

STATUS OF WATER QUALITY GREAT MIAMI RIVER (UPPER) WATERSHED

Table of Contents

B1	Aquatic Life Use Attainment.....	2
	B1.1 Water and Sediment Chemistry.....	11
	B1.2 Trends	14
B2	Recreation Use Attainment	14
B3	Public Drinking Water Supply Use Attainment	16
B4	Human Health Use Attainment.....	16
B5	References	16

Great Miami River (upper) Watershed TMDLs

Ohio EPA completed a survey of 78 sites for biology, chemistry and habitat and 36 sites for bacteria in the Great Miami River (upper) watershed in 2008. The majority of sites, 72.7% (56) evaluated were classified as warmwater habitat (WWH). In the eastern part of the watershed the influence of ground water recharge into the smaller tributaries enables 6 sites (7.8%) to be classified as coldwater habitat (CWH) or with a dual use of CWH and exceptional warmwater habitat (EWH). The effects of county ditch maintenance programs on mainly hydric soils in the western watershed have impacted 9 sites (11.7%) to be classified as modified warmwater habitat–channelized (MWH-C) habitats. Exceptional warmwater habitat was documented in 4 sites (5.2%) of the watershed, mostly on the lower mainstem (3 sites). Each of these aquatic life uses are described in Appendix C in more detail.

Fourteen streams, summarized in Table B-1, were historically unverified or undesignated as to their aquatic life use designation. These streams were either assigned a use designation prior to the development of numerical criteria (unverified) or were never assigned a use designation (undesignated). In one case a verified designation was modified to change a segment of the stream to a different verified use. In another case a verified designation was modified to a dual designation.

Table B-1. Summary of aquatic life use designation changes.

Stream	Size (mi ²)	# of sites	Nested Subwatershed	Old Designation	2008 Designation
Willow Creek	15.2	2	02 01	WWH	WWH (verified)
Little Muchinippi Creek	35.5	2	02 03	WWH	WWH (verified)
Jackson Center Creek	6.86	2	02 03	WWH	MWH-C (verified)
Brandywine Creek	9.02	1	03 06	WWH	WWH (verified)
Rum Creek	28.0	3	03 03	WWH	WWH (verified)
Lee Creek	22.6	1	04 02	WWH	CWH (verified)
Graves Creek	11.0	1	04 02	WWH	CWH (verified)
Indian Creek	15.9	1	04 04	WWH	WWH (verified)
Plum Creek	15.9	3	04 05	WWH	WWH (verified)
Mile Creek	62.7	4	05 02	WWH	MWH-C (verified)
Turtle Creek	36.0	3	06 03	WWH	WWH (verified) ¹
Trib. to GMR (at RM 157.34)	7.6	1	03 02	Undesignated	MWH-C (verified)
Rennick Creek	10.3	1	03 02	Undesignated	WWH (verified)
Spring Creek	8.8	1	05 02	Undesignated	MWH-C (verified)
Miami-Erie Canal	4.3	1	05 03	Undesignated	MWH-C (verified)
McKees Creek	17.8	3	04 01	EWH	EWH/CWH (verified)
Blue Jacket Creek (headwaters to Opossum Run)	14.1	1	03 04	WWH	CWH (verified)

¹ Verification was made only from State Route 705 (river mile 9.54) to the mouth.

The two largest streams in the watershed, the Great Miami River and Loramie Creek (below river mile [RM] 30.42), are designated as primary contact recreation (PCR) class A waters; all other streams (19) are designated as PCR class B waters. More information about the watershed is available in *Biological and Water Quality Study of Great Miami River and Selected Tributaries* (Ohio EPA 2010b), which is located online at: <http://www.epa.ohio.gov/portals/35/documents/ Great Miami River.pdf>.

B1 Aquatic Life Use Attainment

Aquatic life use (ALU) attainment was assessed at seventy-seven sites in the Great Miami River (upper) watershed. Overall, 64% (50) sites were in full attainment of their use designation. Twenty sites (26%) were found to be in partial attainment, and 8 sites (10%) were found to be in non-attainment. Section 3 of the main report has color-coded maps for each subwatershed of the aquatic life use attainment and recreation use attainment.

The majority (24/28, or 86%) of sites not meeting the aquatic use attainment were impacted by habitat alteration caused by channelization. Twenty-six (93%) of the sites failing to meet aquatic use attainment were on or west the Great Miami River. Table B-2 shows aquatic life use attainment in the Great Miami River (upper) watershed.

Great Miami River (upper) Watershed TMDLs

Table B-2. Aquatic life use attainment status at upper Great Miami River basin stations sampled in July-October 2008 and 2009.

