

Level 3 Project Study Plan

2007 Benthic Macroinvertebrate Sampling Upstream of NEORSD CSO Areas

(1) Objective

The objective of this study is to conduct benthic macroinvertebrate and water quality sampling upstream from areas of Northeast Ohio Regional Sewer District (NEORSD)-owned combined sewer overflows (CSOs). The resulting upstream data will be compared with the benthic macroinvertebrate data obtained from these streams, downstream of the NEORSD CSO areas (required by Ohio EPA NPDES Permit No. 3PA00002*FD) to determine the extent to which downstream macroinvertebrate communities may be impacted by CSOs or other environmental factors. This sampling will be conducted by the NEORSD's Water Quality and Industrial Surveillance department (WQIS) and will occur from June 15 through September 30, 2007, as required in the OEPA *Biological Criteria for the Protection of Aquatic Life Volume III* (1987, updated September 30, 1989).

Sample sites for this study are located on Big Creek, Doan Brook, Euclid Creek and Mill Creek, all of which are surface waters within the NEORSD service area. Quantitative and qualitative benthic macroinvertebrate sampling will be conducted at each sample site. The benthic macroinvertebrate results will be compiled and used to calculate an Invertebrate Community Index (ICI) score for each site. Species assemblages and individual metrics will be analyzed. Water sampling data will be evaluated to determine the presence and/or absence of excursions from water quality criteria. An examination of the individual metrics that comprise the ICI will be used in conjunction with water quality data, the Ohio EPA Macroinvertebrate Field Sheet and Qualitative Habitat Evaluation Index (QHEI) results in order to identify impacts to the communities. Results will also be compared to historic data to show temporal as well as spatial trends.

Per agreement with Ohio EPA (June 15, 2007 conference call), in addition to the above sampling, NEORSD will attempt to conduct fish community sampling at each of the sample sites on Big Creek, Doan Brook, Euclid Creek and Mill Creek. This sampling will be dependent upon weather and stream conditions, as well as, availability of NEORSD personnel. If the sampling is conducted, fish community health will be evaluated through the use of Ohio EPA indices (IBI and MIwb, where applicable). An examination of the individual metrics that comprise the IBI will be used in conjunction with water quality data and QHEI results in order to identify impacts to the fish community.

(2) Nonpoint/Point Sources

Point Sources	Nonpoint Sources
CSO(s) outside of NEORSD service area	Urban Runoff
Storm Sewer Outfalls	Landfill Leachate
Upstream tributaries	Spills
Home Sewage Treatment Systems	Agriculture
	Golf Course Runoff

A map has been provided in Appendix A to show point sources that may be influencing the water quality at each sample location. These sources of pollution, along with the nonpoint sources listed in the table above, may be impacting the health of the fish and benthic macroinvertebrate communities and will need to be taken into account when evaluating impacts resulting from NEORSD CSOs. Other factors that may influence ecological conditions during the study include periods of drought and periods of heavy precipitation.

(3) Parameters Covered

Macroinvertebrate quantitative and qualitative samples will be collected and shipped to EA Engineering, Science and Technology for identification and enumeration. EA Engineering, Science and Technology will identify the specimens to the lowest practical taxonomic level and whenever possible, to the level of taxonomy recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987, updated September 30, 1989).

The macroinvertebrate sampling which we will be conducting under this study plan enables the CSO area to be bracketed and will allow us to separate any effects on the macroinvertebrate community which may be entering these water bodies from areas upstream of the CSOs. Moreover, the purpose of the study is not intended to determine full biological attainment of each water body, but simply to compare the impacts that combined sewer overflows have on the macroinvertebrate community. This is consistent with Ohio EPA permit #3PA00002*FD, which does not require the collection of fish where macroinvertebrates are collected. However, an effort will be made to conduct fish community sampling at each of the sample sites for informational purposes.

Water sampling will be conducted at each sampling site approximately every eight days, from the time of HD installation to HD retrieval, unless surface water conditions are deemed unsafe. Appendix B lists the parameters to be tested. Field measurements for dissolved oxygen, pH, temperature and specific conductance

will also be performed. A water quality observation checklist will be completed at each site during each sample collection (Appendix B).

