

Chapter 5. Water Resource Quality

Water Quality Standards and Beneficial Use Designations

Water quality standards contain two distinct elements: designated uses; and numerical or narrative criteria designed to protect and measure attainment of the uses. (OAC 3745-1)

Beneficial use designations describe existing or potential uses of water bodies. They take into consideration the value of the water body for public use, protection and propagation of aquatic life, recreation, agricultural, industrial and other purposes. Ohio EPA assigns beneficial use designations to water bodies in the state. There may be multiple uses assigned to a single water body. Examples of beneficial use designations include: public water supply, primary contact recreation, and aquatic life uses (warmwater habitat, exceptional warmwater habitat, etc.) This section will cover only the use designations found within the OWC watershed, for additional information visit <http://www.epa.state.oh.us/dsw/wqs/index.html#Background>.

Table 30. Overview of Sub-category Use Designations in OWC

Segment	Warmwater Habitat	Agricultural Water Supply	Industrial Water Supply	Primary Contact Recreation	State Resource Water
OWC Estuary (Within Reserve Boundary)	✓			✓	✓
All Other Stream Segments	✓	✓	✓	✓	

AQUATIC HABITAT USE DESIGNATIONS IN OHIO

Water quality standards consist of designated uses and the chemical, physical, and biological criteria designed to represent measurable properties of the environment that are consistent with the goals specified by each use. Prior to 1978, Ohio's water quality standards specified only one general aquatic life use designation for all waters of the state. In 1978, the standards were revised in an attempt to recognize the variability inherent in natural aquatic ecosystems by having a tiered classification scheme for different aquatic life uses. Although the classifications were based upon ecological attributes, the criteria associated with them at the time were entirely chemical and physical. This changed by 1980, when the early biological criteria were developed. These biocriteria, derived from the tiered use designations, were in turn the forerunners of the current system of numeric biocriteria.

The tiered system of use designations provides for different levels of protection and reflects the choices implicit in reconciling the "ideal" (represented by least impacted reference conditions) with the "reality" of the ongoing effects from two centuries of intensive human use of the state's land and water resources.

The aquatic life use designations are assigned to individual waterbody segments based upon the potential to support that use according to narrative and numerical criteria. Observing actual attainment of the criteria in order to designate a particular use is not necessary; if this were the case, there would be little incentive to improve degraded aquatic systems.

The Warmwater Habitat (WWH) use designation is applicable to most of the state's rivers and streams. The Exceptional Warmwater Habitat (EWH) use designation is used for waters with unique and unusual assemblages of aquatic life (e.g., waters with the potential for significant populations of endangered species, unusually good chemical quality, above-average abundance of sensitive species, above-average populations of top carnivores). The Modified Warmwater Habitat (MWH) use designation applies to extensively modified habitats that are capable of supporting the semblance of a warmwater biological community, but fall short of attaining WWH because of functional and structural deficiencies due primarily to altered habitats. The lowest degree of biological integrity, reflecting poor and very poor communities, is Limited Resource Water (LRW).

