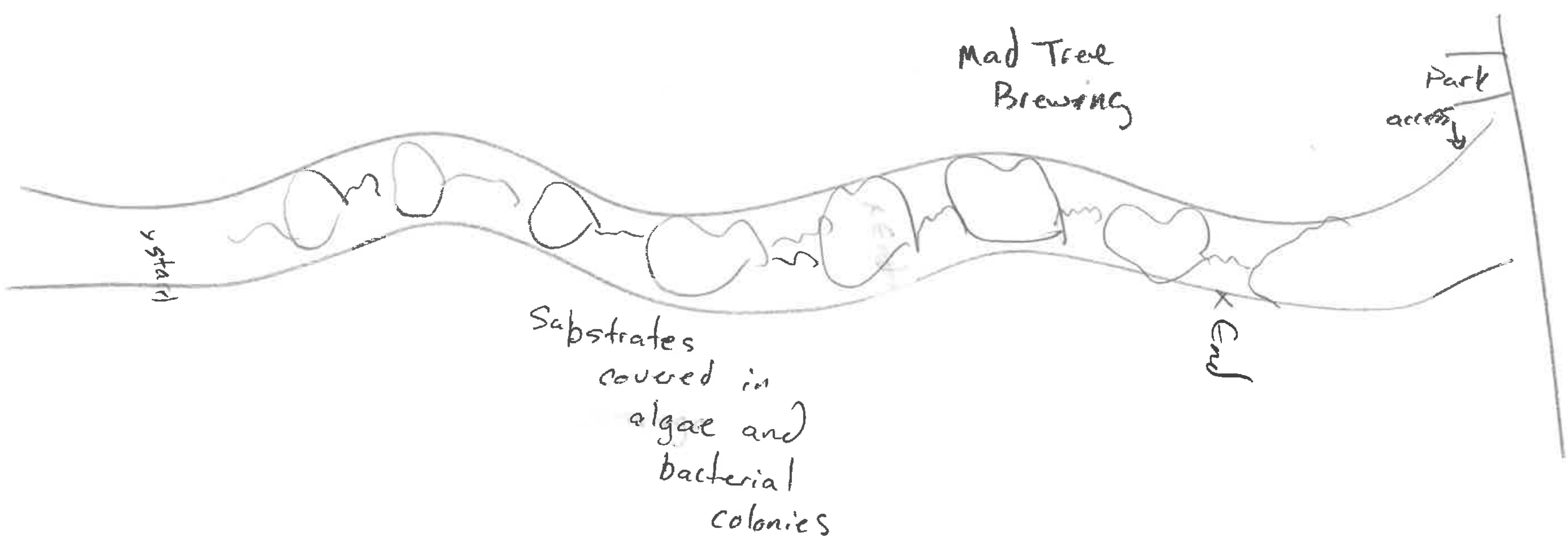
Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 50.5

Stream & Location: Unnamed Tributary to Little Duck Creek RM: 0.2 Date: 7/13/2022

LM82 @ baseball fields Scorers Full Name & Affiliation: MAS -> MBI

River Code: 11-077-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.182451 / 84.369927 Mid Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☒ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☒ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]		
☐ ☐ SAND [6]			☐ ☐ ARTIFICIAL [0]		
☐ ☐ BEDROCK [5]	x	x	(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☒ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:

SILT: ☐ HEAVY [-2] ☒ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☒ MODERATE [-1] ☒ NORMAL [0] ☐ NONE [1]

Substrate: 16.5 (Maximum 20)

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
0 POOLS > 70cm [2]
0 ROOTWADS [1]
3 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
2 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☒ MODERATE 25-75% [7]
☒ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 8 (Maximum 20)

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☒ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☒ LOW [2]	☒ FAIR [3]	☒ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☒ POOR [1]	☒ RECENT OR NO RECOVERY [1]	

Comments

Channel: 9 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	
☐ ☐ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☒ ☒ MODERATE [2]	☐ ☒ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☒ ☐ NARROW 5-10m [2]	☒ ☒ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian: 5.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)
☐ > 1m [6]
☐ 0.7-<1m [4]
☒ 0.4-<0.7m [2]
☐ 0.2-<0.4m [1]
☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average)
☒ POOL WIDTH > RIFFLE WIDTH [2]
☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply
☐ TORRENTIAL [-1] ☒ SLOW [1]
☐ VERY FAST [1] ☐ INTERSTITIAL [-1]
☐ FAST [1] ☐ INTERMITTENT [-2]
☐ MODERATE [1] ☐ EDDIES [1]
Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 5 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
☐ BEST AREAS > 10cm [2]
☐ BEST AREAS 5-10cm [1]
☒ BEST AREAS < 5cm [metric=0]

RUN DEPTH
☐ MAXIMUM > 50cm [2]
☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
☒ STABLE (e.g., Cobble, Boulder) [2]
☐ MOD. STABLE (e.g., Large Gravel) [1]
☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ NONE [2]
☐ LOW [1]
☒ MODERATE [0]
☒ EXTENSIVE [-1]

Comments

Riffle / Run: 2.5 (Maximum 8)

6] GRADIENT

GRADIENT (87.6 ft/mi) ☐ VERY LOW - LOW [2-4]
DRAINAGE AREA (0.59 mi²) ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ____ %GLIDE: ____
%RUN: ____ %RIFFLE: ____

Gradient: 4 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ________ cm
2nd pass ________ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

C] RECREATION AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.18200 , -84.37009
mid 39.182451 , -84.369927
end 39.18298 , -84.36976

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

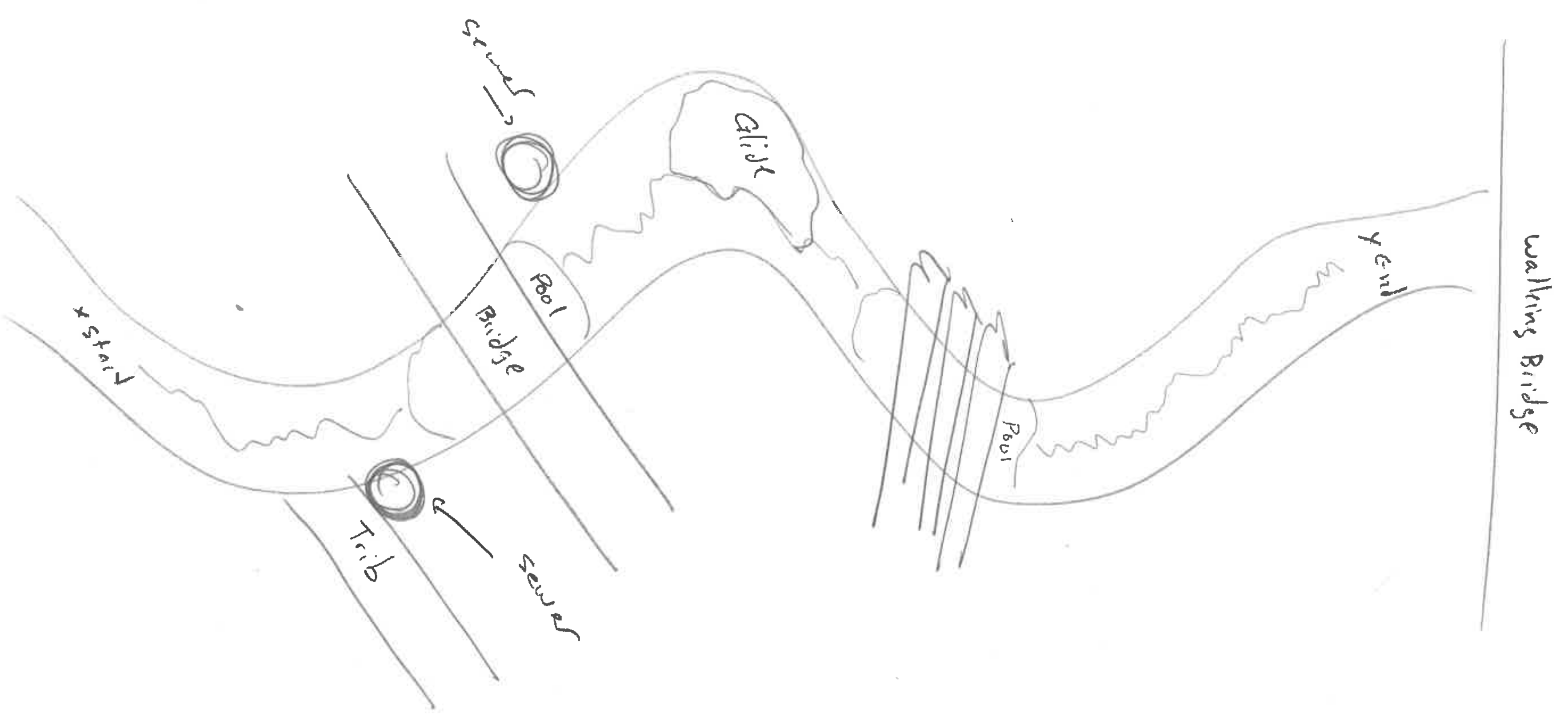
Circle some & *COMMENT*

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 65

Stream & Location: East Fork Duck Creek Behind School RM: 0.5 Date: 7/14/2022
LM84
Scorers Full Name & Affiliation: MBI - MAS
River Code: 11-051-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.165153 / 84.4005500 mid Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE	ORIGIN	QUALITY
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]	x	x	☑ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☐☐ BOULDER [9]		x	☐☐ DETRITUS [3]			☐ TILLS [1]	☐ MODERATE [-1]
☑☐ COBBLE [8]	x	✓	☐☐ MUCK [2]			☐ WETLANDS [0]	☑ NORMAL [0]
☐☑ GRAVEL [7]	x	x	☐☐ SILT [2]			☐ HARDPAN [0]	☐ FREE [1]
☐☐ SAND [6] (very little)	x		☐☐ ARTIFICIAL [0]			☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☐☐ BEDROCK [5]						☐ RIP/RAP [0]	☐ MODERATE [-1]
						☐ LACUSTURINE [0]	☑ NORMAL [0]
						☐ SHALE [-1]	☑ NONE [1]
						☐ COAL FINES [-2]	