Note: Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and Invertebrate Community Index (ICI) scores are based on performance of the biotic community. The Qualitative Habitat Evaluation Index (QHEI) measures physical habitat quality and the streams ability to support a biotic community. Potential Causes and Sources of impairment are listed at sites that did not fully attain their use. All sites are located within the Eastern Cornbelt Plains ecoregion and the 55a and 55b sub-ecoregions. Sampling locations by the 10-digit Hydrologic Unit Code (HUC 10) subwatershed as indicated in green and further stratified at the HUC 12 level (see 12 digit WAU).

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
Biological communities from sub-ecoregion sites shaded in light blue (55b) or orange (55a w/gw) suggest abundant ground water.								
HUC 05080001 03 Bokengehalas Creek - Great Miami River								
Great Miami River (14-001)								
WWH Aquatic Life Use (Existing)								
158.90 ^W – dst. Cherokee Mans Run and Ind. Lake	02	44	10.4	F*	72.5	PARTIAL	Silt, Habitat Alt., Flow Alt.	Ag., Channelization, Impoundment ust.
157.22 ^W - SR 235 (upper), dst. Indian Lake WWTP	02	48	8.4	36	44.5	FULL		
153.45 ^B – Notestine Rd.	06	38 ^{ns}	7.7*	F*	43.5	PARTIAL	Habitat Alt., Silt, Flow Alt., Org. Enrich./DO	Channelization, Ag. Impoundment ust., Major municipal WWTP
146.19 ^B – SR 235 (lower)	06	46	8.9	42	76.0	FULL		
HUC 05080001 04 Stony Creek - Great Miami River								
EWB Aquatic Life Use (Existing)								
143.20 ^B – SR 235 dst. Quincy low-head dam	06	59	9.8	50	79.0	FULL		
142.50 ^B – CR 73, dst. Quincy WWTP	06	54	9.8	E	74.5	FULL		
138.39 ^B – Baker Rd.	06	56	9.7	38*	73.0	PARTIAL	Silt, Habitat Alt.	Ag., Channelization
HUC 05080001 07 Tawawa Creek - Great Miami River								
129.99 ^B - E. N. St, Sidney.	03	56	10.2	46	70.0	FULL		
HUC 05080001 01 Headwaters Great Miami River								

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
North Fork Great Miami River (14-802)								
WWH Aquatic Life Use (Existing)								
10.7 ^H – off Madory Rd.	01	36 ^{ns}	NA	34 ^{ns}	38.5	FULL		
6.31 ^H – Dunn Rd. (2008/2009)	01	36 ^{ns}	NA	P*/G	64.0	FULL	Note FULL macroinvertebrate recovery between 2008 / 2009. Exact Cause and Source Unknown.	
South Fork Great Miami River (14-800)								
WWH Aquatic Life Use (Existing)								
8.00 ^H – SR 638	02	54	NA	50	76.5	FULL		
7.23 ^H – CR 39	02	51	NA	54	76.5	FULL		
5.80 ^W – CR 97	02	42	9.2	56	59.0	FULL		
3.95 ^W – CR 97 ust. SR 117	02	46	8.9	44	76.0	FULL		
1.74 ^W – CR 36	02	46	8.1 ^{ns}	48	83.0	FULL		
Trib. to South Fork Great Miami R. (7.24) aka Belle Center Tributary (14-805)								
WWH Aquatic Life Use (Existing)								
0.55 ^H – SR 638	02	50	NA	MG ^{ns}	44.0	FULL		
Liggit Ditch aka Slow Ditch (14-800-003)								
WWH Aquatic Life Use (Existing)								
0.53 ^H – TR 49	02	44	NA	48	27.5	FULL		
Trib. to South Fork Great Miami R. (5.27) aka New Richland Tributary (14-806)								
WWH Aquatic Life Use (Existing)								
0.50 ^H – CR 97	02	52	NA	E	65.0	FULL		
Van Horn Creek (14-804)								
WWH Aquatic Life Use (Existing)								
0.97 ^H – SR 366	03	34*	NA	F*	60.5	NON	Habitat Alt.	Channelization

