

# **NORTHEAST OHIO REGIONAL SEWER DISTRICT**

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## **2018 West Creek Restoration Environmental Monitoring**



**Prepared by**

**Water Quality and Industrial Surveillance Division**

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## **Introduction**

During 2018, the Northeast Ohio Regional Sewer District (NEORS) completed baseline assessments at two primary headwater 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. The goals of these restoration projects are to improve existing in-stream habitat, construct additional in-stream habitat, and re-stabilize eroding stream banks utilizing bioengineered technology and natural channel design techniques. NEORS conducted water chemistry sampling, habitat assessments, and fish and benthic macroinvertebrate community surveys at Site 5 and river mile (RM) 8.55 on West Creek prior to the stream restoration projects starting. Restoration for RM 8.55 was scheduled to begin March 1, 2019. Site 5 restoration is scheduled for an April 1, 2019, start date. Both projects are expected to be completed in no more than an eight-week time frame.

Sampling was conducted by NEORS Level 3 Qualified Data Collectors who are certified by the Ohio Environmental Protection Agency (EPA) in Fish Community and Benthic Macroinvertebrate Biology, and Chemical Water Quality and Stream Habitat Assessments. Although no NEORS staff possess the Level 3 certification for conducting Headwater Habitat Evaluation Index (HHEI) surveys, staff certified to conduct Qualitative Habitat Evaluation Index (QHEI) surveys conducted the HHEI surveys for this project.

Figure 1 is a map of the sampling locations on West Creek, and Table 1 indicates the sampling locations and includes river mile, latitude/longitude, description and the types of surveys conducted. Figure 2 is a map of the restoration work that will take place at RM 8.55. Figure 3 is a map of the planned restoration work at Site 5. Site 5 is located at approximately RM 0.40 on an unnamed tributary to West Creek.

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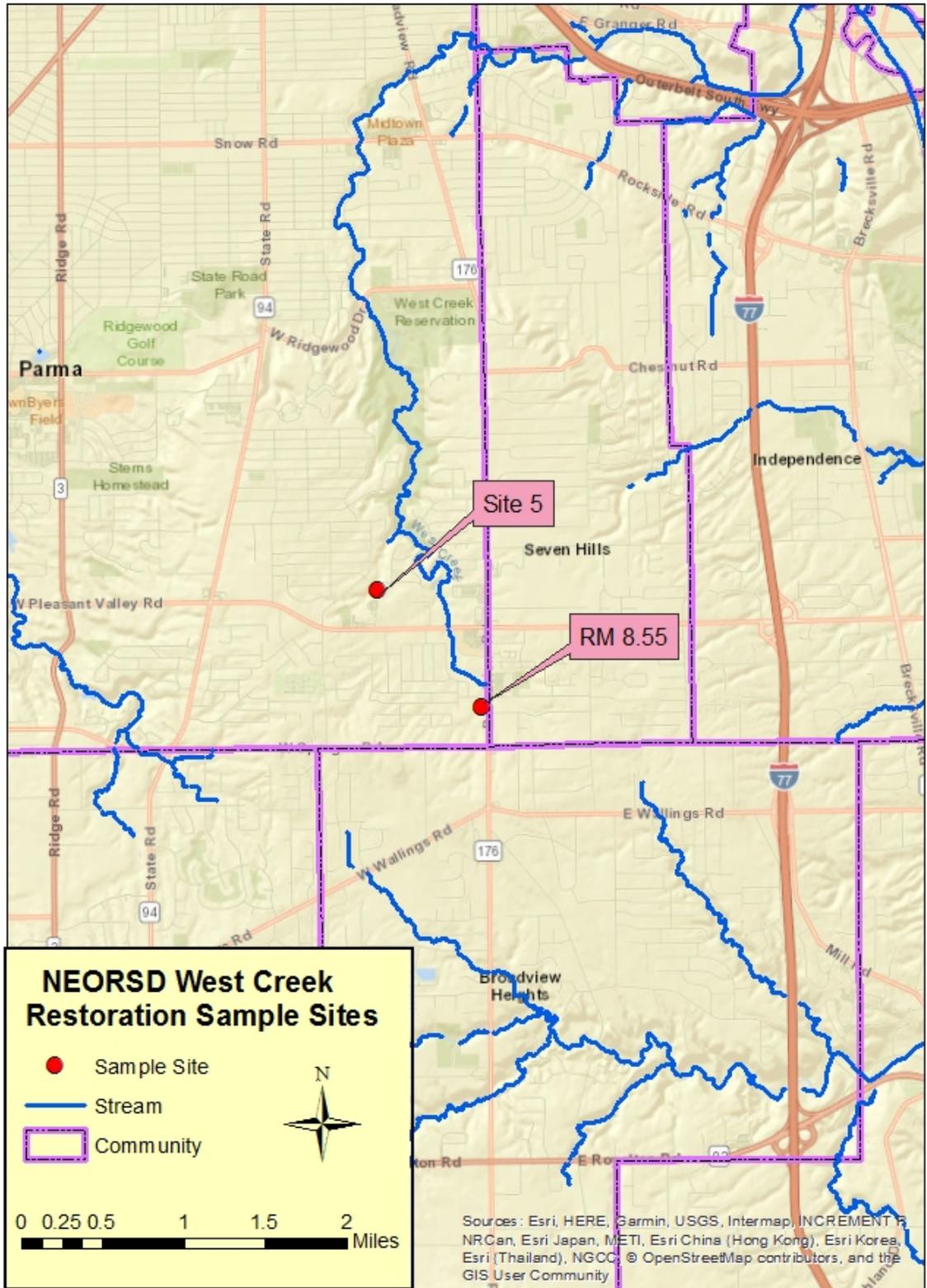


