

NORTHEAST OHIO REGIONAL SEWER DISTRICT

2014 Doan Brook Environmental Monitoring Biological, Water Quality and Habitat Survey Results



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Water Quality and Industrial Surveillance
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Introduction

In 2014, the Northeast Ohio Regional Sewer District (NEORS) conducted water chemistry sampling, habitat assessments, and fish and benthic macroinvertebrate surveys on Doan Brook at river miles (RM) 0.75, 1.40, and 6.70. The data collected was evaluated to determine the extent to which the downstream biological communities may be impacted by combined sewer overflow (CSO) discharge points and other environmental impairments. Sampling was conducted by NEORS Level 3 Qualified Data Collectors certified by the 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 *2014 Doan Brook Environmental Monitoring* approved by Ohio EPA on April 14, 2014.

Macroinvertebrate and water chemistry sampling at RM 0.75 is required by Ohio EPA Permit No. 3PA00002*FD. Fish and habitat assessments are not required, but were conducted to determine the overall quality of water at this location.

Table 1 is a map of the sampling locations evaluated during the study, and Figure 1 indicates the sampling location with respect to river mile, latitude/longitude, description, and the types of surveys conducted. A digital photo catalog of the sampling locations is available upon request by contacting the NEORS Water Quality and Industrial Surveillance Division.

Table 1. Doan Brook Evaluated Sites						
Site Location	Latitude	Longitude	River Mile	Description	HUC 8	Purpose
Doan Brook	41.5330	-81.6296	0.75	Downstream of St. Clair Avenue	Ashtabula-Chagrin 04110003	Evaluate chemistry, habitat, fish, & macroinvertebrates in support of Ohio EPA Permit #3PA00002*FD and watershed assessment
Doan Brook	41.4838	-81.5643	6.70	Upstream of Lee Road	Ashtabula-Chagrin 04110003	Evaluate chemistry, habitat, fish, & macroinvertebrates for watershed assessment
Doan Brook, South Branch	41.4739	-81.5593	1.40	Upstream of Attleboro Road	Ashtabula-Chagrin 04110003	Evaluate chemistry, habitat, fish, & macroinvertebrates for watershed assessment



Figure 1. Doan Brook Sample Locations

Water Chemistry and Bacteriological Sampling

Methods

Water chemistry and bacteriological sampling was conducted six times between June 17, 2014, and July 22, 2014, on Doan Brook and select tributaries. Techniques used for sampling and analyses followed the Ohio EPA *Surface Water Field Sampling Manual* (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 EXO1 or 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 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.

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 OMZA, it generally cannot be determined if Doan Brook 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 brook.

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

Results and Discussion

As a part of the 2014 study, one duplicate and one field blank was collected. The duplicate sample was collected on June 24, 2014, at RM 6.70 for QA/QC purposes. The duplicate sample revealed only one parameter that was rejected due to an RPD that was greater than the acceptable RPD (Table 2). This elevated result could be due to include lack of precision and consistency in sample collection and/or analytical procedures, environmental heterogeneity, and/or improper handling of samples.

Table 2. Duplicate Parameter Analysis					
Date	Site	Parameter	Acceptable RPD (%)	Actual RPD (%)	Qualifier
6/24/2014	RM 6.70	Al	27.3	36.9	Rejected

Over the course of the sampling, one field blank was collected on July 15, 2014. Ohio EPA's Credible Data program includes a data validation protocol for QA/QC samples. Using this protocol, some of the sample results needed to be rejected, downgraded from Level 3 to Level 2 credible data or qualified as estimated values ('J') when compared to the field blanks (Table 3). It is unclear how the field blanks became contaminated and may be due to inappropriate sample collection, handling, or contaminated blank water.

Table 3. Unacceptable Field Blank Parameters					
Date	River Mile on Doan Brook	Parameter (X = Rejected; J = Estimated Value)			
		Cr	NH3	Zn	
07/15/2014	RM 0.75	J		J	
07/15/2014	RM 1.40		X	Level 2	
07/15/2014	RM 6.70	J	J	J	

Paired parameters, those in which one is a subset of the other, for all samples collected were also evaluated and compared for QA/QC purposes. These comparisons

revealed that one set of data for total and dissolved solids needed to be listed as estimated (Table 4). This was due to the total dissolved solids concentration being greater than the total solids concentration, but with the RPD between the parameters still meeting the acceptable level. Because there were no exceedances associated with these parameters, qualification of these results did not significantly change the overall water chemistry assessment of Doan Brook.

