

NORTHEAST OHIO REGIONAL SEWER DISTRICT

2013 West Creek Environmental Monitoring



**Prepared by
Water Quality and Industrial Surveillance Division**

Introduction

During 2007 and 2008, the Northeast Ohio Regional Sewer District (NEORS) completed baseline assessments at sites on West Creek, a tributary to the Cuyahoga River. The baseline assessments were completed to determine the conditions of the creek prior to restoration activities that started in 2009. The goals of these restoration projects were to improve existing in-stream habitat, construct additional in-stream habitat, remove or alter existing permanent structures that are preventing fish migration, and re-stabilize eroding stream banks utilizing bioengineered technology and natural channel design techniques. In 2006, sampling was also conducted on West Creek, but only consisted of habitat and qualitative macroinvertebrate evaluations. The 2007 and 2008 sampling included electrofishing, benthic macroinvertebrate, water chemistry sampling, and habitat assessments.

In 2013, the Northeast Ohio Regional Sewer District (NEORS) conducted water chemistry sampling, habitat assessments, and fish and benthic macroinvertebrate community surveys on West Creek after the completion of the stream restoration project. Sampling was conducted by NEORS Level 3 Qualified Data Collectors certified by Ohio Environmental Protection Agency (EPA) in Fish Community and Benthic Macroinvertebrate Biology, and Chemical Water Quality and Stream Habitat Assessments as explained in the NEORS study plan *2013 West Creek Environmental Monitoring* approved by Ohio EPA on July 10, 2013.

Construction of the stream restoration project was completed at river miles (RM) 3.65, 2.10 and 1.60. Stream restoration at RM 3.65 consisted of limestone boulder bank protection, and 194 cubic yards of boulder cascade over the stream bed and bank to stabilize the natural stream structure and gradient. Restoration work at RM 2.10 consisted of approximately 45 cubic yards of limestone boulder along the south bank for bank stabilization and 641 cubic yards of boulder and concrete grout covered over the stream bed to stabilize the stream gradient. Work at RM 1.60 consisted of placing 2126 cubic yards of limestone boulder and cobble in the stream bed and bank for the construction of three cascades and pools and bank stabilization. Figure 1 is a map of the sampling locations on West Creek, and Table 1 indicates the sampling locations and includes river mile (RM), latitude/longitude, description and the types of surveys conducted.

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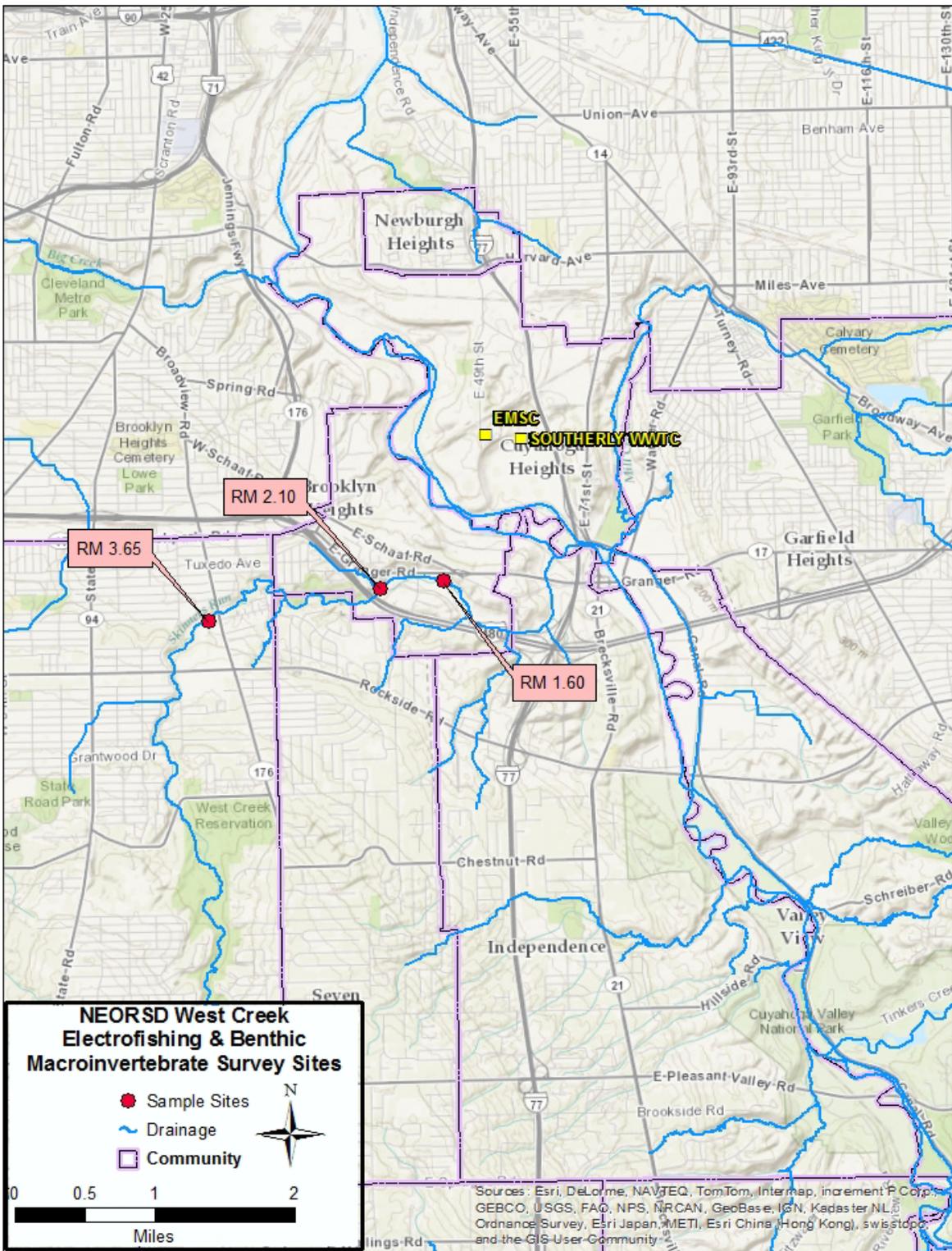


