Ohio Environmental Protection Agency

2014 and 2015 Biological and Habitat Studies of 30 Rivers and Streams in Ohio Evaluating Section 319(h) and SWIF/GLRI Projects

Wildcat Run, RM 1.4, Delaware County, OH

Division of Surface Water
Ecological Assessment Unit

June 2018

Introduction

In 1987, the federal Clean Water Act amendments created a national program to control nonpoint source (NPS) pollution, established under Section 319 of the Clean Water Act. Ohio EPA is the designated water quality agency responsible for administering Ohio's 319 program. Since 1990, Ohio EPA has annually applied for, received and distributed Section 319 grant funds to correct NPS-caused water quality impairment to Ohio's surface water resources. Section 319(h) implementation grant funding is targeted to Ohio waters where NPS pollution is a significant cause of aquatic life use impairments. The cornerstone of Ohio's 319 program is working in partnership with watershed groups and others who are implementing locally developed watershed management plans and restoring surface waters impaired by NPS pollution.

A requirement of each Section 319(h) project is a baseline and post-project water quality monitoring study, used to gauge the effectiveness of the NPS project improvement. For projects approved prior to Federal Fiscal Year (FFY) 2008, the baseline and post-project monitoring was conducted by the subgrantees. Since FFY2008, Ohio EPA's Ecological Assessment Section (EAS) has completed all baseline and post-project environmental monitoring for the projects. Monitoring includes evaluating biological and physical habitat conditions. All biological, physical habitat, field water quality, data processing and data analysis methods and procedures adhere to those specified in the *Surface Water Field Sampling Manual* for water column chemistry, bacteria and flows (Ohio EPA 2013a) for field parameter measurement, *Biological Criteria for the Protection of Aquatic Life*, Volumes II - III (Ohio EPA 1987, 1989a, 1989b, 2013b, 2013c) for biological assemblage assessment, and *The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods and Application* (Ohio EPA 1989c, 2006) for physical habitat assessment.

The following summaries include baseline monitoring conducted at each Section 319(h) grant, statewide Surface Water Improvement Fund (SWIF) and Cuyahoga County GLRI-SWIF grant project areas during the summer and fall of 2014 and 2015 (Table 1, Table 2, Table 3, Table 4). Each summary includes an attainment table, site location table and site location map. Appendices A-E include a compilation of biological and habitat data collected at all collection sites.

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Table 1 — Section 319(h) grant projects pre-project baseline monitoring, 2014

Project #	Project Title	Project Sponsor	Grant Amount
14(h)EPA-12	Mud Brook Stream Restoration – Meadows Subdivision Site	City of Stow	$248,787
14(h)EPA-13	Baldwin Run Stream Restoration Phase 2	City of Lancaster	$95,613
14(h)EPA-18	Pond Brook Tributary Restoration	City of Reminderville	$59,820
14(h)EPA-19	Arcola Creek Headwaters Restoration	Madison Village	$95,107
14(h)EPA-25	St. Mary's Stream Restoration Project	City of Solon	$105,660

Table 2 — Prior year Section 319(h), statewide SWIF and Cuyahoga County GLRI-SWIF grant projects post-project monitoring, 2014.

Project #	Project Title	Project Sponsor	Year Completed
08(h)EPA-29	IVEX of Ohio, Lower Lake Dam Modification and Stream Restoration	Village of Chagrin Falls	2012
09(h)EPA-20	Multifaceted Urban Stream Restoration Project for the Ottawa River at the University of Toledo	University of Toledo	2013
10(h)EPA-10	Pleasant Valley Park Floodplain Restoration Project	Lake Metroparks	2013
10SWIF-GLRI-CUY-068	Green Stabilization of Riparian Area along the Chagrin River in Hunting Valley	Village of Hunting Valley	2012
10(h)EPA-14	Muddy Creek Stream and Riparian Restoration and Protection	City of Mason	2013
10(h)EPA-17	Little Cuyahoga River Restoration-Phase II	City of Akron	2013
10SWIF-145	Wildcat Run Stream Restoration and Stormwater Management Demonstration	Liberty Township	2012
11(h)EPA-14	Harmon Homestead Restoration Project	City of Aurora	2013
11(h)EPA-21	Hill Ditch Stream Restoration and Dam Removal at Toledo Botanical Garden	Toledo Botanical Garden	2014

Table 3 — Section 319(h) grant projects pre-project baseline monitoring, 2015.

Project #	Project Title	Project Sponsor	Grant Amount
15(h)EPA-16	Restoration of Tributary to O'Bannon Creek	Clermont SWCD	$90,458
15(h)EPA-32	Marival/Broadview Stream and Riparian Restoration and Protection	City of Mason	$222,000
15(h)EPA-15	Upper Tuscarawas River Stabilization Project	Springfield Township	$60,000
15(h)EPA-28	Reducing Nutrients and Sediment in Bull Creek	Wood SWCD	$166,533

Table 4 — Prior year Section 319(h) grant projects post-project monitoring, 2015.

Project #	Project Title	Project Sponsor	Year Completed
09(h)EPA-13	Marysville Town Run Restoration Project	City of Marysville	2014
10(h)EPA-18	West Creek Confluence Restoration	West Creek Preservation Commission	2014
11(h)EPA-11	Solomon Run Dam Removal and Stream Restoration	Ursulines of Brown County	2014
11(h)EPA-31	Chippewa Creek-Chippewa Lake Upper Watershed Restoration Phase 2	Medina County Park District	2014
11(h)EPA-18	Lower Olentangy River 5th Ave. Dam Removal and Stream Restoration	Columbus Public Utilities Department	2014
12(h)EPA-28	Blacklick Creek Stream Restoration	Franklin County Metro Parks	2015
10(h)EPA-21	Sycamore Creek at Shawnee Crossing Bank Stabilization	City of Pickerington	2013
12(h)EPA-27	Rose Run Stormwater and Riparian Enhancements	City of New Albany	2015
12(h)EPA-36	East Branch Chagrin River Stream Restoration	Holden Arboretum	2015
12(h)EPA-19	Black River Restoration in Cascade Park	City of Elyria	2015

Mud Brook Stream Restoration – Meadows Subdivision Site

Pre-Project Baseline Monitoring

Project Number: 14(h)EPA-12
Stream Sampled: Tributary to Mud Brook

Summary

The successful completion of this project will:

- Restore approximately 2,400 linear feet of a tributary to Mud Brook (Figure 1) by a raise-grade approach to place the stream in an historic alignment.
- Restore approximately 1.75 acres of the existing and created floodplain by planting native grasses, trees, shrubs and live stakes.
- Maintain the 10-acre property that contains the restoration area as public space.

This project is being implemented consistent with recommendations within the Lower Cuyahoga River Total Maximum Daily Load (TMDL) and/or state-endorsed watershed action plan.

Biological sampling occurred upstream of the project area on the tributary to Mud Brook (RM 1.5), tributary to Mud Brook (RM 1.3) within the proposed project area, and at a downstream location on tributary to Mud Brook (RM 0.4). None of the stations met the biocriteria for the designated Warmwater Habitat (WWH) aquatic life use with only fair to poor biological communities (Table 5, Table 6, Figure 1).

Table 5 — Aquatic Life Use Attainment – Tributary to Mud Brook – WWH Existing.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the tributary to Mud Brook is designated Warmwater Habitat (WWH) within the study area.

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[c]	QHEI	Narrative Assessment Fish/Macroinvertebrates
RM 1.5[H] (0.7)	NON	28*	-	P*	60.3 (Good)	Fair/Poor
RM 1.3[H] (1.0)	NON	18*	-	P*	59.0 (Good)	Poor/Poor
RM 0.4[H] (2.9)	NON	22*	-	F*	35.5 (Poor)	Poor/Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

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

c Narrative evaluation used in lieu of ICI when score not available (P-Poor, F-Fair).

H Headwater electrofishing site.

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

\- No sample taken.

Table 6 — Tributary to Mud Brook sampling locations, 2014.

River Mile	Latitude	Longitude	Sampling Location
1.5	41.176558	-81.462717	1434 Berkshire Rd., Stow, OH 44224
1.3	41.174552	-81.466139	1165 Inverness Ln., Stow, OH 44224
0.4	41.171800	-81.478100	At Hudson Dr.

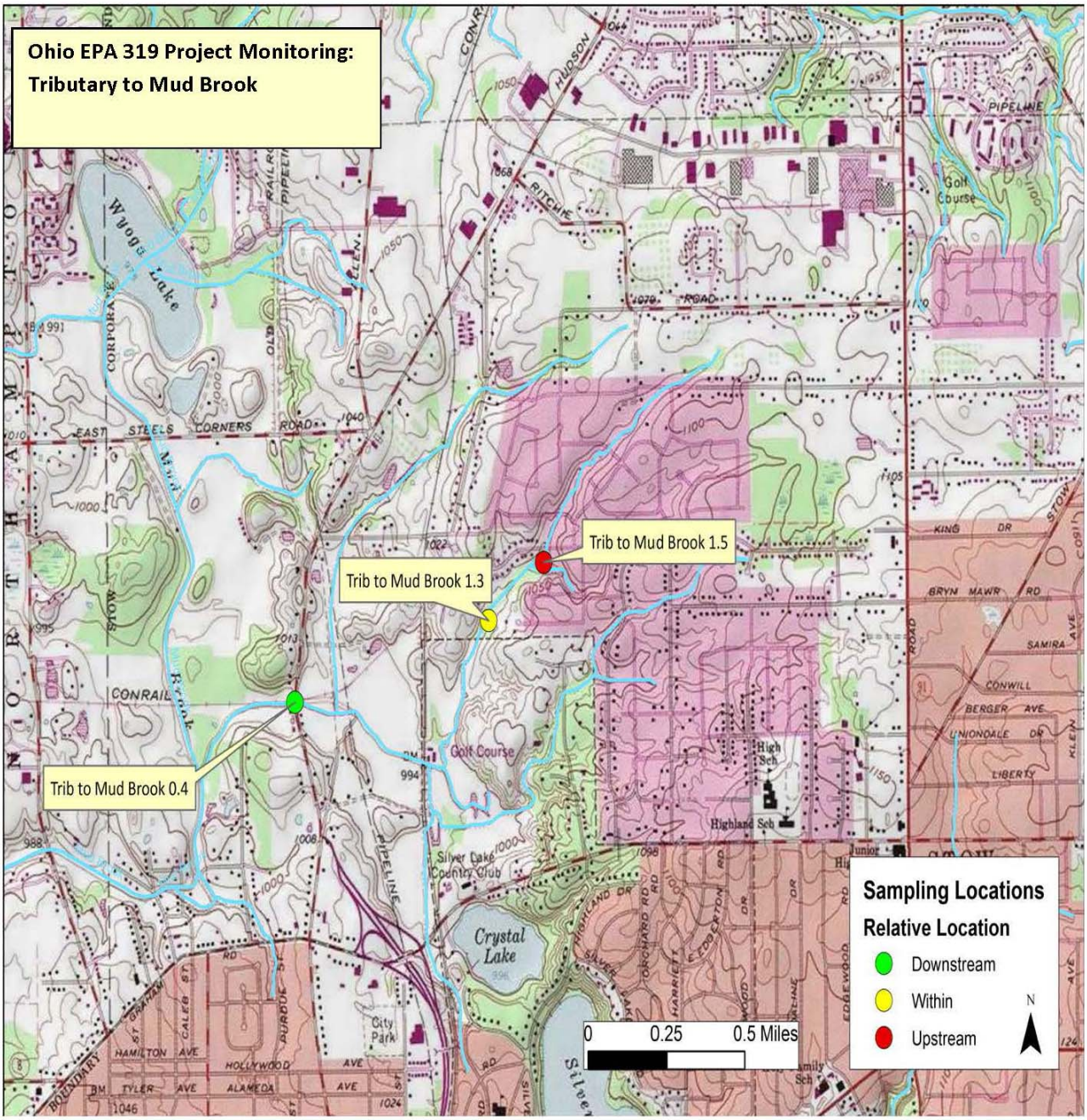

Figure 1 — Tributary to Mud Brook sampling locations, 2014 [14(h)EPA-12 baseline].

Baldwin Run Stream Restoration Phase II

Pre-Project Baseline Monitoring

Project Number: 14(h)EPA-13
Stream Sampled: Baldwin Run, Fetter's Run, Ewing Run

Summary

The project will restore approximately 960 linear feet of Baldwin Run by:

- Removing debris
- Providing invasive species management
- Channel enhancements
- Bank stabilization
- Riparian corridor plantings

The City of Lancaster has discussed the easements with the property owners and will replace the 1939 easement with an inclusive conservation easement. The new easement will be signed, and the old easement vacated prior to project completion. This project is being implemented consistent with recommendations within the Hocking River TMDL and/or state-endorsed watershed action plan.

Biological sampling occurred within (RM 0.6) the proposed project area and downstream (RM 0.3) of the proposed project area on Baldwin Run. One site each on Fetter's Run (RM 1.15) and Ewing Run (RM 0.1) were sampled upstream of the proposed project area. The sampling station on Fetters Run (RM 1.15) met the biocriteria of the designated Warmwater Habitat (WWH) aquatic life use with exceptional to marginally good biological communities. Sampling stations on Baldwin Run partially met the biocriteria of the designated Warmwater Habitat (WWH) aquatic life use with good to marginally good fish communities and fair macroinvertebrate communities. The Ewing Run sampling station at RM 0.1 partially met the Warmwater Habitat (WWH) aquatic life use with very good to fair biological communities (Table 7, Table 8, Figure 2).

Table 7 — Aquatic Life Use Attainment – Baldwin, Ewing and Fetter's Run.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, Baldwin, Ewing and Fetter's Run are designated Warmwater Habitat (WWH).

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[c]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Baldwin Run - WWH Existing						
RM 0.60[H] (11.7)	PARTIAL	38ns	-	F*	66.8 (Good) (excellent)	Marginally Good/Fair
RM 0.30[H] (12.9)	PARTIAL	42	-	F*	68.0 (Good) (excellent)	Good/Fair
Ewing Run - WWH Existing						
RM 0.10[H] (5.2)	PARTIAL	46	-	F*	58.3 (Good)	Very Good/Fair
Fetter's Run - WWH Existing						
RM 1.15[H] (6.1)	FULL	54	-	MG	72.0 (Excellent)	Exceptional/Marginally Good

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

c Narrative evaluation used in lieu of ICI when score not available (F-Fair, MG-Marginally Good).

H Headwater electrofishing site.

- No sample taken.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

Table 8 — Baldwin, Ewing and Fetter's Run sampling locations, 2014.

River Mile	Latitude	Longitude	Sampling Location
0.60	39.715431	-82.580474	Goslin Rd. dst. Confluence
0.30	39.709296	-82.582959	In Lancaster @ Lawrence Rd.
1.15	39.731433	-82.583981	At Lancaster High School, off Arbor Valley Dr.
0.10	39.718833	-82.578832	At Goslin and Pleasantville Rd., Lancaster

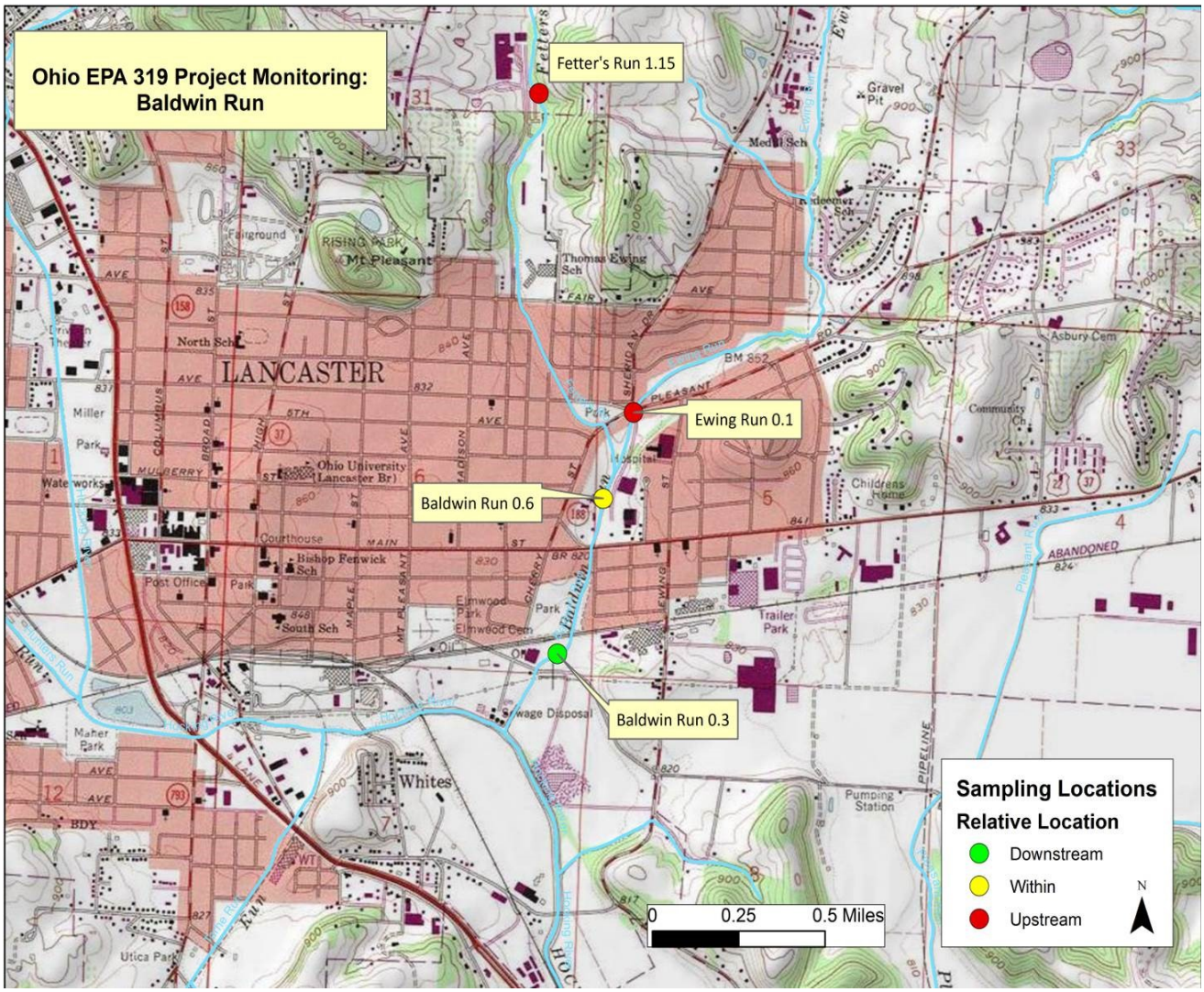

Figure 2 — Baldwin Run study area sampling locations, 2014 [14(h)EPA-13 baseline].

POND BROOK TRIBUTARY RESTORATION

Pre-Project Baseline Monitoring

Project Number: 14(h)EPA-18
Stream Sampled: Tributary to Pond Brook

Summary

The successful completion of this project will:

- Restore function to approximately 1,200 linear feet of a tributary to Pond Brook and adjacent wetland/riparian wetland systems.
- Improve stream habitat such as shading.
- Limit further bank erosion of approximately 1,500 linear feet of stream bank (Figure 3).

Liberty Ledges, LLC. is committed to providing a conservation easement for the project area. This project is being implemented consistent with recommendations within the Lower Cuyahoga River TMDL and/or state-endorsed watershed action plan.

In 2014, the three stations sampled in the tributary to Pond Brook exhibited good habitat conditions with marginally fair to poor biological communities (Table 9, Table 10, Figure 3). Sample sites within (RM 0.5) and downstream (RM 0.01) of the project area did not meet the recommended Warmwater Habitat (WWH) aquatic life use criteria for sites located in the Erie-Ontario Lake Plains (EOLP) ecoregion. The site upstream (RM 0.9) of the proposed project area remains unassessed. However, the quality of the macroinvertebrate community at RM 0.9 was poor, just like the downstream site.

Table 9 — Aquatic Life Use Attainment – Tributary to Pond Brook, 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the tributary to Pond Brook is designated Warmwater Habitat (WWH). A narrative evaluation was used to assess macroinvertebrate quality.

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[c]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Tributary to Pond Brook – WWH recommended						
RM 0.90[H] (1.2)	NON	-	-	P*	-	Poor
RM 0.50[H] (1.3)	NON	28*	-	LF*	70.3 (Good)	Fair/Fair
RM 0.01[H] (1.6)	NON	26*	-	P*	41.8 (Good)	Poor/Poor

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

c Narrative evaluation used in lieu of ICI when score not available (LF-Low Fair, P-Poor).

H Headwater electrofishing site.

- No sample collected.

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

Table 10 — Tributary to Pond Brook sampling locations, 2014.

River Mile	Latitude	Longitude	Sampling Location
0.90	41.339017	-81.418956	At Liberty Rd., Reminderville
0.50	41.340100	-81.412074	At Glenway Dr., Reminderville
0.01	41.337798	-81.403386	At Outriggers Cove, Reminderville

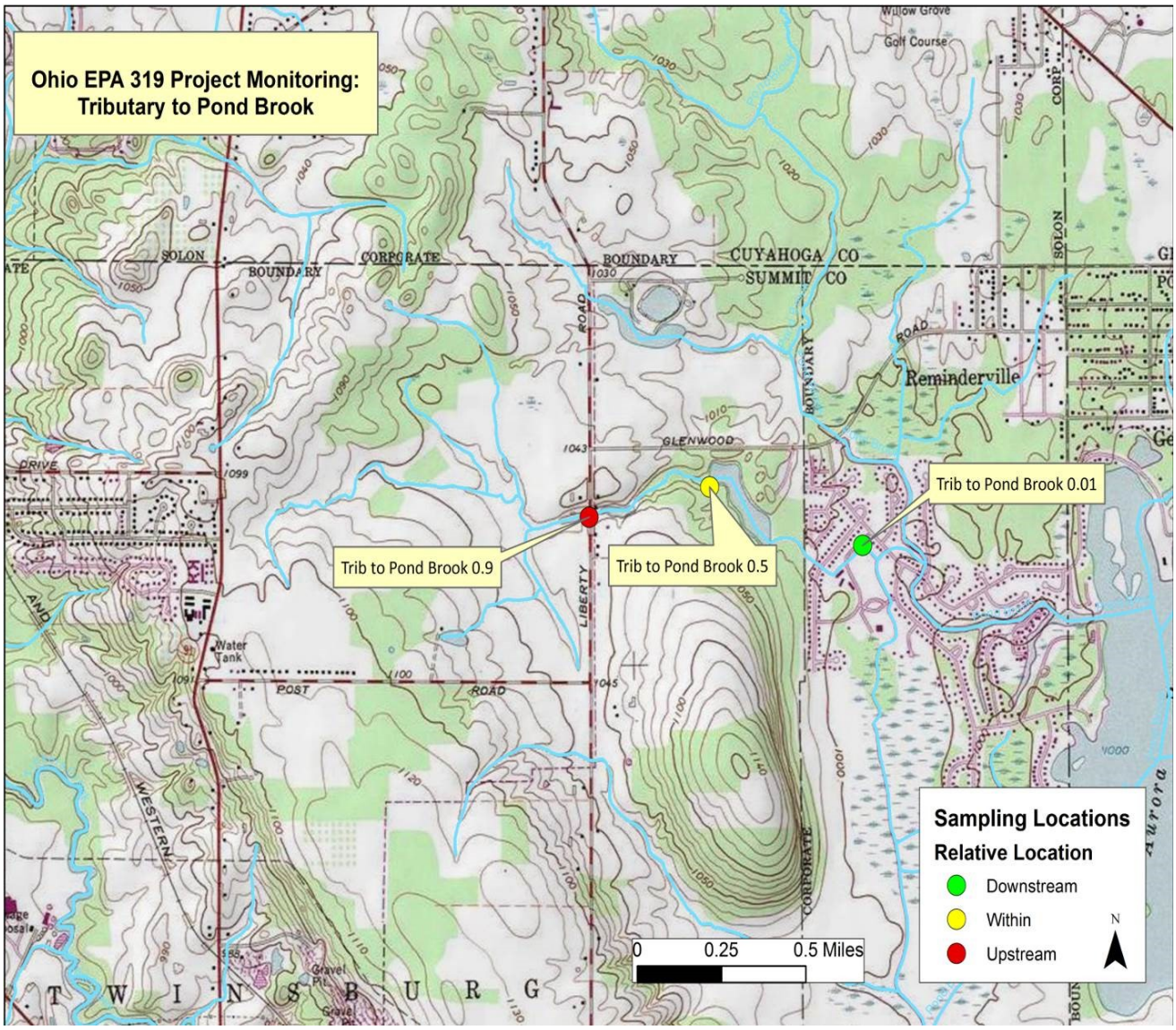

Figure 3 — Tributary to Pond Brook sampling locations, 2014 [14(h)EPA-18 baseline].