Figure 1. 2018 West Creek Restoration Site Sampling Locations

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Table 1. West Creek Sample Locations					
Waterbody	Latitude	Longitude	River Mile	Description	Purpose
West Creek	41.3544	-81.6853	8.55	Upstream of Broadview Road	Evaluate habitat, fish, salamanders, & macroinvertebrates prior to beginning of stream restoration work
West Creek, Site 5	41.3650	-81.6975	---	Upstream of Coventry Drive	Evaluate habitat, fish, salamanders, & macroinvertebrates prior to beginning of stream restoration work

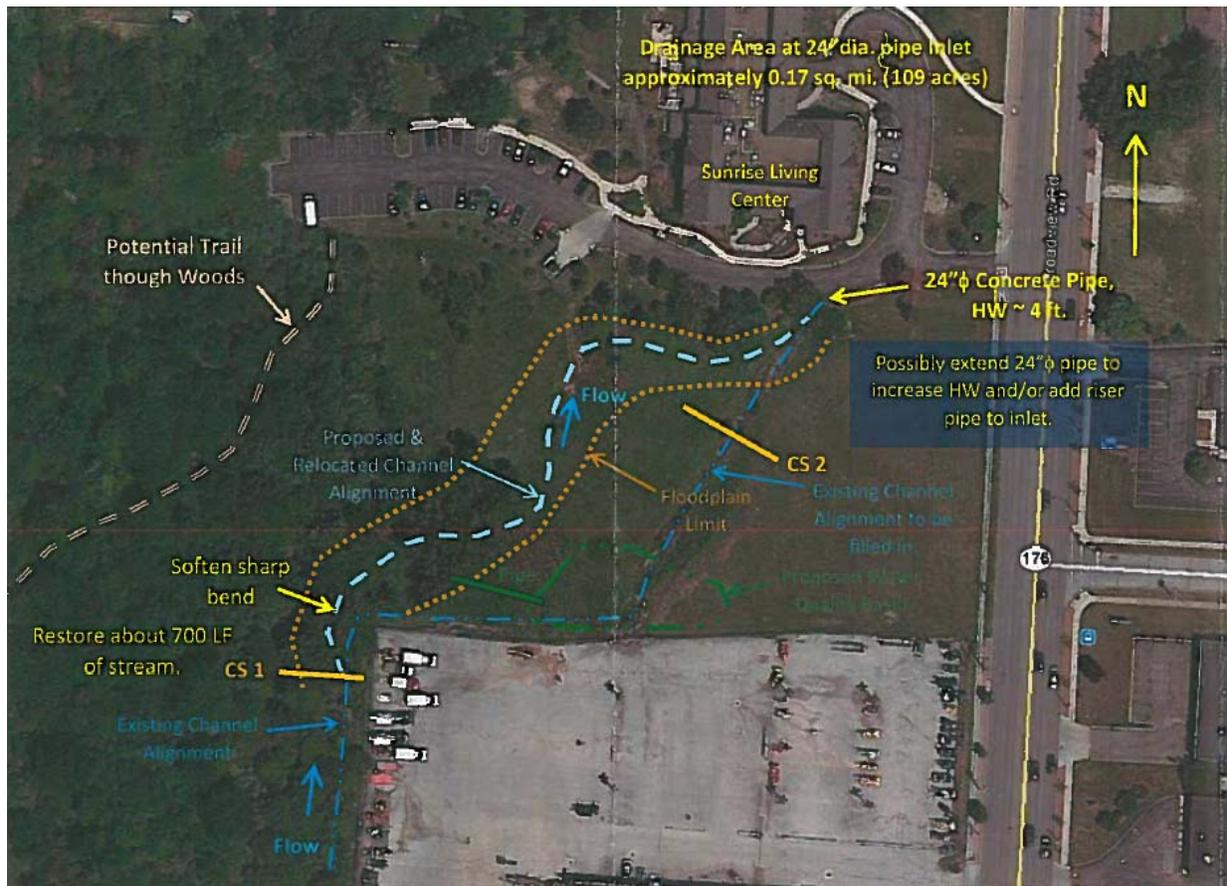


Figure 2. RM 8.55 Future restoration work.