Figure 1. Sampling Locations

Table 1. Sample Locations					
Location	Latitude	Longitude	River Mile	Description	Purpose
Site #11	41.4122	-81.6754	3.65	Upstream of Broadview Road	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work
Site #9A	41.4134	-81.7606	2.10	Downstream from I-480	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work
Site #8	41.4144	-81.6619	1.60	Downstream from Lancaster Drive Bridge	Evaluate habitat, fish, & macroinvertebrates after completion of stream restoration work

Water Chemistry Sampling

Methods

In 2013, water quality samples were collected from West Creek RMs 3.65, 2.10, and 1.60. Samples were collected to determine water quality data post remediation restoration activities that were completed in 2012. Water chemistry and bacteriological sampling was conducted five times between July 23, 2013 and August 20, 2013, on West Creek for a total of fifteen samples. Techniques used for sampling and analyses followed the Ohio EPA *Surface Water Field Sampling Manual for water chemistry, bacteria and flows* (2013). Chemical water quality samples from each site were collected with a 4-liter disposable polyethylene cubitainer with a disposable polypropylene lid, three 473-mL plastic bottles and a 125-mL plastic bottle. The first 473-mL plastic bottle was field preserved with trace nitric acid, the second was field preserved with trace sulfuric acid and the third bottle received no preservative. The sample collected in the 125-mL plastic bottle (Dissolved Reactive Phosphorus) was filtered using a 0.45- μ m PVDF syringe filter. All water quality samples were collected as grab samples. Bacteriological samples were collected in sterilized plastic bottles preserved with sodium thiosulfate. At the time of sampling, measurements for dissolved oxygen, pH, temperature, and conductivity were collected using a YSI 600XL sonde. Duplicate samples and field blanks were each collected at randomly selected sites, at a frequency not less than 5% of the total samples collected. Relative percent difference (RPD) was used to determine the degree of discrepancy between the primary and duplicate sample (Formula 1).

$$\text{Formula 1: } \text{RPD} = \left(\frac{|X-Y|}{((X+Y)/2)} \right) * 100$$

X= is the concentration of the parameter in the primary sample

Y= is the concentration of the parameter in the duplicate sample

The acceptable percent RPD is based on the ratio of the sample concentration and detection limit (Formula 2) (Ohio EPA, 2013).

$$\text{Formula 2: } \text{Acceptable \% RPD} = [(0.9465X^{-0.344}) * 100] + 5$$

X = sample/detection limit ratio

Those RPDs that were higher than acceptable may indicate potential problems with sample collection and, as a result, the data was not used for comparison to the water quality standards.

Mercury analysis for all of the sampling events was done using EPA Method 245.1. Because the detection limit for this method is above the criteria for the Human Health Nondrinking and Protection of Wildlife Outside Mixing Zone Averages (OMZA), it generally cannot be determined if the West Creek was in attainment of those criteria. Instead, this type of mercury sampling was used as a screening tool to determine whether contamination was present above those levels typically found in the river.

Water chemistry analysis sheets for each site are available upon request from the NEORSD WQIS Division.

Results and Discussion

West Creek is designated Warmwater Habitat (WWH), agricultural water supply, industrial water supply, and Class B primary contact recreation. The Class B Primary Contact Recreational Use Criteria apply for *Escherichia coli* (*E. coli*). The water chemistry

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samples collected at each site were compared to the applicable Ohio Water Quality Standards for the designated uses to determine attainment (Ohio EPA, 2011).

A duplicate sample was collected on July 8, 2013, at RM 1.60 for Quality Assurance Quality Control (QA/QC) purposes. The sample showed ammonia being rejected due to a RPD greater than the acceptable level (Table 2).

Table 2. Rejected RPDs					
Date	Site	Parameter	Acceptable RPD (%)	Actual RPD (%)	Qualifier
7/30/2013	RM 1.60	<i>Ammonia</i>	63.8	127.3	Rejected

Paired parameters were also evaluated and compared and showed that total solids and total dissolved solids data needed to be qualified as estimated for samples collected at RM 1.65 on July 30 and August 13 (Table 3).

Table 3. Paired Parameter Analysis					
Date	Site	Parameters	Acceptable RPD (%)	Actual RPD (%)	Qualifier
7/30/2013	RM 1.60	<i>TS (Total Solids) TDS (Total Dissolved Solids)</i>	31.3	8.8	Estimated
8/13/2013	RM 1.60	<i>TS (Total Solids) TDS (Total Dissolved Solids)</i>	16.6	3.5	Estimated

On August 6, 2013, one field blank was collected for QA/QC purposes. A total of five water quality parameters were estimated, rejected or downgraded to Level 2 due to potential field blank contamination. It is unclear how the field blanks became contaminated and may be due to inappropriate sample collection, handling, contaminated blank water and/or interference during analysis. Table 4 lists water quality parameters that were rejected, estimated or downgraded from Level 3 to Level 2 data based on Ohio EPA data validation protocol.