The Ohio EPA Macroinvertebrate Field Sheet will be completed at each site during HD sampler retrieval. In addition, stream habitat will be measured by scoring components of the QHEI at all locations, including the substrate, instream cover, channel morphology, riparian zone and bank erosion, pool/glide and riffle/run quality and gradient.

Fish specimens will be identified to species level, weighed (where applicable), counted and examined for the presence of external anomalies including DELTs (deformities, eroded fins, lesions and tumors).

(4) Field Collection and Data Assessment Techniques

Macroinvertebrate sampling will be conducted using quantitative and qualitative sampling techniques at the locations identified in section 5. Two rounds of quantitative sampling will include installation of a five Hester-Dendy multi-plate artificial substrate sampler assemblage (HD) that is colonized for a six-week period. The installation of multiple HD samplers may occur during each round of sampling due to the tendencies of the HD samplers being vandalized, buried, etc. Furthermore, multiple qualitative samples may be collected during each sampling round, in case of HD sampler loss, in order to sample the macroinvertebrate community during normal flow conditions. Additionally, five Surber square-foot samples may be used in place of an HD sampler where deemed uncollectible due to the HD sampler having been vandalized, buried, etc. Surber samples, if supplemented for a HD sampler, will be used for informational purposes only, and will not be used to calculate an ICI score. Qualitative sampling will be conducted using a D-frame dip net when HD samplers are retrieved. The Ohio EPA Macroinvertebrate Field Sheet will be completed during each HD retrieval. Macroinvertebrate community assemblages will be collected and shipped to EA Engineering, Science and Technology for identification and enumeration. EA Engineering, Science and Technology will identify specimens to the lowest practical taxonomic level and when the condition of the specimen allows, to the level of taxonomy recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987, updated September 30, 1989). Voucher specimens will be collected as described in section (14). Stream flow will be measured with a Marsh-McBirney FloMate Model 2000 Portable Flow Meter when the HD samplers are installed and retrieved.

Contingent on weather and stream conditions, as well as availability of NEORSD personnel, field collections for fish will be attempted at as many of the locations as

possible. The potential locations are listed in the tables in section 5. Sampling will be conducted using longline electrofishing techniques and will consist of shocking all habitat types within a sampling zone, while moving from downstream to upstream. The sampling zone for headwater sites (Big Creek sites #28.1 and #26, Doan Brook sites #19.5, #18.1, and #16.1, and Mill Creek sites #34.6 and #31) will be 0.15 km long. The sampling zone for wading sites (Big Creek site #25 and Euclid Creek sites #1.65, #1.5, and #0.5) will be 0.2 km long. The stunned fish will be collected and placed into a live well for later identification.

If surveys are conducted, fish will be identified to species level, weighed (where applicable), counted, and examined for the presence of external anomalies including DELTs. Fish easily identified will be returned to the site from which they are collected. Subsamples of difficult to identify species will be brought back to the laboratory for verification by NEORSD personnel and, if necessary, sent to The Ohio State University College Museum of Biological Diversity for verification by the Curator and/or Associate Curator of Fish. Voucher specimens will be collected as described in section (14). Endangered species and those too large for preservation will not be collected as voucher specimens, but will instead be photographed. Photographed vouchers will include features that permit definitive identification of the particular species.

Fish will be preserved in 10 percent formalin in the field, soaked in tap water for 24 to 48 hours after 5 to 7 days, then transferred to solutions of 30 and 50 percent ethanol for 5 to 7 days each and, finally, to 70 percent ethanol for long-term storage. Specimens larger than six inches will be slit along the right side and then soaked in formalin for approximately 10 to 14 days before being transferred to water and solutions of 30, 50 and 70 percent ethanol. Label information will include location (description and coordinates), date, time, collectors' names and sample identification code for each specimen collected.

A detailed description of the sampling and analysis methods utilized in the macroinvertebrate and fish surveys, including calculations of the ICI, IBI, and MIwb can be found in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987, updated January 1, 1988 and November 8, 2006) and *III* (1987, updated September 30, 1989).