ARCOLA CREEK STREAM RESTORATION

Pre-Project Baseline Monitoring

Project Number: 14(h)EPA-19
Stream Sampled: Tributary to Arcola Creek

Summary

This project will restore approximately 600 linear feet of a small headwater habitat stream that flows through Fairview Memorial Park cemetery and re-forest approximately 0.7 acre of riparian corridor (Figure 4). Madison Village owns and maintains the Fairview Memorial Park and will continue to do so in perpetuity. The proposed project area was not planned as an active cemetery plot area and will be protected by the village in the future as a natural stream corridor and floodplain area.

The tributary to Arcola Creek was sampled upstream of the proposed restoration area (RM 0.75), within the proposed restoration area at RM 0.6 and downstream of the proposed restoration area at RM 0.12. Sites within and downstream of the proposed project area were not meeting the recommended Warmwater Habitat (WWH) aquatic life use criteria for fish or macroinvertebrate communities (Table 11, Table 12). The site (RM 0.75) upstream of the proposed project area remains unassessed for fish. However, the macroinvertebrate community was similar to the other two sites and received a low/fair narrative evaluation which does not meet the recommended Warmwater Habitat (WWH) aquatic life use criteria.

Table 11 — Aquatic Life Use Attainment – Tributary to Arcola Creek, 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the tributary to Arcola Creek is undesignated but is recommended WWH based on the findings of this assessment.

River Mile (drainage mi²)	Attainment Status[b]	IBI	MIwb[c]	ICI	QHEI	Narrative Assessment Fish/Macroinvertebrates
Tributary to Arcola Creek – WWH Recommended						
RM 0.75[H] (0.5)	NON	-	-	LF*	-	Low Fair
RM 0.60[H] (0.6)	NON	20*	-	LF*	37.0 (Poor)	Poor/Low Fair
RM 0.12[H] (0.6)	NON	30*	-	LF*	27.5 (Very Poor)	Fair/Low Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b WWH criteria apply to undesignated sites.

c MIwb is not applicable to headwater streams with drainage areas < 20 mi².

H Headwater electrofishing site.

- No sample taken.

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

Table 12 — Tributary to Arcola Creek sampling locations, 2014.

River Mile	Latitude	Longitude	Sampling Location
0.75	41.765958	-81.042183	Upst. Fairview Memorial Park, dst. Tribs, off Huntington Woods Dr., or access through cemetery
0.60	41.766728	-81.043978	At Fairview Memorial Park, off River St./OH-528, Madison, OH
0.12	41.771965	-81.045866	At East Main St., near Madison Local Schools, upst. Trib

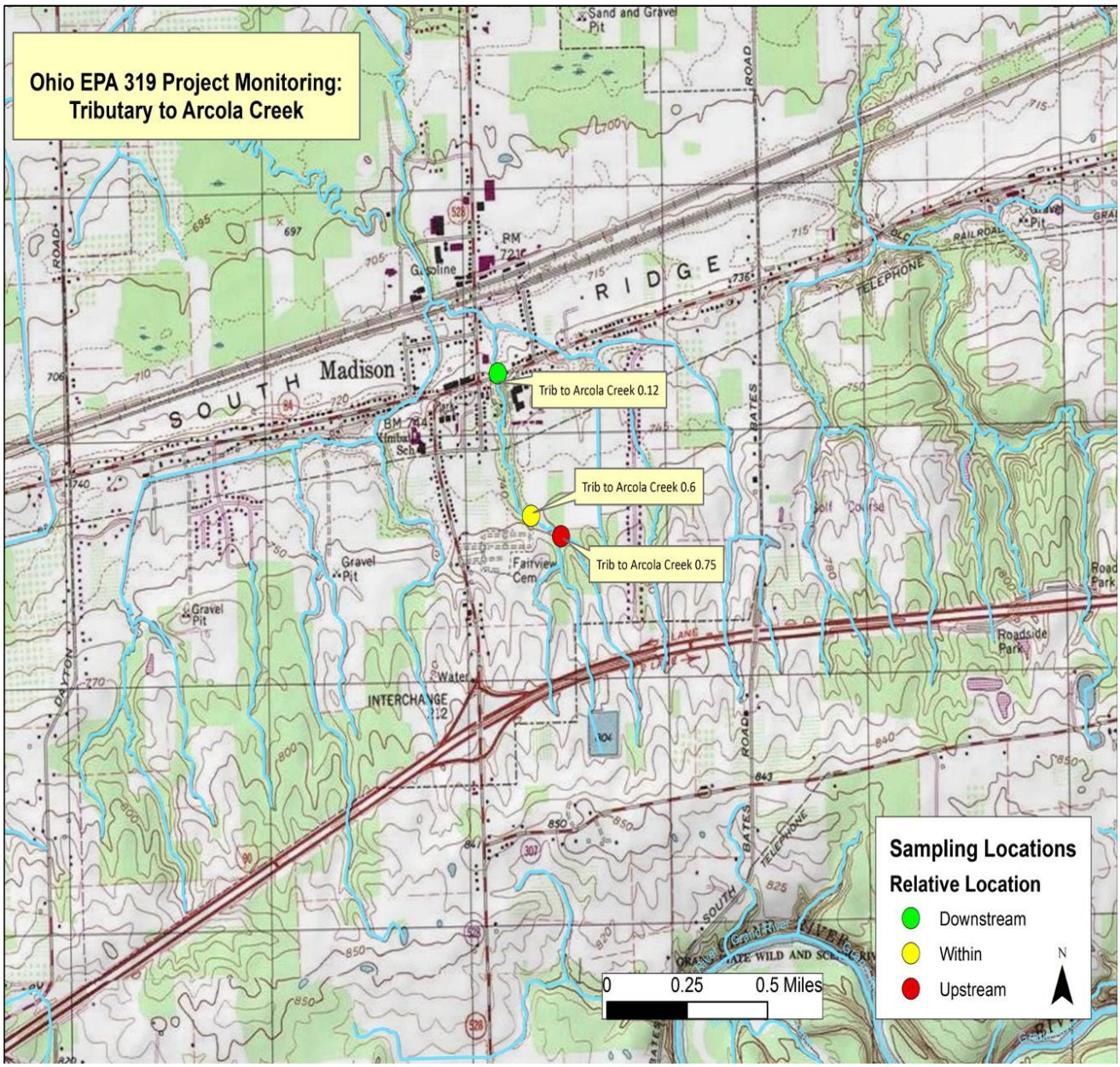

Figure 4 — Tributary to Arcola Creek sampling locations, 2014 [14(h)EPA-19 baseline].

ST. MARY'S STREAM RESTORATION

Pre-Project Baseline Monitoring

Project Number: 14(h)EPA-25
Stream Sampled: Hawthorne Creek

Summary

This project is adjacent to a sanitary sewer line on the property of St. Mary's Ukrainian Catholic Church. Completion of this project will reduce nonpoint source pollutant loadings to Tinkers Creek. This will implement components of the TMDL and Tinkers Creek Watershed Action Plan by:

- Decreasing sedimentation and turbidity.
- Restoring habitat from land development/suburbanization and urban runoff/storm sewers.

The City of Solon restored 430 linear feet of stream through natural streambank stabilization and restored one acre of riparian corridor and vegetated floodplain on Hawthorne Creek, a tributary of Tinkers Creek.

Hawthorne Creek was sampled upstream of the restoration area at RM 3.45, within the proposed restoration area at RM 2.8, and downstream of the restoration area at RM 2.7. The fish and macroinvertebrate communities were not meeting expectations of the designated Warmwater Habitat (WWH) aquatic life use at any of the sampling sites (Table 13, Table 14, Figure 5).

Table 13 — Aquatic Life Use Attainment – Hawthorne Creek, 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, Hawthorne Creek is designated Warmwater Habitat (WWH) within the study area. A narrative evaluation was used to assess macroinvertebrate quality.

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[c]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Hawthorne Creek - WWH						
RM 3.45[H] (2.9)	NON	32*	-	P*	59.8 (Good)	Fair/Poor
RM 2.80[H] (5.3)	NON	24*	-	P*	58.0 (Good)	Poor/Poor
RM 2.70[H] (5.5)	NON	26*	-	LF*	57.0 (Good)	Poor/Low Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

c Narrative evaluation used in lieu of ICI when score not available (F-Fair; P-Poor).

H Headwater electrofishing site.

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

\- No sample collected.

Table 14 — Hawthorne Creek sampling locations, 2014.

River Mile	Latitude	Longitude	Sampling Location
3.45	41.409667	-81.484233	At Cannon Rd./Richmond Rd., Solon, OH. Ideally upst. bridge
2.80	41.404000	-81.487000	Upst. Aurora Rd. bridge near Richmond Rd., Solon, OH
2.70	41.404000	-81.486900	Dst. Aurora Rd. bridge near Richmond Rd., Solon, OH in golf course

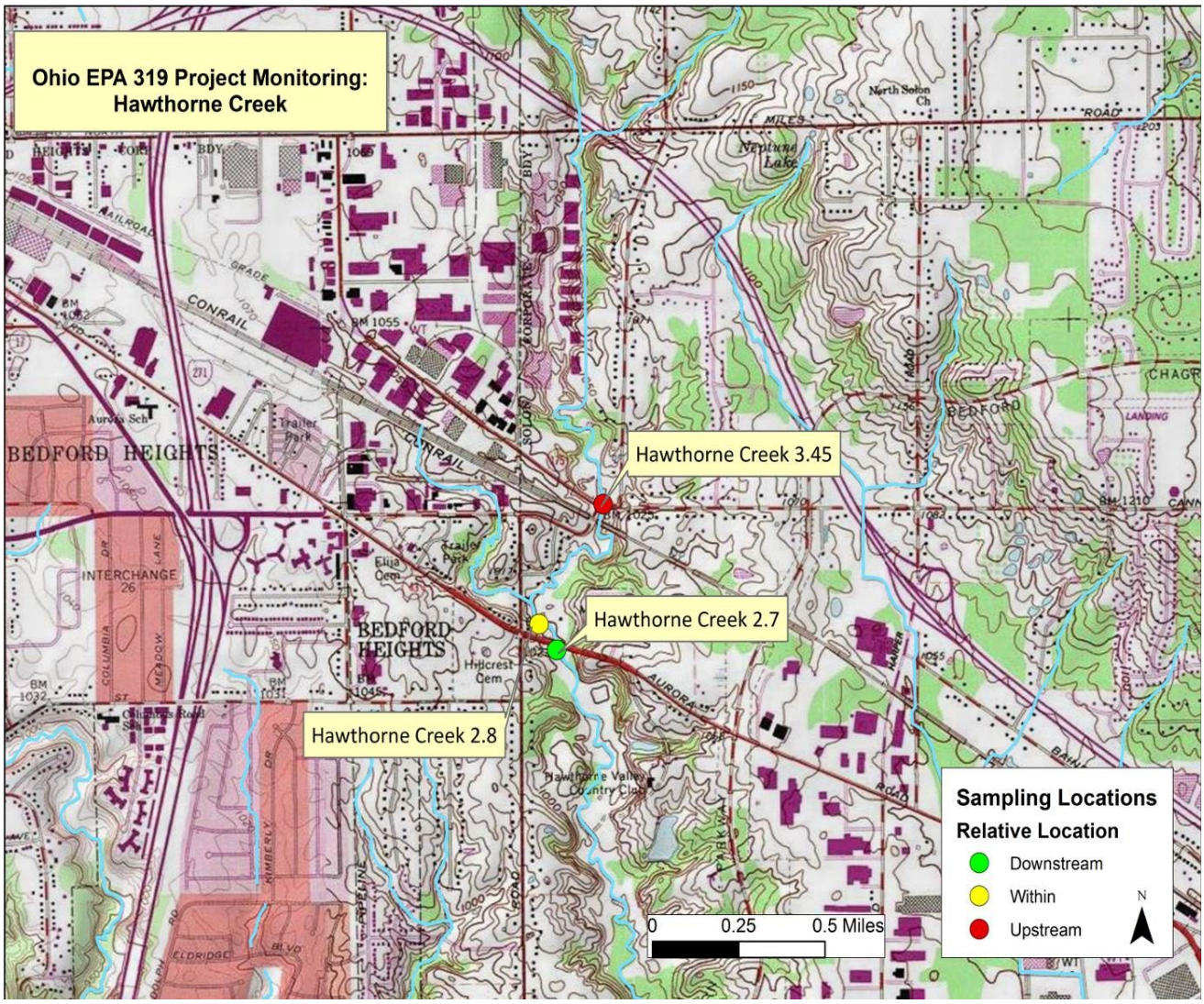

Figure 5 — Hawthorne Creek sampling locations, 2014 [14(h)EPA-25 baseline].

IVEX of Ohio, Lower Lake Dam Modification and Stream Restoration

Post-Project Monitoring

Project Number: 08(h)EPA-29
Stream Sampled: Chagrin River

Summary

The project site is approximately ½ mile upstream of the Village of Chagrin Falls, on the main stem of the Chagrin River. A total of $400,800 in federal Section 319(h) Clean Water Act grant funding was awarded to the Village of Chagrin Falls to lower a 23.1-foot earthen dam at a former industrial facility (IVEX of Ohio). Lowering the dam occurred in two phases and allowed restoration of approximately 2,200 linear feet of the Chagrin River that was previously impaired. The 2012 completion of this project was consistent with recommended implementation projects included in the state-endorsed Chagrin River Watershed Action Plan and in the TMDL study that was completed by Ohio EPA and approved by U.S. EPA.

The 2008 sampling was replicated in 2014 and the Chagrin River was resampled upstream (RM 30.6), downstream (RM 30.0) and within (RM 30.4) the project area (Table 15, Table 16, Figure 6). All three sites are now in full attainment of the designated Warmwater Habitat (WWH) aquatic life use. This is a significant improvement from the 2008 sampling in which the macroinvertebrate community results were poor within the project area (the impoundment) which now has exceptional quality habitat.

Table 15 — Aquatic Life Use Attainment – Chagrin River, 2008 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the Chagrin River is designated Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Chagrin River - WWH						
RM 30.6[W] (56.0)-2014	FULL	41	7.86	50	65.8 (Good)	Good/Marginally Good/Exceptional
RM 30.6[W] (56.0)-2008	FULL	36[ns]	9.0	38	72.0 (Good)	Marginally Good/Very Good/Good
RM 30.4[W] (3.0)-2014	FULL	43	8.09	E	74.8 (Excellent)	Good/Marginally Good/Exceptional
RM 30.4[W] (3.0)-2008	NON	40	7.7[ns]	12*	59.5 (Good)	Good/Marginally Good/Poor
RM 30.0[W] (3.3)-2014	FULL	51	8.90	50	72.0 (Good)	Exceptional/Very Good/Exceptional
RM 30.0[W] (3.3)-2008	FULL	44	8.7	52	71.0 (Good)	Good/Good/Exceptional

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Wading	38
MIwb: Wading	7.9
ICI	34

d Narrative evaluation used in lieu of ICI when score not available (E-Exceptional).

W Wading electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

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

Table 16 — Chagrin River sampling locations, 2008 and 2014.

River Mile	Latitude	Longitude	Sampling Location
30.6	41.438653	-81.378134	Chagrin R. @ Chagrin Falls, upst. Mill Pond, dst. first dam
30.4	41.437858	-81.381350	Chagrin R. @ Chagrin Falls, upst. dam, in Mill Pond
30.0	41.434368	-81.387213	Chagrin R. @ Chagrin Falls @ S. Cleveland St.

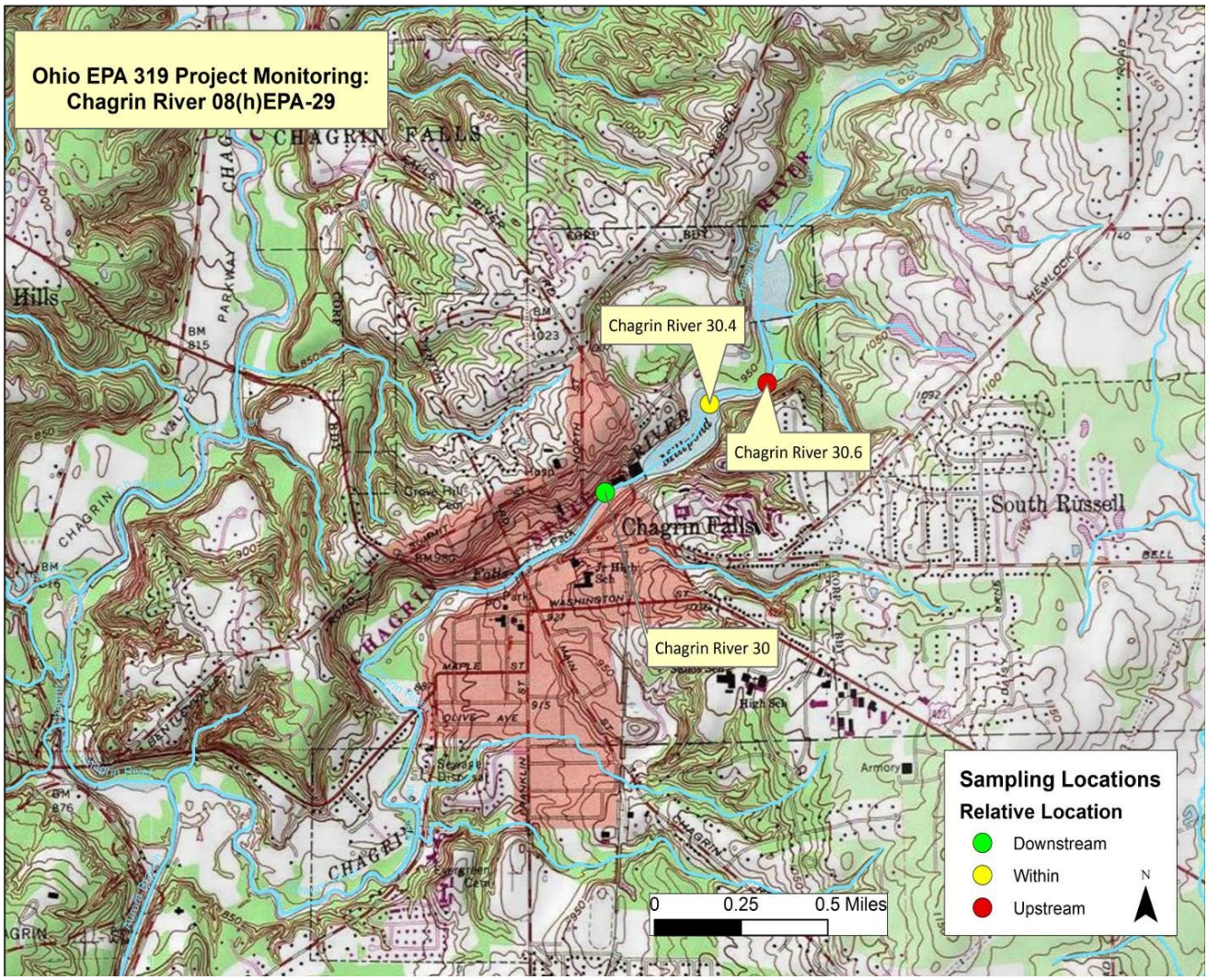

Figure 6 — Chagrin River sampling locations, 2008 and 2014 [08(h)EPA-29].

Multifaceted Urban Stream Restoration Project for the Ottawa River at the University of Toledo

Post-Project Monitoring

Project Number: 09(h)EPA-20
Stream Sampled: Ottawa River

Summary

A total of $235,197 in fiscal year 2009 Section 319(h) grant funding was awarded to allow the University of Toledo to partner with the Toledo Metropolitan Area Council of Governments to restore 900 linear feet of impaired waters of the Ottawa River. Attempts at accomplishing this by addressing habitat and hydromodification impacts on the main campus of the University of Toledo were made. Natural channel design was incorporated to restore the Ottawa River to a more natural stream channel and functional floodplain by:

Installing habitat and flow control features such as:

- Riffles
- Bend-way weirs
- Low-flow concentrators and hydrologic cover stones

Bioengineering stream banks and stabilization including:

- Planting native grasses
- Shrubs, trees and live stacking
- Established vegetated terraces (where possible)
- Protect and enhance storm water discharge points by placing vegetated filter strips where appropriate

This project was implemented consistent with the recommendations in the partially-endorsed Ottawa River/Ten Mile Creek Watershed Action Plan.

The Ottawa River was sampled upstream (RM 11.6), downstream (RM 10.9) and within (RM 11.1) the project area in 2008 and 2014 (Table 17, Table 18, Figure 7). The upstream sampling station fully met the designated Warmwater Habitat (WWH) aquatic life use for fish and macroinvertebrate communities in 2014. Fish and macroinvertebrate communities did not score well enough at the two downstream stations to meet the WWH expectations during the pre- or post-project monitoring.

Table 17 — Aquatic Life Use Attainment – Ottawa River, 2011 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are in the Huron-Erie Lake Plains (HELP) ecoregion. In the Ohio Water Quality Standards, the Ottawa River is designated WWH.

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI	QHEI	Narrative Assessment Fish/Macroinvertebrates
Ottawa River - WWH						
RM 11.6^{W} (154)-2014	FULL	32	6.93^{ns}	30^{ns}	66.5 (Good)	Fair/Fair/Marginally Good
RM 11.6^{W} (154)-2011	NON	27*	4.34*	22*	63.0 (Good)	Poor/Very Poor/Fair Marginally Good
RM 11.1^{W} (154)-2014	NON	24*	6.75^{ns}	20*	55.0 (Good)	Poor/Fair/Fair
RM 11.1^{W} (154)-2011	PARTIAL	33	7.13^{ns}	28*	48.5 (Good)	Fair/Fair/Fair
RM 10.9^{W} (155)-2014	NON	26*	7.87	20*	49.0 (Fair)	Poor/Good/Fair
RM 10.9^{W} (155)-2011	PARTIAL	30^{ns}	6.23*	16*	43.0 (Fair)	Fair/Fair/Fair

Ecoregion Biocriteria: Huron-Erie Lake Plains (HELP)	
Index – Site Type	WWH
IBI: Wading	32
MIwb: Wading	7.3
ICI	34

w Wading electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

* 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.

Table 18 — Ottawa River sampling locations, 2011 and 2014.

River Mile	Latitude	Longitude	Sampling Location
11.6	41.657650	-83.621190	Secor Rd.
11.1	41.659700	-83.612500	Stadium Dr.
10.9	41.661690	-83.604850	Douglass Ave.

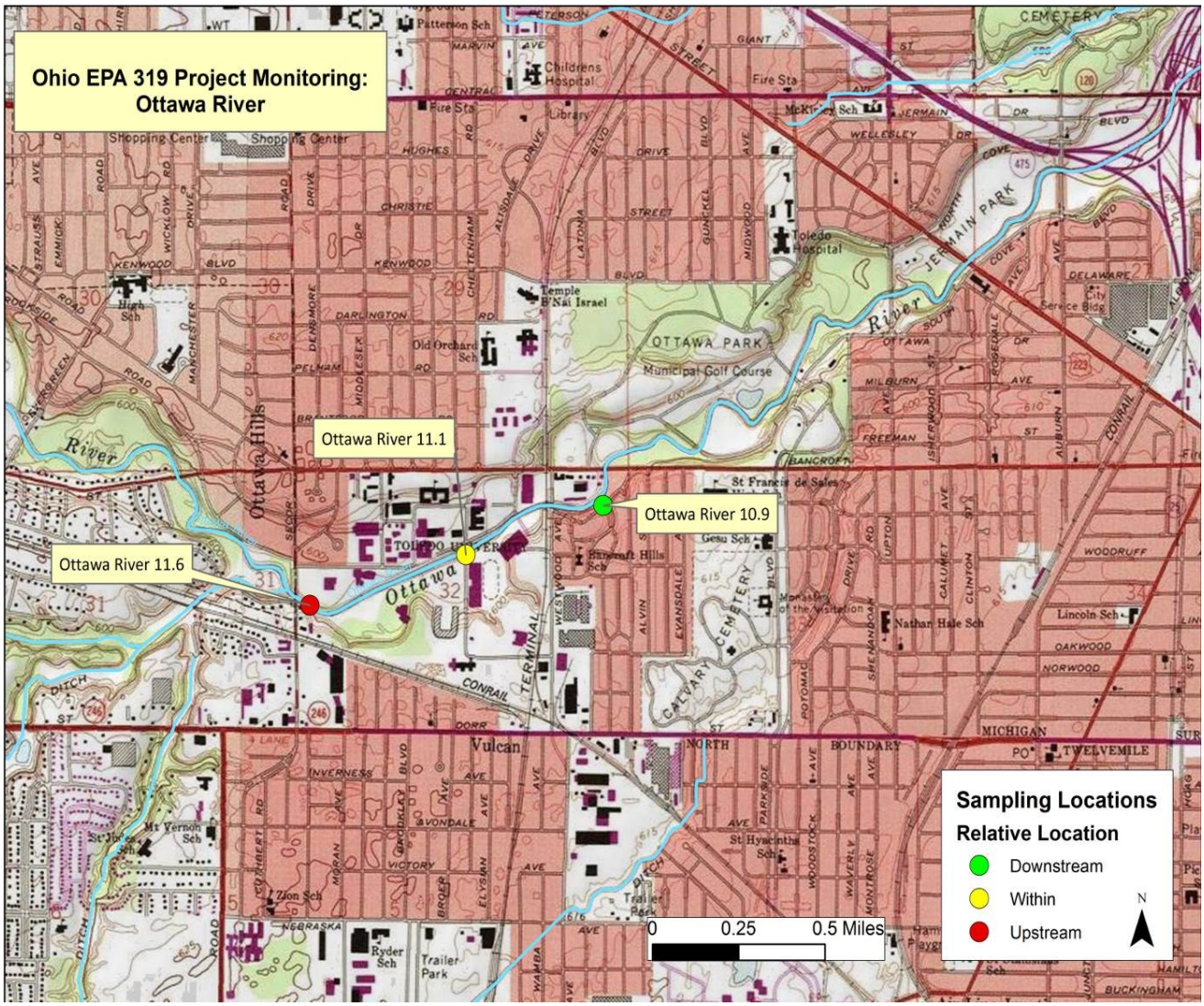

Figure 7 — Ottawa River sampling locations, 2011 and 2014 [09(h)EPA-20].