Table 4. Potential Field Blank Contamination		
TKN	NH ₃	Sn
Cr	DRP	

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The Class B Primary Contact Recreation criteria for West Creek include an *E. coli* criterion not to exceed a single sample maximum (SSM) of 523 colony-forming units per 100 milliliters (CFU/100mL) in more than ten percent of the samples taken during any thirty-day period, and a seasonal geometric mean (SGM) criterion of 161 CFU/100mL (Ohio EPA, 2009b).

West Creek at RM 3.65 was in attainment of the single sample maximum criterion of 523 colony-forming units per 100 milliliters (CFU/100 ml) in more than ten percent of the samples taken in a 30-day period for all 30-day periods between June 23, 2013 and August 20, 2013. The seasonal geometric mean at RM 3.65 was 267.7 CFU/100mL and, therefore, the site was in non-attainment of the seasonal geometric mean criterion of 161 CFU/100 mL (Table 5).

West Creek at RM 2.10 was in non-attainment of the single sample maximum criterion of 523 colony-forming units per 100 milliliters (CFU/100 ml) in more than ten percent of the samples taken in a 30-day period for four 30-day periods between June 23, 2013 and August 13, 2013. The seasonal geometric mean at RM 2.10 was 632.1 CFU/100mL and, therefore, the site was in non-attainment of the seasonal geometric mean criterion of 161 CFU/100 mL (Table 6).

West Creek at RM 1.60 was also in non-attainment by exceeding the single sample maximum criterion of 523 colony-forming units per 100 milliliters (CFU/100 ml) in more than ten percent of the samples taken in a 30-day period for three 30-day periods between July 23, 2013 and August 6, 2013. The seasonal geometric mean at RM 1.60 was 298.0 CFU/100mL and, therefore, the site was in non-attainment of the seasonal geometric mean criterion of 161 CFU/100 mL (Table 7).

West Creek is in an urbanized area having one combined sewer overflow (CSO) entering the creek at RM 2.0, Permit No. 3PA00002 063 (Ohio EPA 1997). The Ohio EPA has stated that the major chemical constraints to West Creek seem to be linked to storm water runoff, construction and failing household waste treatment systems (Ohio EPA 2003). There are approximately 700 household waste treatment systems in the West Creek Watershed (West Creek Preservation Committee [WCPC] 2005). The Ohio Department of Health (ODH) estimates a failure rate of the on-site waste treatment systems around twenty-five percent (ODH 2007). The presence of these failing systems, along with CSO 063, may be the cause of the bacteriological exceedances that were found in West Creek. All of the communities surrounding West Creek are currently in the process of either eliminating the on-site waste treatment systems or are in the planning stages of connection to a sanitary collection system (WCPC 2005). These activities may help to reduce the number of exceedances in the future.

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There were two wet weather sampling event in 2013, which could have contributed to the density of *E. coli* in the stream. The samples collected on July 30, 2013 and August 6, 2013 are considered wet weather¹ sampling events because there was more than 0.25 inches of rain accumulation.

Table 5. 2013 West Creek RM 3.65 <i>E. coli</i> Exceedances (colony-forming units/100mL)				
Sample Date	Result (cfu/100mL)	30-Day Average Concentration (cfu/100mL)	Single Sample Maximum % Days > 523 cfu/100mL	Precipitation within 3-days of sampling Rain Gauge at Parma, N.Royalton
7/23/13	372	276.40	0	0.00
7/30/13	340	252.50	0	0.32
8/06/13	235	223.33	0	1.44
8/13/13	250	217.50	0	0.04
8/20/13	185	--	0	0.00
Seasonal Geomean	267.7	--	--	--

Table 6. 2013 West Creek RM 2.10 <i>E. coli</i> Exceedances (colony-forming units/100mL)				
Sample Date	Result (cfu/100mL)	30-Day Average Concentration (cfu/100mL)	Single Sample Maximum % Days > 523 cfu/100mL	Precipitation within 3- days of Sampling Rain Gauge at Parma, N. Royalton
7/23/13	800	775.00	60.0	0.0
7/30/13	260	768.75	50.0	0.32
8/06/13	1100	938.33	66.7	1.44
8/13/13	1400	857.50	50.0	0.04
8/20/13	315	--	0.0	0.0
Seasonal Geomean	632.09	--	--	--

¹Wet weather sampling events: greater than 0.10 inches of rain but less than 0.25 inches, samples collected that day and the following day are considered wet weather samples; greater than 0.25 inches, the samples collected that day and the following two days are considered wet weather samples.

Table 7. 2013 West Creek RM 1.60 <i>E. coli</i> Exceedances (colony-forming units/100mL)				
Sample Date	Result (cfu/100mL)	30-Day Average Concentration (cfu/100mL)	Single Sample Maximum % Days > 523 cfu/100mL	Precipitation within 3-days of Sampling Rain Gauge at Parma, N. Royalton
7/23/13	420	343.50	20.0	0.00
7/30/13	127.5	324.38	25.0	0.32
8/06/13	530	390.00	33.3	1.44
8/13/13	460	320.00	0.0	0.04
8/20/13	180	--	0.0	0.00
Seasonal Geomean	298.00	--	--	

Ohio EPA's Trophic Index Criterion (TIC) is an index that looks at the measures of nutrients, benthic algae, dissolved oxygen, and the biological components and assigns points to ranges of each indicator. Nutrients were assessed in 2013. For West Creek, the samples collected showed average concentrations of total phosphorus at 0.0624mg/L, 0.056 mg/L, and 0.053 mg/L and DIN at 0.582 mg/L, 0.569 mg/L and 0.434 mg/L at RMs 3.65, 2.10 and 1.60, respectively. Based on these concentrations, all of the West Creek sites for the nutrient component of the TIC indicates that the nutrient concentrations are acceptable because they are typical of healthy streams in working landscapes.

