

NORTHEAST OHIO REGIONAL SEWER DISTRICT

2009 Dugway Brook East Interceptor Relief Sewer Alignment Project (DEIRS) Baseline Assessment Study



**Prepared by
Water Quality and Industrial Surveillance's
Environmental Assessment Section**

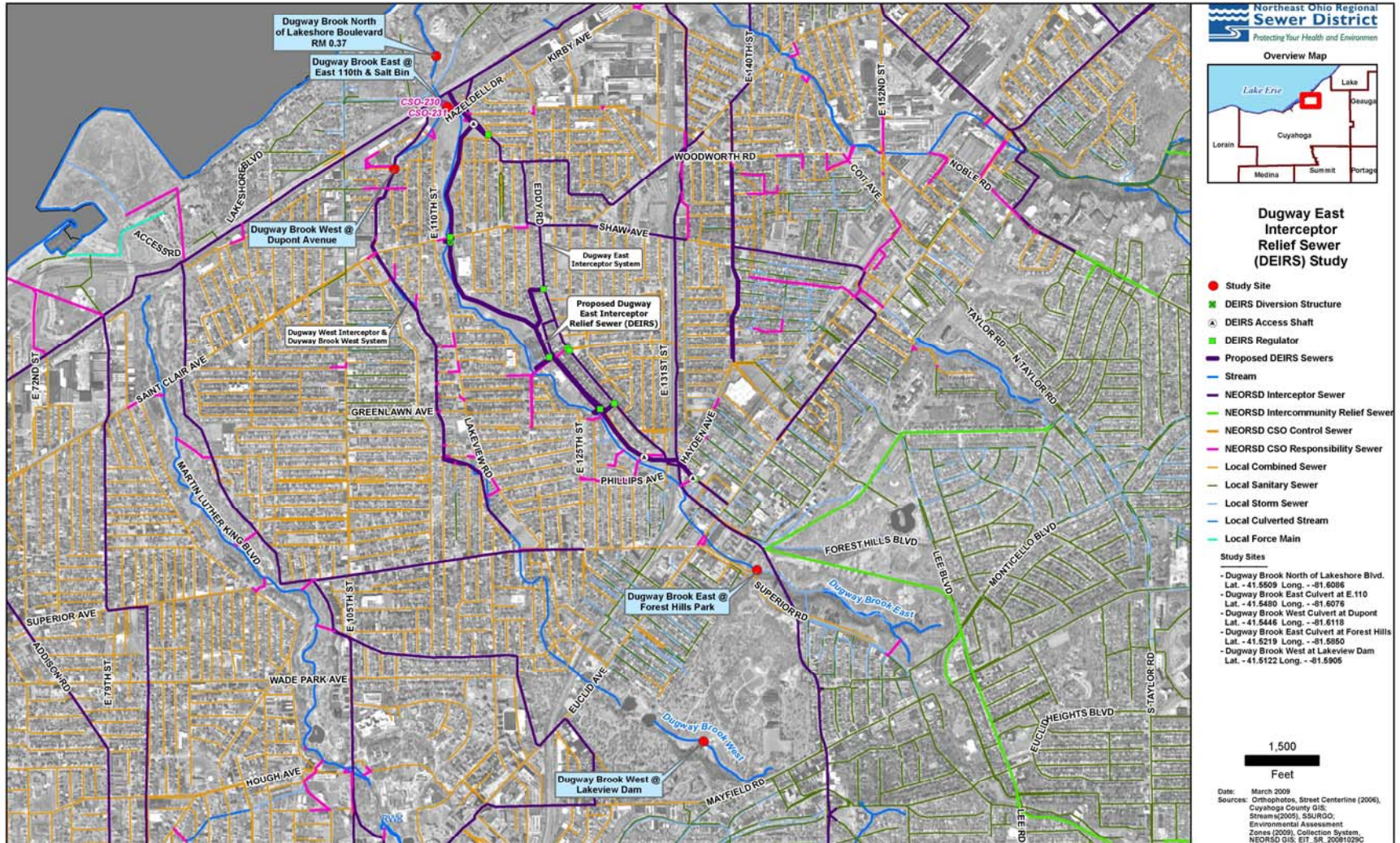
Introduction

In 2009, the Northeast Ohio Regional Sewer District (NEORS) completed a baseline assessment study at sites on Dugway Brook, a tributary to Lake Erie (Figure 1). The purpose of the Dugway East Interceptor Relief Sewer (DEIRS) project is to provide wet weather relief in the existing Dugway East Interceptor Sewer in the cities of Cleveland and East Cleveland. Baseline data was gathered on the East and West Branches of Dugway Brook under a variety of flow conditions. The 2009 sampling included electrofishing, benthic macroinvertebrate sampling, water chemistry and bacteriological sampling, and habitat assessments. Although Dugway Brook has no Aquatic Life or Recreational Use Designation, the Warmwater Habitat Aquatic Life Use Criteria and the Primary Contact Recreational Use Criteria were applied for comparison purposes in this report. The biological integrity of Dugway Brook was assessed at River Mile (RM) 0.37, downstream from Lakeshore Boulevard and results were used to evaluate Dugway Brook in comparison to Ohio EPA's Qualitative Habitat Evaluation Index (QHEI), Index of Biotic Integrity (IBI), and Qualitative Community Tolerance Value (QCTV). A Hester-Dendy artificial substrate sampler was set in Dugway Brook at Lakeshore Boulevard RM 0.37; however, during the course of inspections, the artificial sampler was found to be not completely submerged for the full six-week installation period due to fluctuations of the water level from Lake Erie. The sampler was therefore not processed and an ICI score was not calculated. A qualitative sample was collected in its place and a QCTV value was calculated. Sampling will again be performed once construction is complete to determine the effectiveness of the DEIRS project. Sampling was conducted by NEORS Level 3 Qualified Data Collectors certified by Ohio EPA in Fish Community and Benthic Macroinvertebrate Biology, Chemical Water Quality and Stream Habitat Assessments as explained in the NEORS study plan approved by Ohio EPA on May 12, 2009.