Pleasant Valley Park Floodplain Restoration Project

Post-Project Monitoring

Project Number: 10(h)EPA-10
Stream Sampled: Chagrin River

Summary

Completion of this project restored natural floodplain functions through:

- Preserving 45 acres of riparian areas located along the mainstem of the Chagrin State Scenic River.
- 650 linear feet of existing earthen levees were removed.
- Previously existing wetlands were restored.
- Invasive species management on more than 11 acres of riparian areas.
- Reforestation of the floodplain areas with more than 17 acres of native tree and shrub plantings

All three monitoring stations for the project met the Warmwater Habitat (WWH) designated aquatic life use except for the station downstream of Pleasant Valley Park (RM 10.6) (Table 19, Table 20, Figure 8). In 2014, the fish community Modified Index of Well-being (MIwb) scored below WWH expectations (MIwb=7.23*).

Table 19 — Aquatic Life U se Attainment – Chagrin River 2010 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the Chagrin River is designated Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Chagrin River – WWH						
RM 12.5 [W] (178)-2014	FULL	46	8.15	44	80.8 (Excellent)	Very Good/Good/Very Good
RM 12.5 [W] (178)-2010	FULL	48	8.22	50	80.5 (Excellent)	Very Good/Good/Exceptional
RM 11.1 [W] (186)-2014	FULL	45	8.08	E	73.5 (Excellent)	Good/Good/Exceptional
RM 11.1 [W] (186)-2010	FULL	45	8.08	52	76.3 (Excellent)	Good/Good/Exceptional
RM 10.6 [W] (186)-2014	PARTIAL	44	7.23*	E	81.0 (Excellent)	Good/Fair/Exceptional
RM 10.6 [W] (186)-2010	FULL	47	8.40	52	74.5 (Excellent)	Very Good/Good/Exceptional

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Wading	38
MIwb: Wading	7.9
ICI	34

d Narrative evaluation used in lieu of ICI when score not available (E-Exceptional).

W Wading electrofishing site.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

Table 20 — Chagrin River sampling locations, 2010 and 2014.

River Mile	Latitude	Longitude	Sampling Location
12.5	41.576450	-81.415636	At Old River Farm picnic area
11.1	41.588694	-81.401917	At Old Pleasant Valley Rd.
10.6	41.591760	-81.406850	Chagrin R. dst. Pleasant Valley Park

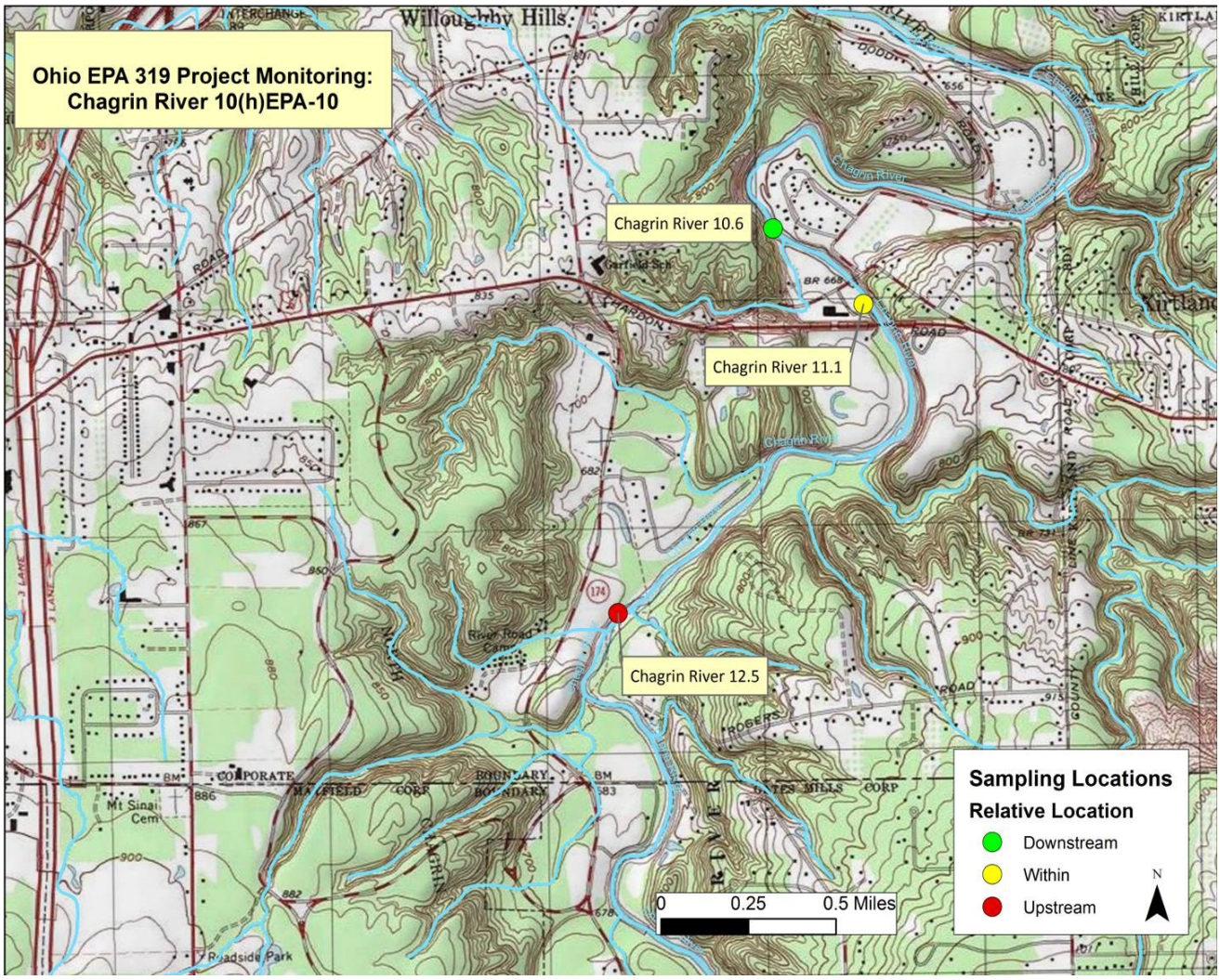

Figure 8 — Chagrin River sampling locations, 2010 and 2014 [10(h)EPA-10].

Green Stabilization of Riparian Area along the Chagrin River in Hunting Valley

Post-Project Monitoring

Project Number: 10SWIF-GLRI-CUY-068
Stream Sampled: Chagrin River

Summary

Completion of this project has reduced sediment loadings into the Chagrin State Scenic River and stabilized 400 linear feet of severely eroding stream bank using green stabilization and engineering practices (vegetative rip-rap). The Chagrin River Watershed Partners, the local watershed group, has recommended this practice to several landowners as an alternative to hard engineering approaches such as rip-rap and gabion baskets. Having an example installed within the river valley provides valuable opportunities to demonstrate green practices to landowners.

This project is also being implemented consistent with the recommendations in the state-endorsed Chagrin River Watershed Action Plan. It is also generally consistent with findings and recommendations within the Chagrin River TMDL study completed by Ohio EPA and approved by U.S. EPA.

Specifically, the project included:

- Restoration of approximately 400 linear feet of currently eroding streambank using bio-engineering (green) vegetative rip-rap practices.
- Planting and restoring 0.3 acres with native species of trees and shrubs following stabilization of the stream bank.
- Conducting a comprehensive education and outreach program.

All six monitoring stations for the project met the Warmwater Habitat (WWH) designated aquatic life use (RM 10.6) (Table 21, Table 22, Figure 9).

Table 21 — Aquatic Life Use Attainment – Chagrin River 2011 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the Chagrin River is designated Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Chagrin River – WWH						
RM 20.1[w] (156)-2014	FULL	-	-	46	-	Exceptional
RM 20.1[w] (156)-2011	FULL	46	8.66	48	86.3 (Excellent)	Very Good/Good/Exceptional
RM 19.9[w] (156)-2014	FULL	46	7.78[ns]	40	76.5 (Excellent)	Very Good/Marginally Good/Exceptional
RM 19.9[w] (156)-2011	FULL	46	8.17	50	72.0 (Good)	Very Good/Good/Exceptional
RM 19.7[w] (157)-2014	FULL	-	-	42	-	Very Good
RM 19.7[w] (157)-2011	FULL	50	9.0	50	81.3 (Excellent)	Exceptional/Very Good/Exceptional

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Wading	38
MIwb: Wading	7.9
ICI	34

d Narrative evaluation used in lieu of ICI when score not available (E-Exceptional).

W Wading electrofishing site.

- No sample collected.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 22 — Chagrin River sampling locations, 2011 and 2014.

River Mile	Latitude	Longitude	Sampling Location
20.1	41.495510	-81.401530	Upst. Hunting Valley restoration area
19.9	41.497030	-81.402570	Adj. Hunting Valley restoration area
19.7	41.498770	-81.400690	Dst. Hunting Valley restoration area

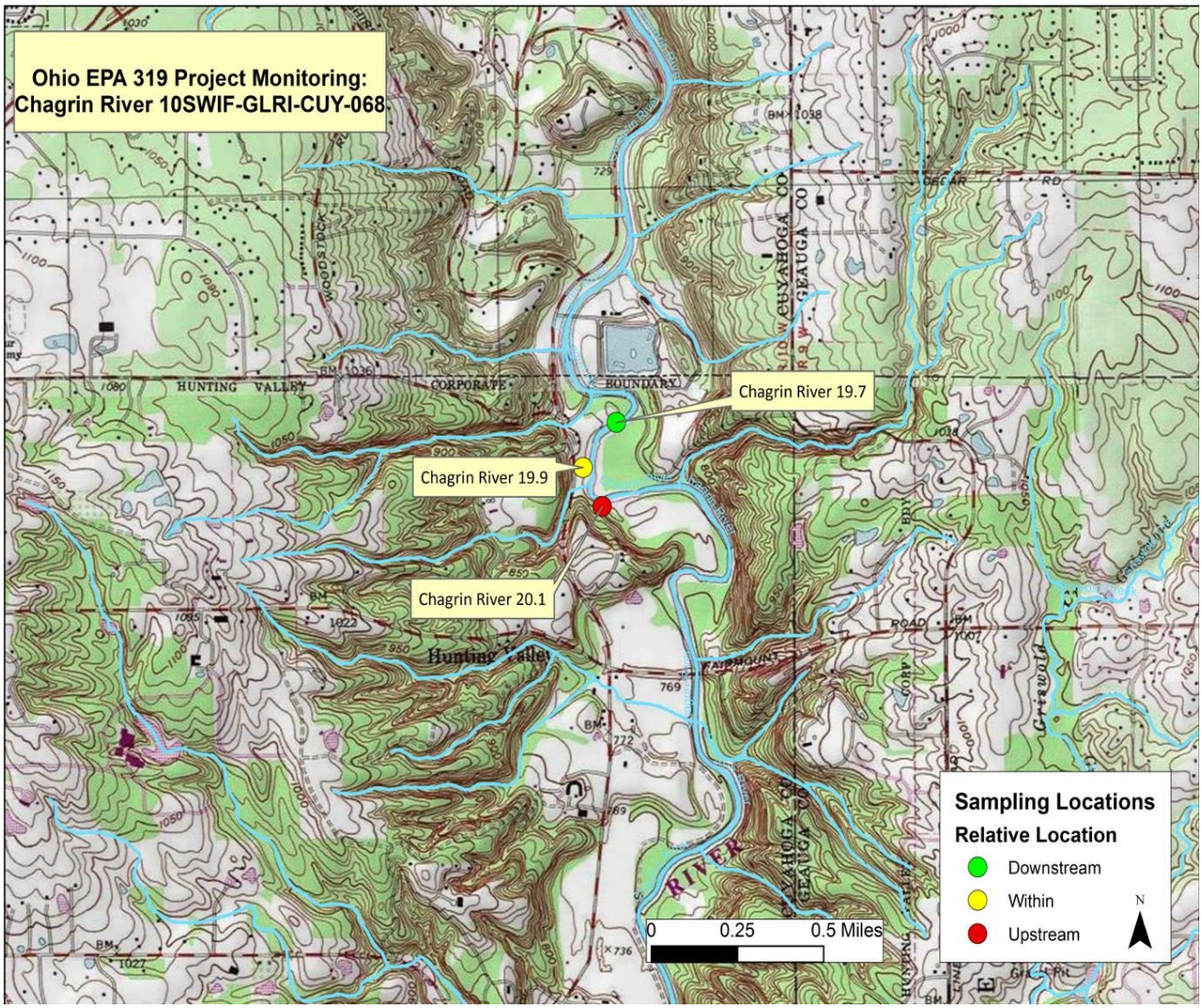

Figure 9 — Chagrin River sampling locations, 2011 and 2014 [10SWIF-GLRI-CUY-068].

Muddy Creek Stream and Riparian Restoration and Protection

Post-Project Monitoring

Project Number: 10(h)EPA-14
Stream Sampled: Muddy Creek

Summary

Completion of this project restored 7,000 linear feet of Muddy Creek to Warmwater Habitat (WWH)-designated aquatic life use. It also reduced sediment and nutrient loadings to the stream caused by unstable and severely eroding stream banks throughout the project area. Using $258,000 in federal Section 319(h) Clean Water Act grant funding, the project restored two sites totaling 1,400 linear feet of Muddy Creek, a tributary to the Little Miami State and National Scenic River. The project resolved existing bank erosion and habitat degradation problems within the stream using natural channel design principles. This project expanded upon approximately 7,000 linear feet of restoration in Muddy Creek completed by the City of Mason in 2009. Stream restoration work occurred upstream and downstream of the locally funded project and consisted of cross vanes to direct flow away from steeply eroded stream banks, establishing a floodplain bench, removing invasive species and re-establishing native riparian plant communities.

Completion reduced sedimentation from severely eroding stream banks and improved riparian and stream functions. The project site is protected in perpetuity through a conservation easement placed upon the 1.5-acre restoration project site. The project site is located within segments of the Little Miami River that are not covered by the approved TMDL or an endorsed watershed action plan. However, the project is consistent with the general restoration and habitat recommendations included in the Little Miami River TMDL and included:

- Restoration of 1,400 linear feet of stream at two sites in Muddy Creek using natural channel design and installation of in-stream habitat features such as cross-vane flow control structures, riffles, runs, pools and a meandering morphology.
- Rehabilitation and enhancement of 2,700 linear feet of riparian habitat through the elimination of non-native invasive species and restoration of the riparian habitat using native plant materials such as hardwood seedlings and shrubs. Total acreage enhanced exceeds three acres.
- Project-specific public education and outreach program including the installation of project signs, an educational/interpretive sign, four project-specific articles within the Warren County SWCD newsletter and the Mason Matters local newspaper. In addition, local school groups were provided the opportunity to volunteer to participate in the invasive species removal activity associated with this restoration project.

Only partial attainment of the Warmwater Habitat (WWH) designated aquatic life use was achieved during the 2010 pre-project monitoring at each of the five monitoring stations. Upon completion of the restoration project all five monitoring stations for the project met the Warmwater Habitat (WWH) designated aquatic life use (Table 23, Table 24, Figure 10).

Table 23 — Aquatic Life Use Attainment – Muddy Creek 2010 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, Muddy Creek is designated Warmwater Habitat (WWH).

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Muddy Creek – WWH						
RM 6.2[H] (5.1)-2014	FULL	38[ns]	-	MG[ns]	56.0 (Good)	Marginally Good/Marginally Good
RM 6.2[H] (5.1)-2010	PARTIAL	40	-	F*	76.3 (Excellent)	Good/Fair
RM 5.9[H] (6.2)-2014	PARTIAL	32*	-	F*	79.0 (Excellent)	Fair/Fair
RM 5.9[H] (6.2)-2010	NON	40	-	F*	78.8 (Excellent)	Good/Fair
RM 4.5[H] (8.2)-2014	FULL	44	-	MG[ns]	73.5 (Excellent)	Good/Marginally Good
RM 4.5[H] (8.2)-2010	FULL	44	-	G	69.8 (Excellent)	Good/Good
RM 3.5[H] (10.0)-2014	FULL	40	-	MG[ns]	81.0 (Excellent)	Good/Marginally Good
RM 3.5[H] (10.0)-2010	PARTIAL	42	-	F*	72.5 (Excellent)	Good/Fair
RM 0.5[H] (15.2)-2014	FULL	54	-	MG[ns]	74.3 (Excellent)	Exceptional/Marginally Good
RM 0.5[H] (15.2)-2010	PARTIAL	54	-	F*	75.8 (Excellent)	Exceptional/Fair

Ecoregion Biocriteria: Interior Plateau (IP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	30

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

d Narrative evaluation used in lieu of ICI when score not available (F-Fair, MG-Marginally Good).

H Headwater electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

- No sample taken.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

Table 24 — Muddy Creek sampling locations, 2010 and 2014.

River Mile	Latitude	Longitude	Sampling Location
6.2	39.351390	-84.319770	At Mason @ Tylersville Rd.
5.9	39.352530	-84.316520	At Mason @ St. Susanna Church
4.5	39.362190	-84.299140	At Mason, 0.5 Miles dst. Kings Mills Rd.
3.5	39.371700	-84.288300	Muddy Creek N of Mason @ St. Rte. 741
0.5	39.369400	-84.248300	Muddy Creek near S. Lebanon @ Mason-Morrow-Milgrove Rd.

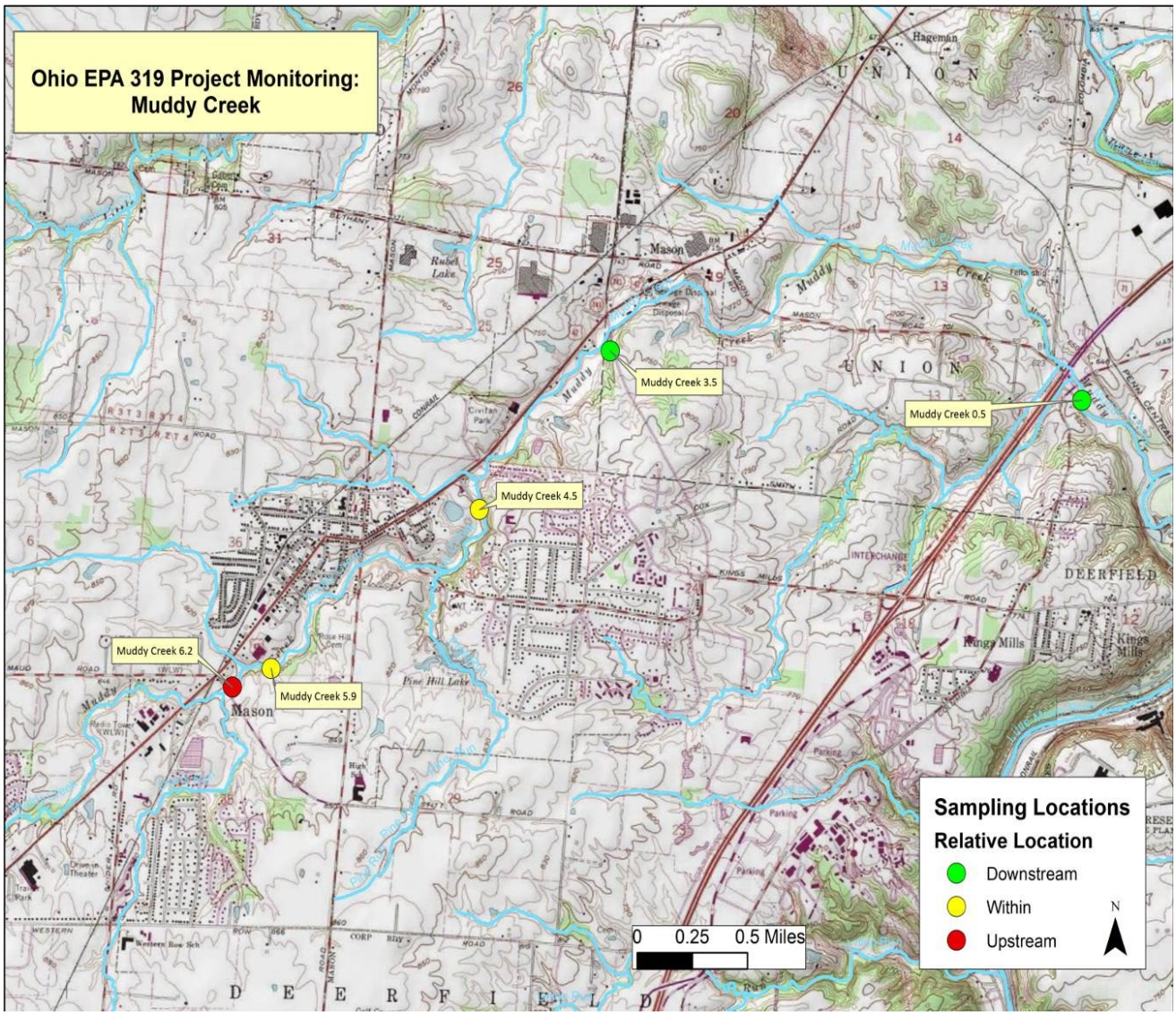

Figure 10 — Muddy Creek sampling locations, 2010 and 2014 [10(h)EPA-14].

Little Cuyahoga River Restoration-Phase II

Post-Project Monitoring

Project Number: 10(h)EPA-17
Stream Sampled: Little Cuyahoga River

Summary

Under Phase 1 in the spring of 2010, more than 2,500 linear feet of the Little Cuyahoga was restored using local and American Recovery and Reinvestment (ARRA) funding. Using $400,000 in federal Section 319(h) Clean Water Act grant funding, the City of Akron conducted Phase 2 of the project to restore 1,570 linear feet of the Little Cuyahoga River and to lower the Kelly Avenue dam by five feet. The dam was impounding the river, causing excess sedimentation, elevated water temperatures and low dissolved oxygen levels. Additionally, a riparian buffer measuring 100-150 feet in width was established and maintained throughout the project site. More than five acres of riparian lands are now protected with a conservation easement.

After the dam was lowered, the former impoundment was restored using natural channel design methods, including development of an appropriately sized channel, meandering pattern and functional floodplain. Removing the dam in its entirety was not a viable option due to upstream bridge structures and in-stream abutments. Completion of this project also resulted in the restoration of six small pocket riparian wetlands within the project site.

The project site is within areas addressed by the Lower Cuyahoga River TMDL and Remedial Action Plan (RAP). Implementation of this project was consistent with restoration and habitat recommendations in both documents and included:

- Lowering of the Kelly Ave. Dam by five feet, reducing the dam impoundment from approximately ½ mile to 1,800 linear feet.
- Restoration using natural channel design methods of more than 1,570 linear feet of stream channel, including the restoration of more than 3,000 linear feet of riparian streambank areas and more than eight acres of riparian forested areas using plantings of native hardwood and shrub species. Riparian forested corridors of 100 to 150 feet in width were established and maintained.
- Restoration of six riparian wetlands encompassing a total of approximately one acre.
- More than eight acres of riparian areas are permanently protected through the placement of the project site under a conservation easement.
- Project-specific education and outreach activities include construction of a project site interpretive panel and development of a project-specific website.