Table 4. Paired Parameter Analysis					
Date	Site	Parameters	Acceptable RPD (%)	Actual RPD (%)	Qualifier
6/24/2014	RM 6.70	<i>TS (Total Solids)</i> <i>TDS (Total Dissolved Solids)</i>	16.5	3.0	Estimated

Doan Brook 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 samples collected at each site were compared to the applicable Ohio Water Quality Standards for the designated uses to determine attainment (Ohio EPA, 2009a).

Water chemistry sampling at the Doan Brook sites in 2014 revealed mercury concentrations that resulted in 30-day averages that exceeded the Human Health Nondrinking Water and Protection of Wildlife Outside Mixing Zone Averages (OMZA) and Tier 1 OMZA for all sampling periods (Table 5). Mercury may be introduced into Doan Brook from CSO discharges and urban runoff within the watershed.

Table 5. 2014 Doan Brook Mercury Concentrations						
Site	Sample Date	Form (units)	Adjusted Concentration*	30-Day Average Concentration	OMZA Criterion Nondrinking	OMZA Criterion Wildlife
RM 0.75	06/17/2014	TR (µg/L)	0.01	0.009	0.0031	0.0013
RM 0.75	06/24/2014	TR (µg/L)	0.005	0.008	0.0031	0.0013
RM 0.75	07/01/2014	TR (µg/L)	0.005	0.009	0.0031	0.0013
RM 0.75	07/08/2014	TR (µg/L)	0.019	0.010	0.0031	0.0013
RM 0.75	07/15/2014	TR (µg/L)	0.005	0.005	0.0031	0.0013
RM 1.40	06/17/2014	TR (µg/L)	0.019	0.018	0.0031	0.0013
RM 1.40	06/24/2014	TR (µg/L)	0.005	0.023	0.0031	0.0013
RM 1.40	07/01/2014	TR (µg/L)	0.005	0.032	0.0031	0.0013
RM 1.40	07/08/2014	TR (µg/L)	0.058	0.018	0.0031	0.0013

Table 5. 2014 Doan Brook Mercury Concentrations						
Site	Sample Date	Form (units)	Adjusted Concentration*	30-Day Average Concentration	OMZA Criterion Nondrinking	OMZA Criterion Wildlife
RM 6.70	06/17/2013	TR (µg/L)	0.005	0.005	0.0031	0.0013
RM 6.70	06/24/2013	TR (µg/L)	0.005	0.005	0.0031	0.0013
RM 6.70	07/01/2013	TR (µg/L)	0.005	0.005	0.0031	0.0013
RM 6.70	07/08/2013	TR (µg/L)	0.005	0.005	0.0031	0.0013

*For concentrations below the MDL, ½ the MDL used as the concentration

The Class B Primary Contact Recreation criteria for Doan Brook include an *E. coli* criterion not to exceed a single sample maximum (SSM) of 523 colony-forming units per 100 milliliters (colony counts/100mL) in more than ten percent of the samples taken during any thirty-day period, and a seasonal geometric mean (SGM) criterion of 161 colony counts/100mL (Ohio EPA, 2009b) (Table 6). Doan Brook exceeded the Class B Primary Contact Recreation SGM at all sites. The SSM criterion was also exceeded for most of the 30-day periods throughout the study. The exception to this was for the 30-day period starting on July 15, 2014, for the site at RM 6.70.

Several wet-weather events happened throughout the sampling season that possibly led to increased levels of mercury and *E. coli* in the samples. On June 16, 2014, there was a wet-weather event¹ that might have caused exceedances on the samples collected on June 17, 2014. Both RMs 0.75 and 6.70 exceeded the criteria for mercury, while RM 0.75 exceeded the criteria for *E. coli*. On June 23, 2014, there was also a wet-weather event. Samples collected on June 24, 2014, had mercury exceedances at all three sample points. Also on this day, *E. coli* exceeded the single-sample maximum value at RMs 0.75 and 1.40. A wet-weather event on July 7, 2014, may have caused samples collected on July 8, 2014, to have exceedances for mercury at RMs 0.75 and 1.40 and for *E. coli* at all three samples points. The samples collected that day had the highest levels of mercury and *E. coli* seen throughout the sampling period; 0.058 µg/L of mercury at RM 1.4, and 37,000 MPN/100mL *E. coli* at RM 0.75. These numbers were much higher than the highest levels sampled from 2013; 0.038 µg/L mercury at RM 1.4 and 7,800 CFU/100mL *E. coli* at RM 0.75.