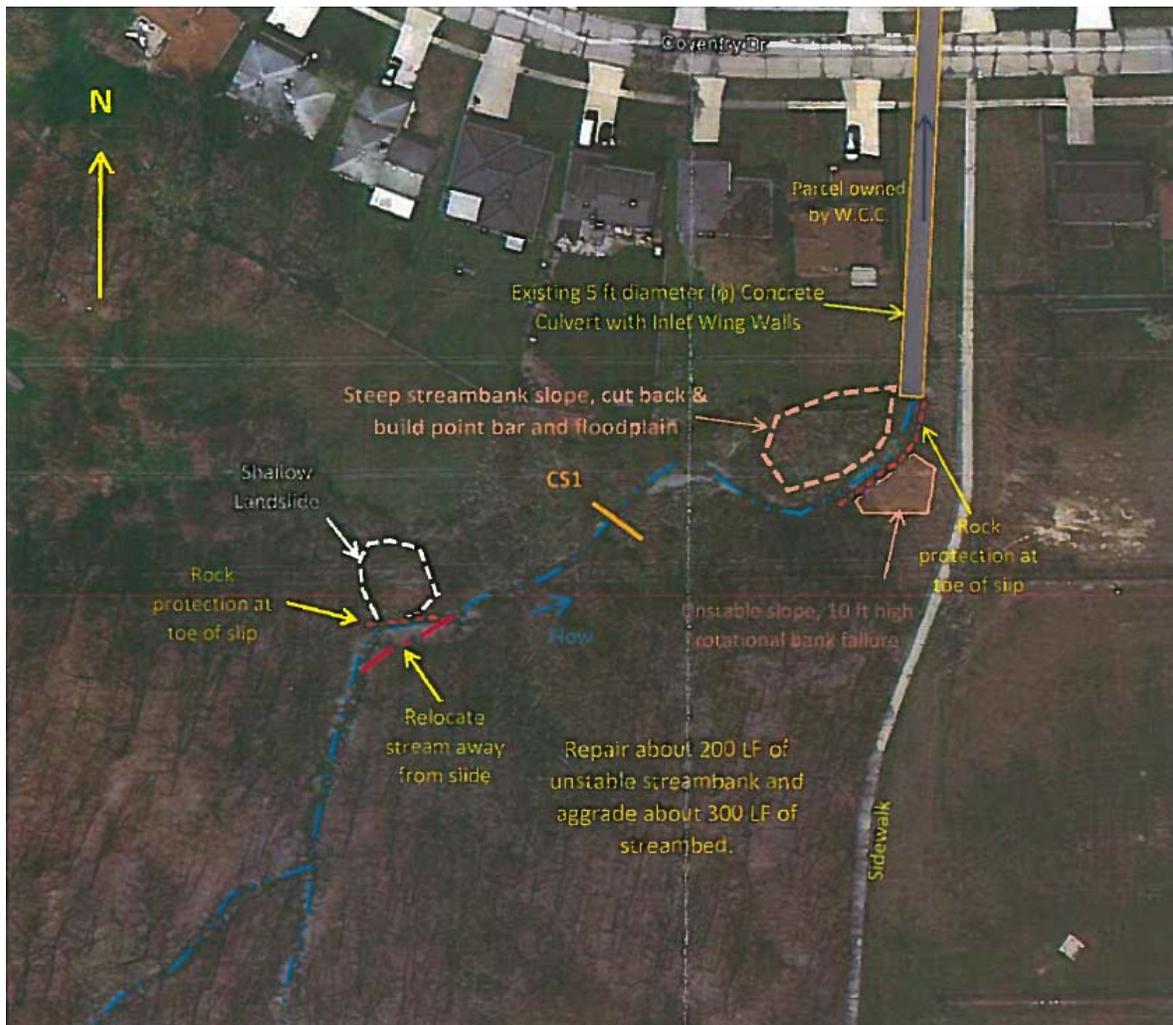


Figure 3. Future restoration work at Site 5.

## Water Chemistry Sampling

### Methods

Water chemistry and bacteriological sampling was conducted five times during 2018. The five sampling events were between June 19, 2018, and July 17, 2018, on West Creek at two sites, RM 8.55 and Site 5. Techniques used for sampling and analyses followed the Ohio EPA *Surface Water Field Sampling Manual for water quality parameters and flows* (2018b). 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- $\mu$ 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 either a YSI EXO1 or 600XL sonde. Duplicate samples and field blanks were collected at randomly selected sites, each 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, 2018b).

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

X = sample/detection limit ratio

Those RPDs that are 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.

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

## Results and Discussion

West Creek is designated Warmwater Habitat (WWH), agricultural water supply, industrial water supply, and primary contact recreation. The water chemistry samples collected at each site were compared to the applicable Ohio Water Quality Standards for the designated uses to determine attainment (Ohio EPA, 2018a).

For the 2018 study, one duplicate sample and one field blank were collected for quality assurance and quality control (QA/QC) purposes. The duplicate sample was collected at RM 8.55 on June 19, 2018. One parameter in the duplicate sample, cobalt, was rejected based on an RPD value outside of the acceptable RPD range (Table 2).

<b>Table 2. Duplicate Parameter Analysis</b>					
Date	Site	Parameter	Acceptable RPD (%)	Actual RPD (%)	Qualifier
RM 8.55	6/19/2018	Co	60.8	112.2	Rejected

The date in which this sample was collected was considered wet weather<sup>1</sup>. A likely reason for the unacceptable difference between the samples could be due to the wet-weather conditions that were present at the time of sampling. Otherwise the difference could potentially be attributed to lack of precision and consistency in sample collection and/or analytical procedures, environmental heterogeneity, and/or improper handling of samples.