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
HUC 05080001 02 <i>Muchinippi Creek</i>								
Muchinippi Creek (14-700)								
WWH Aquatic Life Use (Existing)								
12.98 ^H – SR 196	02	42	NA	MG ^{ns}	37.0	FULL		
12.50 ^H – US 30	02	36 ^{ns}	NA	MG ^{ns}	32.0	FULL		
7.40 ^W – CR 87	04	48	8.6	50	76.5	FULL		
4.76 ^W – Myers Rd.	04	45	8.2	MG ^{ns}	43.0	FULL		
2.37 ^W – SR 274 (sluggish, deep)	04	36 ^{ns}	6.6*	<u>12</u> *	47.0	NON	Alt., Habitat Alt., Silt	Impoundment (log jams), Channelization, Livestock
Willow Creek (14-706)								
WWH Aquatic Life Use (Unverified) / WWH (Recommended)								
3.70 ^H – Wrestle Creek Rd.	01	36 ^{ns}	NA	F*	37.0	PARTIAL	Habitat Alt.	Channelization
0.44 ^H – Idle Rd.	01	38 ^{ns}	NA	F*	37.5	PARTIAL	Habitat Alt.	Channelization
Little Muchinippi Creek (14-703)								
WWH Aquatic Life Use (Unverified) / WWH (Recommended)								
6.05 ^H – Wones Rd.	03	40	NA	F*	41.0	PARTIAL	Habitat Alt.	Channelization
0.62 ^W – Myers Rd.	03	34*	7.7*	36	56.0	PARTIAL	Nutrients, Habitat Alt.	Ag, Channelization
Jackson Center Creek (14-705)								
WWH Aquatic Life Use (Unverified) / MWH-C (Recommended)								
2.90 ^H – SR 274	03	36	NA	<u>P</u> *	33.5	PARTIAL	Habitat Alt.	Channelization
1.80 ^H – Lock 2 Rd. dst. Jackson Center WWTP	03	32	NA	<u>P</u> *	31.0	PARTIAL	Habitat Alt., Silt, Nutrients	Channelization, Ag. Minor municipal WWTP
HUC 05080001 03 <i>Bokengehalas Creek - Great Miami River</i>								
Cherokee Mans Run (14-084)								
WWH Aquatic Life Use (Existing)								
7.56 ^H – SR 117	01	48	NA	MG ^{ns}	82.5	FULL		

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MLwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
<i>Cherokee Mans Run (continued)</i>								
3.38 ^H – US 30	01	48	NA	44	68.0	FULL		
Trib. to Great Miami R. (157.34) (14-001-027)								
Undesignated / MWH-C (Recommended)								
0.07 ^H – ust. from SR 235	02	34	NA	LF*	17.5	PARTIAL	Habitat Alt.	Channelization
Rennick Creek (14-001-026)								
Undesignated / WWH (Recommended)								
0.34 ^H – SR 235	02	<u>26</u> *	NA	F*	50.0	NON	Habitat Alt.	Channelization
Brandywine Creek (14-083)								
WWH Aquatic Life Use (Unverified) / WWH (Recommended)								
0.58 ^H – Notestine Rd.	06	48	NA	F*	46.5	PARTIAL	Habitat Alt.	Channelization
Rum Creek (14-078)								
WWH Aquatic Life Use (Unverified) / WWH (Recommended)								
8.63 ^H – Wildermuth Rd.	03	<u>24</u> *	NA	F*	31.5	NON	Habitat Alt.	Channelization
6.58 ^H – Miranda Rd.	03	32*	NA	MG ^{NS}	41.5	PARTIAL	Habitat Alt.	Channelization (old)
0.79 ^W – CR 58	03	45	7.5*	46	59.0	PARTIAL	Silt	Channelization upstream
Bokengehalas Creek (14-076)								
WWH Aquatic Life Use (Existing)								
12.24 ^H – CR 13, ust spill site	05	46	NA	VG	68.5	FULL		
7.9 ^W – T-31, prior to spill	05	38 ^{NS}	6.3*	--	69.0	(PARTIAL)	Silt, Habitat Alt.	Ag., Channelization
7.9 ^W – 1 week after spill	05	32*	<u>5.6</u> *	P*	69.0	NON	Other	Pesticide application
7.9 - 4 weeks after spill	05	--	--	42	--	(FULL)		
7.9 - 7 weeks after spill	05	--	--	48	--	(FULL)		
4.61 ^W – CR 209 dst. Blue Jacket Creek	05	47	8.6	42	89.0	FULL		

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
<i>Bokengehalas Creek (continued)</i>								
1.13 ^W – Miami St. in DeGraff	05	50	8.8	48	88.5	FULL		
Blue Jacket Creek (14-077)								
<i>WWH Aquatic Life Use (Existing) / CWH Headwaters to Opossum Run (Recommended)</i>								
6.3 ^H – T-216, ust Bellefontaine WWTP	04	40	NA	36 #	70.0	FULL		
<i>WWH Aquatic Life Use (Existing) / WWH Opossum Run to mouth (Recommended)</i>								
5.5 ^H – CR 11, dst. Bellefontaine WWTP	04	44	NA	36 #	84.5	FULL		
0.72 ^H – T-31	04	56	NA	40 #	69.5	FULL		
HUC 05080001 04 <i>Stony Creek - Great Miami River</i>								
Stony Creek (14-072)								
<i>WWH Aquatic Life Use (Existing)</i>								
2.45 ^W – SR 508	03	51	9.6	52	45.0	FULL		
1.58 ^W – T-65A	03	48	7.9 ^{ns}	54	51.5	FULL		
McKees Creek (14-075)								
<i>EWB Aquatic Life Use (Existing) EWB/CWH Recommended</i>								
9.5 ^H – Ludlow Rd.	01	50	NA	VG	75.0	FULL		
5.94 ^H – T-32	01	46	NA	E	72.0	FULL		
0.52 ^H – CR 31	01	48	NA	56	88.5	FULL		
Lee Creek (14-073)								
<i>WWH Aquatic Life Use (Unverified) / CWH Aquatic Life Use (Recommended)</i>								
3.35 ^H – Friend Rd.	02	48	NA	E	97.5	FULL		
Graves Creek (14-074)								
<i>WWH Aquatic Life Use (Unverified) / CWH Aquatic Life Use (Recommended)</i>								
0.48 ^H – T-295	02	48	NA	G	78.0	FULL		