¹ Wet-weather sampling events are considered 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. For wet weather sampling events with greater than 0.25 inches of rain, the samples collected that day and the following two days are considered wet weather samples.

Table 6. 2014 Doan Brook <i>E. coli</i> Densities (MPN/100mL)				
	Sample Date	Result (CFU/100mL)	30-Day Average Density (CFU/100mL)	Single Sample Maximum % Days > 523 CFU/100mL
RM 0.75	6/17/2014	3,585	14,911.60	100
	6/24/2014	27,080	14,790.60	100
	7/1/2014	1,101	11,718.25	100
	7/8/2014	37,000	15,257.33	100
	7/15/2014	5,792	4,386.00	100
	7/22/2014	2,980	---	---
Seasonal Geomean			6392.86	
RM 1.40	6/17/2014	648	6,573.60	80.0
	6/24/2014	1,840	8,055.00	75.0
	7/1/2014	360	10,126.67	66.7
	7/8/2014	29,186	15,010.00	100.0
	7/15/2014	834	---	---
	Seasonal Geomean			1,598.8
RM 6.70	6/17/2014	188	340.8	20.0
	6/24/2014	334	379.0	25.5
	7/1/2014	109	394.0	33.3
	7/8/2014	819	536.5	50.0
	7/15/2014	254	---	---
	Seasonal Geomean			269.6
EC=Estimated Count --- The 30-Day Average Density and the Single Sample Maximum % Days require more than one sample to be taken after the corresponding sample date in order to have an average.				

Ohio EPA's Trophic Index Criterion assigns designations for quality of surface waters based on many factors including nutrients, periphyton, dissolved oxygen, and biological assemblages. This criterion was published in 2011 as a draft, and in March 2013, some aspects of the paper were published in a document called, "Trophic Index Criterion- Rationale and Scoring" (Ohio EPA, Division of Surface Water). The scoring places the streams into one of three categories: impaired, threatened, or acceptable. NEORS does not assess periphyton; however, nutrients were assessed. The scoring is based on levels of total phosphorus and dissolved inorganic nitrogen (DIN).

Of the three sites assessed, Doan Brook RMs 0.75 and 6.70 were both considered "Threatened". For Doan Brook RM 0.75, the samples collected showed an average of 0.20 mg/L total phosphorus and an average of 0.55 mg/L DIN. This narrative rating is

described as “Concentrations observed with high-intensity land use and WWTP loadings” (Ohio EPA). Doan Brook RM 6.70 showed an average of 0.1314 mg/L total phosphorus and an average of 0.23 mg/L DIN. This site was within 0.0014 mg/L total phosphorus of getting an “Acceptable” rating. However, Doan Brook RM 1.40 was analyzed and results showed an average of 0.10 mg/L total phosphorus and an average of 0.26 mg/L DIN. This is a narrative rating of “Acceptable” and is described as, “Concentrations typical of healthy streams in working landscapes”. The high nutrient loading at RMs 0.75 and 6.70 are likely a factor contributing to the low scoring biological criteria assessments which follow in this report. The high nutrient loadings could have resulted from one or more of the following: ongoing construction projects along Doan Brook, fertilizer run-off from two upstream golf courses or several wet weather events during 2014.

Table 7. Ohio EPA Trophic Index Criterion Scoring for the Nutrient Component					
Total Phosphorus (mg/L)	Dissolved Inorganic Nitrogen (mg/L)				
	≤0.44	0.44-1.10	1.10-3.60	3.60-6.70	≥6.70
≤0.04	6	3	3	1	0
0.04-0.08	3	3	3	1	0
0.08-0.13	3	3	1	1	0
0.13-0.40	1	1	1	0	0
≥0.40	0	0	0	0	0

Habitat Assessment

Methods

Instream habitat assessments were conducted on Doan Brook in 2014 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 55 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 NEORS Division.