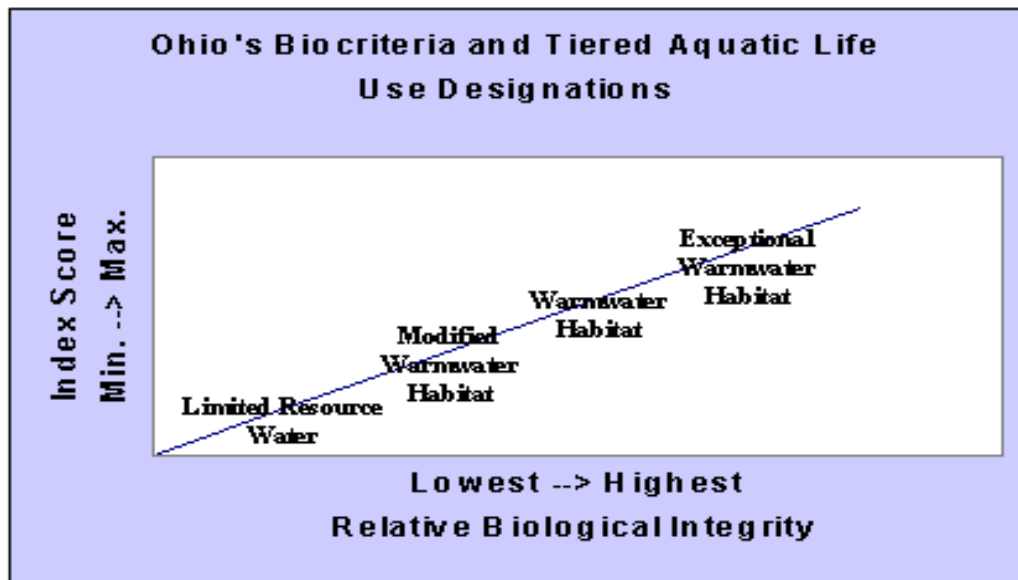


Figure 81: Ohio's Biocriteria Aquatic Life Use Designations defined by the Ohio EPA. (<http://www.epa.gov/waterscience/biocriteria/casestudies/aquaticlifeohio.html>)

Degrees of Use Attainment for Ohio Streams and Rivers: The OEPA has developed a standard set of terms to describe the degree to which biological use attainment is being met. These are as follows:

- A. **Fully Attaining** - All biological indices meet standards.
- B. **Partially Attaining** - One of two or two of three indices do not meet criteria but are not in the poor or very poor category.
- C. **Non-attaining** - None of the indices meet standards or one organism group indicates a severe toxic impact (poor or very poor category) even if the other organism groups indicate attainment.

USE DESIGNATIONS FOR OLD WOMAN CREEK

AQUATIC LIFE

Warmwater Habitat. Water bodies capable of supporting and maintaining a balanced, integrated and adaptive community of warmwater aquatic organisms. The typical assemblages of fish and invertebrates are present, similar to least impact reference condition. This is the baseline regulatory requirement in line with the Clean Water Act “fishable goal” expectations.

Biological Indices. The fish and macroinvertebrate data are used to calculate the following three indices, as described in the OEPA Guide and presented below:

- **Index of Biological Integrity (IBI)** - The index of biological integrity is a measure of fish species diversity and populations. The index is a number that reflects total native species composition, indicator species composition, pollutant intolerant and tolerant species composition, and fish condition. Combined, the higher the calculation, the healthier the aquatic ecosystem; conversely, the lower the index, the poorer the health of the aquatic ecosystem. The highest score is 60.
- **Modified Index of Well Being (MIwb)** - the modified index of well being factors out 13 pollutant tolerant species of fish and includes fish mass in the final analysis. Thus, if the IBI and the MIwb are examined together, an even clearer picture of the health of the biological community emerges. For example, if a high IBI is coupled with a low MIwb, it would tell us that while there is a variety of species and a good number of individuals of each species (high IBI) individual members of these species are smaller than what is expected. This might indicate that while fish are numerous, they are not maturing fully. In turn, this information could be useful in determining which pollution source is impacting the biological community. The highest value of the MIwb is 12. The MIwb is not applied to stream segments with drainage areas less than 20 square miles.

- **Invertebrate Community Index (ICI)** - the invertebrate community index is based on measurements of the macroinvertebrate communities living in a stream or river. It is particularly useful in evaluating stream health because: (1) there are a wide variety of macroinvertebrate taxa, which are known to be pollutant intolerant; and (2) there are a number of macroinvertebrate taxa, which are known to be pollutant tolerant. Like the IBI, the ICI scale is 0 - 60 with higher scores representing healthier macroinvertebrate communities.

Table 31. Ecoregional Biocriteria: Eastern Corn Belt Plains (ECBP) and Eastern-Ontario Lake Plain (EOLP) (Old Woman Creek and Chappel Creek Watersheds TMDL – OEPA 2005).

Site type	IBI		Mlwb		ICI	
	ECBP	EOLP	ECBP	EOLP	ECBP	EOLP
Headwaters	40	40			36	34
Wading	40	38	8.3	7.9	36	34
Boat	42	48	8.3	9.6	36	34

Habitat Assessment.

Qualitative Habitat Evaluation Index (QHEI) The QHEI index is intended to provide a quantitative evaluation of the qualitative physical characteristics of a given stream reach. This index is similar to the biological indices, IBI and ICI and is measured at each site where IBI data is obtained (Ohio EPA 1989). Again, similar to IBI and ICI, QHEI is composed of six metrics which take into account variables such as bottom substrate, channel morphology, riparian cover, and other modifications to the stream stretch under investigation. A QHEI measurement can have a maximum score of 100. The following is a brief description of the metrics comprising Ohio EPA's QHEI as outlined by Ohio EPA (1989).