Figure 1 is a map of the sampling locations on Dugway Brook, and Table 1 indicates the sampling locations and includes river mile (RM) where applicable, latitude/longitude, description, and the types of surveys conducted.

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Figure 1.



This map/data was compiled by the Northeast Ohio Regional Sewer District ("District") which makes every effort to produce and publish the most current and accurate information possible. This map/data was created and compiled to serve the District for planning and analysis purposes. The District makes no warranties, expressed or implied, with respect to the accuracy of this map/data and its use for any specific purpose. The District and its employees expressly disclaim any liability that may result from the use of this map/data. For more information, please contact: Jeffrey Duke, P.E. (Engineering Information & Technology) 3900 Euclid Avenue, Cleveland, Ohio 44115 (216-881-6600).

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Table 1.

Location	Latitude	Longitude	River Mile	Description	Quadrangle	Purpose
Forest Hills Park Forest Hills Blvd. and Forest Hills Ave.	N41.5218°	W81.5850°	N/A	Dugway Brook, East Branch Upstream of DEIRS Alignment	East Cleveland	Evaluate Water Chemistry prior to DEIRS Alignment
East 110th Street Salt Dome Road	N41.5479°	W81.6076°	N/A	Dugway Brook, East Branch Downstream of DEIRS Alignment	East Cleveland	Evaluate Water Chemistry prior to DEIRS Alignment
North of Lakeshore Blvd. North of NEORS D Netting facility	N41.5509°	W81.6086°	0.37	Dugway Brook Main Branch North of Lakeshore Blvd.	East Cleveland	Evaluate Water Chemistry, Fish, Habitat and Macroinvertebrates
Lakeview Cemetery downstream of NEORS D flood control dam.	N41.5122°	W81.5905°	N/A	Dugway Brook, West Branch Upstream section	East Cleveland	Evaluate Water Chemistry, Fish, and Habitat and Macroinvertebrates
10658 Dupont Avenue	N41.5446°	W81.6118°	N/A	Dugway Brook, West Branch Downstream of all CSO's except (D-61, D-03A)	East Cleveland	Evaluate Water Chemistry prior to DEIRS Alignment