Water chemistry sampling and chemical analyses will follow the *Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices* (2006). One 4-liter disposable polyethylene cubitainer with disposable polypropylene lid and two 473 mL plastic Isco bottles will be used to collect a surface grab sample at each location. One duplicate sample and one field blank will be collected at a randomly selected site for each round of sampling. Acid preservation of the samples, as

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specified in standard operating procedure for each parameter, will occur in the field. Appendix B lists the analytical method and detection limits for each parameter analyzed. Field analyses include the use of a Marsh-McBirney FloMate Model 2000 Portable Flow Meter, which measures flow in feet per second, and a YSI-556 MPS Multi-Parameter Water Quality Meter to measure dissolved oxygen, water temperature, specific conductivity and pH at the time of sampling. Meter specifications have been included in Appendix B.

The QHEI, as described in Ohio EPA's, *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application* (1989) will be used to assess aquatic habitat conditions at each sample location.

(5) Sampling Locations

Site Location	Latitude	Longitude	River Mile	Description	Quadrangle	Purpose
Big Creek #26	N41.4460°	W81.7540°	4.40	East Branch at Memphis MetroPark	Lakewood	Evaluate macroinvertebrates and habitat upstream of CSOs
Big Creek #28.1	N41.4230°	W81.8019°	4.70	West Branch at West 150 th	Lakewood	Evaluate macroinvertebrates and habitat upstream of CSOs
Doan Brook #18.1	N41.4838°	W81.5643°	6.70	North Branch Upstream of Lee Road	Shaker Heights	Evaluate macroinvertebrates and habitat upstream of CSOs
Doan Brook #19.5	N41.4739°	W81.5590°	1.40	South Branch US Attleboro Road	Shaker Heights	Evaluate macroinvertebrates and habitat upstream of CSOs
Euclid Creek #1.5	N41.5658°	W81.5358°	2.70	Upstream of Highland Road	East Cleveland	Evaluate macroinvertebrates and habitat upstream of CSOs
Euclid Creek #1.65	N41.5741°	W81.5469°	1.65	Upstream of St. Clair Avenue	East Cleveland	Evaluate macroinvertebrates and habitat upstream of CSOs
Mill Creek #34.6	N41.4305°	W81.5442°	8.30	Upstream of South Miles Road	Shaker Heights	Evaluate macroinvertebrates and habitat upstream of CSOs

Downstream of CSO Permit-Required Sampling Locations*

Site Location	Latitude	Longitude	River Mile	Description	Quadrangle	Purpose
Big Creek #25	N41.4460°	W81.6865°	0.15	Downstream of Jennings Road	Cleveland South	Ohio EPA Permit No. 3PA00002*FD
Doan Brook #16.1	N41.5330°	W81.6296°	0.75	Downstream of St. Clair Avenue	Cleveland North	Ohio EPA Permit No. 3PA00002*FD
Euclid Creek #0.5	N41.5833°	W81.5594°	0.55	Downstream of Lakeshore Avenue	East Cleveland	Ohio EPA Permit No. 3PA00002*FD
Mill Creek #31	N41.4178°	W81.6385°	0.12	Upstream of Canal Road	Cleveland South	Ohio EPA Permit No. 3PA00002*FD

* These locations will be sampled according to Ohio EPA Permit No. 3PA00002*FD and are included here for comparison purposes only.

The purpose of sampling at each location is to compare the macroinvertebrate communities and water quality data from the upstream sampling sites to those from the respective sampling sites located downstream from areas of NEORSD-owned CSOs. Data generated will be used to evaluate the extent to which NEORSD CSOs or other environmental factors may be impacting the downstream macroinvertebrate community.

(6) Schedule

The first round of artificial substrate samplers will be installed on these streams at all of the sites in June 2007 and retrieved six weeks later. The second round of artificial substrate samplers will be installed on these streams at all of the sites approximately in August 2007 and retrieved six weeks later. Specific dates have not been scheduled. River flow and weather conditions will be assessed weekly to determine when the HD sampler installations and retrievals will be conducted.

If possible, one to two electrofishing surveys will be conducted between June 15 and October 15, 2007. Each survey would be conducted at least four to five weeks apart. Specific dates have not been scheduled. Stream and weather conditions, as well as, availability of NEORSD personnel will be assessed weekly to determine when each electrofishing pass will be conducted.

Water samples will be collected approximately every eight days throughout each macroinvertebrate colonization period.