Results and Discussion

The stream segment at RM 0.75 obtained a QHEI score of 62.00, a narrative rating of *Good* (Table 8), exceeding the warmwater habitat target of 55 and the potential to support a healthy fish community. Sand and gravel were the predominant substrate types. Moderate instream cover consisting of shallows, deep pools, boulders, and woody debris were present. This portion of the stream is channelized with low sinuosity, which detracts from the overall score.

The South Branch of Doan Brook at RM 1.40 obtained a score of 61.50 (*Good*). This site is predominantly sand and gravel. It had moderate instream cover including woody debris, shallows, and undercut banks. No functional riffle was identified in this section of stream; this led to a lower overall score.

At RM 6.70, the site obtained a QHEI score of 58.75 (*Good*), exceeding the warmwater habitat target (Table 8). Cobble and gravel were the predominant substrate types. High sinuosity, a lack of channelization, deep pools, and riffles were beneficial to the overall score.

River Mile	Date	QHEI Score	Narrative	Stream Flow (ft ³ /s)*
0.75	7/17/14	62.00	<i>Good</i>	39
1.40 South Branch	7/17/14	61.50	<i>Good</i>	39
6.70	6/16/14	58.75	<i>Good</i>	7.2

*Provisional flow data obtained from USGS 04208700 Euclid Creek flow gauge in Cleveland, Ohio

Electrofishing

Methods

One quantitative electrofishing pass was conducted at RMs 0.75, 6.70, and 1.40 in 2014. Sampling was conducted using either longline or backpack electrofishing techniques and consisted of shocking all habitat types within a sampling zone while moving from downstream to upstream. The sampling zone was 0.15 kilometers individually for all sites. 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 an Ohio EPA index, the Index of Biotic Integrity (IBI). 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 9. Lists of the species, numbers, pollution tolerances and incidence of DELT anomalies for fish collected during the electrofishing passes at each site are available upon request from the NEORSD WQIS Division.

Table 9. 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

In 2014, the fish community at Doan Brook RM 0.75 obtained an IBI score of 28 (*Fair*) compared to the 2013 score of 24 (*Poor*) and failed to meet the WWH IBI criterion of 40 (Table 10 and Figure 2). Of the fish collected, 99% (compared to 96% in 2013) were considered moderately to highly pollution tolerant. The sample consisted mainly of

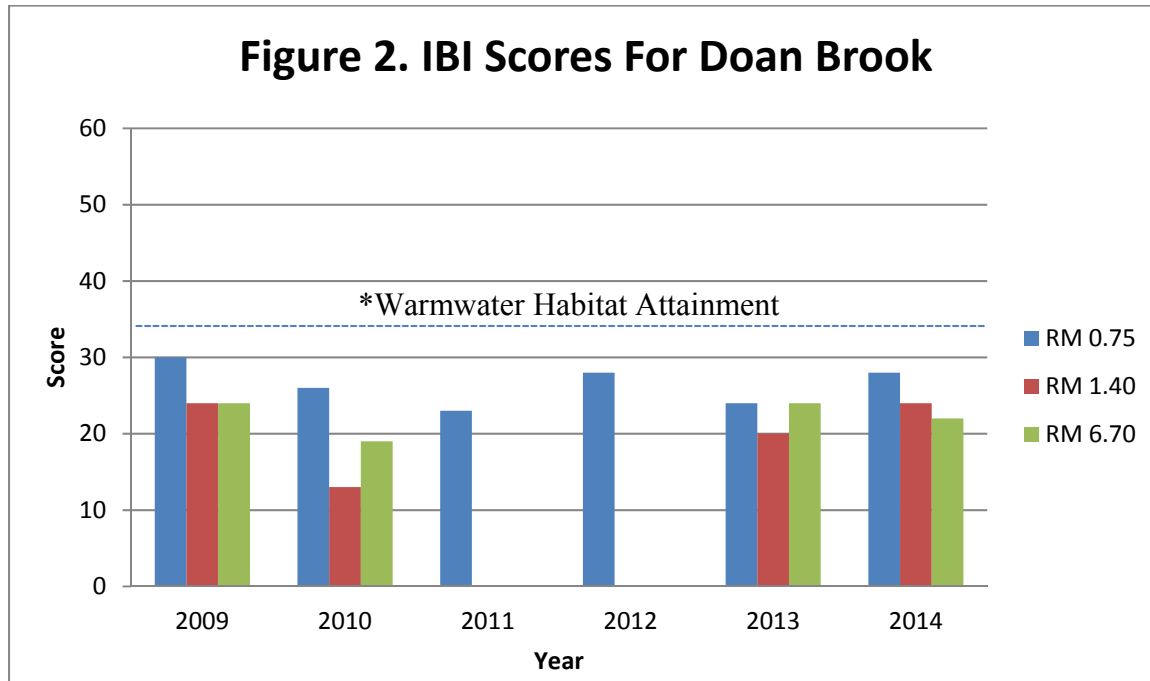
northern bluegill sunfish, pumpkinseed sunfish, and brown and yellow bullheads. The number of DELT anomalies present on fish collected in 2014 was 7.84%, which was lower than 2013's 14%. Degraded water quality indicated by mercury and *E. coli* exceedances at RM 0.75 may have contributed to the abundance of pollution-tolerant fish species and lack of pollution-intolerant species. A QHEI score of 62.00 (*Good*) indicates that necessary instream habitat is present to support a robust fish community; however, the poor water quality of Doan Brook prevents intolerant fish species from establishing populations.