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
Indian Creek (14-069)								
WWH Aquatic Life Use (Unverified) / WWH (Recommended)								
0.01 ^H – at mouth	04	48	NA	E	88.5	FULL		
Plum Creek (14-063)								
WWH Aquatic Life Use (Unverified) / WWH (Recommended)								
9.00 ^H – Miranda Rd.	05	40	NA	MG ^{ns}	53.0	FULL		
5.22 ^H – Fort Loramie-Port Jefferson Rd.	05	38 ^{ns}	NA	G	62.5	FULL		
0.13 ^W – Canal Feeder Rd.	05	38 ^{ns}	8.3	36	84.5	FULL		
HUC 05080001 Headwaters Loramie Creek (-05) and Turtle Creek - Loramie Creek (-06)								
Loramie Creek (14-600)								
WWH Aquatic Life Use (Existing)								
36.84 ^H – Botkins Rd.	05-01	26*	NA	F*	41.0	NON	Habitat Alt., Nutrients	Channelization, Ag.
34.96 ^H – Lock 2 Rd. dst. Botkins WWTP and WTP	05-01	34*	NA	P*	47.5	NON	Nutrients, TDS, Habitat Alt.	Minor municipal WWTP (Botkins), Channelization
30.42 ^W – Hardin-Wapakoneta Rd., ust. Lake Loramie	05-01	30*	7.1*	32 ^{ns}	39.5	PARTIAL	Silt, Flow Alt. Habitat Alt.	Impoundment downstream Channelization
22.10 ^W - dst. Lake Loramie dam	05-03	43	9.6	P*	71.5	NON	Flow Alt., Nutrients (biological Indicators)	Impoundment upstream
20.7 ^W – SR 66, dst. Minster and Lake Loramie WWTPs	05-03	39 ^{ns}	8.0 ^{ns}	34 ^{ns}	52.0	FULL		
19.3 ^W – dst. Mile Creek	06-02	38 ^{ns}	8.5	F*	50.5	PARTIAL	Habitat Alt., Phosphorus	Channelization, Municipal WWTPs, Ag.
18.82 ^W – Schlater Rd.	06-02	34*	7.9 ^{ns}	20*	33.5	PARTIAL	Habitat Alt., Phosphorus	Channelization, Municipal WWTPs, Ag.

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
<i>Loramie Creek (continued)</i>								
14.80 ^W – SR 66 at Newport	06-02	37 ^{ns}	9.0	16*	86.0	PARTIAL	Phosphorus	Municipal WWTPs, Ag.
7.5 ^W – Loramie-Washington Rd.	06-04	38 ^{ns}	9.3	34 ^{ns}	57.0	FULL		
1.87 ^W – Buxton-Fessler Rd.	06-04	53	10.3	42	92.0	FULL		
Miami and Erie Canal (14-600-002)								
Undesignated / MWH-C Aquatic Life Use (Recommended)								
0.1 ^H – dst. Minster WWTP	05-03	28	NA	34	48.5	FULL		
Mile Creek (14-609)								
WWH Aquatic Life Use (Unverified) / MWH-C (Recommended)								
9.80 ^H – Guettemoeller Rd.	05-02	34	NA	P*	33.5	PARTIAL	Habitat Alt., Nutrients (biological Indicators)	Channelization, Ag.
8.74 ^H – Clune Rd.	05-02	26	NA	LF*	28.0	PARTIAL	Habitat Alt., Nutrients (biological Indicators)	Channelization, Ag.
5.97 ^W – Kremer Rd.	05-02	30	8.6	22	26.5	FULL		
0.50 ^W – SR 705	05-02	35	7.6	HF	38.5	FULL		
Spring Creek (14-609-001)								
Undesignated / MWH-C (Recommended)								
0.37 ^H – Baumier-Brandewie Rd.	05-02	32	NA	HF	38.5	FULL		
Ninemile Creek (14-606)								
MWH Aquatic Life Use (Headwaters to RM 4.2 (Existing))								
6.38 ^H – Miller Rd.	06-01	28	NA	26	30.5	FULL		
4.18 ^H – Rangeline Rd.	06-01	30	NA	28	60.5	FULL		
WWH Aquatic Life Use RM 4.2 to mouth (Existing)								
0.23 ^W – Roeth Rd.	06-01	47	9.0	36	80.5	FULL		