Habitat Assessment

Methods

Instream habitat assessments were conducted once at each site upstream of the Cuyahoga River navigation channel in 2013 using the Qualitative Habitat Evaluation Index (QHEI). The QHEI was developed by the Ohio EPA to assess aquatic habitat conditions that may influence the presence or absence of fish species by evaluating the physical attributes of a stream. The index is based on six metrics: stream substrate, instream cover, channel morphology, riparian zone and bank condition, pool and riffle quality, and stream gradient. The QHEI has a maximum score of 100, and a score of 60 or more suggests that sufficient habitat exists to support a fish community that attains the warmwater habitat criterion (Ohio EPA, 2003). A more detailed description of the QHEI can be found in Ohio EPA's *Methods for Assessing Habitat in Flowing Waters: Using the*

Qualitative Habitat Evaluation Index (QHEI) (2006). QHEI field sheets for each site are available upon request from the NEORSD WQIS Division.

Qualitative Habitat Evaluation Index (QHEI) scores were determined for the three restoration sites, RMs 1.60, 2.10, and 3.65, in 2013. The narrative ratings for QHEI scoring for 2013 were evaluated for the QHEI range for headwater sites (Table 8). The QHEI results for 2006, 2007, 2008, and 2013 are provided in Table 9 and depicted graphically in Figure 2. Since 2006, QHEI scores at this site have remained relatively the same, obtaining a “*Fair*” narrative rating.

Table 8. General narrative ranges assigned to QHEI scores. Ranges vary slightly in headwater(<20 sq.mi) vs. larger waters		
Narrative rating	QHEI Range	
	Headwaters	Larger streams
Excellent	≥70	≥75
Good	55 to 69	60 to 74
Fair	43 to 54	45 to 59
Poor	30 to 42	30 to 44
Very Poor	<30	<30
(E)-Excellent (G)-Good (F)-Fair (P)-Poor		

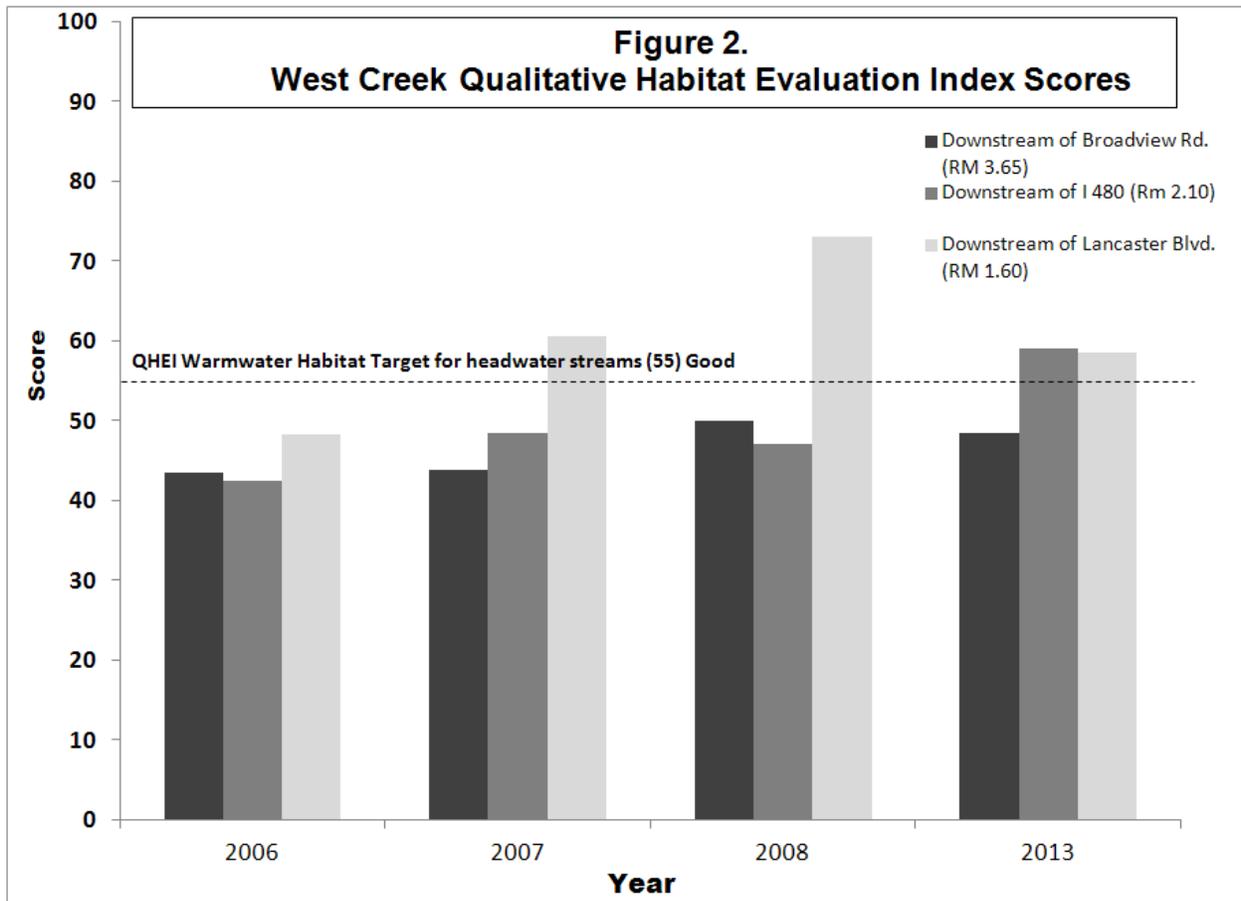
The QHEI score at RM 3.65 was calculated at 48.50 with a narrative rating of “*Fair*”. The 2013 zone corresponded with the electrofishing sampling site, which started just upstream of Broadview Road. Predominantly bedrock substrate was evident throughout the creek. The site included the two step pools from the restoration project. Instream cover consisted of boulders and shallows, and the amount of instream cover was very sparse. No pools had a maximum depth greater than one meter.