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☑ 3 or less [0]

Comments

Substrate 18.5 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

			AMOUNT (Check ONE (Or 2 & average))
0 UNDERCUT BANKS [1]	1 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]	☐ EXTENSIVE >75% [11]
1 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]	☑ MODERATE 25-75% [7]
3 SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]	☐ SPARSE 5-<25% [3]
1 ROOTMATS [1]			☐ NEARLY ABSENT <5% [1]

Comments

Cover 15 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 10.5 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☑ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☑ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☑☐ NARROW 5-10m [2]	☑☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☑ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☑ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 4 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☑ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 8 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☑ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☑ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 5 Maximum 8

6] GRADIENT (123.0 ft/mi)
DRAINAGE AREA (1.99 mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st-sample pass-2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

____ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm
2nd pass ______ cm

CANOPY
- ☑ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.16473, -84.40113
mid 39.165153, -84.400550
end 39.16564, -84.39985

B] AESTHETICS
- ☑ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
POOL: ☐ >100ft2 (AREA) ☐ >3ft (DEPTH)

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

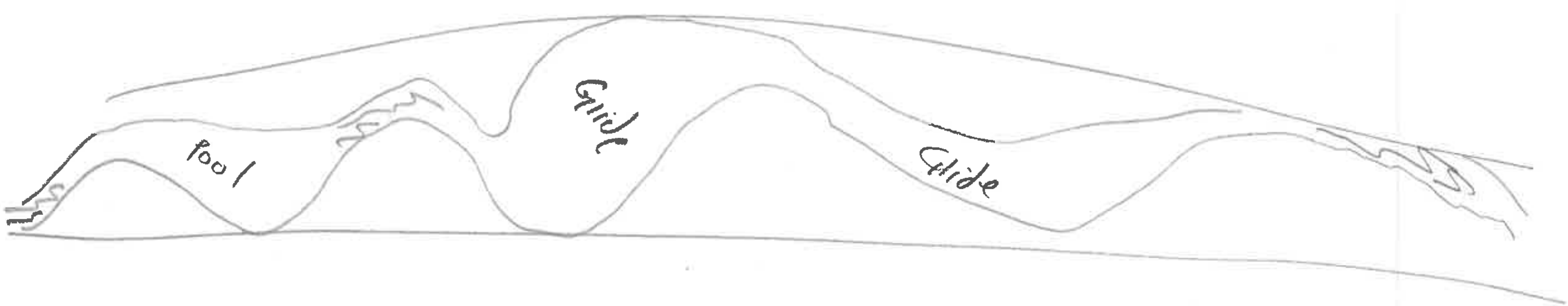
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 62.5

Stream & Location: East Fork Duck Creek - Stewart Ave. RM: 2.0 Date: 7/13/2022

LM85

Scorers Full Name & Affiliation: MAS-MBI

River Code: 11-051-___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.179568 / 84.395161 MID Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☑☐ COBBLE [8]	x	x	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	x	x	☐☐ SILT [2]	x	
☐☐ SAND [6]			☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]	x	x			

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☑ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ NONE [1]

Substrate: 19.5 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 1 ROOTMATS [1]
- 1 POOLS > 70cm [2]
- 1 ROOTWADS [1]
- 3 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT

Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 15 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 11 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☑☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☑ URBAN OR INDUSTRIAL [0]
☑☑ HEAVY / SEVERE [1]	☑☑ NARROW 5-10m [2]	☑☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 4 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH

Check ONE (ONLY!)
- ☐ > 1m [6]
- ☑ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH

Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY

Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 7 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☑ EXTENSIVE [-1]

Comments

Riffle / Run: 2 Maximum 8

6] GRADIENT (132.0 ft/mi)

DRAINAGE AREA (1.31 mi²)

- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ____ %GLIDE: ____

%RUN: ____ %RIFFLE: ____

Gradient: 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st -sample pass- 2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

______ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm
2nd ______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☑ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.18004 , -84.39503
mid 39.179568 , -84.395161
end 39.17908 , -84.39522

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☒ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

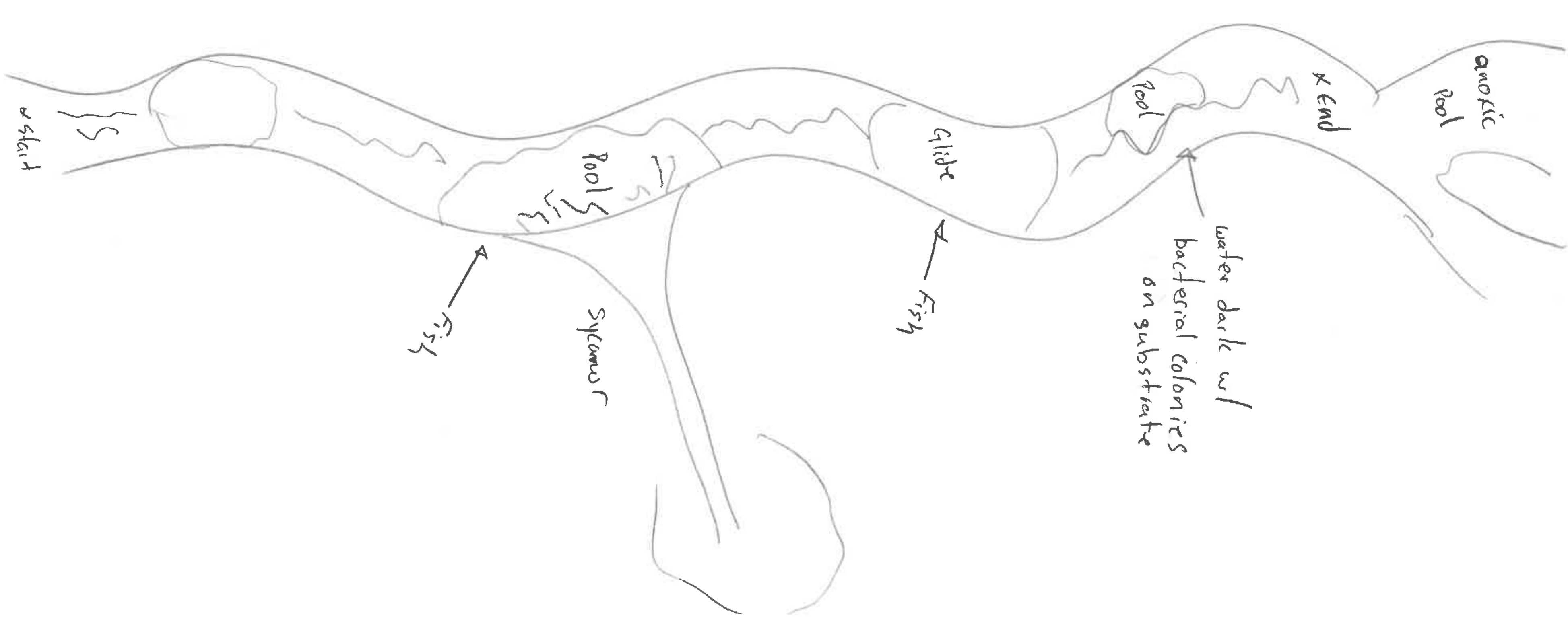
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 56.5

Stream & Location: Little Duck Creek - adj Camargo Rd. RM: 2.4 Date: 7/14/2022

LM86 Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 076 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.160582 / 84.380929 MID Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x		☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]		
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]		
☐☐ SAND [6]			☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN
☑ LIMESTONE [1]
☐ TILLS [1]
☐ WETLANDS [0]
☐ HARDPAN [0]
☐ SANDSTONE [0]
☐ RIP/RAP [0]
☐ LACUSTURINE [0]
☐ SHALE [-1]
☐ COAL FINES [-2]

QUALITY
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate 18 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
0 POOLS > 70cm [2]
1 ROOTWADS [1]
2 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover 13 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☑ NONE [1]
DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☑ FAIR [3] ☐ POOR [1]
CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☑ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]
STABILITY: ☑ HIGH [3] ☑ MODERATE [2] ☐ LOW [1]

Comments

Channel 10 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☐☐ MODERATE [2] ☑☑ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☐☐ MODERATE 10-50m [3] ☑☑ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☑☑ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☐☐ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 4 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!): ☐ > 1m [6] ☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☑ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☐ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 4 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☑ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ☑ MODERATE [0] ☑ EXTENSIVE [-1]