Great Miami River (upper) Watershed TMDLs

River Mile - Location	12 Digit WAU	IBI	MIwb ^a	ICI ^b	QHEI	Attainment Status	Cause(s)	Source(s)
Turtle Creek (14-603)								
WWH Aquatic Life Use (Unverified) / WWH SR 705 (RM 9.54) to mouth (Recommended)								
8.42 ^H – Mason Rd.	06-03	22*	NA	F*	53.5	NON	Nutrients, Habitat Alt.	Ag., Channelization
5.66 ^H – Russel Rd.	06-03	48	NA	MG ^{ns}	78.5	FULL		
0.43 ^W – Stangle Rd.	06-03	47	8.9	E	72.5	FULL		

a - MIwb is not applicable to headwater streams with drainage areas ≤ 20 mi².

b - An evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable due to current velocities. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional

H - Headwaters: sites draining areas ≤ 20 miles².

W - Wadable streams: sites draining areas > 20 miles².

B - Boat sites (large waters).

ns - Non-significant departure from the biocriteria (≤ 4 IBI units or ≤ 0.5 MIwb units).

* - Significant departure from the biocriteria (> 4 IBI units or > 0.5 MIwb units).

- Macroinvertebrate sample collected in 2009

Biological Criteria

Eastern Corn Belt Plains			
Index – Site Type	EWB	WWH	MWH
IBI – Headwaters	50	40	24
IBI – Wading	50	40	24
IBI – Boat	48	42	24
MIwb – Wading	9.4	8.3	6.2
MIwb – Boat	9.6	8.5	5.8
ICI	46	36	22

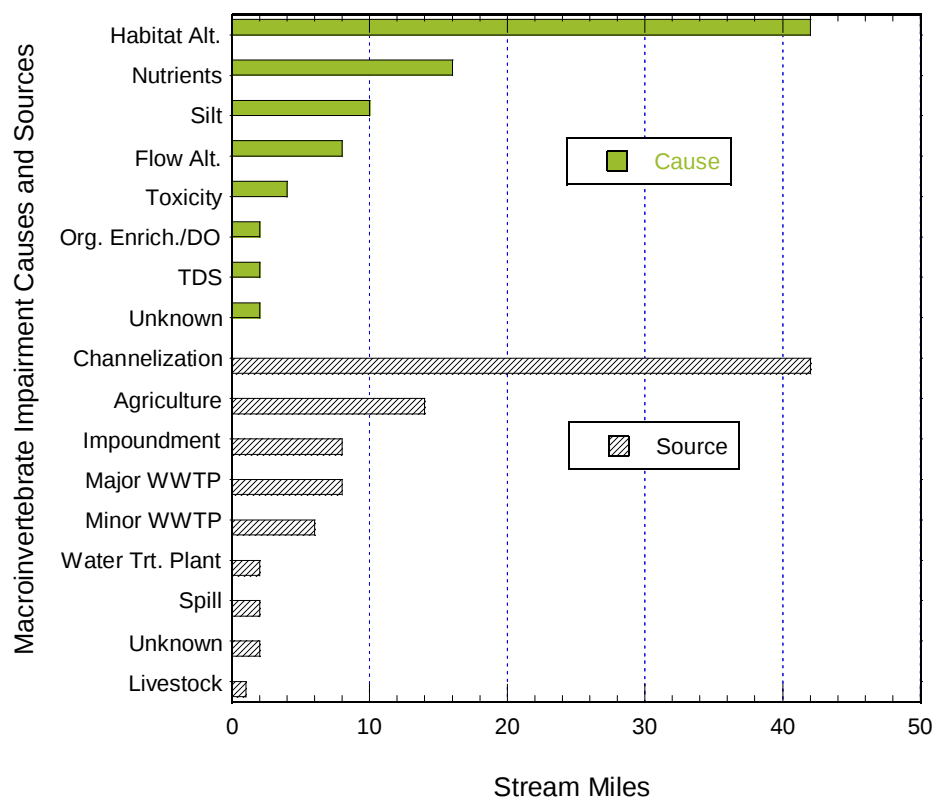


Figure B-1. Suspected causes and sources of impairment (in miles) affecting macroinvertebrate communities from the upper Great Miami River basin study area, 2008-2009.

B1.1 Water and Sediment Chemistry

Both water column and sediment chemistry can help to identify probable causes and sources of impairment.

Water Chemistry

The Great Miami River (upper) watershed land use is over 70% agricultural and nutrients from agriculture are a large contributor to algal blooms that lower water quality by causing large fluctuations in the dissolved oxygen. Wastewater treatment plant discharges also play a major factor to nutrient loading, especially in the Loramie Creek watershed.