Water Chemistry and Bacteriological Sampling

In 2009, water quality samples were collected from Dugway Brook at the five locations listed in the above table. Twenty-five samples were collected from July 22, 2009, to August 17, 2009, at the above five locations, two samples were field blanks. Each sample was analyzed for 42 chemical parameters, plus the field measurements. The sample and the one required sample duplicate were compared for each of the individual parameters reported on the Certificate of Analysis. All of the water chemistry sampling followed the *Manual of Ohio Environmental Protection Agency's* (Ohio EPA) *Surveillance Methods and Quality Assurance Practices* (2009). After the study it was determined that the pH was being calibrated once a week and not daily. Therefore, some of the samples have field pH meter measurements that did not follow the Ohio EPA Surveillance Methods, and those pH results were not compared to the Ohio water quality standards criteria.

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Water quality monitoring of Dugway Brook prior to the DEIRS alignment will provide baseline data which, after work completion, will demonstrate any improvements in water chemistry and the aquatic life community present in the brook.

For each water quality sampling event, a sample was collected in one 4-liter disposable polyethylene Cubitainer with disposable polypropylene lid, two 473-mL plastic bottles and one treated bacteriological bottle. Field parameters were measured in stream, when flow conditions permitted. The plastic bottles were field preserved with either trace nitric acid or trace sulfuric acid. All samples were placed in a cooler with ice and stored on the locked vehicle until the samples were transferred to the NEORSD's Analytical Services sample receiving. All samples were released to an authorized Analytical Services employee with a Chain of Custody.

Field analyses included the use of a YSI-556 MPS Multi-Parameter Water Quality Meter or a YSI 600 XL sonde to measure dissolved oxygen, water temperature, specific conductance and pH at the time of sampling. During the study, it was necessary to utilize a Hanna HI 98129 for pH when the pH calibration on the YSI-556 MPS failed to meet quality assurance and quality control (QA/QC) requirements. A Surface Water Condition Sampling Field Data Form was filled out for each site during each sampling event.

Dugway Brook is in an urbanized area and its drainage area includes the communities of Cleveland, East Cleveland, Cleveland Heights, University Heights, and Bratenahl. The Brook has two main branches, East and West. Most of Dugway Brook is culverted; however, two sites that were sampled, Lakeshore Boulevard and the west branch of Dugway Brook downstream of the NEORSD flood control dam at Lakeview Cemetery, are open. The NEORSD Community Discharge Program Status Report has documented a number of Sanitary Sewer Overflows (SSOs) and Combined Sewer Overflows (CSOs) flowing to Dugway Brook. There are eight SSOs (Table 2) within the Dugway Brook watershed.

Table 2.
 Sanitary Sewer Overflows (SSO's) on Dugway Brook

Community	SSO #	Location
Cleveland Heights	CH-11	Hampshire Lane at Mayfield Rd.
Cleveland Heights	CH-24	3003 Euclid Heights Blvd.
Cleveland Heights	CH-28	Euclid Heights Blvd. and Lee Rd.
Cleveland Heights	CH-10	Hampshire Lane at Mayfield Rd.
Cleveland Heights	CH-25	Cumberland Rd. and Somerton Rd.
Cleveland Heights	CH-30	South Compton and Blanche Rd.
Cleveland Heights	CH-14	Derbyshire at Euclid Hts. Blvd.
University Heights	32	Meadowbrook Blvd. and Canterbury Rd

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On July 22, August 5, and August 17, 2009, the pH at the Dugway Brook West Branch Lakeview Cemetery site was recorded at 9.22 standard units (s.u.), 9.19 s.u. and 9.17 s.u., respectively, exceeding the outside mixing zone maximum (OMZM) warmwater habitat use criterion of 9.0 s.u. Ohio EPA methods require the calibration of pH meter on the day being used. Since calibration did not occur on the day when the elevated pH's was found, the elevated pH's are being presented only as a possible water quality impairment and not an actual exceedance of the water quality standard.

An algae bloom was noted at this site at the time of sampling that day and a high pH can be an indicator of photosynthesis by large quantities of algae growth¹. No other exceedances of the criteria occurred during sampling.