Partial and non-attainment of the Warmwater Habitat (WWH) designated aquatic life use was achieved during the 2010 pre-project monitoring at the monitoring stations. Upon completion of the restoration project none of the monitoring stations met the Warmwater Habitat (WWH) designated aquatic life use (Table 25, Table 26, Figure 11).

Table 25 — Aquatic Life Use Attainment – Little Cuyahoga River 2010 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the Little Cuyahoga River is designated Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI	QHEI	Narrative Assessment Fish/Macroinvertebrates
Little Cuyahoga River – WWH						
RM 7.1[W] (31.0)-2014	NON	23*	6.0*	36*	58.8 (Fair)	Poor/Fair/Fair
RM 7.1[W] (31.0)-2010	NON	30*	6.9*	26*	66.5 (Good)	Fair/Fair/Fair
RM 6.2[W] (47.0)-2014	NON	25*	4.8*	34	57.5 (Fair)	Poor/Poor/Good
RM 6.2[B] (47.0)-2010	NON	25*	5.6*	14*	42.0 (Poor)	Poor/Poor/Fair
RM 5.2[W] (47.0)-2014	NON	25*	6.2*	28*	57.0 (Fair)	Poor/Fair/Fair
RM 5.2[W] (47.0)-2010	PARTIAL	29*	7.3*	34	61.5 (Good)	Fair/Fair/Good

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Wading/Boat	38/40
MIwb: Wading/Boat	7.9/8.7
ICI	34

W Wading electrofishing site.

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

B Boat electrofishing site.

Table 26 — Little Cuyahoga River sampling locations, 2010 and 2014.

River Mile	Latitude	Longitude	Sampling Location
7.1	41.060300	-81.463100	Akron @ Massillon Rd.
6.2	41.063111	-81.480250	Akron, upst. Kelly Ave. Dam (Impounded)
5.2	41.072200	-81.486100	Akron @ Bank St.

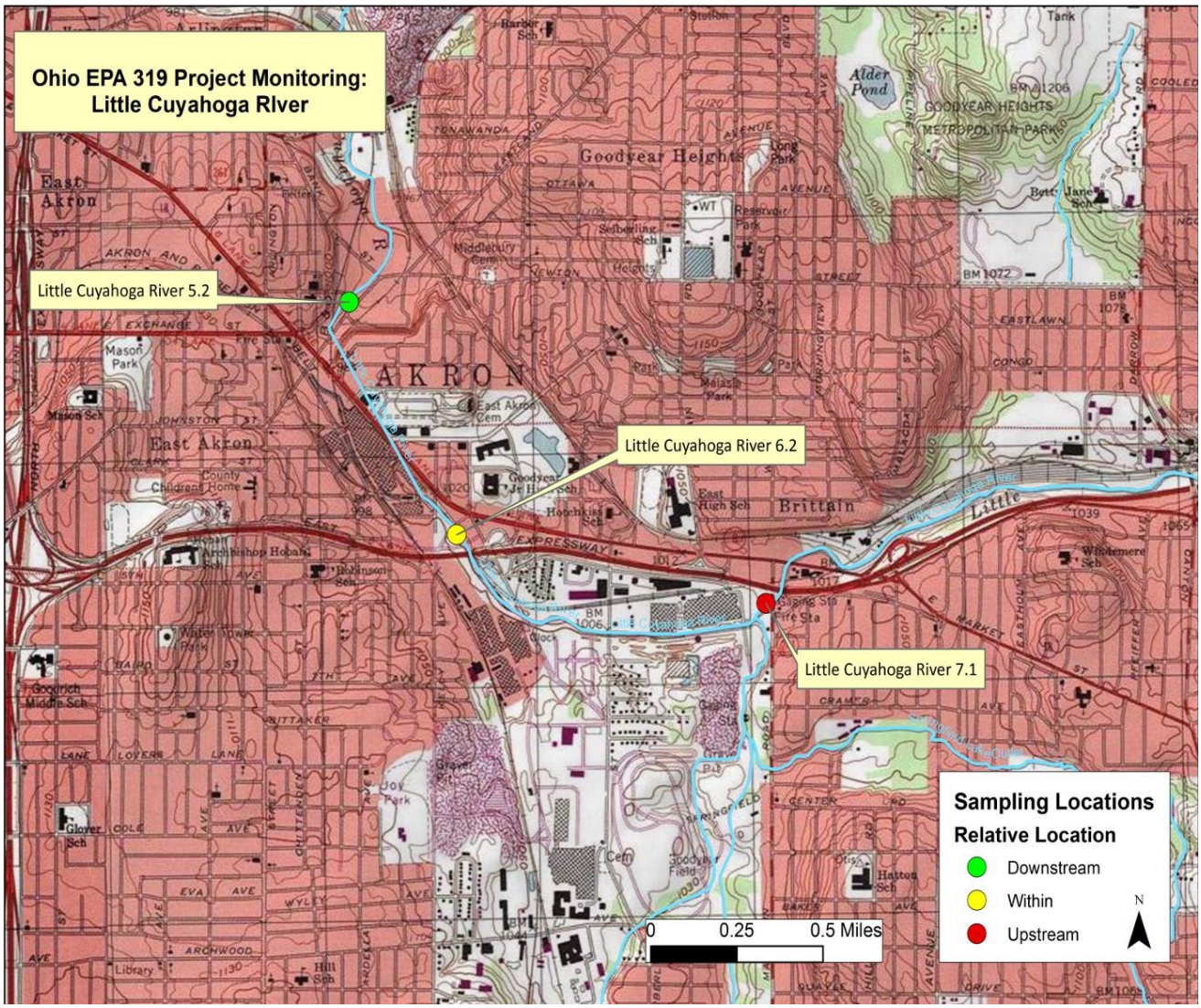

Figure 11 — Little Cuyahoga River sampling locations, 2010 and 2014 [10(h)EPA-17].

Wild Cat Run Stream Restoration and Stormwater Management Demonstration

Post-Project Monitoring

Project Number: 10SWIF-145
Stream Sampled: Wildcat Run

Summary

The project reduced nonpoint source pollutant loadings (nutrient and sediments) to the Olentangy River, and reduced habitat loss by restoration and maintenance of tributary health. Liberty Township restored 500 linear feet of perennial stream using natural channel design with stone riffles and eddy rock groupings. A self-forming channel design, consisting of a vegetated swale and rock check dams within the swale, was implemented on a previously channelized feeder stream.

This project was part of a larger initiative to establish a storm water management demonstration site for innovative storm water practices that will serve as a model for other townships and developers. With a conservation covenant, the park secured 30 acres of wooded stream corridor to be protected in perpetuity.

The project was consistent with findings and recommendations within the Lower Olentangy River TMDL study completed by Ohio EPA and approved by U.S. EPA in 2003.

Specifically, the project included:

- Restoration of 500 linear feet of perennial stream with natural channel design.
- Construction of a 260'x40' self-forming channel on a previously channelized feeder stream.
- Construction of a 450'x8' bottom vegetated swale.
- Protection of 3,800 linear feet of wooded stream corridor with a conservation covenant on approximately 30 acres.

None of the sampling sites achieved attainment of the Warmwater Habitat (WWH) designated aquatic life use for either pre- or post-project monitoring (Table 27, Table 28, Figure 12). However, narrative macroinvertebrate assessments and QHEI scores improved from 2010 to 2014.

Table 27 — Aquatic Life Use Attainment – Wildcat Run 2010 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Wildcat Run is recommended Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status[b]	IBI	MIwb[c]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Wildcat Run – Recommended WWH						
RM 1.7^H (1.1)-2014	NON	30*	-	LF*	62.3 (Good)	Fair/Low Fair
RM 1.7^H (1.1)-2010	NON	38^{ns}	-	P*	55.0 (Good)	Marginally Good/Poor
RM 1.4^H (1.3)-2014	PARTIAL	28*	-	F	68.0 (Good)	Fair/Fair
RM 1.4^H (1.3)-2010	NON	32*	-	LF*	56.0 (Good)	Fair/Low Fair

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	36

b WWH biocriteria is used to score undesignated sites.

c MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI when score not available (P-Poor, LF-Low Fair, F-Fair).

H Headwater electrofishing site.

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

\- No sample taken.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 28 — Wildcat Run sampling locations, 2010 and 2014.

River Mile	Latitude	Longitude	Sampling Location
1.7	40.190130	-83.082170	N of Powell @ Liberty Twp. Park
1.4	40.192517	-83.077611	N of Powell, upst. Liberty Rd.

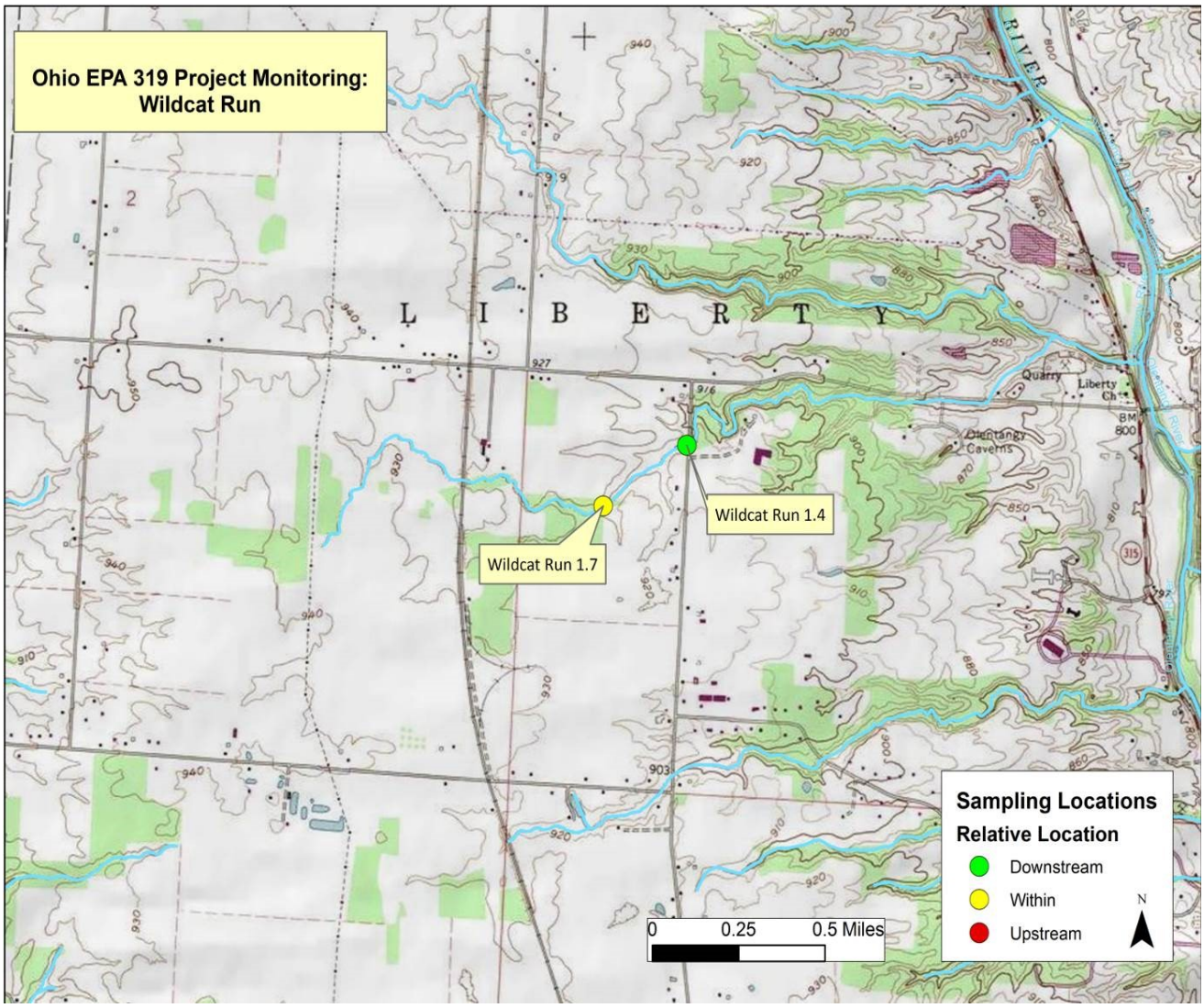

Figure 12 — Wildcat Run sampling locations, 2010 and 2014 [10SWIF-145].

Harmon Homestead Restoration Project

Post-Project Monitoring

Project Number: 11(h)EPA-14
Stream Sampled: Harmon Run and Unnamed Tributary to Harmon Run

Summary

The Harmon Homestead Restoration project:

- Restored floodplain access to 3,190 linear feet of stream.
- Stabilized 1,500 linear feet of streambank.
- Restored three acres of wetland.
- Planted wetland plant species in four acres of wetland and woody vegetation in 17.5 acres of riparian areas.

Restoration work resulted in reduction of:

- 475 pounds/year of nitrogen
- 28 pounds/year of phosphorous
- 138 tons/year of sediment

Additionally, 100 acres of property, including riparian areas and wetlands, were preserved through a conservation easement held by Western Reserve Land Conservancy. The documented value of this donated conservation easement is $300,000, of which $250,000 was used as the local match for this grant.

The project was located at the headwaters of both the Aurora Branch of the Chagrin River and the Cuyahoga River watersheds and upstream of Sunny Lake. The property is part of the City's ongoing efforts to improve the water quality of Sunny Lake and the Aurora Branch of the Chagrin River. The Aurora Branch of the Chagrin River is not currently attaining its Warmwater Habitat (WWH) use, and Sunny Lake has experienced cyanobacteria blooms in the past. Both the restored streams are headwaters of the Aurora Branch of the Chagrin River. The City of Aurora's Harmon Homestead Restoration project has improved the water quality of these downstream water resources.

The stream restoration reconnected the channel with its floodplain and reduced streambank erosion. Stream habitat was improved by installing riffle structures and planting trees along the stream to keep the water cool and provide shelter for fish. Three acres of wetlands were restored, of which approximately two acres are in the Chagrin watershed and approximately one acre is in the Cuyahoga watershed. Besides offering wildlife habitat, wetlands serve as natural water purifiers for both watersheds, encouraging pollutants to settle out as they retain flood water.

The public and government employees and elected officials in surrounding communities were educated about this project through efforts of the City of Aurora and the Chagrin River Watershed Partners, Inc. (CRWP). The city has project information on its website to educate its residents about this stream and wetland restoration project. CRWP has presented to its board of trustees on this project and published project highlights in its annual report. The city and CRWP hosted a volunteer work day for invasive species removal on the property, which included a site tour and a description of the stream and wetland restoration work.

Sample sites on Harmon Run and the tributary to Harmon Run did not meet the recommended WWH aquatic life use during the 2011 and 2014 pre- or post-project monitoring. However, QHEI scores did improve during the 2014 post-project sampling (Table 29, Table 30, Figure 13).

Table 29 — Aquatic Life Use Attainment – Harmon Run and Tributary to Harmon Run 2011 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, Harmon Run and the tributary to Harmon Run are undesignated.

River Mile (drainage mi^2)	Attainment Status[b]	IBI	MIwb[c]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Harmon Run – Recommended WWH						
RM 2.1^H (0.5)-2014	NON	30*	-	P*	62.3 (Good)	Fair/Poor
RM 2.1^H (0.5)-2011	NON	38^{ns}	-	P*	55.0 (Fair)	Marginally Good/Poor
Unnamed Tributary to Harmon Run – Recommended WWH						
RM 0.1^H (0.1)-2014	NON	28*	-	LF*	68.0 (Good)	Fair/Fair
RM 0.1^H (0.1)-2011	NON	32*	-	LF*	56.0 (Fair)	Fair/Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b WWH biocriteria is used to score undesignated sites.

c MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI when score not available (P-Poor, LF-Low Fair).

H Headwater electrofishing site.

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

\- No sample taken.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 30 — Harmon Run and tributary to Harmon Run sampling locations, 2011 and 2014.

River Mile	Latitude	Longitude	Sampling Location
2.1	41.281700	-81.324800	Harmon Run, SE of Sunny Lake, dst. Page Rd.
1.4	41.283125	-81.324186	Trib to Harmon Run (2.0) SE of Sunny Lake, dst. Page Rd. near mouth

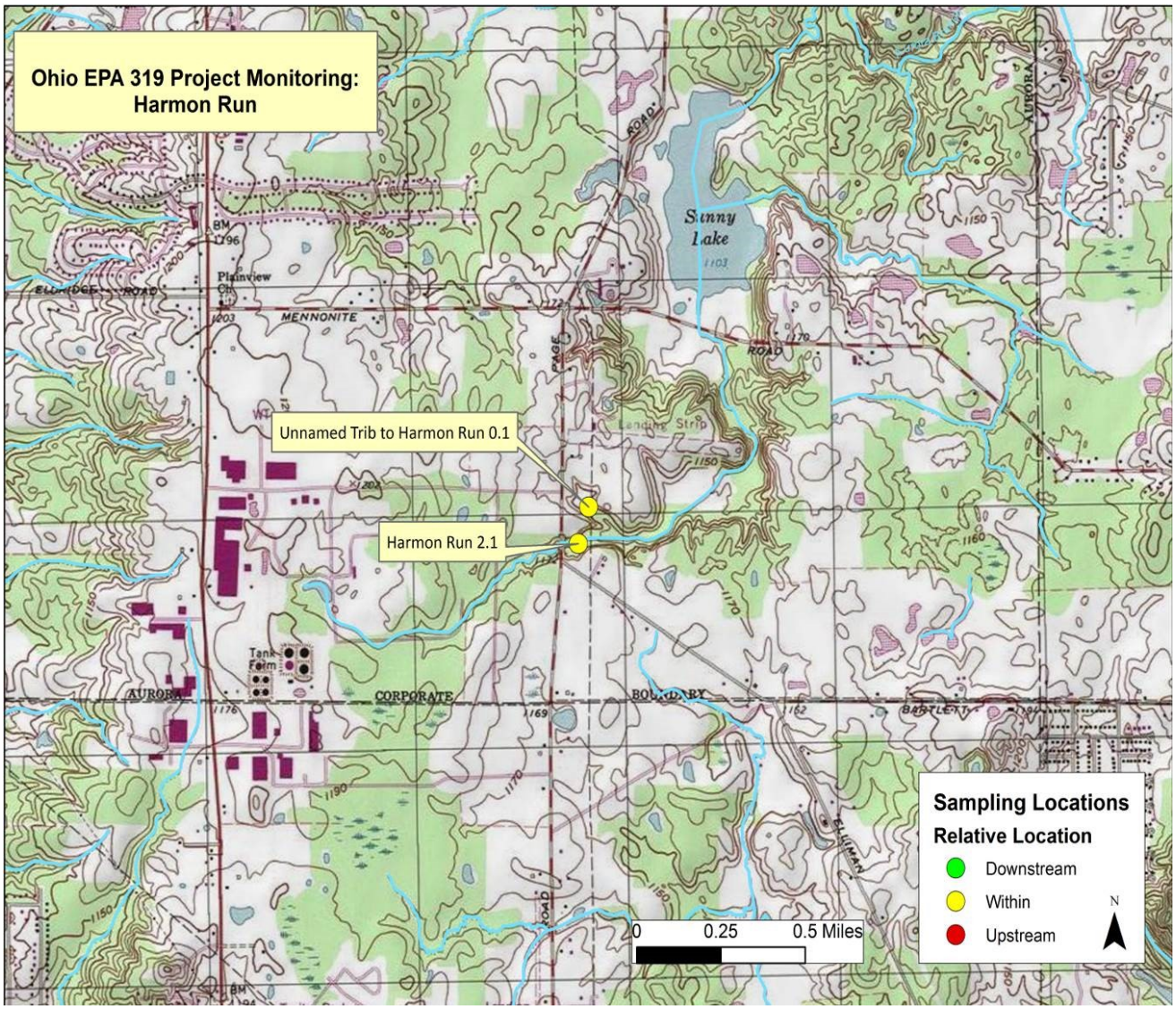

Figure 13 — Harmon Run sampling locations, 2011 and 2014 [11(h)EPA-14].

Hill Ditch Stream Restoration and Dam Removal at Toledo Botanical Garden

Post-Project Monitoring

Project Number: 11(h)EPA-21
Stream Sampled: Hill Ditch

Summary

Completion of this project removed two lowhead dam structures and restored a 1,150-foot segment of Hill Ditch that flows through the Toledo Botanical Garden facilities which impounded the east and west Crosby Lake ponds. Removal restored natural flow conditions to Hill Ditch, as well as 1.7 acres of previously impounded deep-water areas. Stream channel restoration activities followed, using natural channel design and included the installation of four in-stream grade control structures and replanting of 0.32 acres of riparian areas. NPS load reductions resulting from the project included 2,677 pounds/year nitrogen; 1,338 pounds/year phosphorus; and 1,338 tons/year sediments.

Employees of Toledo Botanical Gardens and volunteers planned and implemented a comprehensive planting program that involved native seed collection, germination, plant production, planting and maintenance. Monitoring activities will be completed every five years to assess channel stability, verify erosion and sediment reductions, and various other biological monitoring such as QHEI, IBI and ICI assessments (Section 319 funds will not be used to complete monitoring). This project is in a highly visible location and serves as an effective demonstration of the importance and value of stream restoration in an urban area. Education and outreach activities supporting this project include web pages, project signage, fact sheets, press releases, project displays and an information kiosk.

Specifically, the project included:

- Removal of two lowhead dams followed by the restoration of natural flow to more than 1,150 linear feet of Hill Ditch throughout the grounds of the Toledo Botanical Garden.
- Installation of four in-stream grade/habitat structures.
- Planting of native grass on 0.5 acre in conjunction with the planting of trees, shrubs and live stakes on a third of an acre of riparian areas.
- Installation of 0.5 acre of pocket wetlands.
- Installation of 1.7 acres of deep-water habitat in floodplain.
- Restoration of natural flow and assimilative capacity to Hill Ditch and associated wetland features in the Toledo Botanical Gardens. In addition, this project provides a tableau for water quality related education opportunities.
- Public outreach including website links, signage, fact sheets, press releases and a display.
- Public participation though three tours, six planting days, four stream clean ups and three workshops.

Sample sites on Hill Ditch did not meet the recommended Warmwater Habitat (WWH) aquatic life use during the 2011 and 2014 pre- or post-project monitoring. QHEI scores improved slightly during the 2014 post-project sampling at the downstream site while the QHEI score upstream significantly decreased in 2014 (Table 31, Table 32, Figure 14).

Table 31 — Aquatic Life Use Attainment – Hill Ditch 2011 and 2014.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Huron-Erie Lake Plains (HELP) ecoregion. In the Ohio Water Quality Standards, Hill Ditch is Limited Resource Water (LRW).

River Mile (drainage mi^2)	Attainment Status[c]	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Hill Ditch – Recommended WWH						
RM 2.6[H] (3.5)-2014	NON	24[ns]	-	P*	51.0 (Fair)	Poor/Poor
RM 2.6[H] (3.5)-2011	NON	22*	-	P*	64.5 (Good)	Poor/Poor
RM 2.2[H] (6.3)-2014	NON	20*	-	LF*	60.8 (Good)	Poor/Fair
RM 2.2[H] (6.3)-2011	NON	22*	-	LF*	55.0 (Good)	Poor/Fair

Ecoregion Biocriteria: Huron-Erie Lake Plains (HELP)	
Index – Site Type	WWH
IBI: Headwater	28
ICI	34

c WWH biocriteria is used to score undesignated sites.

b MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI when score not available (P-Poor, LF-Low Fair).

H Headwater electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

- No sample taken.

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

Table 32 — Hill Ditch sampling locations, 2011 and 2014.