Dissolved oxygen (D.O.) accounted for 39% (47 of 120) exceedances of the water quality standards (WQS) across the watershed. Sub-watersheds 02-Muchinippini Creek, 03-Bokengehalas Creek-GMR, 05-headwaters Loramie Creek, and 06 Turtle Creek-Loramie Creek, documented the most impact from low D.O concentrations.

Metals (iron, copper and lead) accounted for 26.7% of the exceedances of water quality standards. Higher concentrations of these three metals are caused by a heavy rainfall event on June 25-26, 2008 that allowed a heavy sediment load to be carried in the water column. Uncontaminated sediment in Ohio has metals as a part of its composition. Ohio Sediment Reference Values (SRV) for the Eastern Corn Belt has Iron (33,000 mg/kg), lead (47 mg/kg) and copper (34 mg/kg). This occurred mostly in subwatersheds 01 and 03 and involved the timing of collection of water column samples.

Great Miami River (upper) Watershed TMDLs

Temperature exceedances were mostly found in sub-watershed 05-Headwaters Loramie Creek, due to habitat modifications removing any riparian cover and having a shallow water column mostly in Mile Creek.

Total dissolved solids (TDS) accounted for 14% of all exceedances of WQS. Ten of the documented exceedances of the WQS were in subwatershed 05 due to WWTP discharges during low flow conditions (September 23) and because the Botkins WWTP has a chronic discharge of salt water from the drinking water treatment facility into the WWTP. The only farm-related pesticide found to be in exceedance of water quality standards was dieldrin, found in 3.3% of exceedances. See Table B-3 for more details.

Table B-3. Exceedances of water quality standards, organized by subwatershed.

Subwatershed	Exceedances				
	Total	D.O.	Cu, Pb, Fe ¹	Temperature	TDS
Headwaters GMR (01)	5	3	1	0	0
Muchinippi Creek (02)	37	19	15	2	0
Bokengehalas Creek-GMR (03)	26	9	16	0	0
Stoney Creek-GMR (04)	2	2	0	0	0
Headwaters Loramie Creek (05)	41	8	0	15	10
Turtle Creek-Loramie Creek (06)	9	6	0	2	1
Total	120	47 (39%)	32 (27%)	19 (16%)	11 (14%)

¹ Cu = copper; Pb = lead; Fe = iron

Figure B-2 shows the highest intensity of water column phosphorus in the Great Miami River (upper) watershed. Sites having phosphorus concentrations over the Associations document guideline are rated by how many times they exceeded the Associations guideline. The impacts in Loramie Creek at Ft. Loramie can be seen as Mile Creek, Miami –Erie Canal (Minster WWTP) and upstream Loramie Creek (Lake Loramie WWTP,Botkins WWTP) converge to cause high phosphorus in-stream concentrations, and algal blooms.

There are three major dischargers (>1 million gallons per day [MGD]) in the Great Miami River (upper) watershed: Bellefontaine (4.5 MGD), Indian Lake WWTP (4.6 MGD) and Minster WWTP (2.5 MGD). Each of these facilities is a large source of phosphorus downstream of their discharge point.

Sediment Chemistry

A total of 43 sediment samples were collected from the Great Miami River (upper) watershed survey area. Five samples were collected on the mainstem and 38 samples were collected among 18 tributaries.

Biological evaluations were conducted at 41 of the 43 sediment sites. Sixty-three percent (26/41) of the sediment sites fully met the designated aquatic life use biological criteria. Fifty percent (13) of the full attainment sites were found to be free of organic contamination and had levels of metals and nutrients below the Ohio Sediment Reference Value (Ohio EPA 2003), the MacDonald sediment guidelines (MacDonald et al. 2000) and the Ontario nutrient guidelines (Persuad et al. 1993).

At the sites where biological impairment was noted, impacts appeared the result of causes other than sediment toxicity. The physical effects of sediment (embeddedness and siltation) were a major source of impact primarily on the benthic community.