The IBI score at RM 1.40 was 24 (*Poor*), which was consistent with years past. This site has only had one species collected in the last 5 years, green sunfish, and in 2014 had a DELT anomaly percentage of 0.0%. This was a slightly lower percentage than in 2013 (4.9%) and 2010 (1%). A total of 18 specimens were collected from the site in 2014; this was compared to 2013 when 82 fish were present and 2010, when 147 and 297 fish were present on two passes. There were exceedances for both mercury and *E. coli* at this site.

At RM 6.70, the IBI score was a 22 with a narrative rating of *Poor*. The site had two species, creek chubs and western blacknose dace. This was one less species than the assessment conducted in 2013, which also had green sunfish. In 2014, 82 fish were collected, up from 2013 when 77 fish were collected, but much lower than 2010 when 382 and 288 fish were collected during two assessments. All of these are pollution-tolerant species. There were no DELT anomalies on the 82 fish collected.

River Mile	Year	IBI Score
0.75	2014	28 (<i>Fair</i>)
	2013	24 (<i>Poor</i>)
	2012	28 (<i>Fair</i>)
	2011	23 (<i>Poor</i>)
	2010	26 (<i>Poor</i>)
	2009	30 (<i>Fair</i>)
1.40	2008	22 (<i>Poor</i>)
	2014	24 (<i>Poor</i>)
	2013	20 (<i>Poor</i>)
	2010	23 (<i>Poor</i>)
	2009	24 (<i>Poor</i>)
6.70	2008	22 (<i>Poor</i>)
	2014	22 (<i>Poor</i>)
	2013	24 (<i>Poor</i>)

2010	19 (<i>Poor</i>)
2009	24 (<i>Poor</i>)
2008	20 (<i>Poor</i>)



*Non-significant departure (≤ 4 IBI units) from applicable criterion

Macroinvertebrate Sampling

Methods

Macroinvertebrates were sampled quantitatively using modified Hester-Dendy (HD) samplers in conjunction with a qualitative assessment of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly), also referred to as EPT taxa, inhabiting available habitats at the time of HD retrieval. Sampling was conducted at all of the locations listed in Table 1. Methods for sampling followed the Ohio EPA's Biological Criteria for the Protection of Aquatic Life, Volume III (1987b). The recommended period for HDs to be installed is six weeks.

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 quantitative and qualitative sampling at each site are available upon request from the WQIS Division.

The overall aquatic macroinvertebrate community in the stream was evaluated using Ohio EPA’s Invertebrate Community Index (ICI) (Ohio EPA 1987a). The ICI consists of ten community metrics (Table 11), each with four scoring categories. Metrics 1-9 are based on the quantitative sample, while Metric 10 is based on the qualitative EPT taxa. The total of the individual metric scores result in the overall score. This scoring evaluates the community against Ohio EPA’s reference sites for each specific eco-region.