- **Substrate** - measures two components - substrate type and substrate quality; takes into account variables like parent material, embeddedness of cobble, gravel and boulders and silt cover. The maximum score is 20
- **Instream Cover** - measures instream cover type and amount. The maximum score is 20
- **Channel Morphology** - includes channel sinuosity, development, stability and channelization; indicates the quality of the stream channel in relation to creation and stability of the macrohabitat. The maximum score is 20
- **Riparian Zone and Bank Erosion** - measures floodplain quality, extent of bank erosion and the width of the riparian zone; serves as indication of the quality of the riparian buffer and floodplain vegetation. The maximum score is 10

- **Pool and Riffle Quality** - component measures include overall diversity of current velocities, pool depth and morphology and riffle-run depth, substrate and substrate quality; serves as indication of the quality of the pool and riffle habitats. The maximum score is a combined 20 (12 for pool, 8 for riffle)
- **Map Gradient** - calculation of elevation drop through sampling area; accounts for varying influence of gradient with respect to stream size. The maximum score is 10

WATER SUPPLY

Agricultural – these are waters suitable for irrigation and livestock watering without treatment.

Industrial - these are waters suitable for commercial and industrial uses, with or without treatment. Criteria for the support of the industrial water supply use designation will vary with the type of industry involved.

RECREATIONAL USE

The recreational season in Ohio is from May 1 to October 15. During this period, surface waters must meet numerical criteria which protect recreational uses.

Primary Contact - are waters suitable for full body contact recreation such as, but not limited to, swimming, canoeing and scuba diving with minimal threat to public health due to water quality.



Figure 82: Canoeing the estuary is one example of primary contact recreational use in OWC. (VanZonest)

STATE RESOURCE WATER

The water is among the very best within Ohio; supports very diverse aquatic life and/or endangered or threatened species.

Overview of Recorded Water Quality Impairments

The Ohio EPA report, *Biological and Water Quality Study of the Vermillion River, Old Woman Creek, Chappel Creek, Sugar Creek, and Selected Lake Erie Tributaries (2002)* concludes that impairments in the OWC watershed affect the aquatic life use designation and not the recreational or water supply use

designations of the creek. The integrated report (2004) and TMDL (2005) for OWC furthered described the impairments as follows:

- **Sediment/Siltation**
- **Nutrient Enrichment**
- **Habitat Alteration**

Causes listed for these impairments are listed include:

- **Non-irrigated crop production**
- **Pasture/Livestock**
- **Channelization**

TMDL Sediment Load Reduction – 2,876.6kg/d (1,050 tons/yr)

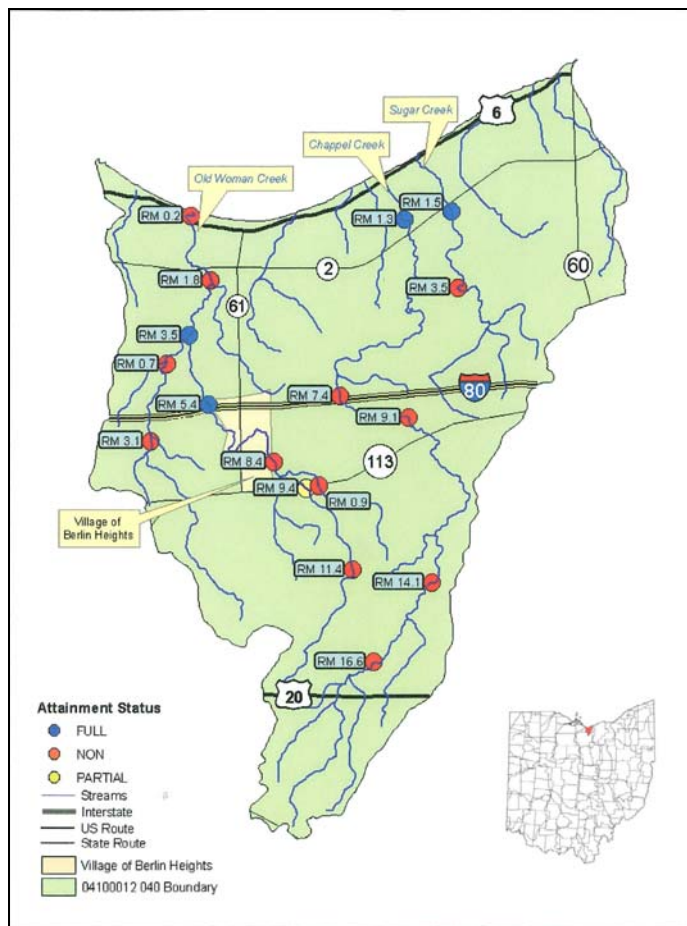


Figure 83: Ohio EPA TMDL study area and attainment status showing Old Woman Creek (OEPA, 2005)