The QHEI score at RM 2.10 was calculated at 59.00 with a narrative rating of “*Good*”. This site begins where the creek exits the culvert under Interstate 480. The predominant substrate type in this section was bedrock and boulder/slab. The habitat of this straight channel was primarily a run/glide with sparse amounts of marginal quality instream cover types consisting of boulders and shallows. Some areas of riffle/pool complexes had fairly good development and both banks exhibited little/ moderate erosion. Commercial development borders the riparian zone on river right. The riparian habitat along river left bank varies in width and land use and is primarily forest land. In 2013, this headwater site met the QHEI warmwater habitat score above 55(*Good*); previous to 2013, scores were rated “*Fair*”.

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The QHEI score at RM 1.60 was calculated at 58.50 with a narrative rating of “*Good*”. This site is located downstream of Lancaster Drive. Boulder and cobble were the predominant substrate types with gravel and sand also prevalent along the stream bottom. Very sparse amounts of instream cover with the presence of shallows, deep pools, and boulders were evident in 2013. The bank on river right, which abuts a commercial development, was steep with areas of moderate tree removal. Tree removal was also evident on the river left bank which borders Granger Road, but offers a wider riparian habitat width of better flood plain quality. Additional construction of the step pools within the stream zone was evaluated in the QHEI scoring. From 2007 to 2013, QHEI scores have been rated “*Good*” to “*Excellent*” at this site.

Table 9. West Creek QHEI Scores				
Location	2006	2007	2008	2013
Upstream of Broadview Rd. (RM 3.65)	43.50 (<i>Fair</i>)	43.75 (<i>Fair</i>)	50.00 (<i>Fair</i>)	48.50 (<i>Fair</i>)
Downstream of I-480 (RM 2.10)	42.50 (<i>Fair</i>)	48.50 (<i>Fair</i>)	47.00 (<i>Fair</i>)	59.00 (<i>Good</i>)
Downstream of Lancaster Dr.(RM 1.60)	48.25 (<i>Fair</i>)	60.50 (<i>Fair</i>)	73.00 (<i>Excellent</i>)	58.50 (<i>Good</i>)



Fish Community Assessment

Methods

One quantitative electrofishing pass was conducted at each site in 2013. Sampling was conducted using longline electrofishing techniques and consisted of shocking all habitat types within a sampling zone while moving from downstream to upstream (HEADWATER). The sampling zone was 0.15 (Headwater), kilometers for each site. The methods that were used followed Ohio EPA protocol methods as detailed in *Biological Criteria for the Protection of Aquatic Life, Volumes II (1987a) and III (1987b)*. Fish collected during the surveys were identified and examined for the presence of anomalies, including DELTs (deformities, eroded fins, lesions, and tumors). All fish were then released to the waters from which they were collected, except for vouchers and those that could not be easily identified in the field.

The electrofishing results for each pass were compiled and utilized to evaluate fish community health through the application of two Ohio EPA indices, the Index of

Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb) which is utilized at boat and wading sites. The IBI incorporates 12 community metrics representing structural and functional attributes. The structural attributes are based upon fish community aspects such as fish numbers and diversity. Functional attributes are based upon fish community aspects such as feeding strategies, environmental tolerances, and disease symptoms. These metrics are individually scored by comparing the data collected at the survey site with values expected at reference sites located in a similar geographical region. The maximum possible IBI score is 60 and the minimum possible score is 12. The summation of the 12 individual metrics scores provides a single-value IBI score, which corresponds to a narrative rating of *Exceptional, Good, Marginally Good, Fair, Poor* or *Very Poor*. The 12 metrics utilized for Headwater sites are listed in Table 10.

Table 10. IBI Metrics (Headwater)
Total number of Native Species
Number of Darters & Sculpins
Number of Headwater Species
Number of Minnow Species
Number of Sensitive Species
Percent Tolerant Species
Percent Pioneering Species
Percent Omnivores
Percent Insectivores
Number of Simple Lithophils
Percent DELT Anomalies
Number of Fish

Results and Discussion

Table 11 shows the IBI scores that were calculated for each site. None of the sites met the Warmwater Habitat (WWH) criterion for headwater sites (Figure 3). The site downstream of I-480 (RM 2.10) was electrofished for the first time in 2013 after habitat construction restoration work was completed.

A score of 32 (*Fair*) was calculated at RM 3.65 in 2013 compared to 30 (*Fair*) in 2008. Once again, the predominant fish collected were blacknose dace and central stoneroller minnow. These fish accounted for 91.6% of the total catch. IBI metric scores of 5 were obtained for low proportion of DELTs, low proportion of pioneering species and low proportion of omnivores present.