Ohio EPA Macroinvertebrate Field Sheets will be completed during the retrieval of each HD sampler.

Habitat evaluations will be conducted one time at each location between June 15 and September 30, 2007.

(7) QA/QC

Quality assurance and quality control of sampling and analysis methods for macroinvertebrate and fish evaluations will follow Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987, updated January 1, 1988 and November 8, 2006) and *III* (1987) and USEPA's *Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*, Second Edition (1999) EPA 841-B-99-002.

Macroinvertebrate community assemblages will be collected and shipped to EA Engineering, Science and Technology for identification and enumeration. EA

Engineering, Science and Technology will identify specimens to the lowest practical taxonomic level and when the condition of the specimen allows, to the level of taxonomy recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987, updated September 30, 1989). The EA Engineering, Science and Technology QA/QC manual is attached (Appendix C). All macroinvertebrate specimens will be returned to NEORSD by EA Engineering, Science and Technology. Voucher specimens for each site will be separated into individual vials and collected as described in section (14). The remaining specimens for each site will be returned in a single container labeled with the site number and method and date of collection. All specimens and accompanying chain-of-custody documentation will be retained by NEORSD and stored at the Environmental & Maintenance Services Center (EMSC) for a period not less than ten years.

Electrofishing equipment will be used according to the guidelines listed in the operation and maintenance manual provided by Coffelt, Inc. Malfunctioning equipment will not be used to conduct surveys. Proper steps will be taken to correct the problem as soon as possible, whether by repairing in the field or at the NEORSD EMSC or by contacting the supplier or an appropriate service company.

Subsamples of difficult to identify species will be brought back to the laboratory for verification by NEORSD personnel and if necessary, sent to The Ohio State University College Museum of Biological Diversity for verification by the Curator and/or Associate Curator of Fish. Voucher specimens will be collected as described in section (14). Endangered species and those too large for preservation will not be collected as voucher specimens, but will instead be photographed. Photographed vouchers will include features that will permit definitive identification of the particular species.

Water samples obtained for chemical analyses will be collected, labeled and then placed on ice inside the field truck. The field truck will remain locked when not occupied/visible. Sampling activities, including sample time and condition of surface water sampled, will be entered in a QDC log book and on the water quality observation checklist. The samples will then be delivered immediately to the NEORSD Analytical Services cooler, after which the door to the cooler will be locked and the samples will be transferred to the custody of Analytical Services. The NEORSD Analytical Services Quality Manual and associated Standard Operating Procedures will be provided to Ohio EPA by the Quality Assurance Officer at Analytical Service. The Quality Assurance Officer at Analytical Service will send updates, revisions and any information on document control to Ohio EPA as needed.

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(8) Work Products

Anticipated work products include ICI scores along with associated individual metric scores, biological data including a list of macroinvertebrate taxa, measured chemical data including field measurements and laboratory analyses, any noted excursions from water quality criteria and QHEI scores. The ICI scores will be supplemented with chemical water quality data, which will be compared to Ohio Water Quality Standards. These will also be compared to weather/precipitation data for information on extreme low-flow and/or high-flow conditions that may adversely affect the communities and QHEI scores. A spreadsheet that presents data including species, numbers, weights, pollution tolerances, the incidence of DELT anomalies, and IBI and MIwb scores will also be produced for fish collected at each site.

(9) Qualified Data Collectors

The following Level 3 Qualified Data Collectors will be involved with this study:

Name	Address	Email Address	Phone Number	QDC Specialty(s)
^{1,2} Kathryn Crestani	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	crestanik@neorsd.org	216-641-6000	QDC - 011 CWQA/SHA
Seth Hothem	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	hothems@neorsd.org	216-641-6000	QDC - 010 CWQA/FCB/SHA
³ Tiffany Moore	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	mooret@neorsd.org	216-641-6000	QDC - 017 CWQA/BMB/SHA
^{4,5} John W. Rhoades	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	rhoadesj@neorsd.org	216-641-6000	QDC - 008 CWQA/FCB/SHA
Tom Zablontny	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	zablontnyt@neorsd.org	216-641-6000	QDC - 018 CWQA/FCB/SHA
Cathy Zamborsky	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	zamborskyc@neorsd.org	216-641-6000	QDC - 009 CWQA/SHA
⁶ Marty Sneen	EA Engineering, Science and Technology 444 Lake Cook Road, Suite #18 Deerfield, IL 60015	msneen@eaest.com	847-945-8010	QDC - 026 BMB
¹ Chemical Water Quality Assessment (CWQA) Project Manager		⁵ Fish Community Biology (FCB) Project Manager		
² Stream Habitat Assessment (SHA)		⁶ Benthic Macroinvertebrate Identification		
³ Benthic Macroinvertebrate Biology (BMB) Project Manager				
⁴ Lead Project Manager				