Although there is no recreational use designation on Dugway Brook, the Primary Contact Recreational Use Criterion for *Escherichia coli* is a geometric mean of *E. coli* content based on not less than five samples within a thirty-day period, which shall not exceed 126 colony forming units per 100 mL (CFU/100 mL) and *E. coli* content shall also not exceed 298 CFU/100 mL in more than ten percent of the samples taken during any thirty-day period," (Ohio EPA, 2009). Table 3 lists the *E. coli* sample results for each site.

The thirty-day geometric mean for *E. coli* content exceeding 298 CFU/100 mL in more than ten percent of the samples taken during any thirty-day period were exceeded over the entire course of the study (56 30-day periods) on Dugway Brook at Forrest Hills Park, East 110th Street, Dupont Avenue, and Lakeshore Boulevard.

At the Lakeview Cemetery site, thirteen thirty-day periods were in attainment of the recreation use criterion for *E. coli*. Forty-three thirty-day periods exceeded the geometric mean, Primary Contact Recreation Use criteria of 126 CFU/100 mL of *E. coli*.

The SSOs and CSOs together with other sources of unknown contamination that have not been identified within the watershed of Dugway Brook may be contributing to the elevated bacteria levels during wet² and/or dry weather. One sample collected on August 11, 2009, during wet weather, may also be contributing to the elevated levels of *E. coli* for that day.

¹ Algal & Aquatic Plant Assessment Program: Algae and Water Quality. Retrieved August 31, 2009, from North Carolina Department of Environment and Natural Resources Web site: <http://h2o.enr.state.nc.us/esb/algal.html>

² 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 were considered wet weather samples.

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Sample Date	Lakeview Cemetery	Forrest Hills Park	East 110th Street	Dupont Avenue	Lakeshore Boulevard	Precipitation within 3 days of Sampling (NEORS D rainfall data) (Total Inches)
	<i>E. coli</i> (CFU/100mL)					
7/22/2009	275	1,800	1,180	780	6,900	0.01
7/29/2009	1,380	720	3,900	7,600	3,760	0.04
8/5/2009	376	1,580	5,500	7,100	23,650	0.00
8/11/2009	2,782	2,164	35,400	6,000	37,300	0.73
8/17/2009	233	350	1,350	1,830	2,560	0.00

Documented dry weather overflows to the east and west branches of Dugway Brook in 2009 are listed in Table 4. The elevated levels of *E. coli* from sampling during dry weather on July 29, 2009 at the Lakeview Cemetery site and Lakeshore Boulevard site are originating from the documented source of sanitary sewage contamination to Dugway Brook in the Cleveland Heights collection system at Coventry and Mayfield Road (see WQIS report, July 8, 2007, sanitary sewage in Dugway Brook). Other sources of contamination may include unknown unpermitted sanitary sewage overflows in the local collection system.

Date found	Location and stream branch	Overflow (gal./event)
1/6/2009	D-86, Superior Ave. S.E. of Terrace Ave.(east)	1,458
3/13/2009	D-8, East 106th and Glenville Ave.(west)	33,929
3/5/2009	D76, 13505 Euclid Ave.(east)	29,620
3/16/2009	D76, 13505 Euclid Ave.(east)	26,928
3/16/2009	D-8, East 106th and Glenville Ave.(west)	7,270
4/13/2009	D-6, East 107th and Elk Ave.(west)	19,388
4/15/2009	D-85, Superior Ave. S. of Hillcrest Ave.(east)	2,525
4/28/2009	D-85, Superior Ave. S. of Hillcrest Ave.(east)	7,539
5/27/2009	D-35, Tuscora Ave.& Linn Dr.(west)	24,235
5/28/2009	D-37, Primrose Ave.at Linn Dr.(west)	7,270
6/24/2009	D-37, Primrose Ave.at Linn Dr.(west)	5,816
7/27/2009	D-32, Berkshire & Linn Dr.(west)	30,294

Each sample was analyzed for chemical parameters, plus the field measurements taken on site. The sample and the sample duplicate were compared for each of the

chemical parameters reported on the Certificate of Analysis. Only hardness and nitrate+nitrite were not compared because they are calculated from other parameters. After an RPD was calculated, any difference greater than 30 percent was investigated as to the possible discrepancy.