Great Miami River (upper) Watershed TMDLs

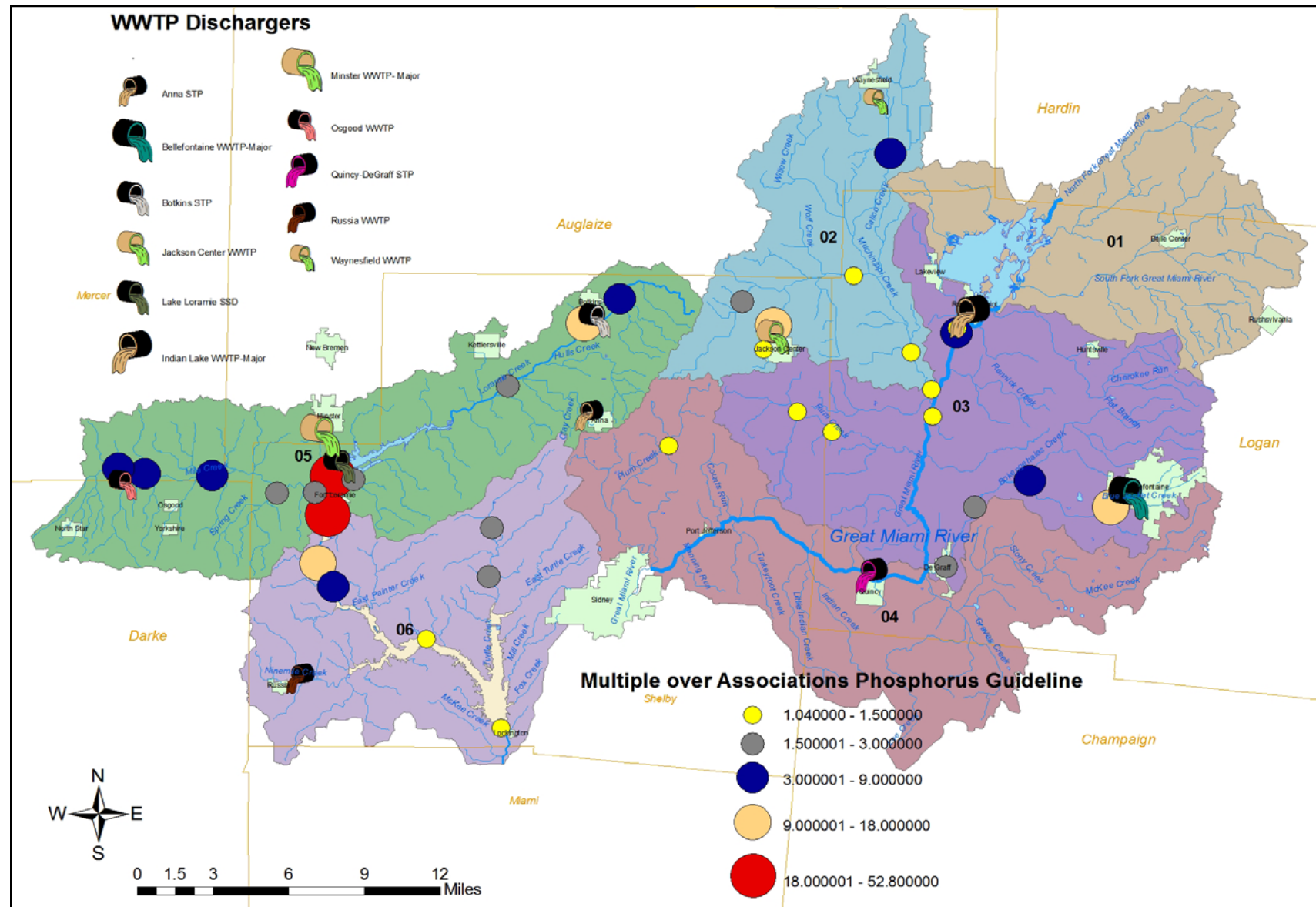


Figure B-2. Relative concentrations of total phosphorus in the Great Miami River (upper) watershed.

B1.2 Trends

The Great Miami River (upper) has been studied in three major surveys (1982, 1994, 2008). Improvements to water quality have been documented in each successive survey. The largest gain in water quality occurred after 1988, when secondary wastewater treatment standards were enacted.

This trend can best be demonstrated by looking at the mainstem downstream of the Indian Lake WWTP. In 1982, the downstream site had an IBI score of 22, which is considered poor. A major facility upgrade was done in 1985 and the IBI improved to 32 (fair) in 1994. The 2008 survey documented the IBI improved to 40 (excellent) for a warmwater habitat designation. Most noticeable was the increase in the physical health of the fish community, which had 7.2% Deformities, Erosion, Lesions, and Tumors (DELT) anomalies in 1994 and had improved to 0.4% DELT anomalies in 2008.

Blue Jacket Creek, Loramie Creek, Muchinippi Creek, Bokengehalas Creek, McKees Creek and the South Fork of the Great Miami River all showed similar trends in improving water quality with each successive survey.