Table 11. ICI Metrics
Total number of taxa
Number of mayfly taxa
Number of caddisfly taxa
Number of dipteran taxa
Percent mayflies
Percent caddisflies
Percent Tanytarsini midges
Percent other diptera and non-insects
Percent tolerant organisms (as defined)
Number of qualitative EPT taxa

Results and Discussion

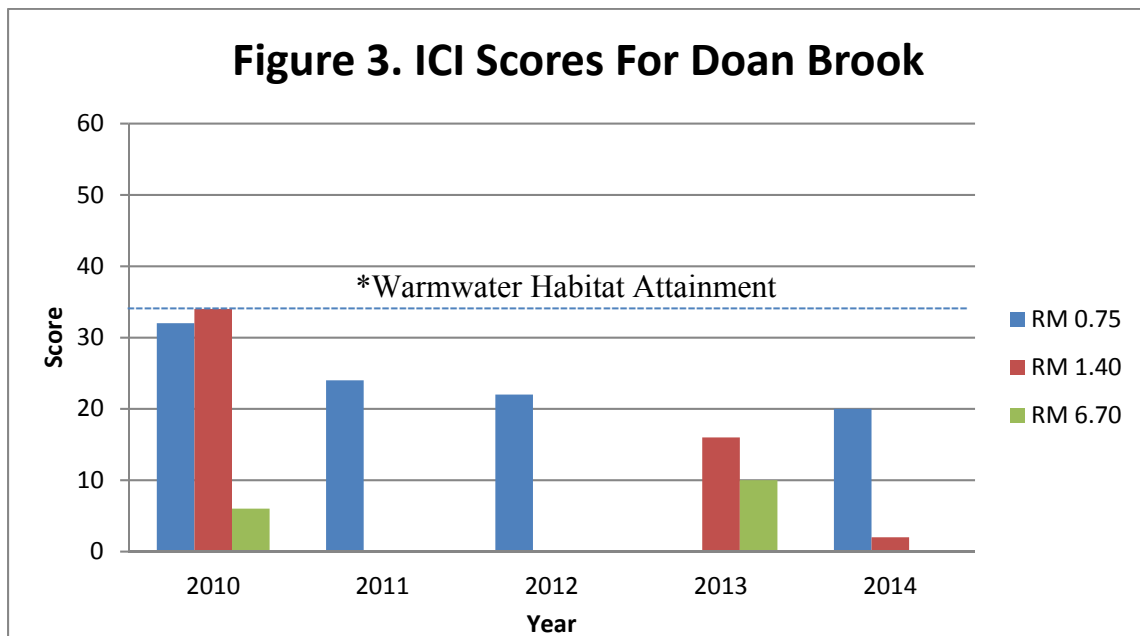
The benthic macroinvertebrate community at Doan Brook RM 0.75 obtained an ICI score of 20 and a narrative rating of *Fair* (Table 12). Two EPT taxa were counted in the qualitative sample. This rating is lower than in years past. Since 2010, the ICI score has consistently declined, from 32 in 2010 down to a 20 in 2014.

Table 12. 2010-2014 Averaged Invertebrate Community Index Scores											
River Mile	2010	Narrative Rating	2011	Narrative Rating	2012	Narrative Rating	2013	Narrative Rating	2014	Narrative Rating	2015
0.75	32	<i>Good</i>	24	<i>Fair</i>	22	<i>Fair</i>	N/A	<i>* Poor</i>	20	<i>Fair</i>	
1.40	34	<i>Good</i>	N/A		N/A		16	<i>Fair</i>	2	<i>Very Poor</i>	
6.70	6	<i>Very Poor</i>	N/A		N/A		10	<i>Poor</i>	N/A		
<ul style="list-style-type: none"> Based on best professional judgment 											

The other sites which were monitored this season were Doan Brook RMs 1.40 and 6.70. The ICI score calculated at Doan Brook RM 1.40 was 2 with a narrative rating of *Very Poor*. This is lower than in years prior. This site was not monitored in 2011 and 2012 and therefore did not have ICI scores for those years, but in 2010, the ICI score was 34. There was one qualitative EPT taxa noted at this site for 2014.

No ICI score was calculated at Doan Brook RM 6.70 due to the loss of the Hester-Dendy sampler. In 2013, the ICI score was 10 for the site, and in 2010 it was a 6. There was no data from 2011 or 2012. No qualitative EPT taxa were collected at this site in 2014. Due to low total taxa, a lack of sensitive taxa, and historical data, the narrative rating of *Poor* was assigned to this site using best professional judgment.