One field blank sample was collected on July 17, 2018, at RM 8.55, for QA/QC purposes. For the field blank, there was one parameter that showed possible contamination. It is unclear how the field blank became contaminated and may be due to inappropriate sample collection, handling, contaminated blank water and/or interference during analysis. Table 3 lists the water quality parameter that was listed as rejected based on Ohio EPA data validation protocol.

<b>Table 3. Parameter Affected by Possible Blank Contamination</b>
TKN

Paired parameters for all samples collected were also evaluated for QA/QC purposes. The comparisons revealed no rejected/estimated data for either sampling site. In 2018, there were zero instances in which the data for the paired parameters needed to be qualified because the sub-parameter was greater than the parent one.

The Primary Contact Recreation criteria for West Creek includes an *E. coli* criterion not to exceed a Statistical Threshold Value (STV) of 410 colony counts/100mL in more than ten percent of the samples taken during any 90-day period, and a 90-day geometric mean criterion of 126 colony counts/100mL (Ohio EPA, 2015a). In accordance with Ohio EPA procedure and practice to qualify *E. coli* exceedances for the Primary Recreation criteria, these calculations are formulated when there are at least five samples collected within a rolling 90-day period. The STV criterion was exceeded at both sites on West Creek during the 2018 study (Table 4). Each site had more than ten percent of the samples collected that were greater than the statistical threshold value of 410 MPN/100mL. West

<sup>1</sup> Wet-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.

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Creek also exceeded the primary contact recreation 90-day geometric mean at both sites. The Ohio Department of Health (ODH) estimates a failure rate of on-site waste treatment systems around twenty-five percent (ODH 2007). The presence of these failing systems, potential animal waste and any illicit discharges, may be the cause of the bacteriological exceedances that were found in West Creek. 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. Apart from the exceedances for *E. coli*, and a low DO reading at Site 5 on July 2, 2018, the two sites on West Creek met all other water quality criteria for the 2018 season.