Table 32. Ecoregion Location, Use Designation, and Aquatic Life Use Attainment of the OWC Watershed. (Old Woman Creek and Chappel Creek TMDL – OEPA 2005).

Main Branches of OWC (east and west)

River Mile	Drainage Area	IBI	MIwb	ICI	QHEI	Attainment Status	Impairment
WWH –ECBP Ecoregion							
11.4	2.4	<u>24</u> *	NA	<u>P</u> *		NON [^]	Flow Alteration
9.4	3.4	36 ^{ns}	NA	F*	44.0	PARTIAL	Siltation/Habitat Alteration
WWH –EOLP Ecoregion							
8.4	7.8	32*	NA	P*	74.5	NON	Organic/Nutrient Enrichment
5.4	11.8	38 ^{ns}	NA	G	66.0	FULL	
3.5	21.0	38 ^{ns}	NA	MG ^{ns}	73.5	FULL	
1.8	29.0	<u>24</u> *	NA	<u>16</u> *		NON	Siltation/Nutrient Enrichment
0.2	30.0	<u>19</u> *	<u>5.4</u> *	<u>P</u> *	36.5	NON	Siltation/Nutrient Enrichment

Tributary to OWC (RM 8.82)

River Mile	Drainage Area	IBI	MIwb	ICI	QHEI	Attainment Status	Impairment
Undesignated/Recommended WWH –ECBP Ecoregion							
0.9	1.8			VP*		NON	Siltation/Habitat Alteration

Tributary to OWC (RM 3.7)

River Mile	Drainage Area	IBI	MIwb	ICI	QHEI	Attainment Status	Impairment
Undesignated/Recommended WWH –EOLP Ecoregion							
4.9	4.5	28*	NA	F*	67.5	NON [^]	Flow Alteration
5.4	7.9	<u>26</u> *	NA	<u>P</u>		NON [^]	Flow Alteration

ICI categories – VP (very poor), P (poor), F (fair), G (good), MG (moderately good), G (good)

* -Indicates significant departure from applicable biocriteria (< 4 IBI or ICI units, or < 0.5 MIwb units). Underlined scores are in the poor or very poor range.

NS – Not Significant departure from biocriteria (< 4 IBI or ICI units, or < 0.5 MIwb units)

[^]NOTE: Flow alteration was not addressed in the TMDL under the assumption this “impairment” was a naturally caused event due to drought.

Old Woman Creek NERR Water Quality

Table 33: Water quality in the lower reach of Woman Creek at the N&W Railroad Bridge for four time periods.

Parameter	1981-1983	1995-1997	1998-2000	2006-2008
Temperature (°C)				
mean	11.4	13.7	15.4	14.7
range	-2.0-25.0	0.4-24.6	0.7-24.5	2.4-23.2
Dissolved Oxygen (mg/l)				
mean	9.5	8.9	7.7	8.3
range	1.8-15.0	4.4-14.4	2.6-15.1	6.3-12.9
Specific Conductivity (µmhos/cm)				
mean	706	613	636	687
range	389-1191	403-1117	317-1074	414-974
Turbidity (NTU)				
mean	23.6	23.5	29.9	21.80
range	2.4-150	2.9-300	1.6-354	3.1-100
Soluble Reactive Phosphorus (µg P/l)				
mean	31.4	28.9	41.5	22.98
range	1.5-129.9	1.4-103.8	0.0-468.2	2.2 – 58.5
Nitrate (mgN/l)				
mean	1.918	2.652	3.168	2.60
range	0.012-7.578	0.0-6.354	0.008-15.153	.0031-13.333
Ammonia (mgN/l)				
mean	0.155	0.147	0.089	.0477
range	0.001-1.472	0.008-.840	0.015-0.526	0.002-2.243