Comments

Riffle / Run 3.5 Maximum 8

6] GRADIENT (333.0 ft/mi)

DRAINAGE AREA (0.22 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___
%RUN: ___ %RIFFLE: ___

Gradient 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass _____ cm
2nd pass _____ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☑ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.15995 -84.38103
Mid 39.160582 -84.380929
end 39.16127 -84.38081

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

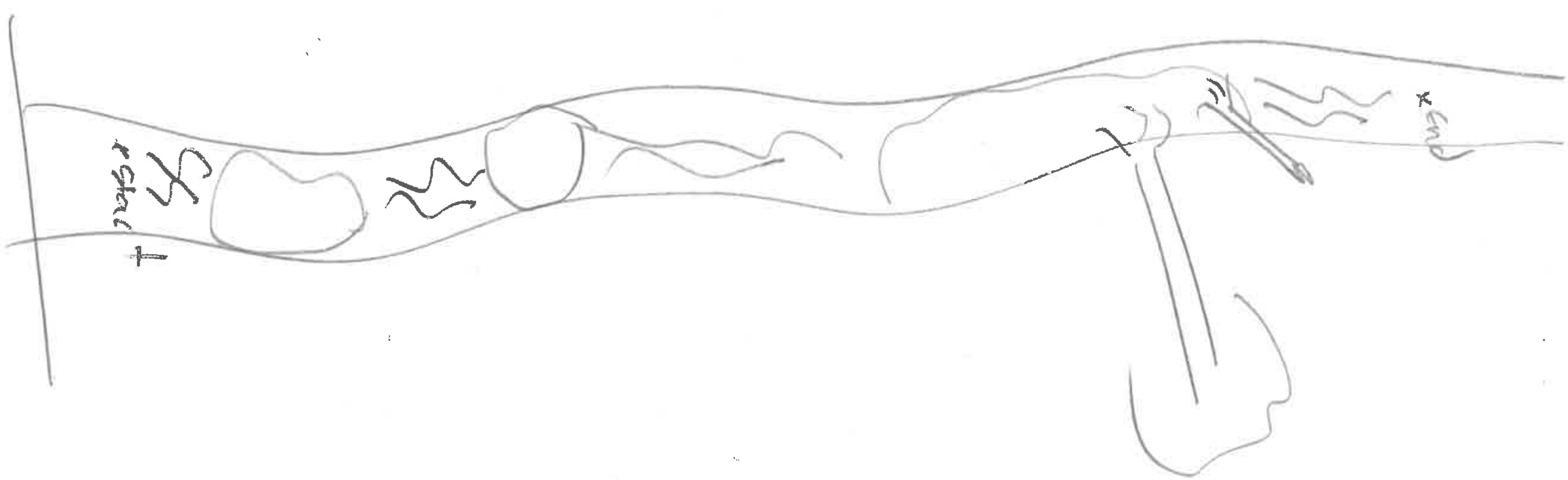
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 61

Stream & Location: Little Duck Creek adj. Plainville Rd. LM87

RM: 1.9 Date: 7/14/2022

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 076 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.158639 / 84.380862 Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE	ORIGIN	QUALITY
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]			☑ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☐☐ BOULDER [9]	x	x	☐☐ DETRITUS [3]			☐ TILLS [1]	☐ MODERATE [-1]
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]			☐ WETLANDS [0]	☐ NORMAL [0]
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]			☐ HARDPAN [0]	☑ FREE [1]
☐☐ SAND [6]			☐☐ ARTIFICIAL [0]	x		☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)			☐ RIP/RAP [0]	☐ MODERATE [-1]
						☐ LACUSTURINE [0]	☐ NORMAL [0]
						☐ SHALE [-1]	☑ NONE [1]
						☐ COAL FINES [-2]	

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Substrate: 19.5 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]
1 ROOTMATS [1]		

AMOUNT — Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 14

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 11.5

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☑☑ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 4

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☑ 0.2-<0.4m [1]		☐ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 4

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 4

6] GRADIENT (384.0 ft/mi)

DRAINAGE AREA (0.45 mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient Maximum 10: 4

EPA 4520 06/16/06

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE (1st-sample pass-2nd)
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

___ meters

CLARITY (1st --sample pass-- 2nd)
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm
2nd ______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☑ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.15820 -84.38090
mid 39.158639 -84.380862
end 39.15915 -84.38103

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

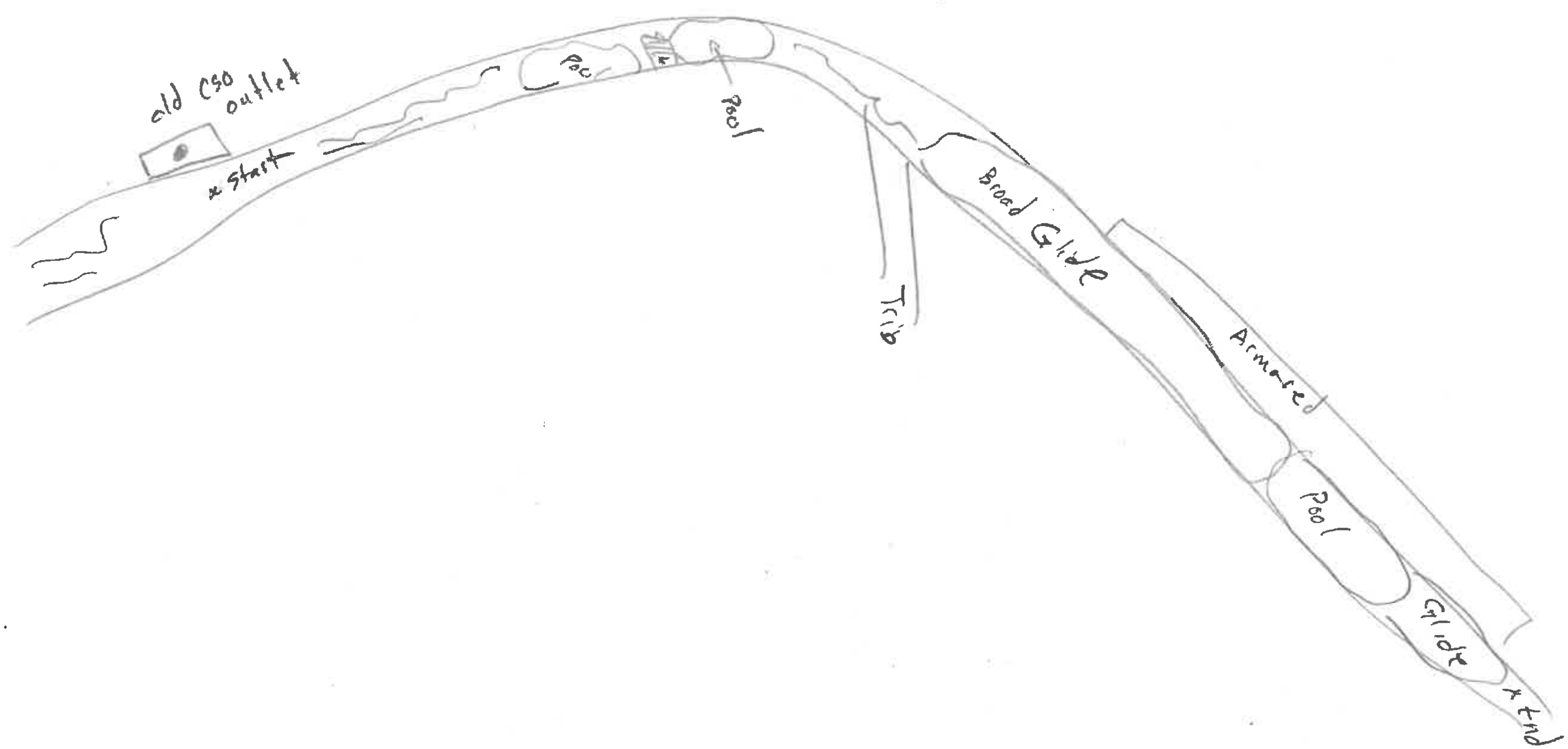
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 61

Stream & Location: Little Duck Creek - Settle St. RM: 1.0 Date: 7/22/2022

LM90 Scorers Full Name & Affiliation: MAS MBI

River Code: 11 - 076 - ___ STORET #: ______ Lat./Long. (NAD 83 - decimal °): 39.156941 / 84.384261 Middle Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]	x	
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]		
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]	x	x
☐☐ BEDROCK [5]					

very little

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate 18 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]
0 POOLS > 70cm [2]
1 ROOTWADS [1]
2 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover 13 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☑ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☑ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☑ HIGH [3] ☑ MODERATE [2] ☐ LOW [1]

Comments

Channel 10.5 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☑☑ MODERATE [2] ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☑☑ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☑☑ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☐☐ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 6 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☐ > 1m [6] ☐ 0.7-<1m [4] ☑ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☐ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current 5 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☑ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2] ☑ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☑ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run 4.5 Maximum 8

6] GRADIENT (312.0 ft/mi)

DRAINAGE AREA (0.55 mi²)

☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient 4 Maximum 10

EPA 4520 06/16/06

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass _____ cm
2nd _____ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☑ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.15678 -84.38477
mid 39.156941 -84.384261
end 39.15716 -84.38356

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

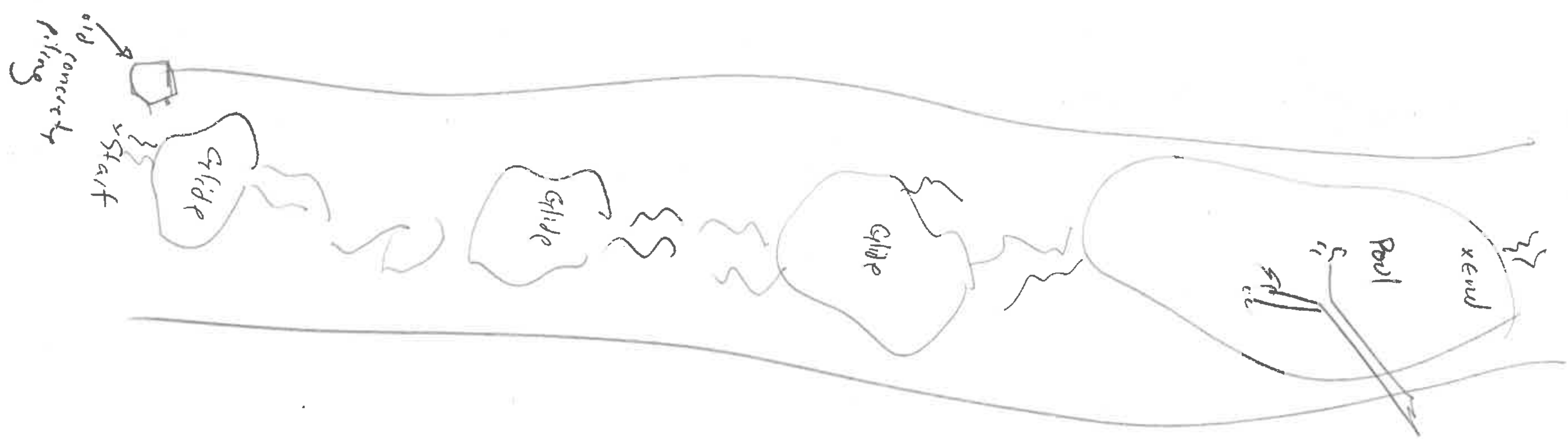
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 66.5

Stream & Location: Little Duck Creek - Wooster + Red Bank Rds. *RM:* 0.49 *Date:* 7/21/2022

LM92 *Scorers Full Name & Affiliation:* MBI - MAS

River Code: 11 - 076 - ___ *STORET #:* ______ *Lat./Long.:* (NAD 83 - decimal °) 39.135668 / 84.401274 middle *Office verified location* ☐

1] *SUBSTRATE*
Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]	x	
☐☐ BOULDER [9]	x		☐☐ DETRITUS [3]		
☐☑ COBBLE [8]	x	x	☐☐ MUCK [2]		
☑☐ GRAVEL [7]	x	x	☐☐ SILT [2]		
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

ORIGIN Check ONE (Or 2 & average)
- ☑ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☑ NONE [1]

Substrate Maximum 20: 20

2] *INSTREAM COVER*
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 3 SHALLOWS (IN SLOW WATER) [1]
- 1 ROOTMATS [1]
- 0 POOLS > 70cm [2]
- 2 ROOTWADS [1]
- 3 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☑ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: 13

3] *CHANNEL MORPHOLOGY*
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☑ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☑ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: 14.5

4] *BANK EROSION AND RIPARIAN ZONE*
Check ONE in each category for *EACH BANK* (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐☐ NONE / LITTLE [3]
- ☑☑ MODERATE [2]
- ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐☐ WIDE > 50m [4]
- ☐☐ MODERATE 10-50m [3]
- ☑☑ NARROW 5-10m [2]
- ☐☐ VERY NARROW < 5m [1]
- ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐☐ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☐☐ OPEN PASTURE, ROWCROP [0]
- ☐☐ CONSERVATION TILLAGE [1]
- ☑☑ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: 4

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☑ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12: 6

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☑ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☑ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☑ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: 5

6] *GRADIENT* (133.0 ft/mi)
DRAINAGE AREA (1.68 mi²)
- ☐ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient Maximum 10: 4

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☑ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☑ OTHER

140 meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm
2nd pass ______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☑ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.13591 -84.40179
mid 39.135668 -84.401274
end 39.13583 -84.40058

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

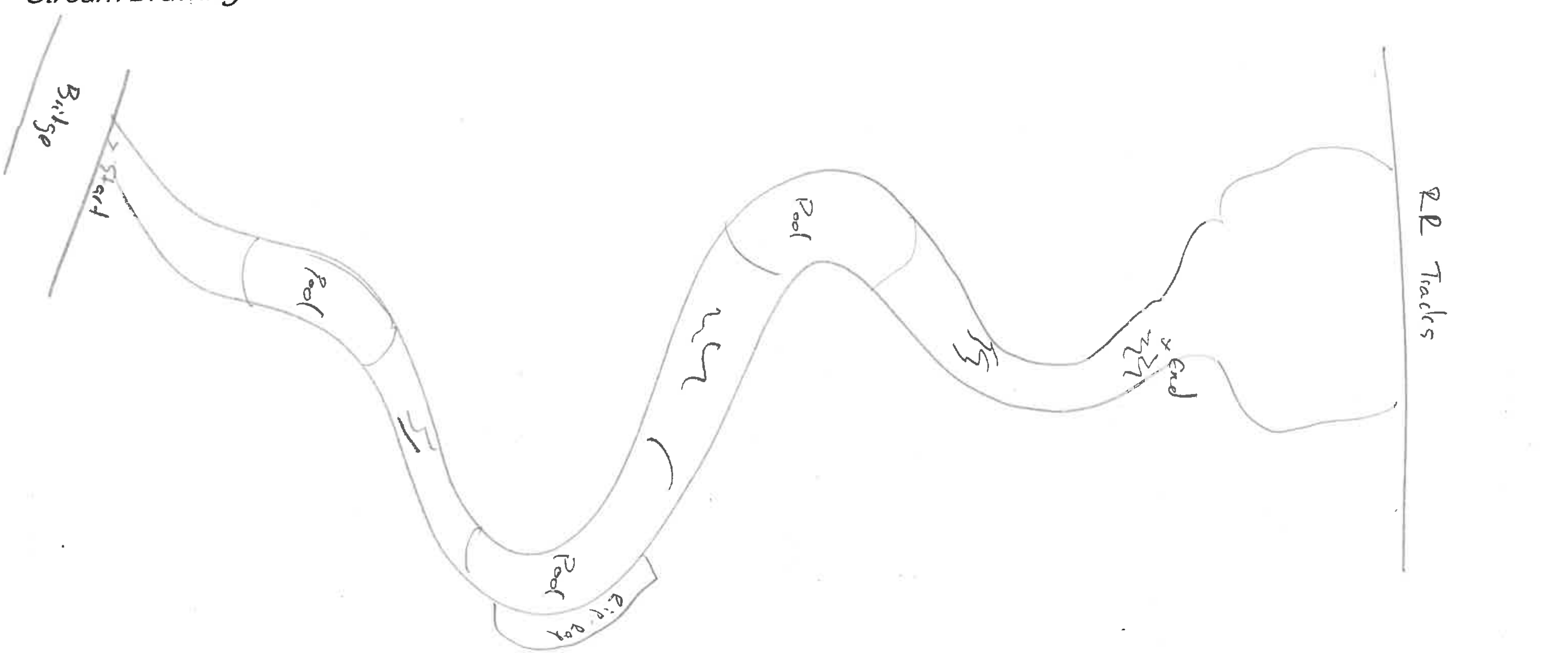
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 59

Stream & Location: Clough Creek adj. Clough Pike ~LM95 RM: 3.2 Date: 7/21/2022

Scorers Full Name & Affiliation: MAS - MBI

River Code: 11 - 002 - ___ STORET #: ______ Lat./Long.: (NAD 83 - decimal °) 39.093248 / 84.363153 Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	x	x	☐☐ HARDPAN [4]		
☐☐ BOULDER [9]		x	☐☐ DETRITUS [3]		
☑☐ COBBLE [8]	x	x	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	x	x	☐☐ SILT [2]		
☐☐ SAND [6]	x		☐☐ ARTIFICIAL [0]	x	x
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN	QUALITY
☑ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☐ TILLS [1]	☐ MODERATE [-1]
☐ WETLANDS [0]	☑ NORMAL [0]
☐ HARDPAN [0]	☑ FREE [1]
☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☐ RIP/RAP [0]	☐ MODERATE [-1]
☐ LACUSTURINE [0]	☐ NORMAL [0]
☐ SHALE [-1]	☑ NONE [1]
☐ COAL FINES [-2]	

Substrate: 19.5 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
2 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	0 LOGS OR WOODY DEBRIS [1]
1 ROOTMATS [1]		

AMOUNT — Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 12 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☑ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 10.5 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☑☑ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 4 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)	CHANNEL WIDTH — Check ONE (Or 2 & average)	CURRENT VELOCITY — Check ALL that apply	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☑ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 6 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☑ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 3 Maximum 8