**Table 4. 2018 West Creek *E. coli* Densities (most-probable number/100mL)**

Date	RM 8.55	Site 5
6/19/2018*	17,410	13,000
6/26/2018*	3,730	498
7/2/2018	56	5,570
7/10/2018	11,530	1,082
7/17/2018*	12,740	1,960
90-Day Geometric Mean	3,511.9	2,380.7
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"></div> <div style="width: 85%;">Exceeds statistical threshold value (STV)</div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 15%;"></div> <div style="width: 85%;">Exceeds geometric mean criterion for 90-day period</div> </div>		
<small>*Wet-Weather Event: 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.</small>		

Additionally, three sampling events were considered wet-weather sampling events in 2018. These wet-weather events could have also contributed to the elevated density of *E. coli* in the stream. The samples collected on June 19, June 26, and July 17, 2018, are considered wet-weather sampling events because there was more than 0.10 inches of rain accumulation prior to the sampling event taking place.

Mercury analysis for all the sampling events was completed using EPA Method 245.1. The detection limit for this method is above the criteria for the Human Health Nondrinking and Protection of Wildlife Outside Mixing Zone Averages (OMZA), so it generally cannot be determined if the sites were in attainment of those criteria. Instead, this type of mercury sampling was used as a screening tool to determine whether contamination was present above the detection limit. Based on the sampling that was completed, mercury was not present at levels above those normally found in the watershed (USEPA, 2004).

## Habitat Assessment

### Methods

Instream habitat assessments were conducted once per site on West Creek in 2018 using the Headwater Habitat Evaluation Index (HHEI). A primary headwater habitat (PHWH) stream is a surface water of the state, having a defined bed and bank, with either continuous or periodical flowing water, with watershed area less than or equal to 1.0mi<sup>2</sup>, and maximum pool depths equal to or less than 40 cm. Both RM 8.55 and Site 5 fit this definition.

The HHEI can be used to score physical habitat features that have been found to be statistically important determinants of biological community structure in PHWH streams. The index is based on three metrics: stream substrate, maximum pool depth, and bank full width. The HHEI has a maximum score of 100. A more detailed description of the HHEI can be found in Ohio EPA's *Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams* (Ohio EPA, 2012). HHEI field sheets for each site are available upon request from the NEORSD WQIS Division.

### Results and Discussion

HHEI scores were determined for the two sites, West Creek RMs 8.55 and Site 5 in 2018. The HHEI results for 2018 are provided in Table 5.

<b>Table 5. 2018 West Creek Restoration Sites HHEI Scores</b>		
<b>Year</b>	<b>Upstream of Coventry Dr. (Site 5)</b>	<b>Upstream of Broadview Rd. (RM 8.55)</b>
2018	81.0	70.0

The HHEI score at RM 8.55 was calculated at 70.00 in 2018. The zone begins approximately 75-feet upstream of Broadview Road. Gravel and sand were the most common substrates throughout the reach in 2018. Maximum pool depth was greater than 30 centimeters in one location. Bank full width was averaged at greater than 4.0 meters throughout the reach. Due to the channelization of the reach, there was no sinuosity present. The reach was completely overrun with cattails. Instream cover was minimal outside of the cattails.

The HHEI score at Site 5 was calculated at 81.00 in 2018. The zone started approximately 150-feet upstream of Coventry Drive. Predominantly boulder slabs and gravel substrate were present throughout the stream reach. Maximum pool depth was greater than 30 centimeters within the reach. Bank full width was averaged at greater than 4.0 meters throughout the reach. The future restoration area is in a small block of woods behind Normandy High School. Woody debris is present in and around the stream reach. In addition to the woody debris, other instream cover included undercut banks, rootwads, and shallows in slow water. With two and a half well defined bends, sinuosity is good within the reach. Heavy erosion on river left is present as well. Using the primary headwater habitat classification flow chart based on HHEI scoring, it was suggested that both sites on West Creek be evaluated for a biotic community to determine the proper classification for each.

## **Fish Community Assessment**

### **Methods**

One qualitative electrofishing pass was conducted at Site 5 on West Creek in 2018. No electrofishing survey was conducted at RM 8.55. Sampling was conducted at Site 5 using backpack electrofishing techniques and consisted of shocking all habitat types within the sampling zone while moving from downstream to upstream. The sampling zone was 150 feet. 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 (1987 b)*. If fish were collected during the surveys, they were identified and examined for the presence of anomalies, including DELTs (deformities, eroded fins, lesions, and tumors). All fish would then be released to the waters from which they were collected, except for those that could not be easily identified in the field. Fish field sheets are available upon request from the NEORSD WQIS Division.