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A QHEI score of 48.5 was obtained at RM 3.65 in 2013, which is in the “*Fair*” range. Predominantly bedrock substrate, sparse amounts of instream cover and no deep pools (>3 feet) accounted for a “*Fair*” fish index score. Improvements in the fish index scores should be evident once habitat renovation work is completed at all sites on West Creek. A concrete flume at RM 1.10 is currently acting as a fish migration barrier to the site.

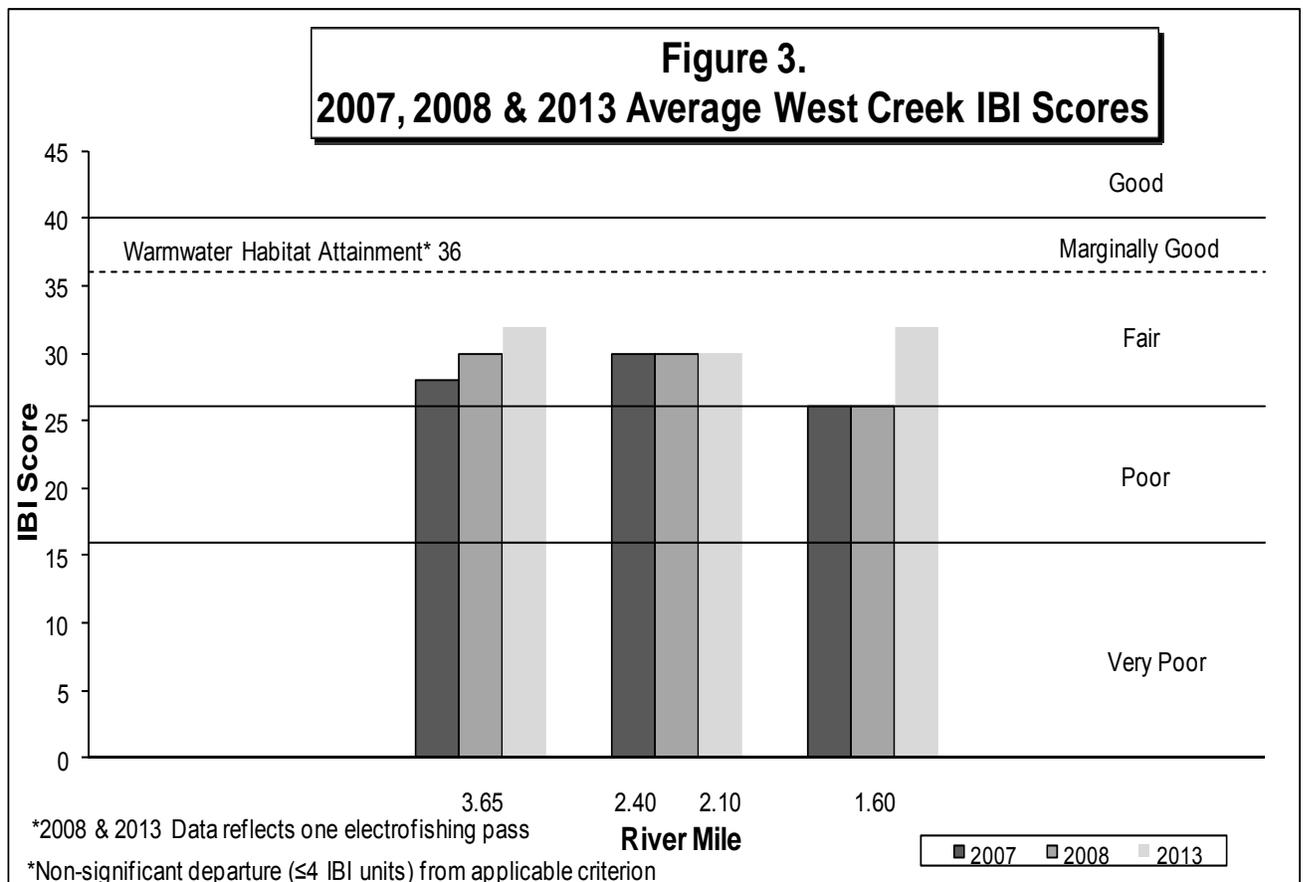
At RM 2.10 a score of 30 (*Fair*) was calculated in 2013. The score calculated in 2008 was 30 (*Fair*). Ninety-four percent of the total catch was predominantly blacknose dace and central stoneroller minnows. In 2013, IBI metric scores of 5 were obtained for low proportion of DELTs (0%), low proportion of pioneering species (3.3%) and low proportion of omnivores (3.1%) present, and a large number of individuals collected (1337).

At RM 2.10, a QHEI score of 59.0 “*Good*” was obtained. This score increased from a score of 47 “*Fair*” obtained in 2008. A habitat assessment of fairly good developed pools and riffles and addition of step pools from the habitat restoration work correlates with an IBI score of 30 (*Fair*). The bedrock substrate, fair straight channel development, sparse instream cover, and downstream migration barriers are limiting factors to a more diverse fish community.

A score of 32 (*Fair*) was calculated at RM 1.60 in 2013. In 2008, a score of 26 (*Poor*) was calculated. The predominant fish collected in 2013 were blacknose dace and central stoneroller minnow. These two species accounted for 97% of the total catch. IBI metric scores of 5 were obtained for low proportion of DELTs (0%), low proportion of pioneering species (2.5%), low proportion of omnivores (0.3%) present and a large number of individuals collected (2988).