6] GRADIENT (85.4 ft/mi) DRAINAGE AREA (1.95 mi²)
☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ( ) %GLIDE: ( )
%RUN: ( ) %RIFFLE: ( )

Gradient: 4 Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☑ OTHER

STAGE
1st-sample pass-2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☑ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☑ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

____ meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☑ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass ______ cm
2nd pass ______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☑ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

Comment RE: Reach consistency/ Is reach typical of steam?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

beg 39.09337 -84.36395
mid 39.093248 -84.363153
end 39.09309 -84.36224

B] AESTHETICS
- ☑ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

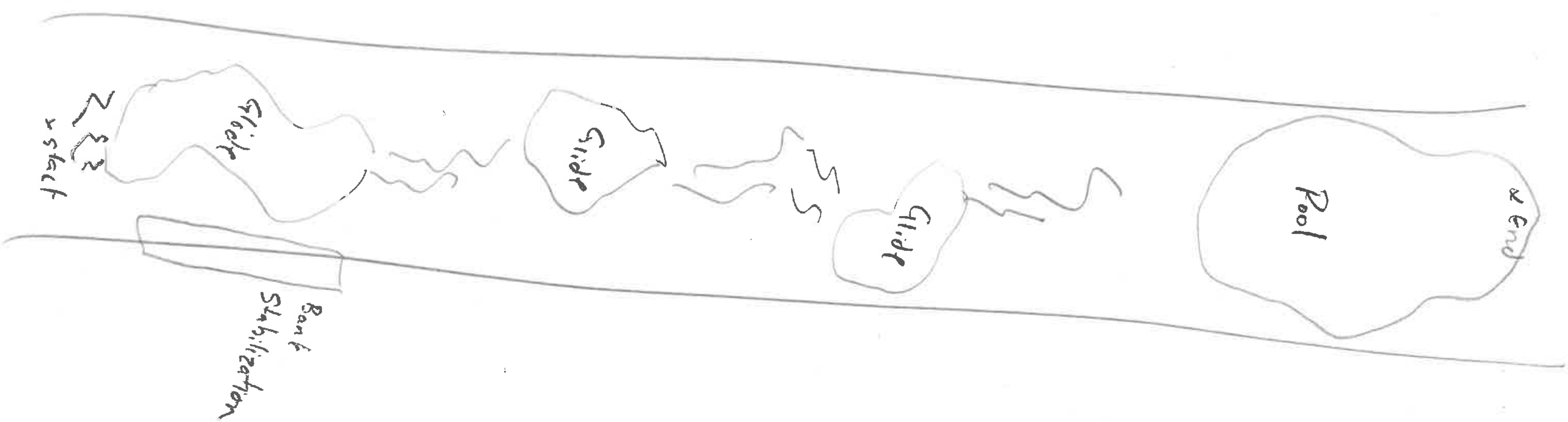
D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:



Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 59.5

Stream & Location: Clough Creek — Beechmont + Elstum RM: 0.6 Date: 7/21/2022
LM98
Scorers Full Name & Affiliation: MAS + MBI
River Code: 11-002- STORET #: Lat./Long. (NAD 83 - decimal °): 39.106208 / 84.394193 middle Office verified location ☐

22
40
62
22
84
37
121

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	x	x	☐ ☐ HARDPAN [4]		
☐ ☐ BOULDER [9]			☐ ☐ DETRITUS [3]		
☐ ☑ COBBLE [8]	x	x	☐ ☐ MUCK [2]		
☑ ☐ GRAVEL [7]	x	x	☐ ☐ SILT [2]		
☐ ☐ SAND [6]	x		☐ ☐ ARTIFICIAL [0]	x	
☐ ☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN: ☑ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY:
SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate: 18 — Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
0 POOLS > 70cm [2]
0 ROOTWADS [1]
3 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
0 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 10 — Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☑ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 10 — Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R):
☑ ☐ NONE / LITTLE [3]
☑ ☐ MODERATE [2]
☐ ☑ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R):
☑ ☐ WIDE > 50m [4]
☐ ☐ MODERATE 10-50m [3]
☐ ☑ NARROW 5-10m [2]
☐ ☑ VERY NARROW < 5m [1]
☐ ☐ NONE [0]

FLOOD PLAIN QUALITY (L R):
☑ ☐ FOREST, SWAMP [3]
☐ ☐ SHRUB OR OLD FIELD [2]
☑ ☐ RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ FENCED PASTURE [1]
☐ ☐ OPEN PASTURE, ROWCROP [0]
☐ ☐ CONSERVATION TILLAGE [1]
☐ ☑ URBAN OR INDUSTRIAL [0]
☐ ☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 5.5 — Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)
☐ > 1m [6]
☐ 0.7-<1m [4]
☑ 0.4-<0.7m [2]
☐ 0.2-<0.4m [1]
☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average)
☑ POOL WIDTH > RIFFLE WIDTH [2]
☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply
☐ TORRENTIAL [-1]
☐ VERY FAST [1]
☐ FAST [1]
☑ MODERATE [1]
☑ SLOW [1]
☐ INTERSTITIAL [-1]
☐ INTERMITTENT [-2]
☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 6 — Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).

☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
☐ BEST AREAS > 10cm [2]
☑ BEST AREAS 5-10cm [1]
☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH
☐ MAXIMUM > 50cm [2]
☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
☑ STABLE (e.g., Cobble, Boulder) [2]
☐ MOD. STABLE (e.g., Large Gravel) [1]
☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☑ NONE [2]
☐ LOW [1]
☐ MODERATE [0]
☐ EXTENSIVE [-1]

Comments

Riffle / Run: 6 — Maximum 8

6] GRADIENT (66.6 ft/ml)

DRAINAGE AREA (7.81 mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ? %GLIDE:
%RUN: %RIFFLE:

Gradient: 4 — Maximum 10

A] SAMPLED REACH
Check ALL that apply

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_____ meters

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

pass 1st _____ cm
2nd _____ cm

Comment RE: *Reach consistency/* Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

beg 39.10579 -84.39470
mid 39.106208 -84.394193
end 39.10683 -84.39400

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION
AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

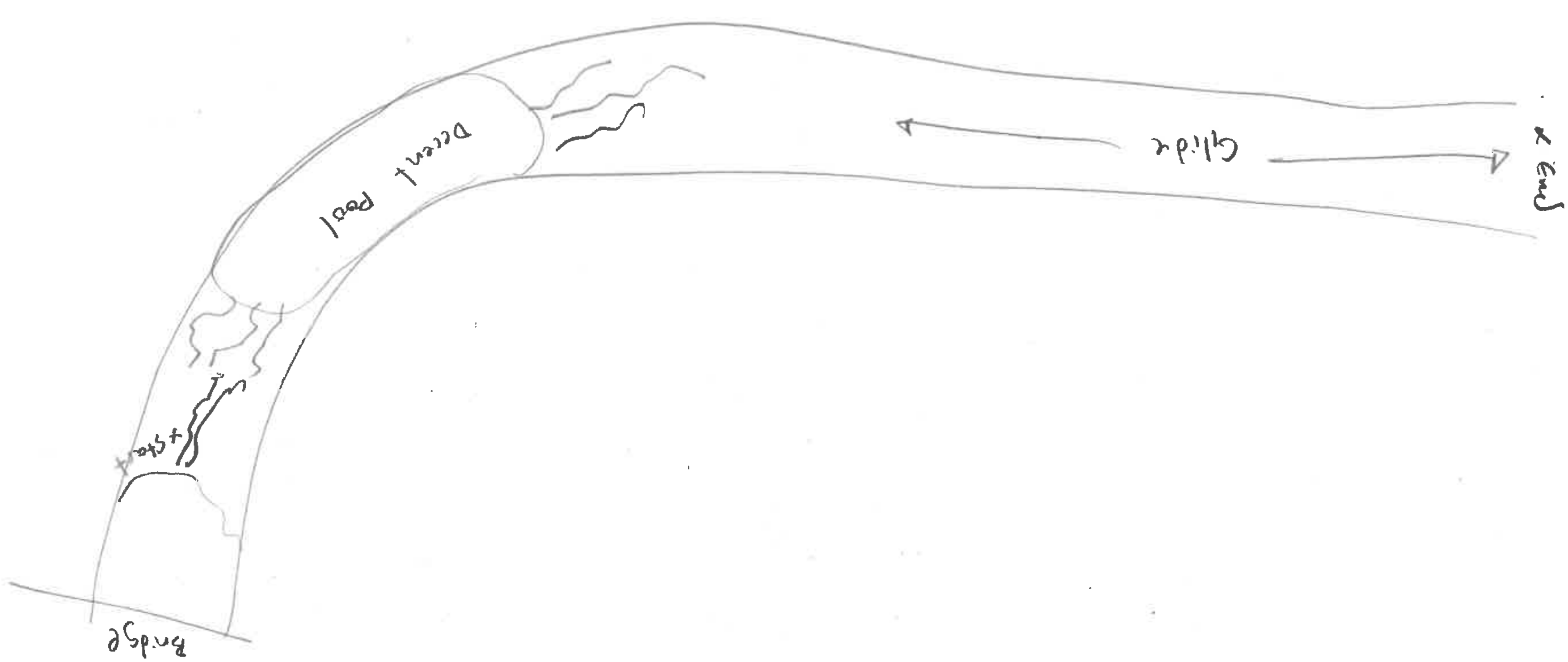
Circle some & COMMENT

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_2O / TILE / H_2O TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



Appendix D

Little Miami River 2022 Primary Headwater Habitat Data
D-1: PHWH Evaluation

Appendix D1. Primary Headwater Aquatic Life Use information for the small Little Miami River tributaries during 2022.