River Mile	Latitude	Longitude	Sampling Location
2.6	41.667220	-83.675350	Dst. Carriage Dr., upst. Toledo Botanical Gardens ponds
2.2	41.665410	-83.670030	Upst. Reynolds Rd., dst. Toledo Botanical Gardens ponds

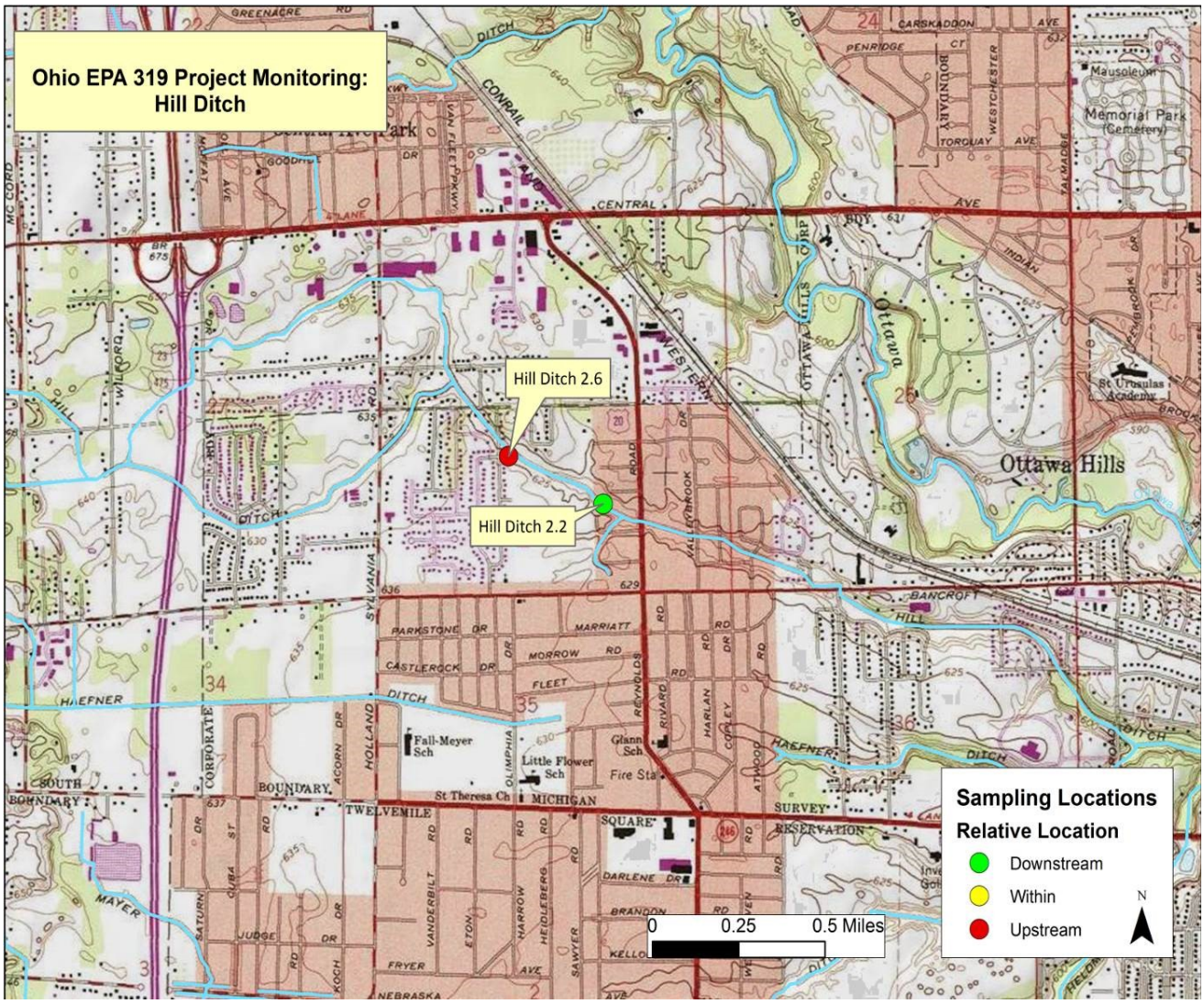

Figure 14 — Hill Ditch sampling locations, 2011 and 2014 [11(h)EPA-21].

Restoration of Tributary to O'Bannon Creek

Pre-Project Baseline Monitoring

Project Number: 15(h)EPA-16
Stream Sampled: Tributary to O'Bannon Creek (RM 2.15)

Summary

Completion of this project will improve aquatic habitat through restoration of 620 linear feet of a tributary to O'Bannon Creek (RM 2.15) and stabilization 500 feet of stream bank 0.7 mile upstream of the main stem of O'Bannon Creek in Goshen Township, Clermont County, Ohio.

Specifically, the project will include:

- Restoration of 300 linear feet of floodplain.
- Restoration of 620 linear feet of floodplain.
- Installation of four in-stream habitat structures.
- Restoration of 500 linear feet of stream bank using bio-engineering.
- Restoration of 500 linear feet of stream bank by recontouring or regrading.
- Stabilization of 500 linear feet of stream bank using bio-engineering.
- Planting of 0.6 acres of trees, shrubs and/or live stakes in riparian areas.

The upstream site on tributary to O'Bannon Creek (RM 2.15) at RM 0.9 partially met the recommended Warmwater Habitat (WWH) aquatic life use (Table 33, Table 34, Figure 15). Both downstream sites (RMs 0.6 and 0.3) fully met the recommended Warmwater Habitat (WWH) aquatic life use. In 2015, all three sample locations scored excellent QHEI values.

Table 33 — Aquatic Life Use Attainment – Tributary to O'Bannon Creek (Rm 2.15) 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, Tributary to O'Bannon Creek (RM 2.15) is undesignated.

River Mile (drainage mi^2)	Attainment Status[b]	IBI	MIwb[c]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Tributary to O'Bannon Creek (RM 2.15) – Recommended WWH						
RM 0.9^H (7.9)-2015	PARTIAL	34*	-	MG^{ns}	70.8 (Excellent)	Fair/Marginally Good
RM 0.6^H (7.9)-2015	FULL	38^{ns}	-	MG^{ns}	71.0 (Excellent)	Marginally Good/Marginally Good
RM 0.3^H (7.9)-2015	FULL	36^{ns}	-	MG^{ns}	83.0 (Excellent)	Marginally Good/Marginally Good

Ecoregion Biocriteria: Interior Plateau (IP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	30

b WWH biocriteria is used to score undesignated sites.

c MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI when score not available (MG – Marginally Good).

H Headwater electrofishing site.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

\- No sample taken.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 34 — Tributary to O'Bannon Creek (RM 2.15) sampling locations, 2015.

River Mile	Latitude	Longitude	Sampling Location
0.9	39.2549	-84.2241	Trib to O'Bannon Creek (Rm 2.15) upst. 319 project
0.6	39.2563	-84.2224	Trib to O'Bannon Creek (Rm 2.15) @ 319 project
0.3	39.2576	-84.2261	Trib to O'Bannon Creek (Rm 2.15) dst. 319 project @ Neale Lane

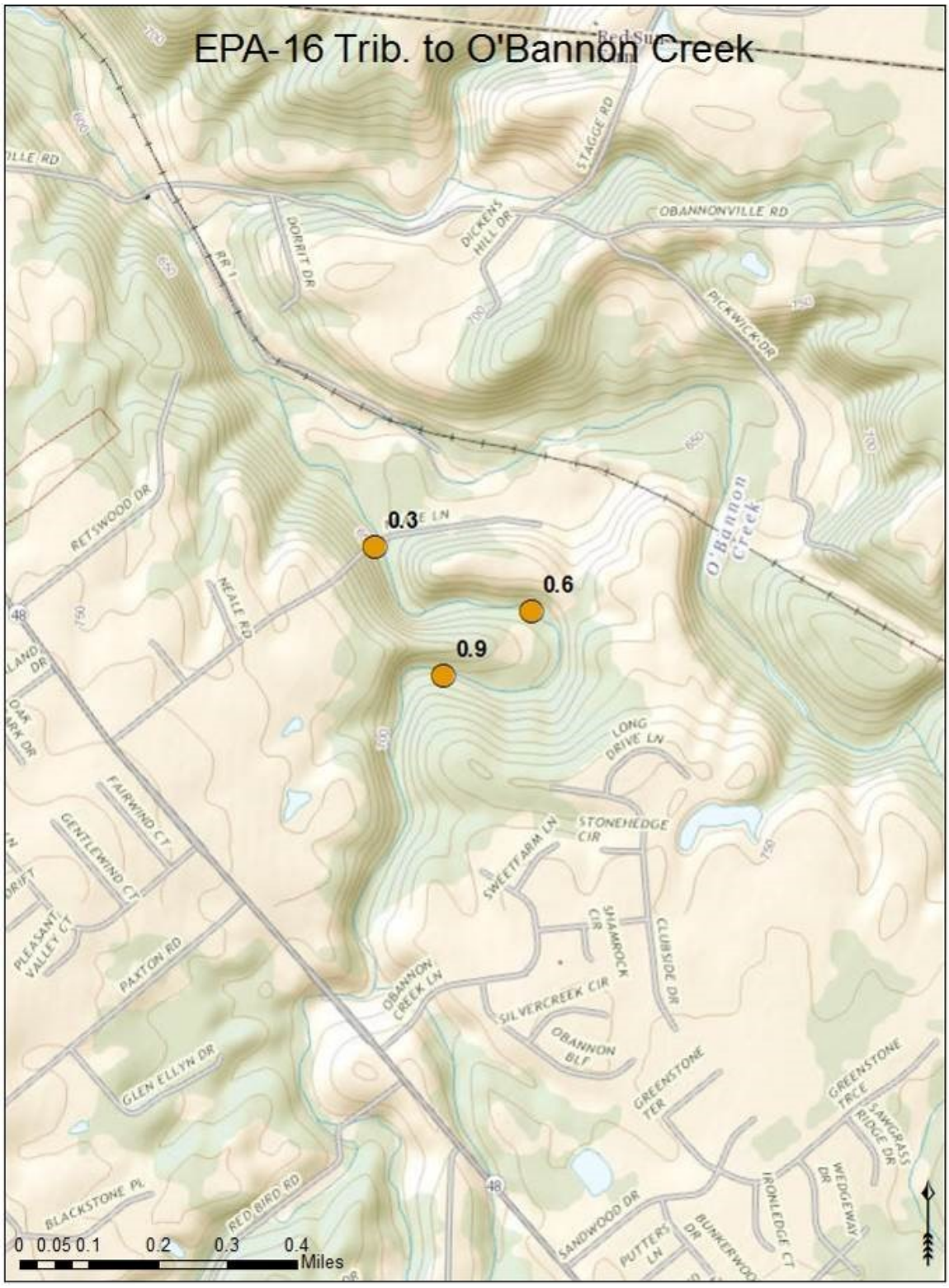

Figure 15 — Tributary to O'Bannon Creek sampling locations with river miles indicated, 2015 [15(h)EPA-16].

Marival/Broadview Stream and Riparian Restoration and Protection	*Pre-Project Baseline Monitoring* Project Number: 15(h)EPA-32 Stream Sampled: Tributary to Muddy Creek (RM 4.06)

Summary

Completion of this project will reduce nonpoint source pollutant loadings to Muddy Creek by restoring 3,200 linear feet of a headwater tributary, which addresses bank erosion and habitat degradation, and by acquiring a conservation easement for protection in perpetuity.

Specifically, the project will include:

- Restoration of 700 linear feet of stream channel.
- Installation of three in-stream habitat structures.
- Installation of two grade structures.
- Restoration of 1,000 linear feet of stream bank using bio-engineering.
- Restoration of 1,500 linear feet of stream bank by recontouring or regrading.
- Planting one acre of native grasses in riparian areas.
- Planting a half acre of trees, shrubs and/or live stakes in riparian areas.
- Acquiring one acre of conservation easement.

The sample site on the tributary to Muddy Creek (RM 4.06) at RM 0.1 was found to have a poor macroinvertebrate community and did not meet the recommended Warmwater Habitat (WWH) aquatic life use (Table 35, Table 36, Figure 16).

Table 35 — Aquatic Life Use Attainment – Tributary to Muddy Creek (RM 4.06) 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, Tributary to Muddy Creek (RM 4.06) is undesignated.

River Mile (drainage mi²)	Attainment Status[c]	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Tributary to Muddy Creek (RM 4.06) – Recommended WWH						
RM 0.1 (0.2)-2015	NONE	-	-	P*	-	Poor

Ecoregion Biocriteria: Interior Plateau (IP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	30

c WWH biocriteria used for undesignated sites.

d Narrative evaluation used in lieu of ICI when score not available (P-Poor).

- No sample taken.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

Table 36 — Tributary to Muddy Creek (RM 4.06) sampling locations, 2015.

River Mile	Latitude	Longitude	Sampling Location
0.1	39.3669	-84.2954	Trib to Muddy Creek (Rm 4.06) dst. Stone Ridge Dr. (dst. lower reach restoration)

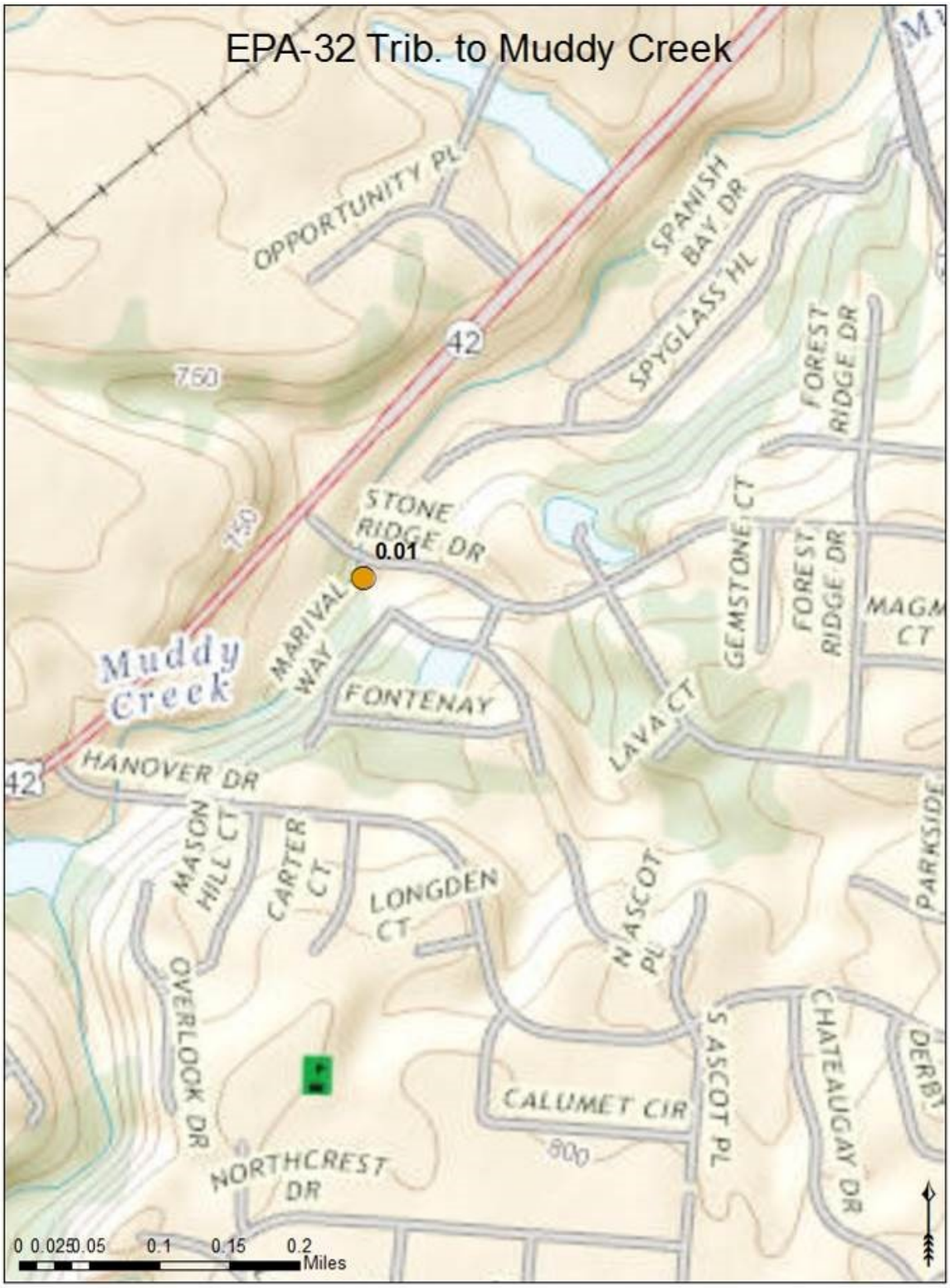

Figure 16 — Tributary to Muddy Creek (RM 4.06) sampling location with river mile indicated, 2015 [15(h)EPA-32].

Upper Tuscarawas River Stabilization Project

Pre-Project Baseline Monitoring

Project Number: 15(h)EPA-15
Stream Sampled: Tuscarawas River

Summary

Completion of this project will reduce nonpoint source pollutant loadings to upper Tuscarawas River and stabilize the stream corridor to minimize erosion. Improve aquatic habitat by re-vegetating the floodplain to minimize erosion, maximize shading and increase habitat. A conservation easement will be conveyed protecting the site in perpetuity.

Specifically, the project will include:

- Restoration of 2,300 linear feet of floodplain.
- Installation of three erosion- and sediment-control structures.
- Installation of three in-stream habitat structures.
- Removal/treatment of 10 acres of invasive species.
- Planting of 10 acres of trees, shrubs and/or live stakes in riparian zone.
- Completion of an appraisal report.
- Acquisition of 12 acres of conservation easements.

Due to low MIwb values, all three sample sites on the Tuscarawas River partially met the Warmwater Habitat (WWH) aquatic life use in 2015 (Table 37, Table 38, Figure 17).

Table 37 — Aquatic Life Use Attainment – Tuscarawas River 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, the Tuscarawas River is Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Tuscarawas River – WWH						
RM 123.10[W] (25.5)-2015	PARTIAL	43	6.6*	G	69.8 (Excellent)	Fair/Marginally Good
RM 122.05[W] (27.3)-2015	PARTIAL	37[ns]	7.3*	46	63.5 (Excellent)	Marginally Good/Marginally Good
RM 120.10[W] (32.3)-2015	PARTIAL	41	7.3*	46	81.8 (Excellent)	Marginally Good/Marginally Good

Ecoregion Biocriteria: Interior Plateau (IP)	
Index – Site Type	WWH
IBI: Wading	40
MIwb: Wading	8.1
ICI	30

d Narrative evaluation used in lieu of ICI when score not available (G-Good).

W Wading electrofishing site.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 38 — Tuscarawas River sampling locations, 2015.

River Mile	Latitude	Longitude	Sampling Location
123.10	40.9942	-81.4456	Tuscarawas R. near Uniontown @ Pressler Rd.
122.05	40.9946	-81.4591	Tuscarawas R. upst. Massillon Rd. free flowing
120.10	41.0090	-81.4790	Tuscarawas R. S of Akron, upst. Summit Co. Wastewater Treatment Plant

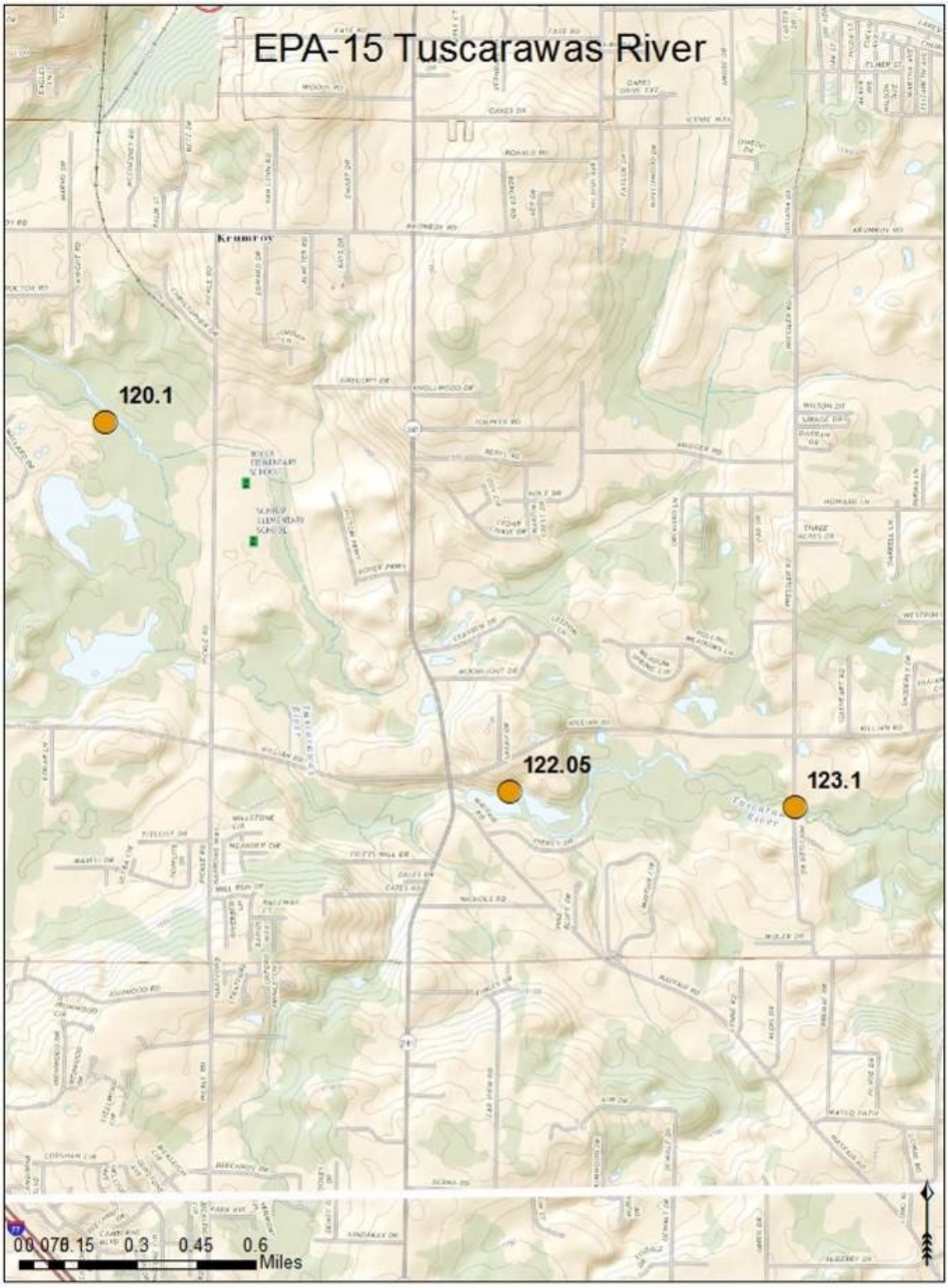

Figure 17 — Tuscarawas River sampling locations with river miles indicated, 2015 [15(h)EPA-15].

Reducing Nutrients and Sediment in Bull Creek

Pre-Project Baseline Monitoring

Project Number: 15(h)EPA-28
Stream Sampled: Bull Creek and Eckert Ditch

Summary

Completion of this project will reduce nonpoint source pollutant loadings to Bull Creek and Eckert Ditch. Nutrient and sediment reductions for the following practices were calculated as part of the watershed action plan in the table below:

Table 39 — Watershed action plan nutrient and sediment reduction goals, 2015.

Practice	P (lb/ac/yr)	N (lb/ac/yr)	Sediment (t/ac/yr)
Cover crop	0.85	1.69	0.42
Controlled drainage	0.34	0.86	0.38
Hay	0.65	1.3	0.33
Cons. Tillage	0.147	2.03	0.04

Specifically, the project will include:

- Planting of 1,200 acres of cover/manure crops.
- Development of 1,000 acres of nutrient management plans.
- Implementation of 500 acres of conservation tillage practices.
- Installation of 13 erosion and sediment control structures.
- Implementation of 250 acres of grass/legume rotations.
- Installation of 34 tile control structures.

All three sample sites on Bull Creek fully met the designated Warmwater Habitat (WWH) aquatic life use in 2015 during the pre-project sampling (Table 40, Table 41, Figure 18). Both sample sites on Eckert Ditch also attained the recommended Warmwater Habitat (WWH) aquatic life use in 2015. QHEI scores reflected good to fair habitat quality in Bull Creek. Conversely, the habitat in Eckert Ditch was found to be in poor to very poor condition during the pre-project monitoring.

Table 40 — Aquatic Life Use Attainment – Bull Creek and Tributary (Eckert Ditch) to Bull Creek (RM 0.17) 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Huron-Erie Lake Plains (HELP) ecoregion. In the Ohio Water Quality Standards, Bull Creek is Warmwater Habitat (WWH) and Eckert Ditch is undesignated.

River Mile (drainage mi²)	Attainment Status[c]	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Bull Creek – WWH						
RM 8.45[H] (8.3)-2015	FULL	36	-	G	60.5 (Good)	Marginally Good/Good
RM 3.90[H] (19.0)-2015	FULL	46	-	G	44.0 (Fair)	Very Good/Good
RM 0.64[W] (29.8)-2015	FULL	33	8.6	50	49.8 (Fair)	Fair/Exceptional
Tributary (Eckert Ditch) to Bull Creek (RM 0.17) – Recommended WWH						
RM 5.05[H] (4.1)-2015	FULL	38	-	MG[ns]	31.0 (Poor)	Marginally Good/Marginally Good
RM 0.65[H] (8.8)-2015	FULL	38	-	G	25.3 (Very Poor)	Marginally Good/Good

Ecoregion Biocriteria: Huron-Erie Lake Plains (HELP)	
Index – Site Type	WWH
IBI: Headwater/Wading	28/32
MIwb: Wading	7.9
ICI	34

c WWH biocriteria is applied to undesignated sites.