B2 Recreation Use Attainment

Bacteriological impairment was pervasive throughout the watershed in PCR class A and PCR class B streams (Table B-4). The PCR criteria were exceeded at 73% of sites (*i.e.*, 27 of 37). Row crop agriculture was a suspected source of contamination at all of the impaired sites (100%). Normal row crop agricultural activity may also include manure application to farm fields as portions of the basin (particularly in the western, Loramie Creek watershed) drain some of the highest manure-producing counties in the state (Columbus Dispatch, Oct. 16, 2010). Biosolids from the larger local municipal WWTPs at Russells Point, Bellefontaine, Lake Loramie, and Minster are also spread on area fields near the facilities. Urban runoff was the suspected contaminant source at 37% of the non-attaining sites followed by unsewered communities and on-site septic systems (19%), sanitary sewer overflows and wildlife (11% each). Both feedlots and unrestricted livestock access accounted for 7% of suspected contaminant sources at impaired sites. A deteriorating wastewater collection system in Jackson Center may also have contributed to impairment at one location immediately downstream.

Table B-4. Recreation use attainment in the Great Miami River (upper) watershed.

Location	River Mile	PCR Class	Samples (#)	Year	Geometric Mean	Attainment Status	Sources of Bacteria
Great Miami River	158.2	A	5	2008	576	NON	G, H, J
Great Miami River	157.2	A	5	2008	379	NON	F, G, H
		A	1	2009	-	N/A	
Great Miami River	146.2	A	5	2008	432	NON	H
Great Miami River	143.2	A	5	2008	126	FULL	
Great Miami River	142.5	A	5	2008	81	FULL	
Great Miami River	130.0	A	4	2008	122	FULL	
		A	12	2009	239	NON	G, H
North Fork GMR	6.31	B	5	2008	534	NON	H
		B	2	2009	380	NON	H

Great Miami River (upper) Watershed TMDLs

Location	River Mile	PCR Class	Samples (#)	Year	Geometric Mean	Attainment Status	Sources of Bacteria
South Fork GMR	3.95	B	5	2008	1838	NON	B, H
		B	2	2009	1348	NON	B, H
Muchinippi Creek	12.5	B	5	2008	1544	NON	D, G, H
Muchinippi Creek	0.32	B	5	2008	109	FULL	
		B	1	2009	-	N/A	
Willow Creek	0.44	B	5	2008	138	FULL	
Little Muchinippi Ck	0.62	B	5	2008	97	FULL	
Jackson Center Creek	1.8	B	5	2008	324	NON	A, C ¹ , H
Rum Creek	0.79	B	4	2008	239	NON	B, H
Bokengehalas Creek	7.88	B	5	2008	255	NON	H
Bokengehalas Creek	1.13	B	5	2008	706	NON	G, H
		B	2	2009	668	NON	G, H
Blue Jacket Creek	5.39	B	5	2008	359	NON	G, H
Stony Creek	1.58	B	5	2008	690	NON	H
McKees Creek	0.52	B	5	2008	670	NON	H
Graves Creek	0.48	B	5	2008	1036	NON	D, H
Indian Creek	0.01	B	5	2008	683	NON	D, H
Plum Creek	0.13	B	5	2008	462	NON	H
Loramie Creek	36.84	B	5	2008	58	FULL	
Loramie Creek	34.96	B	5	2008	5221	NON	H
Loramie Creek	30.42	A	5	2008	426	NON	H
Loramie Creek	22.1	A	5	2008	662	NON	H, J
Loramie Creek	20.7	A	5	2008	565	NON	F, G, H
Loramie Creek	18.82	A	5	2008	264	NON	H, I
Loramie Creek	16.51	A	5	2008	74	FULL	
		A	10	2009	124	FULL	
Loramie Creek	1.87	A	4	2008	297	NON	H
		A	10	2009	144	NON	H, J
Miami Erie Canal	0.01	B	5	2008	497	NON	F, G, H
Mile Creek	5.97	B	5	2008	587	NON	D, H, I
Mile Creek	0.5	B	5	2008	75	FULL	
		B	1	2009	-	N/A	
Spring Creek	0.37	B	5	2008	118	FULL	
Ninemile Creek	4.18	B	5	2008	566	NON	G, H
Ninemile Creek	0.23	B	5	2008	252	NON	G, H
Turtle Creek	0.43	B	4	2008	85	Full	

Suspected Sources of Bacteria:

A	Home sewage treatment systems	F	Sanitary sewer overflows (SSOs)
B	Livestock access to stream	G	Urban runoff (city, village, etc.)
C ¹	Wastewater treatment plant	H	Agricultural runoff
D	Unsewered community	I	Animal Feedlot Operation
E	Combined sewer overflow (CSOs)	J	Wildlife (geese, etc)

¹ Deteriorating collection system

B3 Public Drinking Water Supply Use Attainment

No public drinking water supply intakes were located in the Great Miami River (upper) watershed.

B4 Human Health Use Attainment

Fish tissue samples were collected at two locations on the Great Miami River mainstem. However, these data were insufficient to assess the use for the two nested subwatersheds in which the sites were located (Rennick Creek-Great Miami River and Turkeyfoot Creek-Great Miami River). Data collected from Indian Lake showed that the Indian Lake-Great Miami River nested subwatershed is fully supporting the human health use.

B5 References

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