Site ID	RM	Year	River	Location:
LM54	**2.40**	**2022**	(11086) Unnamed Trib (1.82) to Trib to Sycamore	Glenover Dr. and Raiders Run

HHEI Info:	HHEI Score:	***81.0***	Substrate:	**36.0**	Pool:	**15.0**	Bankfull	**30.0**	Channel:	***Recovered***	Flow:	***Interm.***
QHEI Info:	QHEI Score:		Substrate:		Pool:		Max Z.:		Channel		Flow:	
Drainage Size:	**1.60**		Riffle:		Ripar:		Cover:		PHW Class:	**PHW3**		
FISH Info:	IBI Score:	**Dry**	Species:	**1.0**	Sensitive Sp.:	**0.0**	% Pioneer:	**0.00**	Headwater Sp.	**0.00**		
MACRO Info:	ICI Score:		QUAL EPT:	**0**	Coldwater Taxa.:	**0**	Intols:		Sens.	**0**	Toler:	V. Tol.
Salamanders:	**X**	Adults:		Larvae:	**7**	*Eurycea cirrigera*			Alternate Site ID:			

Site ID	RM	Year	River	Location:
LM71	**6.10**	**2022**	(11004) Duck Creek	Norwood/Harris Ave.

HHEI Info:	HHEI Score:	***61.0***	Substrate:	**21.0**	Pool:	**20.0**	Bankfull	**30.0**	Channel:	***Natural***	Flow:	***Flowing***
QHEI Info:	QHEI Score:	***26.0***	Substrate:	**0.5**	Pool:	**4.0**	Max Z.:	**20-40 cm**	Channel	**6.5**	Flow:	***Flowing***
Drainage Size:	**2.24**		Riffle:	**0.0**	Ripar:	**3.0**	Cover:	**8.0**	PHW Class:	**LRW**		
FISH Info:	IBI Score:	**No Fish**	Species:	**0.0**	Sensitive Sp.:	**0.0**	% Pioneer:	**0.00**	Headwater Sp.	**0.00**		
MACRO Info:	ICI Score:		QUAL EPT:	**0**	Coldwater Taxa.:	**0**	Intols:		Sens.	**0**	Toler:	V. Tol.
Salamanders:		Adults:		Larvae:		*None Captured*			Alternate Site ID:			

Site ID	RM	Year	River	Location:
LM80	**0.10**	**2022**	(11075) Unnamed Tributary to Duck Creek at RM 4.	Kennedy Ave.

HHEI Info:	HHEI Score:	***69.0***	Substrate:	**24.0**	Pool:	**20.0**	Bankfull	**25.0**	Channel:	***Natural***	Flow:	***Flowing***
QHEI Info:	QHEI Score:	***34.5***	Substrate:	**6.5**	Pool:	**2.0**	Max Z.:	**< 20 cm**	Channel	**7.0**	Flow:	***Flowing***
Drainage Size:	**1.42**		Riffle:	**2.0**	Ripar:	**4.0**	Cover:	**9.0**	PHW Class:	**LRW**		
FISH Info:	IBI Score:	**No Fish**	Species:		Sensitive Sp.:		% Pioneer:		Headwater Sp.			
MACRO Info:	ICI Score:		QUAL EPT:	**2**	Coldwater Taxa.:	**0**	Intols:		Sens.	**0**	Toler:	V. Tol.
Salamanders:		Adults:		Larvae:		*None Captured*			Alternate Site ID:			

Site ID	RM	Year	River	Location:
LM81	**2.30**	**2022**	(11051) East Fork Duck Creek	end of Tamworth Dr.

HHEI Info:	HHEI Score:	***51.0***	Substrate:	**36.0**	Pool:		Bankfull	**15.0**	Channel:	***Recovering***	Flow:	***Ephem.***
QHEI Info:	QHEI Score:		Substrate:		Pool:		Max Z.:		Channel		Flow:	
Drainage Size:	**0.50**		Riffle:		Ripar:		Cover:		PHW Class:	**PHW2**		
FISH Info:	IBI Score:	**Dry**	Species:	**1.0**	Sensitive Sp.:	**0.0**	% Pioneer:	**0.00**	Headwater Sp.	**0.00**		
MACRO Info:	ICI Score:		QUAL EPT:	**0**	Coldwater Taxa.:	**0**	Intols:		Sens.	**0**	Toler:	V. Tol.
Salamanders:		Adults:		Larvae:		*None Captured*			Alternate Site ID:			

Appendix D1. Primary Headwater Aquatic Life Use information for the small Little Miami River tributaries during 2022.

Site ID	RM	Year	River	Location:
LM82	**0.20**	**2022**	(11077) Unnamed Tributary to Little Duck Creek a	at baseball field

HHEI Info: HHEI Score: ***93.0*** Substrate: **33.0** Pool: **30.0** Bankfull **30.0** Channel: ***Recovering*** Flow: ***Flowing***

QHEI Info: QHEI Score: ***50.5*** Substrate: **16.5** Pool: **5.0** Max Z.: **40-70 cm** Channel **9.0** Flow: ***Flowing***

Drainage Size: **0.59** Riffle: **2.5** Ripar: **5.5** Cover: **8.0** PHW Class: **PHW3A**

FISH Info: IBI Score: **28** Species: **2.0** Sensitive Sp.: **0.0** % Pioneer: **26.06** Headwater Sp. **1.00**

MACRO Info: ICI Score: QUAL EPT: **4** Coldwater Taxa.: **1** Intols: Sens. **3** Toler: V. Tol.

Salamanders: **X** Adults: Larvae: **2** *Eurycea cirrigera* Alternate Site ID:

Site ID	RM	Year	River	Location:
LM83	**0.80**	**2022**	(11075) Unnamed Tributary to Duck Creek at RM 4.	behind Home Depot

HHEI Info: HHEI Score: ***37.0*** Substrate: **7.0** Pool: Bankfull **30.0** Channel: ***Recovering*** Flow: ***Interm.***

QHEI Info: QHEI Score: Substrate: Pool: Max Z.: Channel Flow:

Drainage Size: **1.20** Riffle: Ripar: Cover: PHW Class: **PHW2**

FISH Info: IBI Score: **Dry** Species: **1.0** Sensitive Sp.: **0.0** % Pioneer: **0.00** Headwater Sp. **0.00**

MACRO Info: ICI Score: QUAL EPT: **0** Coldwater Taxa.: **0** Intols: Sens. **0** Toler: V. Tol.

Salamanders: Adults: Larvae: *None Captured* Alternate Site ID:

Site ID	RM	Year	River	Location:
LM86	**2.40**	**2022**	(11076) Little Duck Creek	adj. Camargo Rd.

HHEI Info: HHEI Score: ***89.0*** Substrate: **29.0** Pool: **30.0** Bankfull **30.0** Channel: ***Recovered*** Flow: ***Flowing***

QHEI Info: QHEI Score: ***56.5*** Substrate: **18.0** Pool: **4.0** Max Z.: **20-40 cm** Channel **10.0** Flow: ***Flowing***

Drainage Size: **0.22** Riffle: **3.5** Ripar: **4.0** Cover: **13.0** PHW Class: **WWH**

FISH Info: IBI Score: **32** Species: **3.0** Sensitive Sp.: **0.0** % Pioneer: **21.16** Headwater Sp. **1.00**

MACRO Info: ICI Score: QUAL EPT: **7** Coldwater Taxa.: **0** Intols: Sens. **3** Toler: V. Tol.

Salamanders: **X** Adults: **1** Larvae: **4** *Eurycea cirrigera* Alternate Site ID:

Site ID	RM	Year	River	Location:
LM87	**1.90**	**2022**	(11076) Little Duck Creek	adj. Plainville Rd.

HHEI Info: HHEI Score: ***84.0*** Substrate: **29.0** Pool: **25.0** Bankfull **30.0** Channel: ***Recovering*** Flow: ***Flowing***

QHEI Info: QHEI Score: ***61.0*** Substrate: **19.5** Pool: **4.0** Max Z.: **20-40 cm** Channel **11.5** Flow: ***Flowing***

Drainage Size: **0.45** Riffle: **4.0** Ripar: **4.0** Cover: **14.0** PHW Class: **WWH**

FISH Info: IBI Score: **32** Species: **4.0** Sensitive Sp.: **0.0** % Pioneer: **39.41** Headwater Sp. **1.00**

MACRO Info: ICI Score: QUAL EPT: **9** Coldwater Taxa.: **2** Intols: Sens. **4** Toler: V. Tol.