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

d Narrative evaluation used in lieu of ICI when score not available (G-Good).

H Headwater electrofishing site.

- No sample taken.

W Wading electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 41 — Bull Creek and Eckert Ditch sampling locations, 2015.

River Mile	Latitude	Longitude	Sampling Location
8.45	41.1898	-83.5934	Bull Creek NE of Bairdstown @ Eagleville Rd.
3.90	41.2542	-83.6119	Bull Creek @ Jerry City Rd.
0.64	41.3111	-83.5858	Bull Creek near mouth @ Greensburg Pike
5.05	41.2395	-83.5806	Trib (Eckert Ditch) to Bull Creek (Rm 0.17) @ Cygnet Rd.
0.65	41.2965	-83.5826	Trib (Eckert Ditch) to Bull Creek (Rm 0.17) @ Mermill Rd.

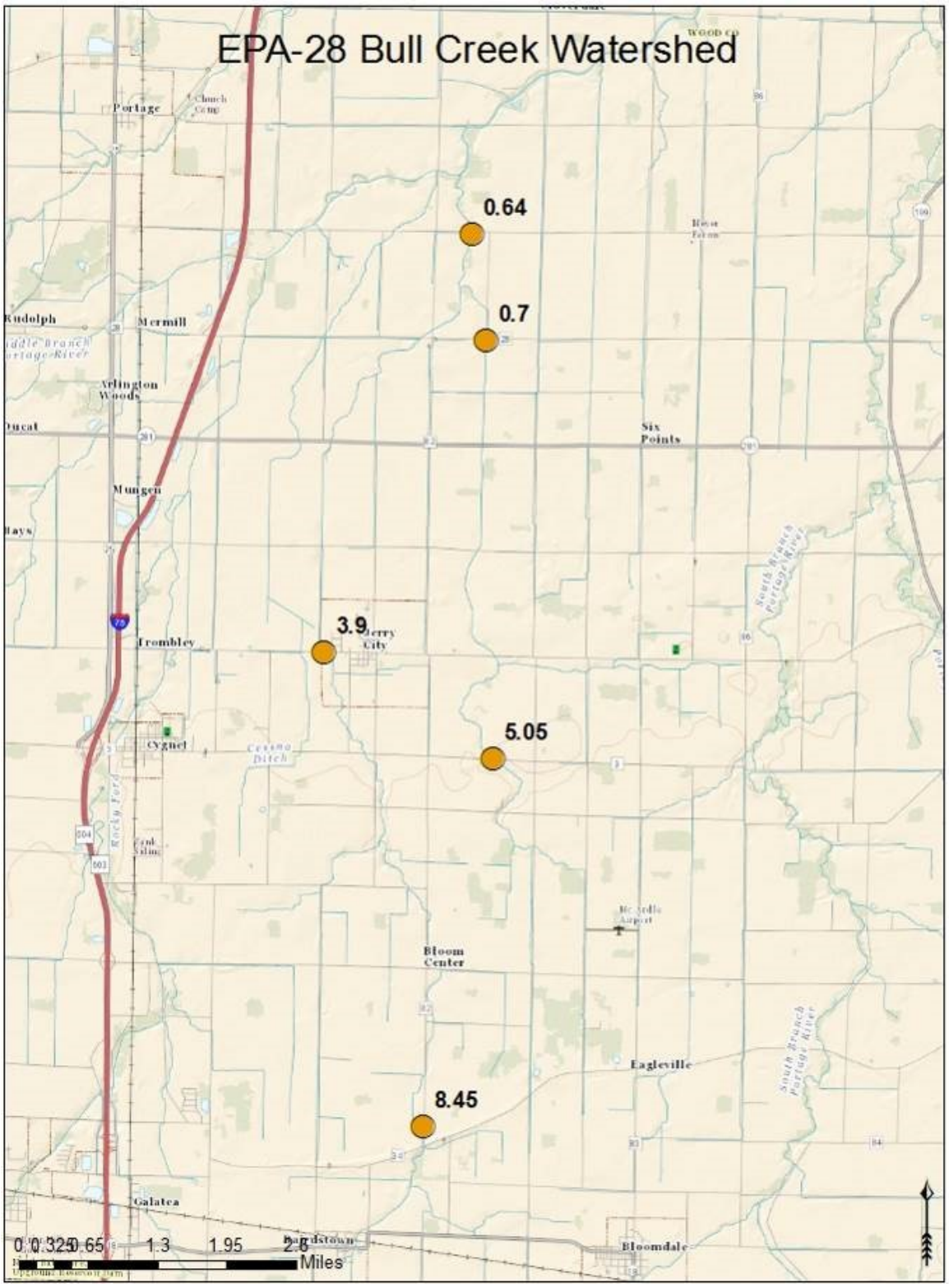

Figure 18 — Bull Creek watershed sampling locations with river miles indicated, 2015 [15(h)EPA-28].

Marysville Town Run Restoration Project

Post-Project Monitoring

Project Number: 09(h)EPA-13
Stream Sampled: Town Run

Summary

Completion of this project would have resulted in the restoration of 340 linear feet of Town Run. The stream has been channelized and straightened and its banks were hardened with patches of concrete, asphalt, discarded concrete, bricks and rubble. There is no in-stream or riparian habitat of value. Natural channel design techniques were employed to attempt a restoration goal of a QHEI of at least 60, which is the minimum needed to attain Warmwater Habitat (WWH) biocriteria. The 2009 QHEI score in the project area was 50 and Town Run did not meet its designated WWH aquatic life use.

The restoration was limited by city streets and parking lots on all sides of the restoration site. While the discarded concrete rubble was cleaned up and the banks were planted and reshaped, attempts to create a more natural habitat were largely unsuccessful and the QHEI score actually decreased to 39.8. Town Run is not connected to a floodplain and is characterized by steeply leveed banks surrounded by impervious surfaces (Figure 19). Town Run is shallower with no pools and remains unshaded after restoration. These factors have increased photosynthesis and exacerbated the nutrient problem detailed in the Mill Creek technical support document.

Illicit sewage discharges were discovered during the pre-project monitoring. These pollution issues have been addressed by the City of Marysville as part of this restoration project. The improved water quality conditions were reflected in the post-project monitoring fish IBI scores (Table 42, Table 43, Figure 20). The fish community score in the project area went from poor quality to full attainment of the WWH aquatic life use. Conversely, macroinvertebrate community health narratives were unchanged. This was most likely due to the highly eutrophic conditions encountered during the 2009 sampling which were still present in the 2015 sampling with algae covering the substrates.

Figure 19 — Town Run between 4th and 5th Streets in Marysville (RM 0.2), post-restoration sampling 2015.

Table 42 — Aquatic Life Use Attainment – Town Run 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Town Run is Warmwater Habitat (WWH).

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Town Run – WWH						
RM 0.75[H] (1.3)-2015	NON	32*	-	P*	60.0 (Good)	Fair/Poor
RM 0.75[H] (1.3)-2009	NON	22*	-	P*	44.0 (Fair)	Poor/Poor
RM 0.21[H] (1.7)-2015	NON	40	-	VP*	39.8 (Poor)	Good/Very Poor
RM 0.21[H] (1.7)-2009	NON	20*	-	VP*	50.0 (Fair)	Poor/Very Poor

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	36

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

d Narrative evaluation used in lieu of ICI when score not available (P-Poor, VP-Very Poor).

H Headwater electrofishing site.

* 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.

\- No sample taken.

Table 43 — Town Run sampling locations, 2009 and 2015.

River Mile	Latitude	Longitude	Sampling Location
0.7	40.2297	-83.3647	Eljier Park/Walnut St., Marysville
0.2	40.2358	-83.3650	Between E. 4th and E. 5th streets, Marysville

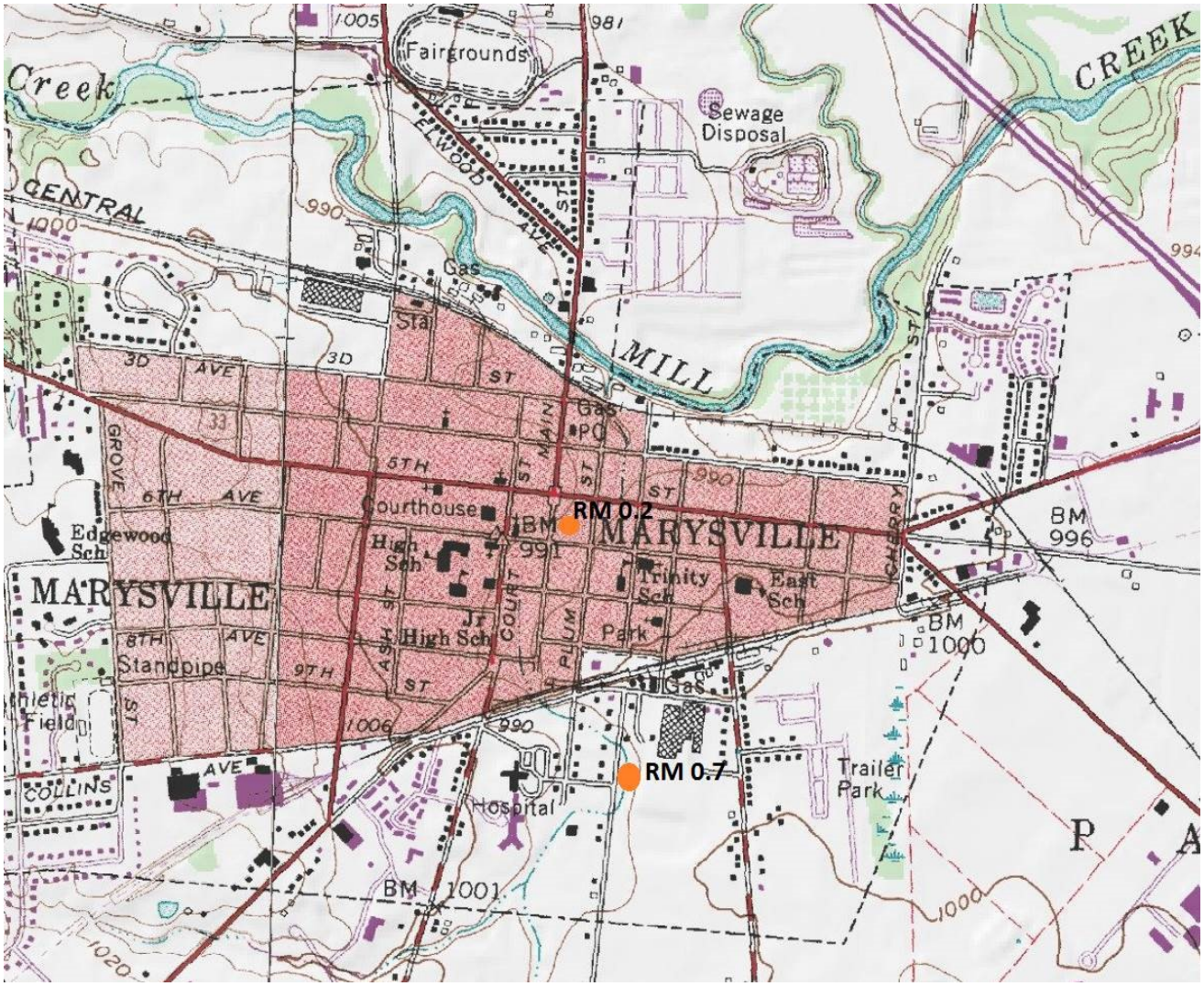

Figure 20 — Town Run sampling locations with river miles indicated, 2009 and 2015 [09(h)EPA-13].

West Creek Confluence Restoration

Post-Project Monitoring

Project Number: 10(h)EPA-18
Stream Sampled: West Creek

Summary

The project site was within areas that are addressed by the Lower Cuyahoga River TMDL and Remedial Action Plan. Implementation of this project was consistent with restoration and habitat recommendations in both documents and included:

- Restoration of 1,100 linear feet of the West Creek using natural channel design methods including log cribs, live branch layering, log weirs, live staking and others.
- Restoration of eight acres of riparian wetlands and two acres of vernal pools.
- Restoration of riparian forested areas using plantings of 7,000-10,000 native tree seedlings and shrubs.
- Restoration of two acres of wetlands and riparian forested areas using plantings with native hardwood tree species.

Trends for the pre- and post-monitoring upstream and downstream of the project area on West Creek (RM 1.85 and RM 0.19) showed little improvement with narratively fair bug evaluations (Table 44, Table 45, Figure 21). The fish community downstream of the project area showed the largest improvement but was within the nonsignificant range, increasing just four IBI points.

Table 44 — Aquatic Life Use Attainment – West Creek 2010 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, West Creek is Warmwater Habitat (WWH).

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
West Creek – WWH						
RM 1.85[H] (9.1)-2015	NON	-	-	F*	-	Fair
RM 1.85[H] (9.2)-2010	NON	32*	-	F*	65.5 (Good)	Fair/Fair
^RM 0.19[H] (13.2)-2015	NON	38[ns]	-	F*	57.0 (Good)	Marginally Good/Fair
RM 0.19[H] (13.2)-2010	NON	34*	-	F*	56.8 (Good)	Fair/Fair

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

d Narrative evaluation used in lieu of ICI when score not available (F-Fair).

H Headwater electrofishing site.

- No sample taken.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

^ Fish sample collected by Northeast Ohio Regional Sewer District (NEORSD) at RM 0.19 in 2015.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 45 — West Creek sampling locations, 2010 and 2015.

River Mile	Latitude	Longitude	Sampling Location
1.85	41.4148	-81.6652	West Creek near Brooklyn Heights @ Lancaster Rd.
0.19	41.4147	-81.6478	West Creek near Brooklyn Heights @ St. Rte. 17 (Granger Rd.)

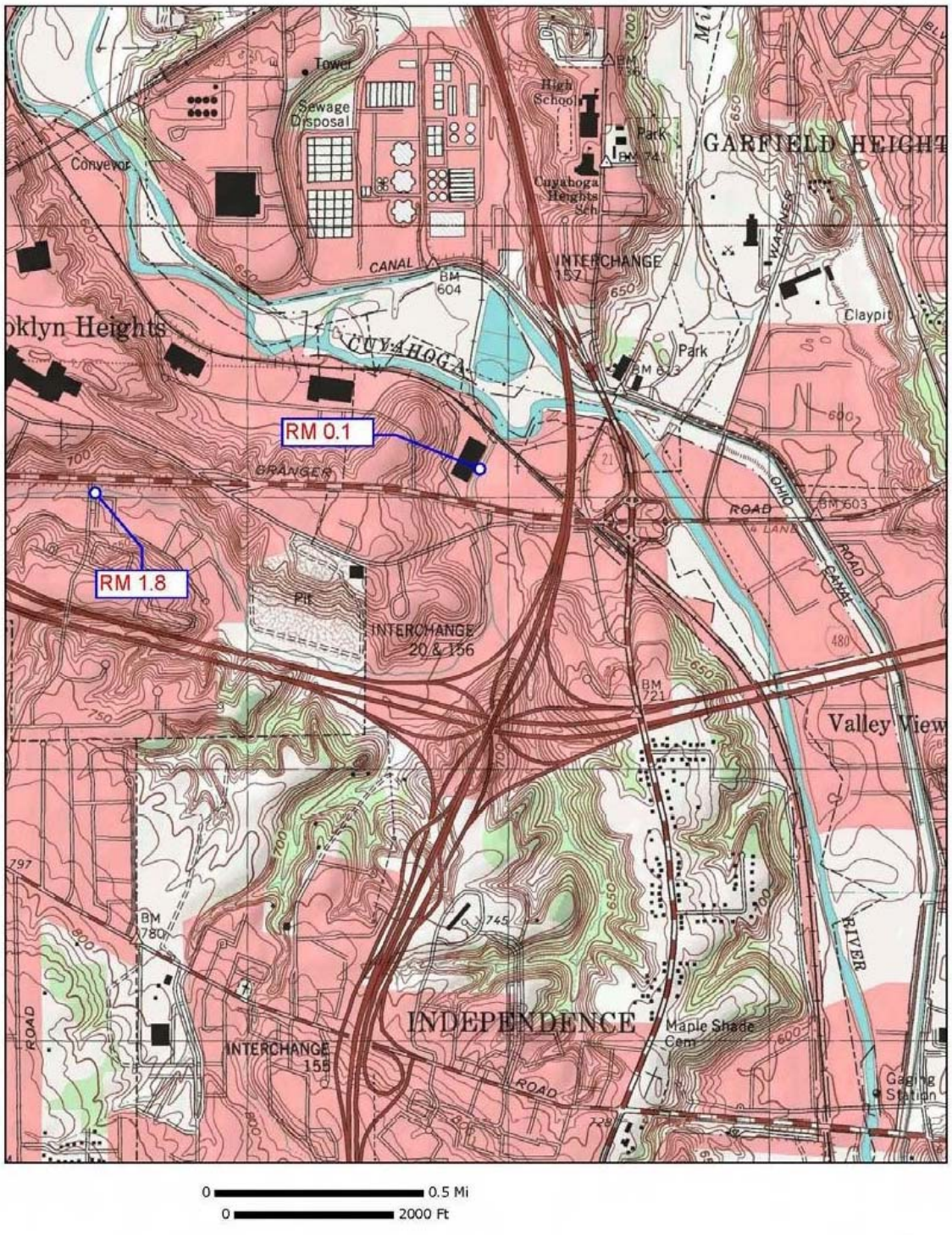

Figure 21 — West Creek sampling locations with river miles indicated, 2010 and 2015 [10(h)EPA-18].

Solomon Run Dam Removal and Stream Restoration

Post-Project Monitoring

Project Number: 11(h)EPA-11
Stream Sampled: Solomon Run

Summary

Completion of this project helped with the removal of a lowhead dam and restoration of approximately 2,400 linear feet of Solomon Run. Restoration activities included the removal and beneficial use of accumulated sediments from the former dam pool, natural channel design and bio-engineering methods for restoring the stream channel and surrounding streambanks, and the installation of two in-stream habitat structures.

Specifically, the project included:

- Removal of one lowhead dam structure.
- Removal and beneficial use land application of 17,000 cubic yards of sediment and debris removed from dam pool.
- Restoration of 2,400 lineal feet of stream channel (using natural channel design).
- Restoration of 2,400 lineal feet of streambank using re-grading, re-contouring and bio-engineering.
- Installation of two in-stream habitat structures.
- Planting 10 acres of native grasses in riparian area.
- Planting five acres of trees, shrubs and/or live stakes in riparian area.
- Acquisition of 40 acres of conservation easements.
- Reduction of NPS pollutant impacts in the East Fork Little Miami watershed through removal of the historic lowhead dam and restoration of Solomon Run. Accumulated sediment was removed, the former dam pool eliminated resulting in an increase in IBI, ICI and QHEI scores.
- Public outreach included website links, signage, display, press releases, public meetings, tours, newsletters and project signage.

Trends for the pre- and post-monitoring upstream and downstream of the project area on Solomon Run (RMs 4.08, 3.30, and 2.90) showed little improvement (Table 46, Table 47, Figure 22). While the fish community showed no improvement, macroinvertebrate community results narratively improved at the up and downstream monitoring locations. Attainment status at the downstream site (RM 2.90) went from partial to non-attainment during the 2015 post-project monitoring due to a decrease in the IBI score.

Table 46 — Aquatic Life Use Attainment – Solomon Run 2011 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, Solomon Run is Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Solomon Run – WWH						
RM 4.08^H (3.7)-2015	NON	26*	-	MG^{ns}	49.5 (Fair)	Poor/Marginally Good
RM 4.08^H (3.7)-2011	NON	26*	-	LF*	46.8 (Fair)	Poor/Low Fair
RM 3.30^H (4.1)-2015	PARTIAL	30*	-	MG^{ns}	52.5 (Fair)	Fair/Fair
RM 3.30^H (4.1)-2011	-	-	-	-	-	
RM 2.90^H (5.0)-2015	NON	28*	-	F*	66.5 (Good)	Fair/Fair
RM 2.90^H (5.0)-2011	PARTIAL	36^{ns}	-	LF*	65.0 (Good)	Marginally Good/Low Fair

Ecoregion Biocriteria: Interior Plateau (IP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	30

b MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI when score not available (MG-Marginally Good, LF-Low Fair).

H Headwater electrofishing site.

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

- No sample taken.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 47 — Solomon Run sampling locations, 2011 and 2015.

River Mile	Latitude	Longitude	Sampling Location
4.08	39.2136	-83.8792	Solomon Run upst. St. Martin @ Brown County Inn Rd.
3.30	39.2100	-83.8900	Solomon Run @ Old St. Martin Reservoir (free-flowing)
2.90	39.2061	-83.8944	Solomon Run S of St. Martin @ St. Rte. 251

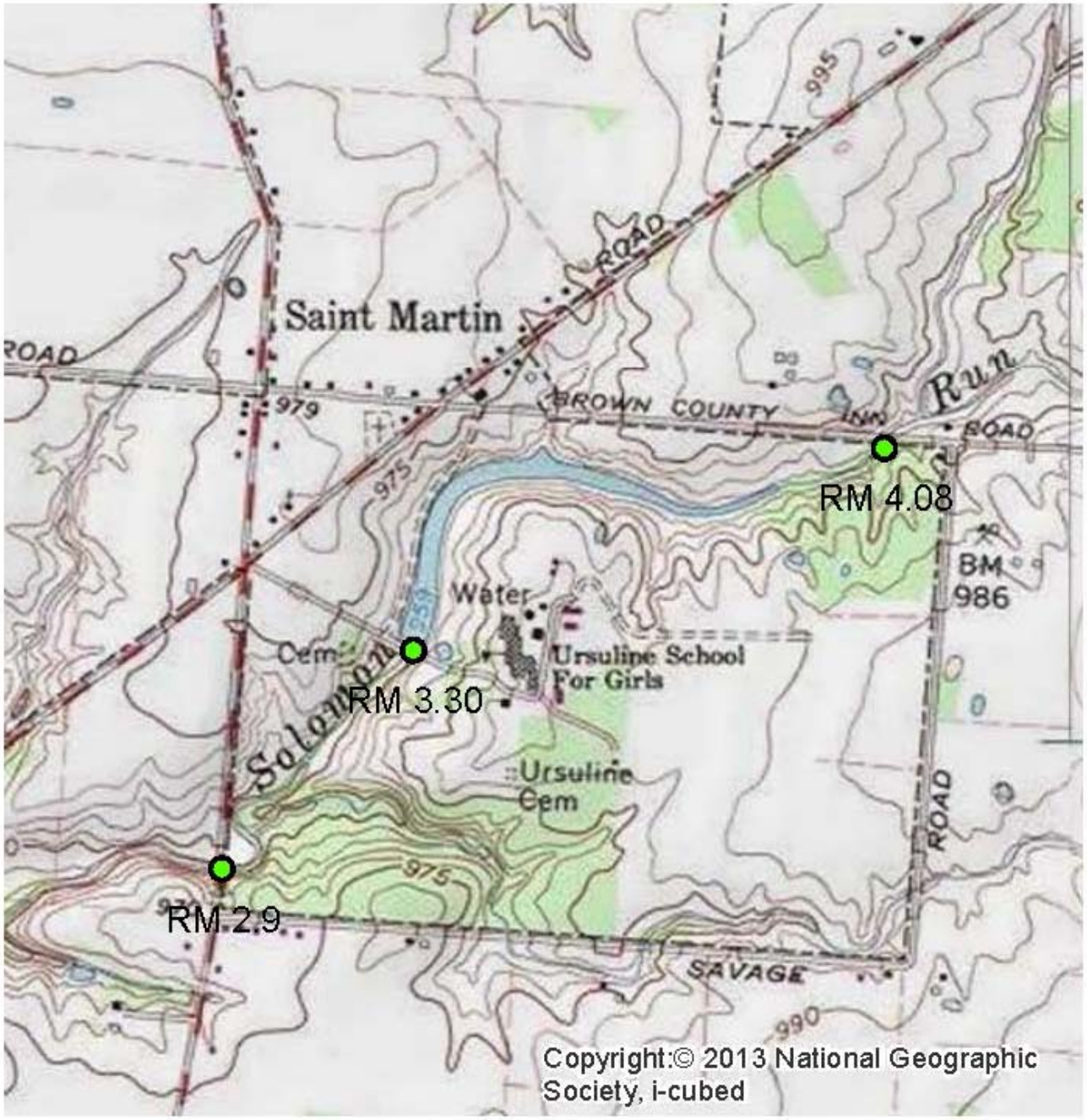

Figure 22 — Solomon Run sampling locations with river miles indicated, 2011 and 2015 [11(h)EPA-11].