The relative percent difference (RPD) for the duplicate samples was calculated using Formula 1 as follows:

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

X= is the concentration of analyte in the primary sample

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

Two duplicate samples were collected on Dugway Brook at RM 0.37. There were five instances where the RPD was greater than 30 percent. On July 29, 2009, COD and Selenium were less than the Practical Quantitation Limit (PQL), and Total Suspended Solids (TSS), was slightly greater than ten times the PQL. Because the concentrations of COD and Selenium were less than 10 times the practical quantitation limit, the increased RPD values were attributed to the difference between concentrations of relatively small numbers. On August 11, 2009, the Arsenic value was less than the PQL and on that same day the TSS value was slightly greater than 10 times the PQL. No explanation can be given to the differences in Arsenic and TSS values. All the results are still considered valid and should be averaged when used.

All Certificate of Analysis sheets and Surface Water Condition Sampling Field Data Forms are available upon request from the NEORSD Water Quality and Industrial Surveillance, Environmental Assessment Group.

Habitat Assessment

The Qualitative Habitat Evaluation Index (QHEI) score was determined for the site on Dugway Brook at Lakeshore Boulevard (RM 0.37) in 2009. The QHEI, developed by Ohio EPA, is used to assess the aquatic habitat conditions at each sample location by providing an evaluation of the physical components of a stream. The index is based on six metrics: stream substrate, instream cover, stream channel morphology, riparian and bank condition, pool and riffle quality and stream gradient. These metrics describe the physical attributes of a stream and may be important in explaining why fish species are present or absent. A more detailed description of the QHEI can be found in Ohio EPA's

(2006), *Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)*. The QHEI field sheet for this site is available upon request.

A score of 55 (Good) was obtained for RM 0.37. Gravel and sand were the two predominant substrate types within the stream reach. Sparse to moderate instream cover consisted of undercut banks, overhanging vegetation, shallows, rootmats and rootwads, deep pools and submersed logs. Poor to fair stream channel development existed in this relatively straight section of stream. No functional riffle was present in this section of the stream. QHEI scores ≥ 60 indicate the potential for aquatic life use criteria attainment. When completing the QHEI scoring, organic enrichment was evident in the stretch of stream sampled for fish. Evidence of nuisance odors from the disturbance of the substrate of organic material along the creek bottom was documented when completing the QHEI.

Electrofishing

Methods

Electrofishing was conducted one time at the Lakeshore Boulevard site (RM 0.37) in 2009. Sampling was conducted using longline electrofishing techniques and consisted of shocking all habitat types within a sampling zone, which was 0.15 kilometers in length, while moving from downstream to upstream. The methods that were used followed Ohio EPA protocol methods described in *Biological Criteria for the Protection of Aquatic Life, Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities* (1987). Fish were identified to species level, counted, and examined for the presence of external anomalies including deformities, erosions, lesions, and tumors (DELTs). The results from this sampling were used to calculate an Index of Biotic Integrity (IBI) score for the site. A Modified Index of Well Being (MIwb) was not calculated because this site had a drainage area less than twenty square miles.

A list of the species, numbers, pollution tolerances and incidence of DELT anomalies for fish collected during the electrofishing is available upon request.

Results and Discussion

An IBI score of 36 was calculated for RM 0.37 for the one electrofishing pass. This site met the Warmwater Habitat (WWH) criterion for headwater sites (Figure 2), even though the criterion is not applicable to Dugway Brook.

A total of six species were collected at this site, the dominant fish being the pumpkinseed sunfish. The other fish were comprised of common emerald shiners, common white sucker, goldfish, largemouth bass and a fathead minnow.

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This site is the most downstream site and closest to Lake Erie; the high number of sunfish species may have made the transition from the Lake to the sluggish brook. The high number of pumpkinseed sunfish appeared to influence the fish community scores. IBI metric scores of five were obtained for the low proportion of tolerant species (0.73%), low proportion of omnivore species (0.73%), high proportion of insectivores (99%), low proportion of pioneering species (0.24%), number of individuals collected (816), and few DELT anomalies (0.24%). A score of five is the highest score possible in the scoring criteria. The number of pumpkinseed sunfish collected (380) represented 92% of the total fish collected, dominating the fish collected at this site.