Salamanders: **X** Adults: **1** Larvae: **3** *Eurycea cirrigera* Alternate Site ID:

Appendix D1. Primary Headwater Aquatic Life Use information for the small Little Miami River tributaries during 2022.

Site ID	RM	Year	River	Location:
LM90	**1.00**	**2022**	(11076) Little Duck Creek	Settle St.

HHEI Info: HHEI Score: ***89.0*** Substrate: **29.0** Pool: **30.0** Bankfull **30.0** Channel: ***Recovering*** Flow: ***Flowing***

QHEI Info: QHEI Score: ***61.0*** Substrate: **18.0** Pool: **5.0** Max Z.: **40-70 cm** Channel **10.5** Flow: ***Flowing***

Drainage Size: **0.55** Riffle: **4.5** Ripar: **6.0** Cover: **13.0** PHW Class: **WWH**

FISH Info: IBI Score: **32** Species: **4.0** Sensitive Sp.: **0.0** % Pioneer: **44.99** Headwater Sp. **1.00**

MACRO Info: ICI Score: QUAL EPT: **8** Coldwater Taxa.: **0** Intols: Sens. **4** Toler: V. Tol.

Salamanders: **X** Adults: Larvae: **4** *Eurycea cirrigera* Alternate Site ID:

Appendix E

Little Miami River 2022 Chemical Water Quality Data

E-1: 2017 Sampling Sites
E-2: Raw Chemical Data

(Contact Laura Boyd, MSDGC at Laura.Boyd@cincinnati-oh.gov for Excel files)

Site ID	Basin	Stream	River_Stream Name	Lat	Long	RM	Location Description	CSO/SSO/PSO/WWTP	Drain. Area (mi.^{2})	Geo-metric Level	Fish	Macro-inverts.	Habitat	Field Chem.	Demand	Nutrients	Metals	Organics	Supple-mental	Data-Sonde	Benthic Chloro-phyll a	Sediment Metals	Sediment Organics
LM01	11	001	Little Miami River	39.318200	-84.252000	27.90	Dst. U.S. Rt. 22/St. Rt. 3 - L. Miami State Park	WWTPs	1140	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM02	11	001	Little Miami River (RF06)	39.271300	-84.259400	24.10	Ust. O'Bannon Cr.		1145	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM03	11	001	Little Miami River	39.253100	-84.280800	22.30	Ust. Polk Run WWTP	WWTP	1150	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM05	11	001	Little Miami River	39.246900	-84.294700	21.50	Hopewell Rd. (Bridge Street)	WWTP	1160	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM07	11	001	Little Miami River	39.213100	-84.313600	18.50	Camargo Rd.	WWTP	1187	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM08	11	001	Little Miami River	39.208600	-84.306900	17.70	Canoe access dst. St. Rt. 126		1190	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM09	11	001	Little Miami River	39.172500	-84.298600	13.10	Wooster Pike - Milford		1203	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM11	11	001	Little Miami River	39.150000	-84.313300	10.90	Intersection of Mt. Carmel & Round Bottom Rd.	WWTP (via E. Fork)	1707	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM12	11	001	Little Miami River	39.136700	-84.351900	8.10	Newtown Rd.		1710	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM13	11	001	Little Miami River	39.138960	-84.374780	6.83	R.R. Trestle/Mariemont		1720	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM15	11	001	Little Miami River	39.118340	-84.399626	4.10	Ust. Duck Creek		1740	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM16A	11	001	Little Miami River	39.109430	-84.401780	3.70	Dst. Duck Creek/Ust. Beechmont Ave.	Duck Cr. CSOs	1752	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM16	11	001	Little Miami River	39.108900	-84.401700	3.50	Beechmont Ave. dst. Duck Cr., ust. Clough Cr.	CSO 476,~~470,471~~	1752	1	A	HD	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM17	11	001	Little Miami River	39.085300	-84.419700	1.60	Kellog Ave.	CSO 476,~~470,471~~	1754	1	A	na	QHEI	6X	6X	6X	6X	3X	Bact (6X)	X	X	X	X
LM50	11	007	Sycamore Creek	39.217300	-84.331600	1.10	Loveland Rd.	SSO 1008,579	12.5	5	E	HD	QHEI	4X	4X	4X	4X	4X	Bact (4X)	X	X	X	X
LM51	11	007	Sycamore Creek	39.223300	-84.326400	0.50	Dst. N. Fork	SSO 1008,579	24.0	4	D,E	HD	QHEI	4X	4X	4X	4X	4X	Bact (4X)	X	X	X	X
LM52	11	007	Sycamore Creek	39.225800	-84.322500	0.10	Dst. Sycamore Cr. WWTP	WWTP, SSO 1008,579	24.0	4	D,E	HD	QHEI	4X	4X	4X	4X	4X	Bact (4X)	X	X	X	X
LM54	11	086	U.T. @1.82 to U.T. Sycamore Cr. @1.12	39.215640	-84.365430	0.40	Behind house on Pepperell Rd.		1.58	8	F	QL/PH	QHEI/HHEI	4X	4X	4X	4X	4X	Bact (2X)				
LM55	11	049	Un. Trib to Sycamore Cr. @1.12	39.215580	-84.349070	1.20	Upstream Blome Rd bridge	SSO 705,647	4.22	7	E	QL	QHEI	4X	4X	4X	4X	4X	Bact (2X)				
LM56	11	049	Un. Trib to Sycamore Cr. @1.12	39.216220	-84.336150	0.20	Nearest 8174 Loveland Maderia Dr	SSO 705,647	5.61	6	E	HD,QL	QHEI	4X	4X	4X	4X	4X	Bact (2X)				
LM71	11	004	Duck Creek	39.161670	-84.437870	6.10	Norwood/Harris Ave	CSO 170,500,501	0.29	9	F	QL/PH	QHEI/HHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM72	11	004	Duck Creek	39.165278	-84.418056	5.14	Duck Creek Road	CSO 43,671,553	1.80	8	E,F	QL/PH	QHEI/HHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM73	11	004	Duck Creek	39.160370	-84.416680	4.58	Steel Place	CSO 188,61,43	1.91	8	E,F	QL/PH	QHEI/HHEI	4X	4X	4X	4X	1X	Bact (4X)	X	X	X	X
LM74	11	004	Duck Creek	39.156330	-84.407720	3.90	Dst. E. Fork Duck Creek	CSO 68,66,556	9.56	6	E	HD	QHEI	4X	4X	4X	4X	1X	Bact (4X)	X	X	X	X
LM75	11	004	Duck Creek	39.149308	-84.407592	3.40	Erie Avenue	CSO 136,80,205	10.20	5	E	HD	QHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM76	11	004	Duck Creek	39.143300	-84.404700	2.80	Red Bank Rd. and Fair Ln.	CSO 84,83,199	11.60	5	E	HD	QHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM77	11	004	Duck Creek	39.132778	-84.404722	2.00	Wooster Rd.	CSO 84,83,199	14.40	5	E	HD	QHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM79	11	004	Duck Creek	39.121700	-84.410800	0.90	Ust. Wooster Rd.	CSO 86,85,84	14.70	8	E	QL/PH	QHEI/HHEI	4X	4X	4X	4X	4X	Bact (4X)			X	X
LM80	11	075	Un. Trib. to Duck Cr. @4.80	39.167100	-84.419725	0.10	Kennedy Avenue	CSO 556,554,555	1.40	8	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)			X	X
LM83	11	075	Un. Trib. to Duck Cr.k @4.80	39.174040	-84.423555	0.80	Behind Home Depot	CSO 556,554,555	1.20	8	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)			X	X
LM82	11	077	Un. Trib. to L. Duck Cr. @4.42	39.183260	-84.370000	0.20	At baseball field	CSO 556,554,555	1.40	9	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)			X	X
LM81	11	004	East Fork Duck Creek	39.182490	-84.398990	2.30	End of Tamworth Dr.		0.29	8	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)	X	X	X	X
LM84	11	051	East Fork Duck Creek	39.164718	-84.400937	0.70	Behind John P. Parker School		2.20	8	E,F	QL/PH	QHEI/HHEI	4X	4X	4X	4X	4X	Bact (4X)			X	X
LM85	11	051	East Fork Duck Creek	39.179440	-84.396040	2.00	Stewart Ave.	CSO 556,554,555	1.30	8	F	QL/PH	QHEI/HHEI	4X	4X	4X	4X	4X	Bact (4X)			X	X
LM86	11	076	Little Duck Creek	39.159890	-84.380880	2.40	Camargo Road	SSO 1014,1057	0.22	9	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)			X	X
LM87	11	076	Little Duck Creek	39.158333	-84.381389	1.90	Plainville Road	SSO 1014,1057	0.50	9	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)			X	X
LM90	11	076	Little Duck Creek	39.156350	-84.385094	1.00	Settle Street	CSO 69,72,71	0.55	9	F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)			X	X
LM92	11	076	Little Duck Creek	39.136111	-84.400000	0.49	Wooster Rd. @Red Bank		14.50	5	E	HD	QHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM40	11	009	Polk Run	39.250800	-84.298900	0.30	East Kemper Rd.		10.80	5	E	HD	QHEI	4X	4X	4X	4X	2X	Bact (4X)	X	X	X	X
LM95	11	002	Clough Creek	39.093600	-84.365000	3.20	Clough Pike and Bridges Rd.		2.10	8	E,F	QL/PH	QHEI/HHEI	2X	4X	4X	4X	4X	Bact (2X)				
LM98	11	002	Clough Creek	39.106300	-84.397200	0.40	St. Rt. 125	CSO 182,476;SSO 588,589	7.97	6	E	QL	QHEI	2X	4X	4X	4X	4X	Bact (2X)	X	X	X	X
										41	**41**	**41**	**41**							**28**	**28**	**37**	**37**
	Level 1 (>300 mi^2): 14									**Fish:**		**Bugs:**		**Chemical Paramters by Group**									
	Level 2 (164 mi^2): 0									A (2X) - 14		HD - 22		Temp.	BOD5	NH3-N	Cd	BNAs	*E. coli*			Cd	BNAs
	Level 3 (82 mi^2): 0									D&E (2X) - 8		QL - 4		Conductivity	Chloride	NO3-N	Cu	VOCs				Cu	VOCs
	Level 4 (42 mi^2): 2									E (1X) - 4		QL/PH - 15		D.O.	Sulfate	TKN	Pb	PAHs				Pb	PAHs
	Level 5 (21 mi^2): 6									E,F (1X) - 9		**Total**: 41		pH	TDS	Total P	Zn	Pesticides				Zn	Pesticides
	Level 6 (10 mi^2): 3									F (1X) - 5					SSC	Seston. Chl a	Fe					Fe	PCBs
	Level 7 (5.0 mi^2): 1									**Total**: 41		**Chem WQ**:			Cond.	Benth. Chl a	Ca					Ca	
	Level 8 (2.5 mi^2): 10											6X: 14			pH		Mg					Mg	
	Level 9 (1.0 mi^2): 5											4X: 27					As					As	
	Total Sites: 41											**Total**: 41											