Chippewa Creek-Chippewa Lake Upper Watershed Restoration Phase 2

Post-Project Monitoring

Project Number: 11(h)EPA-31
Stream Sampled: Chippewa Creek

Summary

Completion of this project assisted Medina County Park District in eliminating 600 feet of channelized farm ditch and restoring it with 3,400 lineal feet of two-stage channel and functional floodplain. The restored tributary was directed into existing riparian wetlands adjacent to the Chippewa Inlet tributary.

The project was supported with project-specific education and outreach activities including the preparation and distribution of press releases, a project-specific fact sheet, public meetings and project signage. Project monitoring will occur initially to verify baseline conditions and then be completed on an annual basis for a period of five years to verify successful growth and evolution of the natural system and processes.

Specifically, the project included:

- Restoration of approximately 600 linear feet of maintained agricultural ditch by conversion to 3,400 linear feet of two-stage channel and redirecting flow through 20 acres of existing riparian wetlands.
- Restoration of 2,000 linear feet of floodplain including planting of native grasses, forbs, shrubs, and trees on 10 acres of riparian areas.
- Installation of two sediment and erosion-control structures.
- Installation of 15 in-stream habitat structures.
- Installation of two grade structures.
- Removal of 20 acres of invasive plant species.
- Restoration of natural flow and assimilative capacity to this historically-channelized system; by redirecting all flow from this tributary through a series of existing wetlands.

Trends for the pre- and post-monitoring upstream and downstream of the project area on Chippewa Creek (RMs 23.32 and 21.70) showed significant improvement (Table 48, Table 49, Figure 23). The upstream site went from non-attainment to full-attainment of the designated WWH aquatic life use. Macroinvertebrate communities at the downstream site narratively improved from poor to low fair.

Table 48 — Aquatic Life Use Attainment – Chippewa Creek 2011 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, Chippewa Creek is Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Chippewa Creek – WWH						
RM 23.32[H] (9.3)-2015	FULL	40	-	VG	40.8 (Poor)	Good/Very Good
RM 23.32[H] (9.3)-2011	NON	36[ns]	-	P*	44.0 (Fair)	Marginally Good/Poor
RM 21.70[H] (14.6)-2015	-	-	-	LF*	-	Low Fair
RM 21.70[H] (14.6)-2011	NON	36[ns]	-	P*	46.0 (Fair)	Marginally Good/Poor

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	34

b MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI when score not available (P-Poor, VG-Very Good, and LF-Low Fair).

H Headwater electrofishing site.

- No sample taken.

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

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 49 — Chippewa Creek sampling locations, 2011 and 2015.

River Mile	Latitude	Longitude	Sampling Location
23.32	41.0990	-81.9200	Chippewa Creek upst. Chippewa Lake @ St. Rte. 162
21.70	41.0766	-81.9124	Chippewa Creek just upst. Chippewa Lake @ Chippewa Rd.

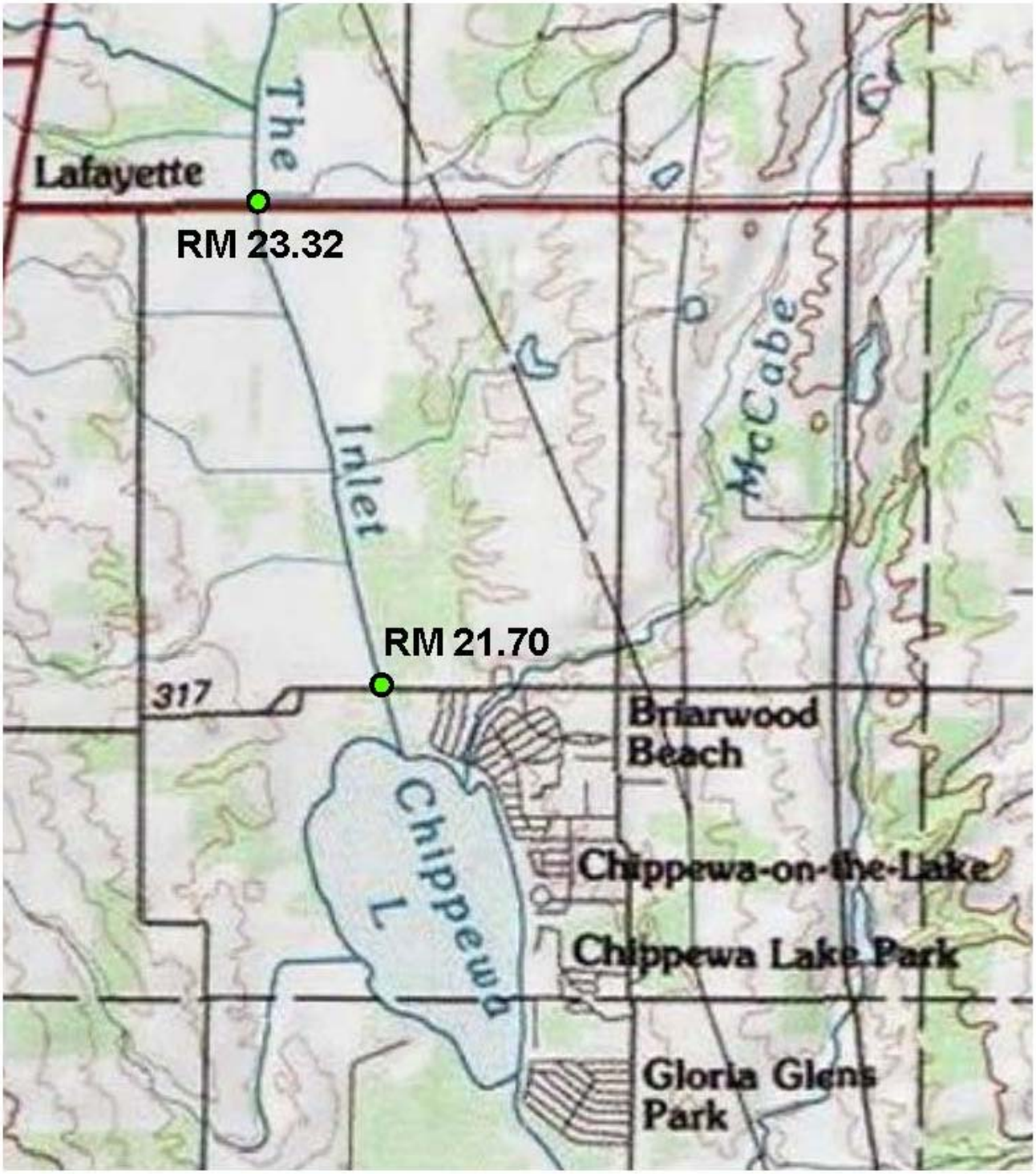

Figure 23 — Chippewa Creek sampling locations with river miles indicated, 2011 and 2015 [11(h)EPA-31].

Lower Olentangy River 5th Ave. Dam Removal and Stream Restoration

Post-Project Monitoring

Project Number: 11(h)EPA-18
Stream Sampled: Olentangy River

Summary

Completion of this project assisted the City of Columbus with stream restoration efforts following the removal of the 5th Avenue Dam on the Olentangy River. Removal of the 5th Avenue Dam has been recommended numerous times in a variety of documents and reports. The impounded area behind this dam is noted in the Olentangy River watershed TMDL as one of the most biologically impaired segments of the lower Olentangy River.

This project facilitated riparian restoration and installation of in-stream habitat and grade structures designed to stabilize the streambanks and stream channel and to prevent headcutting following dam removal. The project was supported with extensive outreach and public involvement due to the high-profile nature of the structure and project location. This project is an extension of the project planning and design work that was completed under provisions of project number 06(h)EPA-27.

Specifically, the project included:

- Removal of one dam.
- In-stream channel and riparian area restoration of 8,395 linear feet of riparian areas including plantings and grading as needed. In-stream restoration included the installation of grade structures and habitat features as needed to eliminate headcutting and other instability that may occur.
- Disposal of 6,350 cubic yards of dam debris.
- Reduction in NPS-related impairment in the Lower Olentangy River by restoring approximately two miles of the Olentangy River to an unimpeded natural state.
- Public outreach — video, website link, signage, fact sheet, tours, newsletters, a survey and project signage.

Trends for the pre- and post-monitoring upstream, within and downstream of the project area on the Olentangy River (RMs 3.93, 2.20 and 0.65) showed significant improvements within the project area (Table 50, Table 51, Figure 24). The aquatic community improved from non-attainment of the designated Modified Warmwater Habitat (MWH) criteria to fully meeting the recommended Exceptional Warmwater Habitat (EWH) criteria.

Table 50 — Aquatic Life Use Attainment – Olentangy River 2011 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Olentangy River is Warmwater Habitat (WWH) at RMs 3.93 and 0.65. The previously impounded section at RM 2.20 was listed as Modified Warmwater Habitat (MWH) and is now recommended Exceptional Warmwater Habitat (EWH) from this point downstream to the mouth.

River Mile (drainage mi²)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Olentangy River – WWH						
RM 3.93[B] (535.0)-2015	FULL	51	11.1	E	79.8 (Excellent)	Exceptional/Exceptional/Fair
RM 3.93[B] (535.0)-2011	FULL	54	9.7	E	77.0 (Excellent)	Exceptional/Exceptional/Fair
Olentangy River – Recommended WWH						
RM 2.20[W] (540.0)-2015	FULL	48	9.4	50	66.5 (Good)	Very Good/Exceptional/Exceptional
RM 2.20[B] (540.0)-2011	NON	42	7.7*	10*	47.0 (Fair)	Good/Fair/Poor
Olentangy River – WWH						
RM 0.65[B] (543.0)-2015	FULL	47	10.4	46	84.0 (Excellent)	Very Good/Exceptional/Exceptional
RM 0.65[B] (543.0)-2011	FULL	50	10.1	48	82.5 (Excellent)	Exceptional/Exceptional/Exceptional

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)	
Index – Site Type	WWH
IBI: Wading/Boat	40/42
MIwb: Wading/Boat	8.3/8.5
ICI	36

d Narrative evaluation used in lieu of ICI (E-Exceptional).

B Boat electrofishing site.

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

W Wading electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 51 — Olentangy River sampling locations, 2011 and 2015.

River Mile	Latitude	Longitude	Sampling Location
3.93	40.0161	-83.0162	Columbus, Olentangy R. @ Dodridge St.
2.20	39.9915	-83.0243	Columbus, Olentangy R. @ King Ave. (free-flowing)
0.65	39.9720	-83.0207	Columbus, Olentangy R. @ railroad dst. Goodale St.

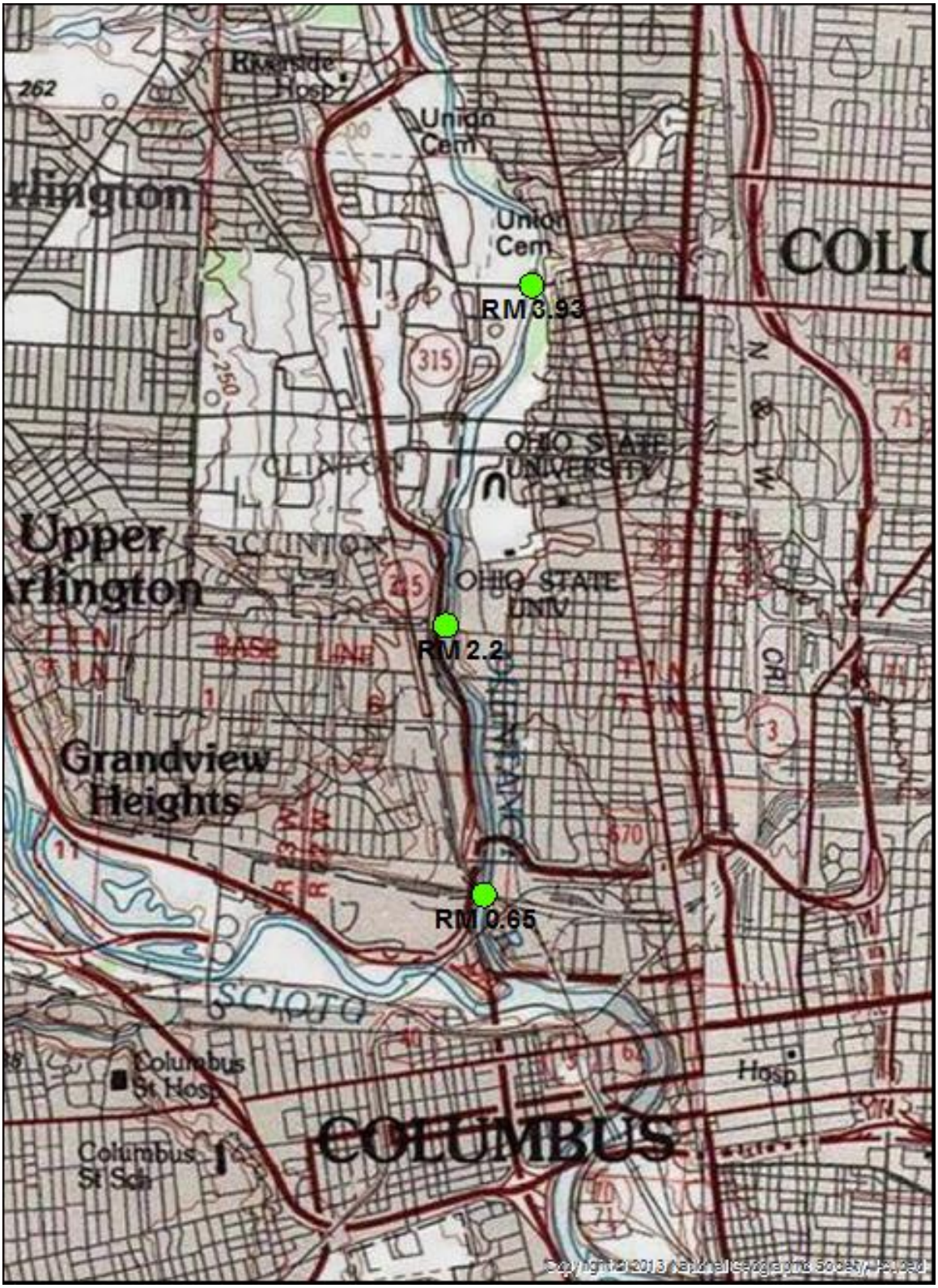

Figure 24 — Olentangy River sampling locations with river miles indicated, 2011 and 2015 [11(h)EPA-18].

Blacklick Creek Stream Restoration

Post-Project Monitoring

Project Number: 12(h)EPA-28
Stream Sampled: Blacklick Creek

Summary

Completion of this project stabilized severely eroding banks and implemented significant in-stream habitat improvements along the main-stem of Blacklick Creek between U.S. Route 33 and Winchester Pike. This project restored natural flow to the permanent channel of Blacklick Creek that was impacted due to a breach between Blacklick Creek and an adjacent storm water detention basin. 895 linear feet of stream channel was restored through a combination of natural channel design techniques, including in-stream habitat and grade control features and riparian plantings. Additionally, the 23.76-acre area is inside designated parkland that contains the Blacklick Greenway Trail and will be permanently protected by a conservation easement. The project reduced the loads of nitrogen by 229 pounds/year, phosphorus by 114 pounds/year and sediments by 114 tons/year.

Specifically, the project included:

- Restoration of 895 linear feet of stream channel and 4,850 linear feet of natural flow.
- Installation of four in-stream erosion and sediment control structures.
- Installation of four in-stream habitat structures and four grade structures.
- Planting of 475 container shrubs and trees and 6,900 bare root shrubs and trees.
- Planting of 3.8 acres of trees, shrubs and native grasses in riparian area.
- Acquisition of 22 acres of conservation easement.

Trends for the pre- and post-monitoring in Blacklick Creek (RMs 4.80, 4.35 and 2.40) showed significant improvements in the macroinvertebrate community at river miles 4.35 and 2.40 (Table 52, Table 53, Figure 25). Warmwater Habitat (WWH) aquatic life use attainment improved from partial to full attainment at these sites while the upstream site (RM 4.8) remained in partial attainment due to consistently low ICI scores.

Table 52 — Aquatic Life Use Attainment – Blacklick Creek 2011 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is located in the Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Blacklick Creek is Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Blacklick Creek – WWH						
RM 4.80[W] (57.0)-2015	PARTIAL	48	9.3	26*	79.0 (Excellent)	Very Good/Very Good/Fair
RM 4.80[W] (57.0)-2012	PARTIAL	49	9.1	26*	71.8 (Good)	Very Good/Very Good/Fair
RM 4.35[W] (57.0)-2015	FULL	42	8.5	44	72.5 (Good)	Good/Good/Very Good
RM 4.35[W] (57.0)-2012	PARTIAL	40	8.7	26*	78.8 (Excellent)	Good/Good/Fair
RM 2.40[W] (58.7)-2015	FULL	42	7.8[ns]	46	64.3 (Good)	Good/Marginally Good/Exceptional
RM 2.40[W] (58.7)-2012	PARTIAL	48	9.8	26*	80.5 (Excellent)	Very Good/Exceptional/Fair

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)	
Index – Site Type	WWH
IBI: Wading	40
Miwb: Wading	8.3
ICI	36

d Narrative evaluation used in lieu of ICI (E-Exceptional).

W Wading electrofishing site.

* Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 Miwb units).

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 Miwb units).

Table 53 — Blacklick Creek sampling locations, 2012 and 2015.

River Mile	Latitude	Longitude	Sampling Location
4.80	39.8944	-82.8594	Blacklick Creek just dst. Blacklick Estates Wastewater Treatment Plant
4.35	39.8906	-82.8637	Blacklick Creek S of Whitehall @ Winchester Pike
2.40	39.8732	-82.8782	Blacklick Creek @ Groveport, behind Ohio EPA building

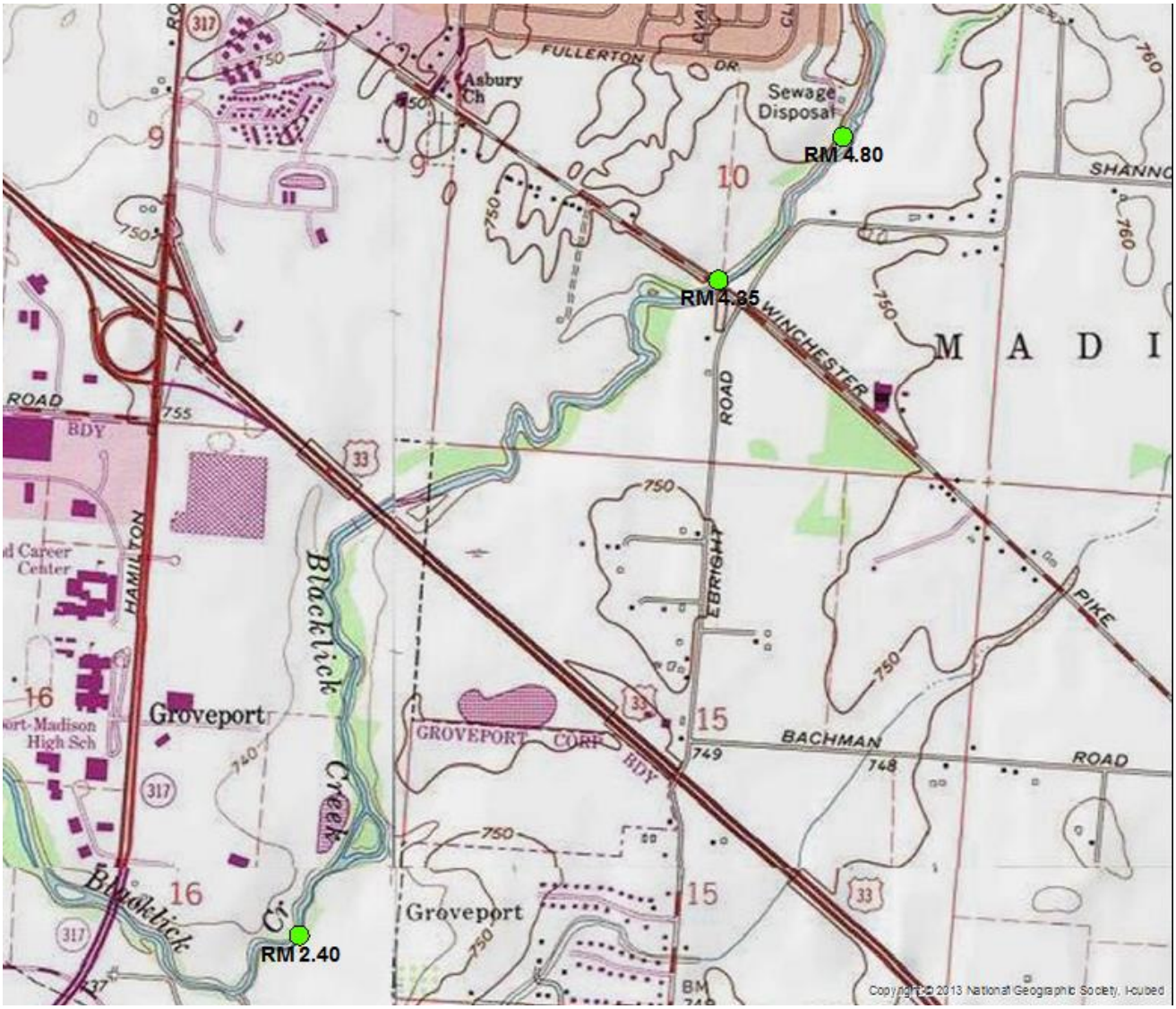

Figure 25 — Blacklick Creek sampling locations with river miles indicated, 2012 and 2015 [12(h)EPA-28].

Sycamore Creek at Shawnee Crossing Bank Stabilization

Post-Project Monitoring

Project Number: 10(h)EPA-21
Stream Sampled: Sycamore Creek

Summary

Completion of this project stabilized and restored severely eroding stream bank in Sycamore Creek and reduced sediment. The project regraded and stabilized eroding banks on Sycamore Creek in the Walnut Creek Watershed and included stabilization and restoration of 480 linear feet of severely eroded stream bank along Sycamore Creek. Riparian restoration and stream bank stabilization employed rip-rap toe reinforcement with regrading, recontouring and bioengineering methods such as root wads, live stakes and/or filter socks with live plantings above the toe. Grading was completed to reconnect the creek to its floodplain. Removal of one acre of invasive plants was incidental with this work and the city reintroduced native riparian vegetation and maintained established trees to the best extent possible. This project was generally consistent with findings and recommendations within the Walnut Creek TMDL study completed by Ohio EPA and approved by U.S. EPA in 2004.

Specifically, the project included:

- Restoration and stabilization of approximately 480 linear feet of floodplain using bio-engineering, regrading and/or recontouring of stream bank.
- Planting of trees, shrubs and/or live stakes in approximately one acre of riparian area and removal/treatment of invasive species.

Fish and macroinvertebrate index scores remained similar between sampling years in Sycamore Creek (RMs 7.05, 6.64 and 5.90). Very good to exceptional fish communities and marginally good to good macroinvertebrate communities in Sycamore Creek characterized the aquatic community which fully met the designated Warmwater Habitat (WWH) aquatic life use (Table 54, Table 55, Figure 26).

Table 54 — Aquatic Life Use Attainment – Sycamore Creek 2012 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Sycamore Creek is Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Sycamore Creek – WWH						
RM 7.05^H (10.6)-2015	FULL	50	-	MG^{ns}	83.5 (Excellent)	Exceptional/Marginally Good
RM 7.05^H (10.6)-2010	FULL	56	-	G	71.8 (Good)	Exceptional/Good
RM 6.64^H (11.7)-2015	FULL	50	-	MG^{ns}	84.0 (Good)	Exceptional/Marginally Good
RM 6.64^H (11.7)-2010	FULL	52	-	G	80.3 (Excellent)	Exceptional/Good
RM 5.90^H (14.8)-2015	FULL	56	-	G	73.8 (Good)	Exceptional/Good
RM 5.90^H (14.8)-2010	FULL	48	-	G	72.8 (Excellent)	Very Good/Good

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	36

b MIwb is not applicable to headwater streams with drainage areas < 20 mi^2.

d Narrative evaluation used in lieu of ICI (G-Good, MG-Marginally Good).

H Headwater electrofishing site.

- No sample taken.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

Table 55 — Sycamore Creek sampling locations, 2012 and 2015.