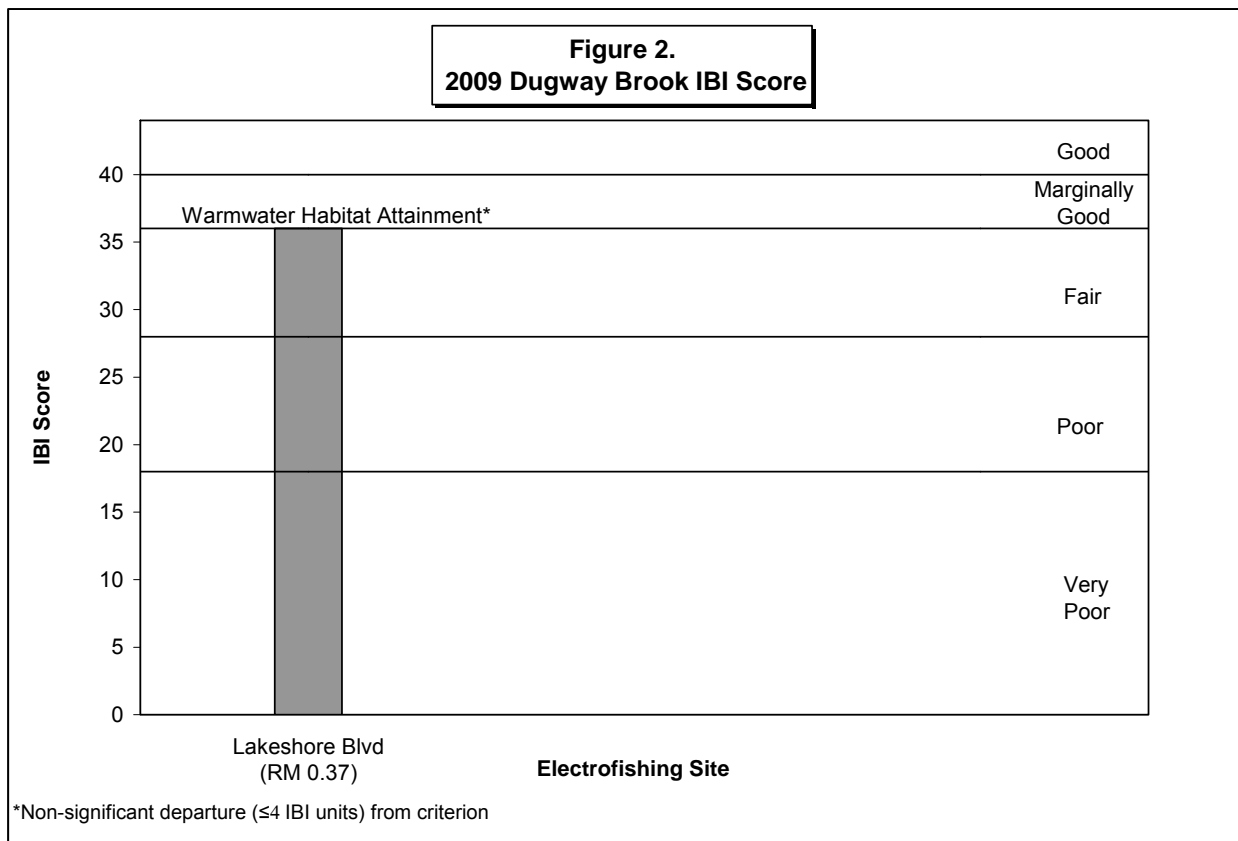


Figure 2 shows the IBI attainment status of Dugway Brook at Lakeshore Boulevard for the 2009 sampling season. Dugway Brook has no Aquatic Life or Recreational Use Designation; however, the IBI criterion was met at this site and the habitat, based upon the QHEI scoring, demonstrated a “Good” habitat. This “Good” habitat score demonstrated favorable habitat conditions for all species collected because of the moderate instream cover present consisting of pools greater than three feet deep, the abundance of woody debris, undercut banks, rootwads and rootmats, and overhanging vegetation. The water chemistry samples showed one excursion of the warmwater habitat

water quality standards; however, bacteriological sampling results showed very poor results at all sampling sites. Organic enrichment was evident in the stretch of stream sampled for fish. Evidence of nuisance odors from the disturbance of organic material along the creek bottom was documented. Organic enrichment is considered an impairment³ to the fish community in the creek.