Appendix F

F-1: Ohio EPA Stream Nutrient Assessment Procedure (SNAP) Matrix and Flow Chart

Proposed Stream Nutrient Assessment Procedure (SNAP; Ohio EPA 2015b)				
STEP 1	***STEP 2***	***STEP 3***	***STEP 4***	
Biological Criteria	**Diel D.O. Swing**[2]	**Benthic Chlorophyll**[3]	**Preliminary Assessment: Trophic Condition Status of Evaluated Segment or Waterbody**	
All indices attaining or in non-significant departure[1]	Normal or low swings (≤6.5 mg/l)	Low to moderate (≤320 mg/m^2)	Attaining use / Not threatened	
		High (>320 mg/m^2)	Attaining use, but may be threatened	*See Flow Chart A*
	Wide swings (>6.5 mg/l)	Low (≤182 mg/m^2)		
		Moderate to high (>182 mg/m^2)		
Non-attaining (one or more indices below nonsignificant departure)	Normal or low swings (≤6.5 mg/l)	Low to moderate (≤320 mg/m^2)	Impaired, but cause(s) other than nutrients	*See Flow Chart B*
		High (>320 mg/m^2)	Impaired; likely nutrients over-enrichment	*See Flow Chart C*
	Wide swings (>6.5 mg/l)	Low (≤182 mg/m^2)		
		Moderate to high (>182 mg/m^2)	Impaired; Nutrients over-enrichment	

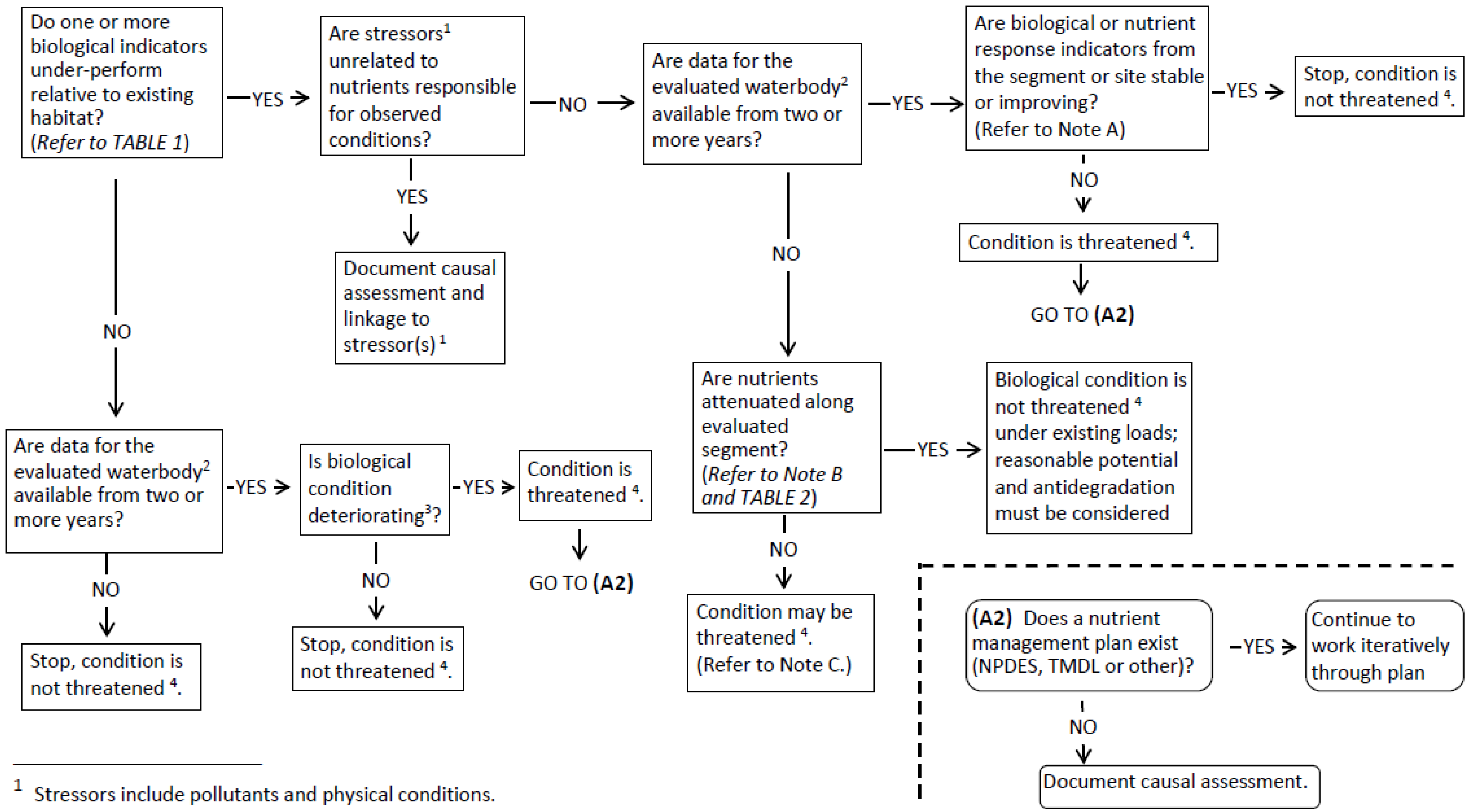
[1] Non-significant departure from biocriteria values accounts for background variability in measurements for biological indices. In accordance with “Biological Criteria for the Protection of Aquatic Life: Volume II: Users Manual for Biological Field Assessment of Ohio Surface Waters”, Ohio EPA (1987, updated 2015b), non-significant departure is 4 points for IBI and ICI, and 0.5 point for MIwb.

[2] Threshold value for 24-hour DO swing based upon a change point of 6.5 mg/l between DO swing and minimum DO. “Low to normal” DO swing is ≤6.5 mg/l. “Wide” DO swing is >6.5 mg/l. Data used for analysis from Technical Support Document for Nutrient Water Quality Standards for Ohio Rivers and Streams, Ohio EPA (2011).

[3] Threshold values for benthic chlorophyll a are based upon change points between benthic chlorophyll a and DO swings or Invertebrate Community Index (ICI). “Low” chlorophyll a is ≤182 mg/m2. “Moderate” chlorophyll a is >182 and ≤320 mg/m2. “High” chlorophyll a is >320 mg/m2. Data used for analysis from Technical Support Document for Nutrient Water Quality Standards for Ohio Rivers and Streams, Ohio EPA (2011).

FLOW CHART A. – DECISION TREE FOR DETERMINING WHEN BIOLOGICALLY ATTAINING CONDITION STATUS IS THREATENED BY NUTRIENTS

For application when biological criteria are attaining, but one or both nutrient response indicators (DO swing or benthic chlorophyll) are elevated.



[1] Stressors include pollutants and physical conditions.

[2] The geographic scope or length of evaluated stream segments are defined in approved study plans.

[3] For a given location, a decrease of 5 or more IBI or ICI points, or 0.6 or more MIWb points between sampling years represents a significant change. Trends for waterbodies are formally evaluated in Biological and Water Quality Technical Support Documents.

[4] As recommended by US EPA in its integrated reporting guidance (*Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act*), "threatened" waters are currently attaining WQSs but are expected to not meet WQSs by the next listing cycle (every two years). For example, a declining trend may indicate threatened status, whereas a stable or improving trend would not.