### **Results and Discussion**

A qualitative electrofishing survey was not conducted at RM 8.55 for several reasons. Electrofishing in this reach did not take place due to the extreme density of cattails within the stream as well as the narrow stream width itself. Additionally, the depth of the stream throughout most of the reach was not conducive to supporting a headwater fish population. During the habitat survey, no fish were observed throughout the stream reach. An absence of fish species indicates a severe stress caused by man induced perturbation or loss of habitat due to a lack of water (Ohio EPA, 1987a). The channelization and minimal water within the stream could be having a negative impact on the stream reach. It is

unlikely that this section of West Creek, in its current condition, could successfully support a fish population.

A qualitative electrofishing survey was conducted at Site 5 on July 13, 2018. There were zero fish collected during the survey, which indicates that this site was not capable of supporting a WWH fish community. Lack of habitat would not have an adverse impact on a fish community if it was present, as the HHEI scored well at this site. Oxygen levels were low during one of the water chemistry sampling events on July 2, 2018. Limitations to the establishment of well-balanced fish communities in primary headwater streams can result from the lack of suitable forage, barriers to migration (natural or artificial) or the lack of refugia during low and zero flow conditions. Additionally, there often exists in natural watersheds a lower limit in watershed size and stream scale where fish are no longer observed, but are replaced by salamanders as the dominant vertebrate predator (Ohio EPA, 2018). This is likely the case at Site 5 as fourteen northern two-lined salamanders (*Eurycea bislineata*) were collected at the site.

## **Salamander Sampling**

### **Methods**

Salamanders were sampled using a qualitative assessment to determine presence or absence of any salamander species. Methods for sampling followed the Ohio EPA Field Evaluation Manual for Ohio's Primary Headwater Streams (2018c). Samples were vouchered and brought back to the lab at NEORSD for identification. Specimens were identified to the species level.

### **Results and Discussion**

A qualitative salamander survey was conducted at RM 8.55 on July 13, 2018. There were no salamanders collected or observed during this survey. A primary headwater stream classification is not given based on zero salamanders collected. A qualitative salamander survey was conducted at Site 5 on July 13, 2018. Fourteen northern two-lined salamanders were collected during the survey. A combination of adults and larvae were collected. Based on the collection of these salamanders and the evidence of reproduction, Site 5 can be considered a "Group A Spring Water Salamander Assemblage".

## Macroinvertebrate Sampling

### Methods

Macroinvertebrates were only sampled using a qualitative assessment of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly), also referred to as EPT taxa, inhabiting available habitats. Methods for sampling followed the Ohio EPA's Biological Criteria for the Protection of Aquatic Life, Volume III (1987b). The macroinvertebrate samples were sent to Third Rock Consulting of Lexington, Kentucky, for identification and enumeration. Specimens were identified to the lowest practical taxonomic level as defined by the Ohio EPA (1987b). Lists of the species collected during the qualitative sampling at each site are available upon request from WQIS.

### Results and Discussion

For West Creek RM 8.55 and Site 5, a narrative assessment was designated for these sample sites based on data from qualitative sampling (See Table 6), and by utilizing the best professional judgment of the macroinvertebrate Qualified Data Collectors (QDCs). In addition to the narrative assessments, headwater macroinvertebrate field evaluation index (HMFEI) scores were calculated as well. Factors considered in the assignment of narrative ratings include, but are not limited to, total site drainage area; macroinvertebrate population composition in the qualitative sample with respect to the number of total taxa, EPT (Ephemeroptera, Plecoptera, and Trichoptera) taxa, pollution sensitive taxa, and pollution tolerant taxa; and organism abundance within individual families or groups noted during sample collection.