The following is a list of persons not qualified as level 3 data collectors who may be involved in the project. Prior to the start of sampling, the project managers will explain to each of these and any other individuals the proper methods for macroinvertebrate, electrofishing and water quality sample collections. Sampling will only be completed under the direct observation of a QDC. The lead project manager will be responsible for reviewing all reports and data analysis prepared by qualified personnel prior to completion.

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Name	Address	Email Address	Phone Number
Joseph Broz	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	brozj@neorsd.org	216-641-6000
Tim Dobriansky	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	dobrianskyt@neorsd.org	216-641-6000
Rae Grant	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	grantr@neorsd.org	216-641-6000
Lateefah Hafeez	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	hafeezl@neorsd.org	216-641-6000
Eric Hinton	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	hintone@neorsd.org	216-641-6000
Ronald Maichle	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	maichler@neorsd.org	216-641-6000
Mike Pavlik	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	pavlikm@neorsd.org	216-641-6000
Francisco Rivera	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	riveraf@neorsd.org	216-641-6000
Kevin Roff	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	roffk@neorsd.org	216-641-6000
Frank Schuschu	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	schuschuf@neorsd.org	216-641-6000
Elizabeth Toot-Levy	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	toot-levye@neorsd.org	216-641-6000
Wolfram vonKiparski	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	vonkiparskiw@neorsd.org	216-641-6000
Timothy Whipple	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	whippet@neorsd.org	216-641-6000
Mohammed Zachariah	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	zachariahm@neorsd.org	216-641-6000

- (10) Documentation of approval of project manager and other personnel as level 3 qualified data collectors

See attached (Appendix D).

- (11) Contract laboratory contact information

Marty Sneen, Benthic Specialist (QDC# 026)
 EA Engineering, Science and Technology
 444 Lake Cook Road Suite #18
 Deerfield, IL 60015
msneen@eaest.com
 847-945-8010 ext. 108

Any fish that is not positively identified in the field or NEORSD laboratory will be sent to The Ohio State University College Museum of Biological Diversity for verification by the Curator of Fish. Fish will be identified to the species level.

Dr. Ted Cavender, Curator of Fish / Mr. Marc Kibbey, Associate Curator of Fish
1315 Kinnear Road, Columbus, Ohio 43212
cavender.1@osu.edu / kibbey.3@osu.edu
614-292-7873

(12) ODNR collectors' permit

See attached (Appendix E).

(13) Catalog Statement

A digital photo catalog of all sampling locations will be maintained for 10 years and will include photos of the specific sampling location(s), the riparian zone adjacent to the sampling location(s) and the general land use in the immediate vicinity of the sampling location(s).

Signature: _____ Date: _____

(14) Voucher Specimen Statement

Based on Ohio EPA's Final Responsiveness Summary of the Credible Data Rules (3/24/06), NEORSD is requesting approval of an alternative vouchering protocol, as follows:

NEORSD will maintain a benthic macroinvertebrate or fish voucher collection which includes two specimens of each species or taxa collected during the course of biological sampling from any stream within the NEORSD's service area. When benthic macroinvertebrate specimens from other surface waters are collected within the same year and identified by the same QDC, one voucher collection will be created to represent the specimens collected from those streams. A separate collection for each sampling event will not be maintained.

NEORSD will provide specimen vouchers to the Director upon request. This collection will be stored at the NEORSD laboratory in the Environmental and Maintenance Services Center.