The QHEI narrative rating at RM 1.60 went from “*Excellent*” in 2008 to “*Good*” in 2013 and the reason the score was higher in 2008 is that there was more instream cover consisting of undercut banks, overhanging vegetation, rootmats, rootwads, aquatic macrophytes and logs and woody debris present. Fish Index scores went from “*Poor*” (26) in 2008 to “*Fair*” (32) in 2013. The boulder cobble substrate with the addition of the step pools may have contributed to the increase in the fish index score.

Table 11. Index of Biotic Integrity (IBI) Scores				
Site	Year	2007	2008	2013
	RM	Average	Pass 1	Pass 1
US Broadview Road	3.65	31	30	32
Brooklyn Heights Park *(downstream of I-480)	2.40, *(2.10)	32	30	*(30)
DS Lancaster Drive	1.60	26	26	32



Macroinvertebrate Sampling

Methods

Benthic macroinvertebrates were sampled quantitatively for one six-week period in 2013 using a modified HD substrate sampler in conjunction with a qualitative assessment performed during HD retrieval. The modified HD is a type of sampling that has been utilized by the Ohio EPA since 1973. Methods for sampling followed the Ohio EPA's Biological Criteria for the Protection of Aquatic Life, Volume III (1987b).

The Invertebrate Community Index (ICI) was used as the principal measure of overall macroinvertebrate community condition. Developed by the Ohio EPA, the ICI is a modification of the Index of Biotic Integrity for fish (OEPA 1987a). The ICI consists of ten individually scored structural community metrics listed in Table 12.

Macroinvertebrate qualitative samples were sent to Third Rock Consulting for identification and enumeration. Specimens were identified to the lowest practical taxonomic level as recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987, updated September 30, 1989; November 8, 2006; and August 26, 2008). The taxa lists and enumerations are available upon request. The recommended period for HDs to be installed is six weeks.

Table 12. ICI Metrics
Total Number of Taxa
Total Number of Mayfly Taxa
Total Number of Caddisfly Taxa
Total Number of Dipteran Taxa
Percent Mayflies
Percent Caddisflies
Percent Tanytarsini Midges
Percent Other Dipterans and Non-Insects
Percent Tolerant Organisms
Total Number of Qualitative EPT Taxa

Results and Discussion

In 2013, all of the sites were in attainment of the WWH ICI criterion of 34. In Table 13 the 2013 sampling results are summarized.

Table 13. 2013 West Creek Macroinvertebrate Assessment				
River Mile	Retrieval Date	ICI Score*	Predominant Organism(s) in Qualitative Sampling	Comments
3.65	09/04/13	34	Baetids	Drainage less than 10 square miles, Current 0.35fps
2.10	09/04/13	44	Baetids, Isopods, Flatworms	Drainage less than 10 square miles, Current 0.73 fps
1.60	09/24/13	38	Flatworms, midges	Drainage less than 10 square miles Current 1.84 fps
* WWH for the ICI Criterion is ≥ 34 units: Non-significant departure from attainment is ≤ 4 units				

The invertebrate community composition is essential in determining the quality of the stream. The qualitative sampling showed 24 taxa collected in the sample at RM 3.65 with the predominant organisms being Baetid mayflies. Twenty Eight taxa were collected at RM 2.10 with the predominant organisms being Flatworms. Thirty taxa were collected at RM 1.60 with the predominant organisms also being Flatworms. Macroinvertebrate community composition will improve, as pollution tolerant species or other organism compositions decrease over time.

In 2013, an ICI score of 34 was calculated at RM 3.65 with a narrative rating of “Good”. Prior year ICI scores in 2007 and 2008 were 40 and 36, respectively. It is unknown why the scores have decreased; however, the numbers and percent caddisflies, number of dipterans, and percent mayflies all have decreased since 2007. It may take some time for invertebrates to become acclimated to the habitat changes that occurred as part of the restoration work before an improvement is documented in the scores.