Doan Brook RM 6.70 is downstream of Horseshoe Lake in Shaker Heights. Samples collected by NEORSD in the late 1990s just upstream of Horseshoe Lake have shown elevated solids and nutrients (Goosh, 2001). There are no CSOs upstream of RM 6.70; however, there are 19 outfalls with illicit discharge along the north branch of Doan Brook, which may be contributing to the high phosphorous, *E. coli*, and total solids levels. All of these outfalls have been sampled within 2010-2014, and some of the discharges, when analyzed, had elevated *E. coli* levels and appear to be intermittent in nature.



*Non-significant departure (≤ 4 ICI units) from application criterion

Conclusions

Bacteriological sampling showed elevated *E. coli* densities at all Doan Brook sites, an indication of generally poor water quality conditions. As a result, a relatively high percentage of pollution-tolerant fish and macroinvertebrate species were present in the stream. Wet-weather flows originating from outfalls and containing illicit discharges may be contributing to the elevated levels of *E. coli* and other pollutants. A stream enhancement project that was taking place at RM 1.0 between June 24, 2013, and October 15, 2014, may have led to increased pollutants and sediment loads in Doan Brook.

The main branch of Doan Brook has an especially high number of illicit discharges upstream of Horseshoe Lake where *E. coli* levels have been historically high. This is an issue which NEORS is currently working on throughout the service area, but it is one that will take time due to the large quantity of outfalls that have been analyzed as being elevated. Nutrient loadings above the acceptable level, as those measured at RM 0.75 and 6.70, may be preventing Doan Brook from supporting a more diverse macroinvertebrate community. It would be beneficial to collect and analyze a few samples upstream and downstream of Horseshoe Lake in order to determine if it is contributing nutrients to the stream or if the illicit discharges are the main source within the area around RM 6.70. An overview of the scores for the 2014 assessment is shown in Table 13.

QHEI scores for Doan Brook were all considered *Good* for 2014, indicating that necessary instream habitat is present to support many species of fish. However, due to poor water quality, intolerant fish species cannot establish populations. The fish community in Doan Brook is limited to a few tolerant species due to the degraded water quality. From 2009 through 2014, six electrofishing passes were completed at the Doan Brook site at RM 0.75. Of the six passes completed, the IBI score has stayed between 23 and 30, keeping this sample point in the *Poor* to *Fair* range. Seven out of the eleven species of fish collected at RM 0.75 in 2014 were highly pollution-tolerant and three others were moderately pollution tolerant. The other two sites that were assessed also had a poor fish community present; RM 1.40 only had one species present, and RM 6.70 only had two species, all highly tolerant.

The macroinvertebrate community in Doan Brook RM 0.75 received an ICI score of 20 and a *Fair* rating. The recorded rating for RM 1.40 was only a 2, lower than the 16 it received in 2013, and much lower than 2010's score of 34. An ICI score was not determined for RM 6.70 due to the loss of the Hester-Dendy. This site has received *Poor* ratings in 2009, 2010, and 2013.

Doan Brook therefore did not meet the standards for Aquatic Life Use and received Non-Attainment status (Table 13). Stream habitat in Doan Brook met Ohio

EPA’s target for WWH; however, water quality did not as exceedances occurred for *E. coli* and mercury. Therefore, water quality may need to improve before the biotic communities can do likewise.

Table 13. 2014 Doan Brook Survey Results					
River Mile	IBI Score/ Narrative Rating	ICI Score/ Narrative Rating	Aquatic Life Use Attainment Status	QHEI Score/ Narrative Rating	Water Quality Exceedances
0.75	28/ <i>Fair</i>	20/ <i>Fair</i>	NON	62.0/ <i>Good</i>	<i>E. coli</i> , Mercury
1.40	24/ <i>Poor</i>	2/ <i>Very Poor</i>	NON	61.5/ <i>Good</i>	<i>E. coli</i> , Mercury
6.70	22/ <i>Poor</i>	--/ <i>Poor</i>	NON	58.75/ <i>Good</i>	<i>E. coli</i> , Mercury
WWH biocriterion attainment: IBI score of 36; ICI score of 30 Nonsignificant departure: ≤4 IBI units; ≤4 ICI units --HD not collected; qualitative assessment only *Narrative rating based on best professional judgment and habitat evaluation					

Acknowledgments

Field activities and report review completed by the following, except where otherwise noted:

Kelsey Amidon
 Donna Friedman
 Seth Hothem
 Ron Maichle
 Mark Matteson
 Mario Meany, Author
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