Table 6. 2018 West Creek Macroinvertebrate Assessment					
River Mile	Year	ICI Score*	HMFEI Score	Narrative	Comments
8.55	2018	-	21	<i>Fair</i>	No HD Installed
Site 5	2018	-	30	<i>Good</i>	No HD Installed
* WWH for the ICI Criterion is $\geq 34$ units: Non-significant departure from attainment is $\leq 4$ units					

West Creek RM 8.55 was assigned a narrative rating of *Fair* in 2018. From the qualitative sample that was collected, 18 total macroinvertebrate taxa were found. Of those taxa, zero were found to be EPT taxa. During field collection, the diversity of the organisms found at the site was comparatively low, along with the densities of all taxa found at the site. The low taxa diversity and density was most probably an effect of the

poor conditions present in the stream. There was poor quality substrate with extensive embeddedness present throughout the reach. Embeddedness combined with low water and excessive vegetation all are likely having a negative impact on the stream. Low diversity of taxa, low density, and zero EPT taxa for a very small drainage area (0.06 mi<sup>2</sup>), support a narrative rating of *Fair* for the 2018 sampling season in terms of warmwater habitat attainment.

Three distinct macroinvertebrate assemblages have been identified in primary headwater streams. These communities are defined based on a variety of factors including: the number of coldwater indicator taxa present, the number of EPT taxa, and the number of sensitive taxa found at a said location. Based on zero cold water species of macroinvertebrates being collected at RM 8.55, it cannot be considered a Type A Spring Water stream. With no evidence of salamander reproduction, no presence of any warm water adapted fish species, and an HMFEI score greater than seven, West Creek RM 8.55 is considered a “Small Drainage Warm Water Stream”.

From the qualitative sample collected at Site 5 in 2018, 21 total macroinvertebrate taxa were found. Of those 21 taxa, four were found to be EPT taxa. One of the common organisms found at this site was *Chimarra atterima*. Although this organism classifies as moderately intolerant of pollution, the density of the organisms found at the site was comparatively low, along with the densities of all taxa found at the site. Overall, West Creek Site 5 was given a narrative rating of *Good* for the 2018 sampling season.

From a macroinvertebrate standpoint, just like West Creek RM 8.55, Site 5 does not have enough coldwater macroinvertebrate indicator taxa present to be considered a “Type A Spring Water Stream”. If there is a shortage of coldwater macroinvertebrate taxa collected, stream designation is based on the evidence of reproducing populations of either the two-lined salamander or the longtail salamander. Collection of juvenile and adult northern two-lined salamanders at Site 5 is definitive evidence of a reproducing population of two-lined salamanders. With this evidence and the absence of coldwater vertebrate species (Ohio EPA, 2018), a Type A Spring Water is indicated at Site 5.

## Conclusions

Results from the bacteriological sampling, headwater habitat evaluation assessments, and fish and macroinvertebrate assessments show these primary headwater sites of West Creek may have some limiting factors and environmental stressors resulting in low fish and macroinvertebrate index scores and/or narrative ratings. Bacteriological samples collected at all sites showed water quality exceedances for bacteria most of the time. The overall attainment status of West Creek is summarized in Table 7.

Table 7. 2018 West Creek Survey Results					
River Mile	Aquatic Life Use Attainment Status	IBI Score (Narrative Rating)	ICI Score (Narrative Rating)	HHEI Score	Water Quality Exceedances
8.55	Non	<i>Very Poor</i>	<i>*Fair</i>	70.0	<i>E. coli</i>
Site 5	Non	<i>Very Poor</i>	<i>*Good</i>	81.0	<i>E. coli</i>
WWH Biocriteria attainment IBI Score of 40; ICI Score of 34 Non-significant departure: $\leq 4$ IBI units, $\leq 4$ ICI units. *Narrative rating based on best professional judgment					

The fish and benthic macroinvertebrate communities at both sites were in non-attainment of the warmwater habitat designated use. The lack of a diverse fish community at both locations may be due to the small watershed that drains through the sites. A small watershed in the upper reaches of a primary headwater stream are typically not conducive to supporting a healthy fish assemblage. Once home sewage treatment systems and illicit discharges within the watershed are eliminated, an improvement in the bacteria sampling results as well as macroinvertebrate and fish diversity should be noticed.

After conducting Level 3 assessments on both West Creek RM 8.55 and Site 5, both sites were given a primary headwater stream classification. With a lack of coldwater fish and macroinvertebrate species, no signs of salamanders or any reproduction, no warmwater adapted fish species, and an HMFEI score of 21, West Creek RM 8.55 is considered a “Small Drainage Warm Water Stream”. With zero coldwater fish or macroinvertebrates collected, and the evidence of northern two-lined salamander reproduction, West Creek Site 5 is considered a “Type A Spring Water” headwater habitat. Future monitoring of these sites will help determine if any changes in classification have occurred as a result of the restoration activities that will be completed there.

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