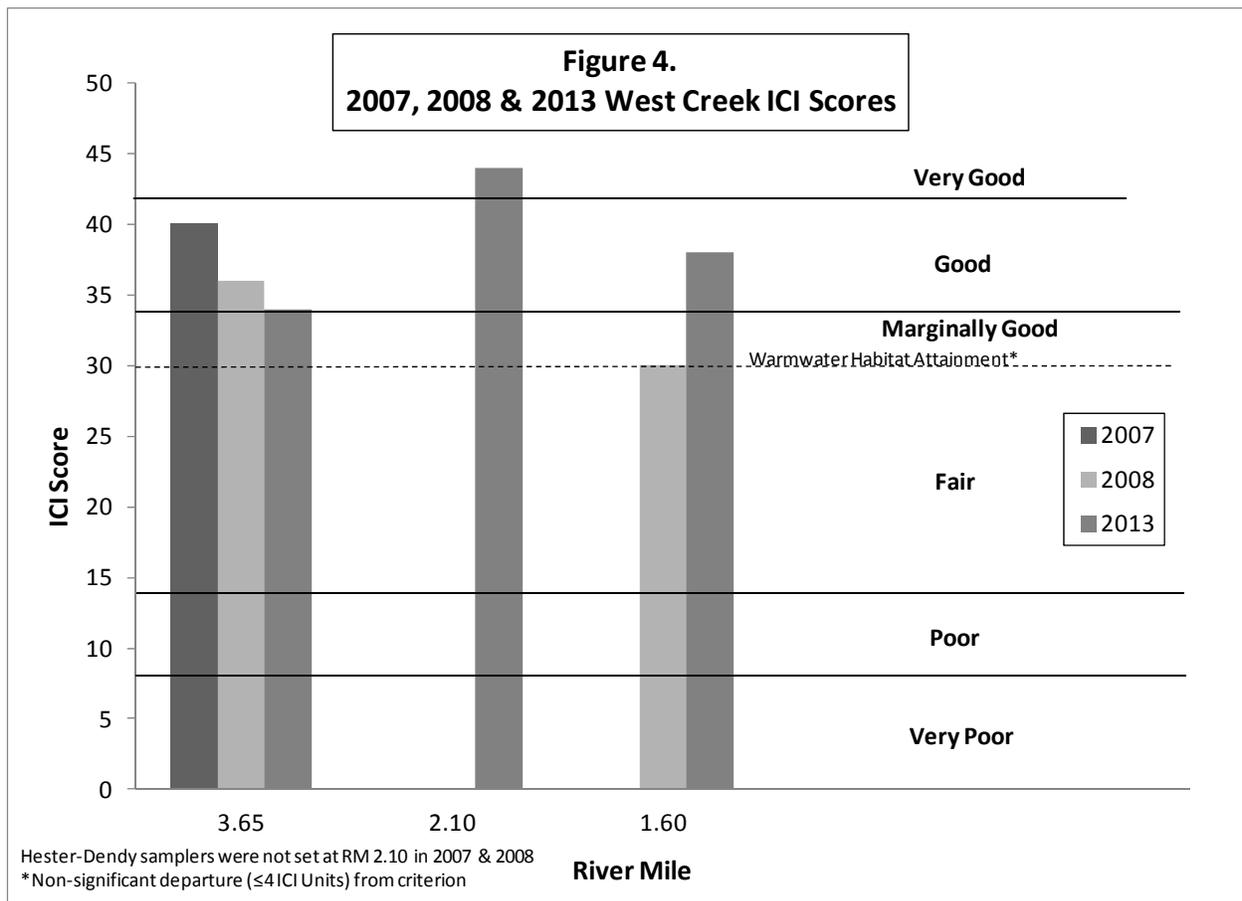
An ICI score of 44 was calculated at RM 2.10 with a narrative rating of “Very Good”. Thirty-three taxa were collected and the dominant group was *Tanytarsus glabrescens* group species 7. This group accounted for thirty-six percent of the taxa collected at this site. Hester Dendy samplers were not set in 2007 and 2008, and therefore, no ICI scores are available for those years.

An ICI score of 30 was calculated at RM 1.60 with a narrative rating of (“Marginally Good”) compared to a 38 (“Good”) in 2008. In 2008, thirty-three total taxa were collected and the dominant taxa were the moderately tolerant *Cricotopus tremulus* group. This group accounted for 15 percent of the total invertebrates collected. In 2013, thirty-five taxa were collected with the dominant taxa collected being Oligochaeta and the moderately intolerant *Ceratopsyche morose*. These two taxa accounted for thirty

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percent of the total taxa collected. The ICI score was “*Very Good*” in 2013 because of the number and percent of caddisfly taxa and the number of Dipteran taxa that were collected at this site. Table 14 summarizes West Creek ICI scores from 2007, 2008 and 2013, and Figure 4 also graphically depicts ICI scores for these years.

Table 14. Invertebrate Community Index (ICI) Scores			
Year	2007	2008	2013
Site	ICI Score	ICI Score	ICI Score
Upstream of Broadview Rd. (RM 3.65)	40	36	34
Downstream of I-480 (RM 2.10)	-	-	44
Downstream of Lancaster Dr. (RM 1.60)	-	30	38



Conclusions

With all sampling sites meeting the WWH Invertebrate Community Index criterion score of 34, the overall macroinvertebrate community appears to be relatively healthy on West Creek. The fish communities in West Creek at all sites were in the “Fair” range. The lack of a diverse fish community at most of the sites may be the result of poor/fair natural substrate quality consisting of bedrock. Bedrock substrate was the predominant substrate at two sites. Additionally, permanent instream structures are impeding upstream fish migration within the creek and from the Cuyahoga River. Once on site residential waste treatment systems and CSO 063 are eliminated, an improvement in the bacteria sampling results should be noticed.

Future bacteriological, chemical and biological monitoring will take place at these sites again in 2014 and any additional sites where habitat restoration work has been completed. The overall attainment status of West Creek is summarized in Table 15.

Table 15. 2013 West Creek Survey Results						
River Mile	Aquatic Life Use Attainment Status	IBI Score (Narrative Rating)	MIwb Score (Narrative Rating)	ICI Score (Narrative Rating)	QHEI Score (Narrative Rating)	Water Quality Exceedances
3.65	Partial	32 (Fair)	NA	34 (Good*)	48.50 (Fair)	<i>E. coli</i>
2.10	Partial	30 (Fair)	NA	44 (Very Good)	59.00 (Good)	<i>E. coli</i>
1.60	Partial	32 (Fair)	NA	38 (Good)	58.50 (Good)	<i>E. coli</i>
WWH Biocriteria attainment IBI Score of 40; ICI Score of 34 Non-significant departure: ≤ 4 IBI units; ≤ 0.5 MIwb units *Narrative rating based on best professional judgment N/A Not Applicable						

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Analytical Services Division – Completed analysis for all water chemistry sampling

Reference List

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