River Mile	Latitude	Longitude	Sampling Location
7.05	39.8788	-82.7258	Sycamore Creek upst. Pickerington @ Driveway off St. Rte. 256
6.64	39.8792	-82.7331	Sycamore Creek @ St. Rte. 256
5.90	39.8796	-82.7428	Sycamore Creek @ Pickerington, dst. railroad, dst. St. Rte. 256

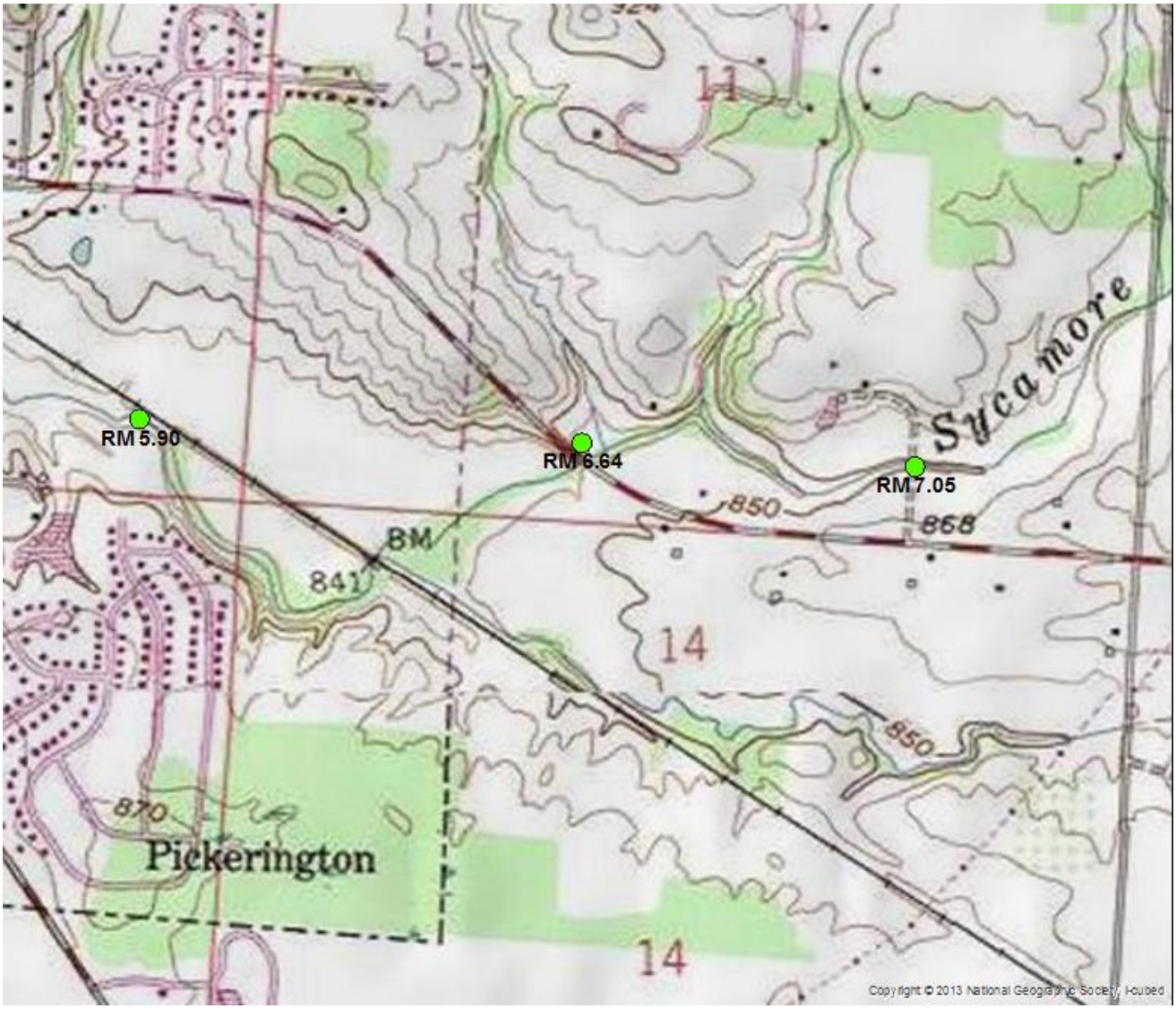

Figure 26 — Sycamore Creek sampling locations with river miles indicated, 2012 and 2015 [10(h)EPA-21].

Rose Run Stormwater and Riparian Enhancements

Post-Project Monitoring

Project Number: 12(h)EPA-27
Stream Sampled: Rose Run

Summary

Completion of this project reduced NPS pollutant loadings to Rose Run by stabilizing/providing sufficient streamside habitat via stream restoration and stabilization and riparian plantings; and by retrofitting the storm water drainage and detention pond into treatment wetlands. The City of New Albany made storm water improvements at New Albany High School and restored riparian enhancements along Rose Run (downstream of high school). At the high school, an existing storm water detention basin was retrofitted into a treatment wetland including varying water elevations and micro pools. The existing storm water conveyance ditch was retrofitted into a linear high marsh and functions as the initial treatment area prior to discharge to the larger wetland complex within the pond. This provided two discrete stages of storm water treatment prior to discharge into Rose Run. The project was integrated into New Albany's environmental science curriculum. Riparian enhancements on Rose Run included restoration and stabilization of 291 feet of Rose Run. Bank stabilization consisted of live branch plantings and coir rolls and matting to replace rip-rap which was in use on the existing meander. This project was implemented consistent with recommendations included in the Big Walnut Creek TMDL study approved by U.S. EPA in 2005.

Specifically, the project included:

- Construction of one acre of treatment wetland.
- Restoration and stabilization of 291 linear feet of stream bank.
- Installation of one sediment and erosion control structure.
- Removal of 3.5 acres of invasive plant species in riparian area.
- Planting of four acres of trees and shrubs and 0.5 acre of native grasses in riparian area.

Fish and macroinvertebrate community quality remained the same downstream of the project area at RM 0.47 (Table 56, Table 57, Figure 27). Post-project monitoring at the upstream sites showed improved biological communities in 2015, which went from non to partial attainment of the designated Warmwater Habitat (WWH) aquatic life use. Narrative habitat conditions in the project area improved from good to excellent quality.

Table 56 — Aquatic Life Use Attainment – Rose Run 2012 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Rose Run is Warmwater Habitat (WWH).

River Mile (drainage mi²)	Attainment Status	IBI	MIwb[b]	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
Rose Run – WWH						
RM 1.87[H] (1.7)-2015	PARTIAL	36[ns]	-	LF*	62.8 (Good)	Marginally Good/Low Fair
RM 1.87[H] (1.7)-2012	NON	34*	-	P*	60.5 (Good)	Fair/Poor
RM 1.60[H] (1.9)-2015	PARTIAL	42	-	F*	72.8 (Excellent)	Good/Fair
RM 1.60[H] (1.9)-2012	NON	32*	-	F*	63.3 (Good)	Fair/Fair
RM 0.47[H] (2.9)-2015	PARTIAL	42	-	F*	69.8 (Excellent)	Good/Fair
RM 0.47[H] (2.9)-2012	PARTIAL	42	-	F*	67.5 (Good)	Good/Fair

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	36

b MIwb is not applicable to headwater streams with drainage areas < 20 mi².

d Narrative evaluation used in lieu of ICI (P-Poor, LF-Low Fair, and F-Fair).

H Headwater electrofishing site.

ns Indicates nonsignificant departure from applicable biocriteria (<4 IBI or ICI units or <0.5 MIwb units).

- No Sample taken.

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

Table 57 — Rose Run sampling locations, 2012 and 2015.

River Mile	Latitude	Longitude	Sampling Location
1.87	40.0825	-82.8139	New Albany, Rose Run 0.2 mi. dst. U.S. Rte. 62
1.60	40.0814	-82.8216	New Albany, Rose Run @ Fodor Rd.
0.47	40.0727	-82.8317	Rose Run dst. New Albany @ Harlem Rd.

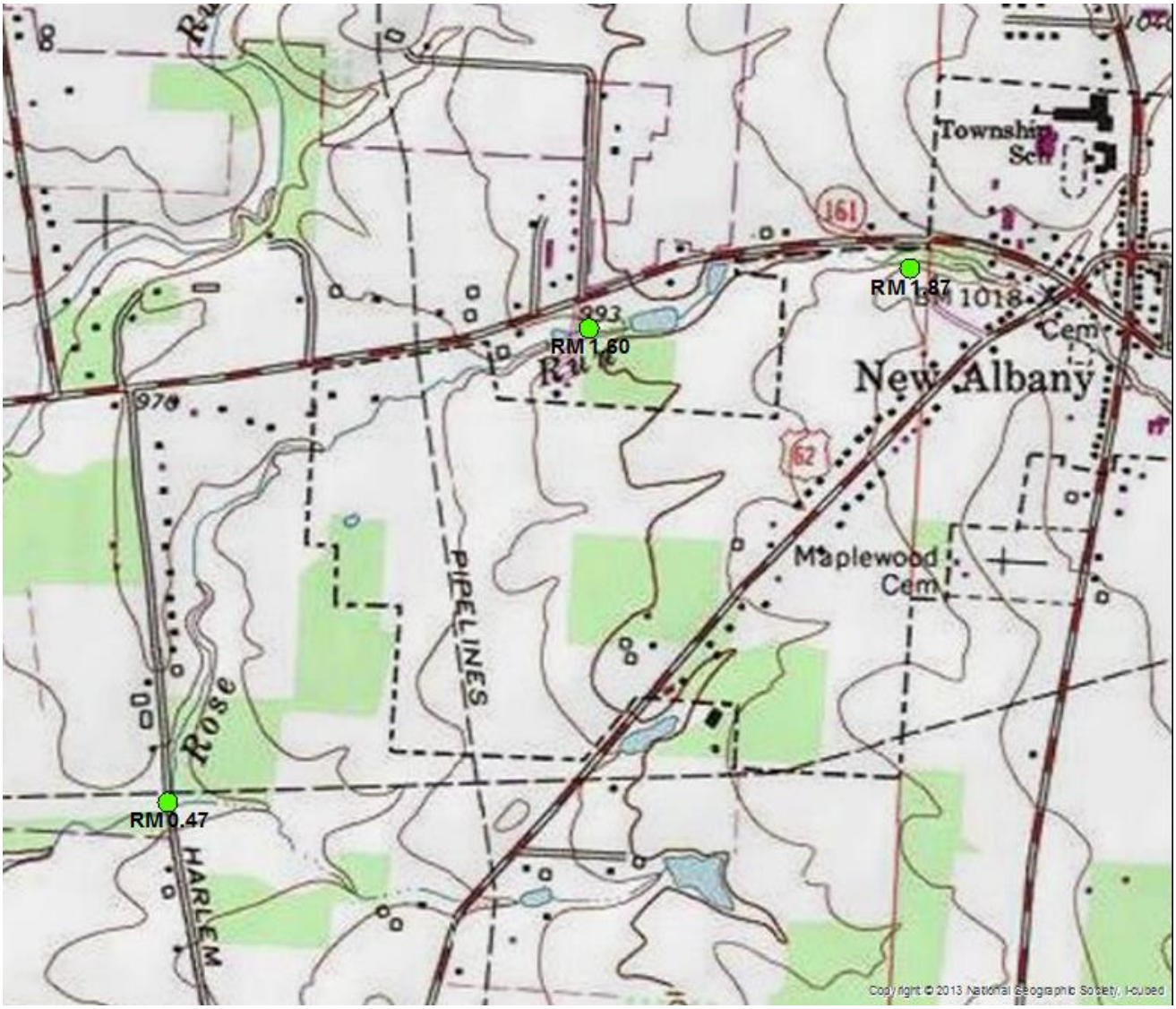

Figure 27 — Rose Run sampling locations with river miles indicated, 2012 and 2015 [12(h)EPA-27].

East Branch Chagrin River Stream Restoration

Post-Project Monitoring

Project Number: 12(h)EPA-36
Stream Sampled: East Branch Chagrin River

Summary

Completion of this project reduced NPS pollutant loadings to the East Branch of the Chagrin River by stabilizing/providing sufficient streamside via levee removal and riparian plantings; and restoring a channelized headwater tributary using natural channel principles along with reconnection with a forested floodplain. The East Branch was stabilized using bio-engineering principles such as dormant willow posting, root wads and branch layering, while the unnamed headwater tributary restoration included a meandering stream channel that has connectivity to an ecologically appropriate floodplain of appropriate width and elevation and riparian corridor plantings. This project was implemented consistent with recommendations in the state-endorsed Chagrin River watershed action plan.

Specifically, the project included:

- Removal of 385 linear feet of levee.
- Restoration and stabilization of 715 linear feet of stream bank by regrading and bio-engineering.
- Restoring natural flow to 330 linear feet of stream channel and adjacent floodplain.
- Restoring natural floodplain on three acres.

Fish and macroinvertebrate community quality remained relatively similar before and after the restoration project (Table 58, Table 59, Figure 28). QHEI scores within the project area also remained relatively steady between sampling years.

Table 58 — Aquatic Life Use Attainment – East Branch Chagrin River 2012 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, East Branch Chagrin River is Coldwater Habitat (CWH).

River Mile (drainage mi²)	Attainment Status	IBI	MIwb	ICI[d]	QHEI	Narrative Assessment Fish/Macroinvertebrates
East Branch Chagrin River – CWH						
RM 12.15[W] (22.4)-2015	FULL	41	8.4	54	76.0 (Excellent)	Good/Good/Exceptional
RM 12.15[W] (22.4)-2012	FULL	42	8.3	54	67.0 (Good)	Good/Good/Exceptional
RM 11.75[W] (23.5)-2015	FULL	42	8.4	56	85.0 (Excellent)	Good/Good/Exceptional
RM 11.75[W] (23.5)-2012	FULL	44	8.2	56	82.3 (Excellent)	Good/Good/Exceptional
RM 11.38[W] (24.2)-2015	FULL	42	8.0	E	70.0 (Good)	Good/Good/Exceptional
RM 11.38[W] (24.2)-2012	FULL	40	7.7	46	67.8 (Good)	Good/Marginally Good/Exceptional

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Headwater	40
ICI	36

d Narrative evaluation used in lieu of ICI (E-Exceptional).

W Wading electrofishing site.

Table 59 — East Branch Chagrin River sampling locations, 2012 and 2015.

River Mile	Latitude	Longitude	Sampling Location
12.15	41.5961	-81.2949	E. Br. Chagrin R. @ Kirtland Rd.
11.75	41.6009	-81.2909	E. Br. Chagrin R. adj. Wisner Rd. @ Riverwood Farm
11.38	41.6055	-81.2918	E. Br. Chagrin R. @ Wisner Rd.

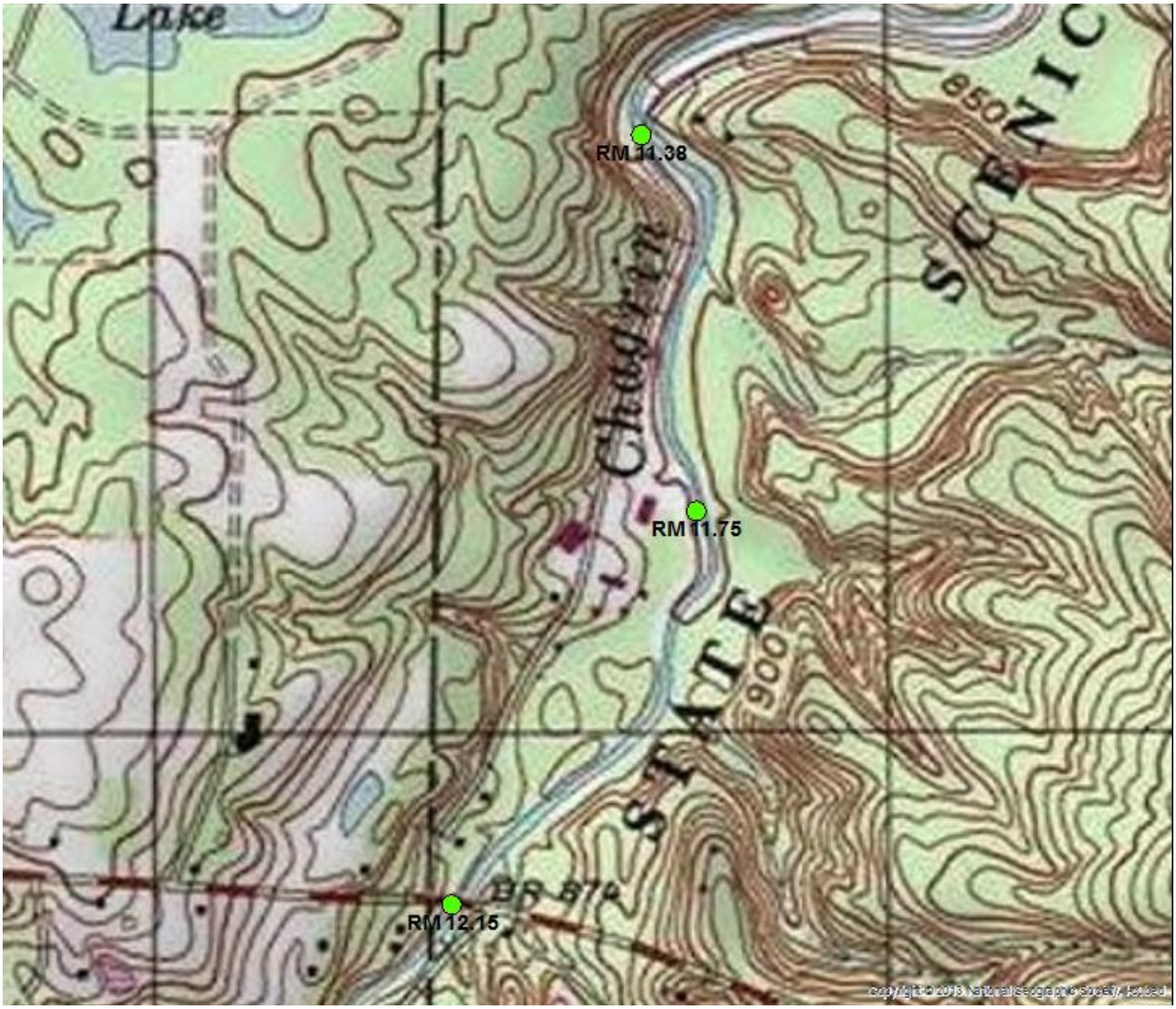

Figure 28 — East Branch Chagrin River sampling locations with river miles indicated, 2012 and 2015 [12(h)EPA-36].

Black River Restoration in Cascade Park

Post-Project Monitoring

Project Number: 12(h)EPA-19
Stream Sampled: Black River

Summary

Completion of this project reduced NPS pollutant loadings to the mainstem of the Black River. The City of Elyria stabilized and restored the stream bank to reduce erosion and its contribution to the sediment load and included the installation of in-stream structure(s) and flow control, stream bank stabilization and bio-engineering, and establishment/enhancement of vegetated riparian buffers. This project is consistent with findings and recommendations within the Black River TMDL study approved by U.S. EPA in 2008.

Specifically, the project included:

- Restoration of 1,300 linear feet of stream channel.
- Restoration and stabilization of 1,300 linear feet of stream bank using bio-engineering, recontouring and/or regarding.
- Removal/treatment of 1.6 acres of invasive species in riparian area.
- Planting of 1.6 acres of trees, shrubs and/or live stakes in riparian area.
- Acquisition of 1.6 acres of conservation easements

Stream habitat and fish community index scores remained relatively similar before and after the restoration project (Table 60, Table 61, Figure 29). The macroinvertebrate community health improved significantly from narratively good to excellent quality, increasing 14 ICI points in the post-restoration sampling.

Table 60 — Aquatic Life Use Attainment – Black River 2012 and 2015.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. The stream site is in the Erie-Ontario Lake Plains (EOLP) ecoregion. In the Ohio Water Quality Standards, the Black River is Warmwater Habitat (WWH).

River Mile (drainage mi^2)	Attainment Status	IBI	MIwb	ICI	QHEI	Narrative Assessment Fish/Macroinvertebrates
Black River – WWH						
RM 14.95[W] (396.0)-2015	FULL	45	9.7	50	82.3 (Excellent)	Good/Exceptional/Exceptional
RM 14.95[B] (396.0)-2012	FULL	45	9.4	36	83.0 (Excellent)	Very Good/Very Good/Good

Ecoregion Biocriteria: Erie-Ontario Lake Plains (EOLP)	
Index – Site Type	WWH
IBI: Wading/Boat	38/40
MIwb: Wading/Boat	7.9/8.7
ICI	34

W Wading electrofishing site.

B Boat electrofishing site.

Table 61 — Black River sampling locations, 2012 and 2015.

River Mile	Latitude	Longitude	Sampling Location
14.95	41.3793	-82.1077	Elyria, Black R. @ Cascade Park

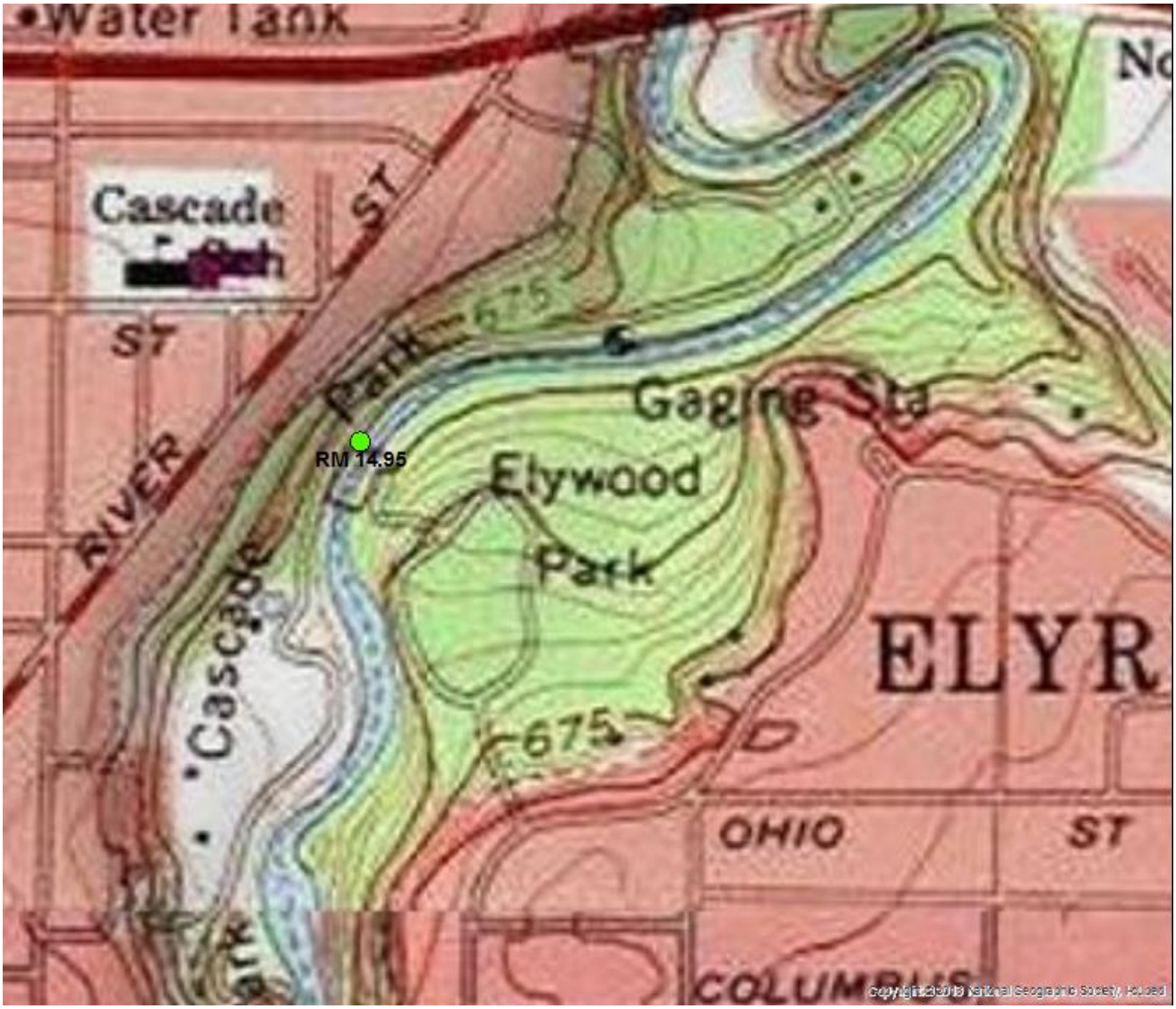

Figure 29 — Black River sampling locations with river miles indicated, 2012 and 2015 [12(h)EPA-19].

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