Macroinvertebrate Sampling

Methods

On July 13, 2009, a Hester-Dendy artificial substrate sampler was set in Dugway Brook at Lakeshore Boulevard River Mile 0.37; however, during the course of inspections, the artificial sampler was found to be not completely submersed for the full six-week installation period due to fluctuations of the water level from Lake Erie. The sampler was therefore not processed. A qualitative sample was collected in its place and used to calculate a Qualitative Community Tolerance Value (QCTV) score. Although Dugway Brook has no designated Aquatic Life Use, the QCTV score was calculated against Warmwater Habitat Aquatic Life Use Criteria for comparison purposes only. The QCTV is calculated from a qualitative multi-habitat sample when a Hester-Dendy cannot be collected. This sampling effort consisted of collection of macroinvertebrate taxa from the natural habitats at sites within each of the habitat types (riffle, run, pool, margins). Macroinvertebrate samples were shipped to EA Engineering, Science and Technology (Deerfield, IL) for identification and enumeration. The QCTV score is the median pollution tolerance value calculated from the collected species that have an associated tolerance value.

Higher QCTV scores are related to the presence of taxa associated with higher community ICI scores. If the QCTV score is greater than 37.15, it is associated with better water quality. A score between 37.15 (the 25th percentile) and 34.30 (the 75th percentile) implies that the attainment status cannot be determined from the QCTV score and best professional judgment should be used instead to determine attainment. A score less than 34.30 indicates the presence of taxa seen in waters that are typically associated with poorer water quality (OEPA 1999). The taxa list and enumerations are available upon request.

Results and Discussion

Although an ICI score was not calculated, a QCTV score of 24 was obtained from qualitative sampling. The QCTV score, with a narrative rating of *Fair/Poor*, suggests

³ Source: 1996 Ohio Water Resource Inventory (305b Report)

that the site would not achieve the WWH criterion if it were applicable to Dugway Brook.

Of the 14 invertebrate taxa collected, six taxa included organisms that appear to be extremely pollution tolerant, and these organisms tend to predominate in very stressed environments. These taxa included Oligochaeta, *Cricotopus (C.) bicinctus*, *Cricotopus (Isocladius) sylvestris* group, *Chironomus* sp., *Polypedilum (P.) illinoense*, and *Physa*. These organisms are listed as being tolerant to organic degradation as a disturbance in the aquatic ecosystem. The Dipteran taxa that were collected at this site, which included *Cricotopus (C.) bicinctus*, *Cricotopus (Isocladius) sylvestris* group, *Chironomus* sp., *Polypedilum (P.) illinoense* are taxa that also have the greatest range of pollution tolerances and do not usually disappear in the environment. The macroinvertebrate communities at this site are impaired and underperformed the fish community. Although no elevated levels of BOD were measured at this site, the organically enriched material that was disturbed in the stream bed resulted in impaired conditions of the macroinvertebrates.

Conclusions

Organic enrichment may be the inhibiting factor affecting the macroinvertebrate community. Macroinvertebrate species find these conditions stressful, which can show negative impacts. Intolerant species may be replaced by more tolerant species, which is typical of a degraded warmwater stream. In 2009, the good habitat conditions promoted higher fish community scores. Additionally, transitional species of fish such as the sunfish and emerald shiners, most likely from Lake Erie, may have contributed to an increase in fish community scores. The lack of a riffle across this stream reach may have limited species of pollution intolerant fish and macroinvertebrates that prefer riffle habitats.

Once the DEIRS and Dugway West Interceptor Relief Sewer (DWIRS) projects on the east and west branches of Dugway Brook are complete, and the amount of combined sewage overflows discharging to the brook is reduced, macroinvertebrate and fish community scores are expected to improve at this site.

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