Signature: _____ Date: _____

(15) Trespassing Statement

I, _____, have not been convicted or pleaded guilty to a Violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Signature: _____ Date: _____

I, _____, have not been convicted or pleaded guilty to a Violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Signature: _____ Date: _____

I, _____, have not been convicted or pleaded guilty to a Violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Signature: _____ Date: _____

I, _____, have not been convicted or pleaded guilty to a Violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

Signature: _____ Date: _____

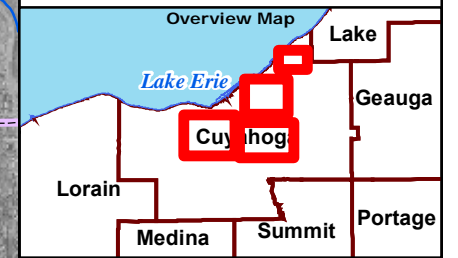
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Signature: _____ Date: _____

I, _____, have not been convicted or pleaded guilty to a Violation of section 2911.21 of the Revised Code (criminal trespass) or a substantially similar municipal ordinance within the previous five years.

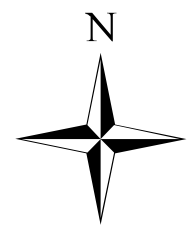
Signature: _____ Date: _____

Appendix A

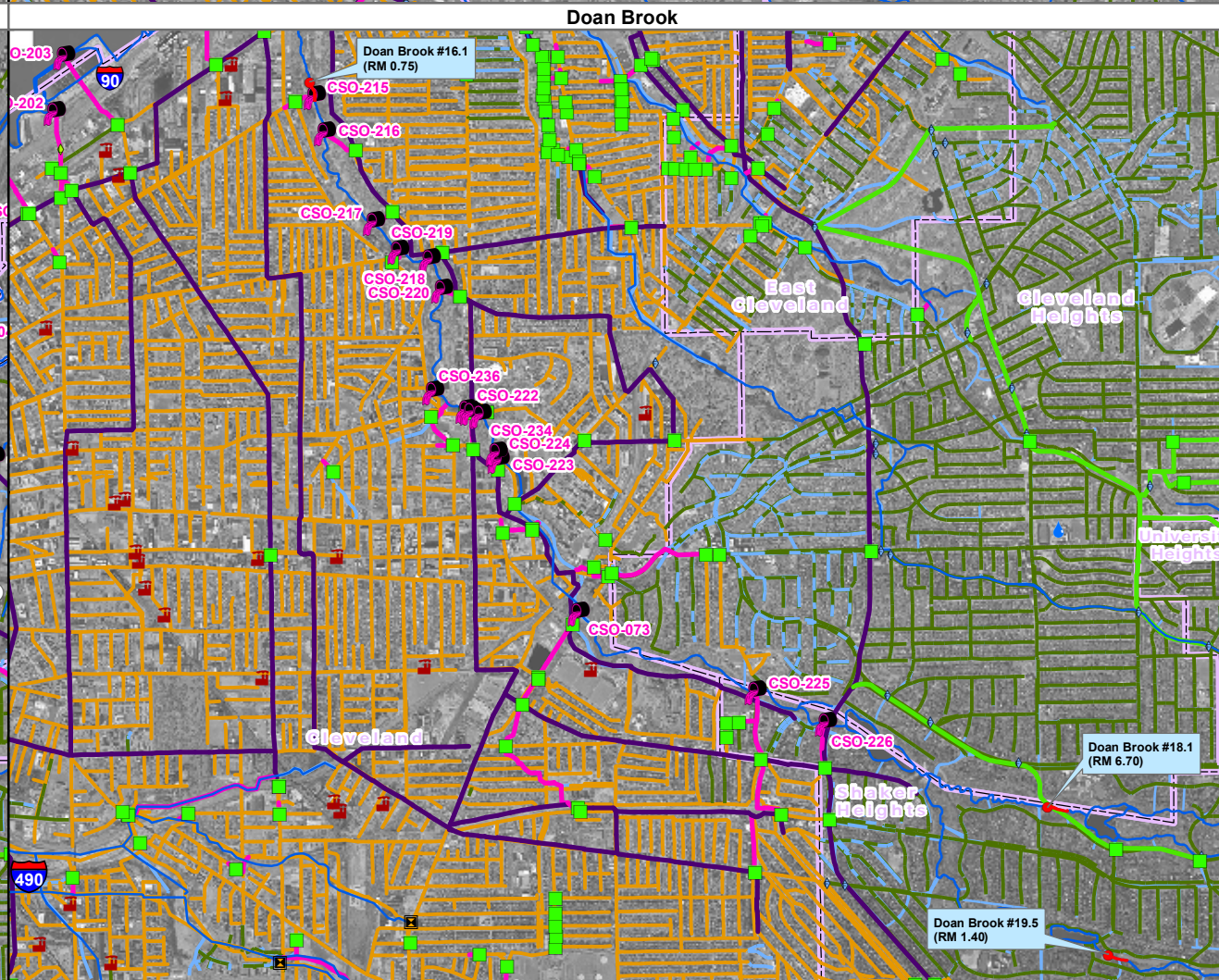
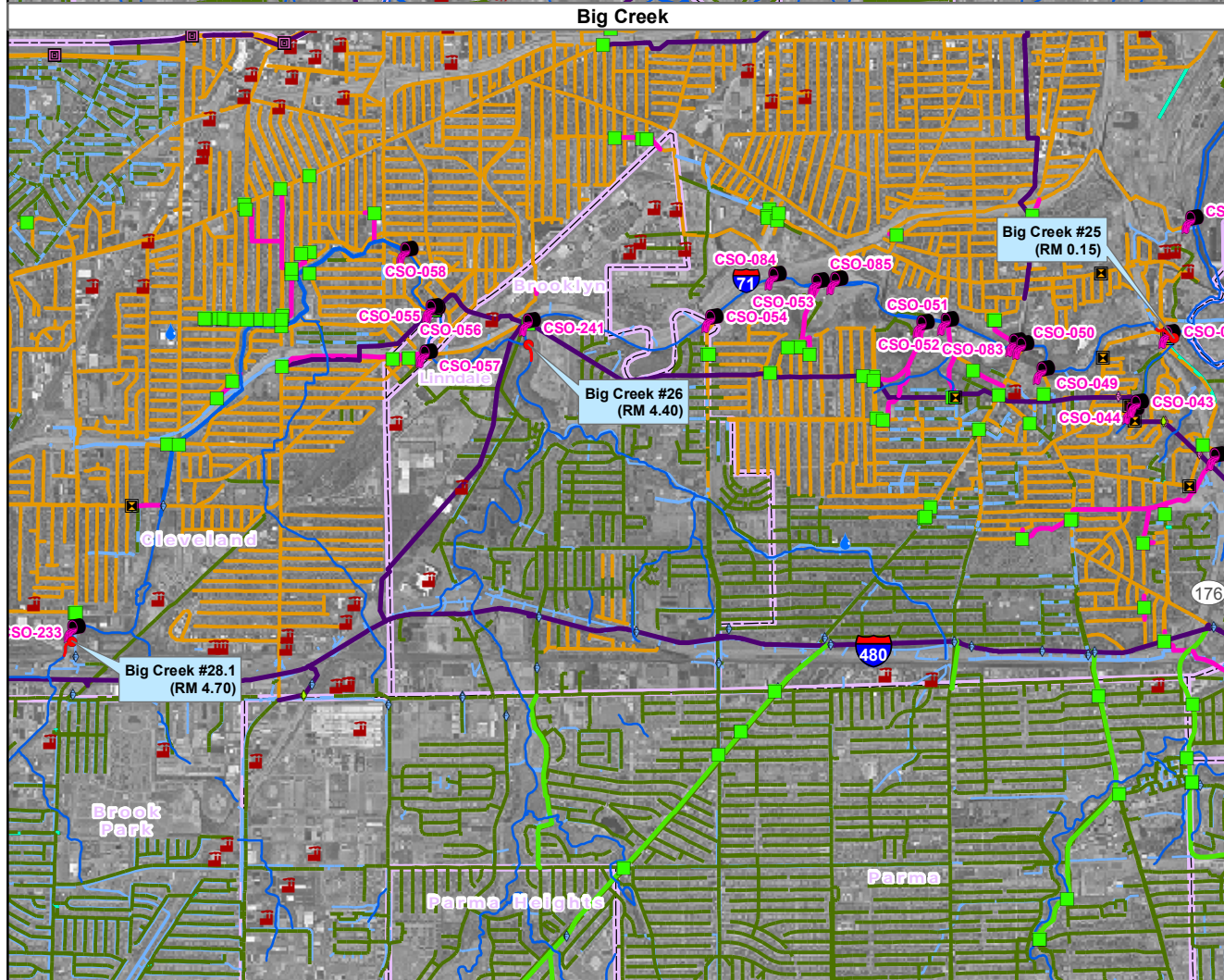
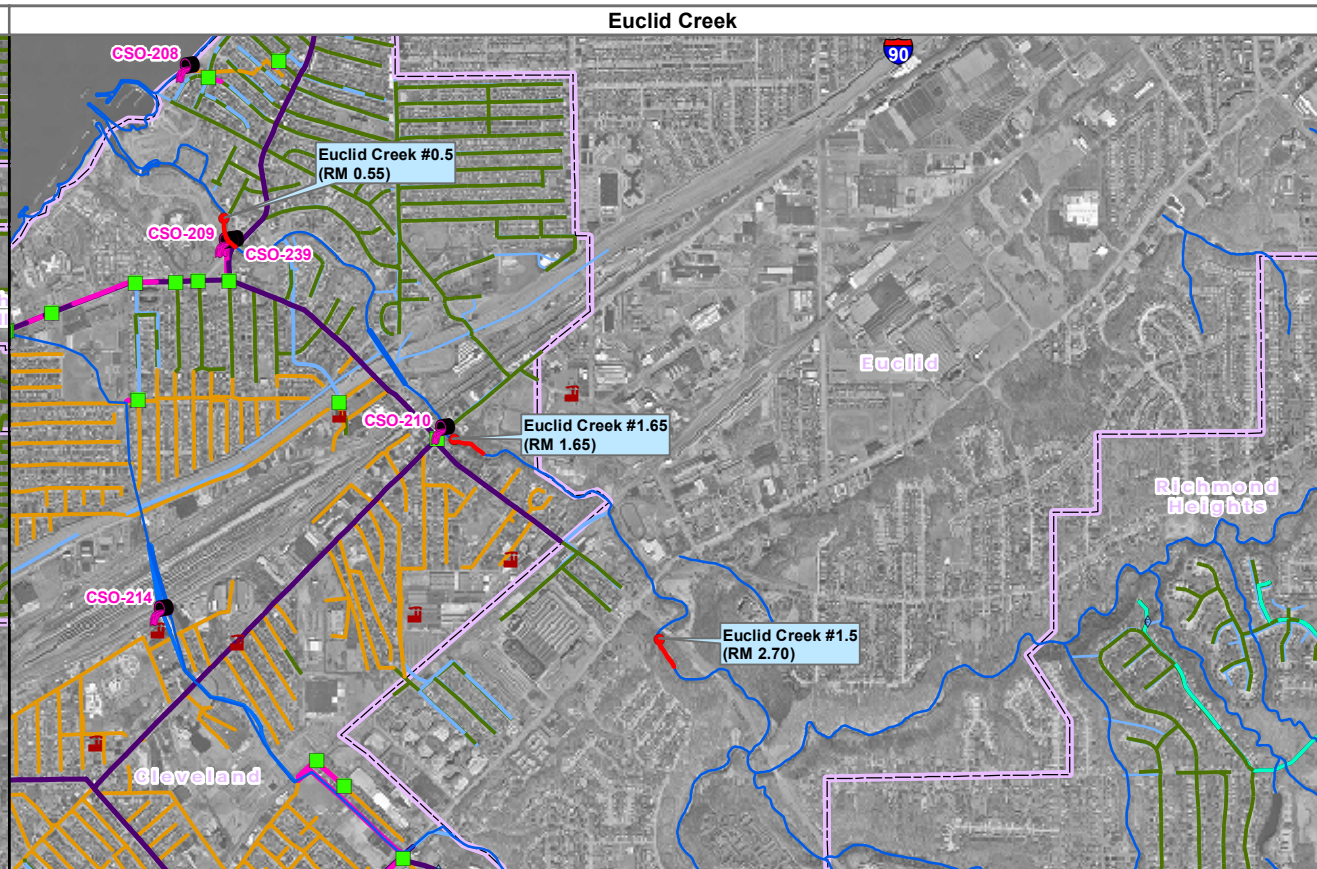
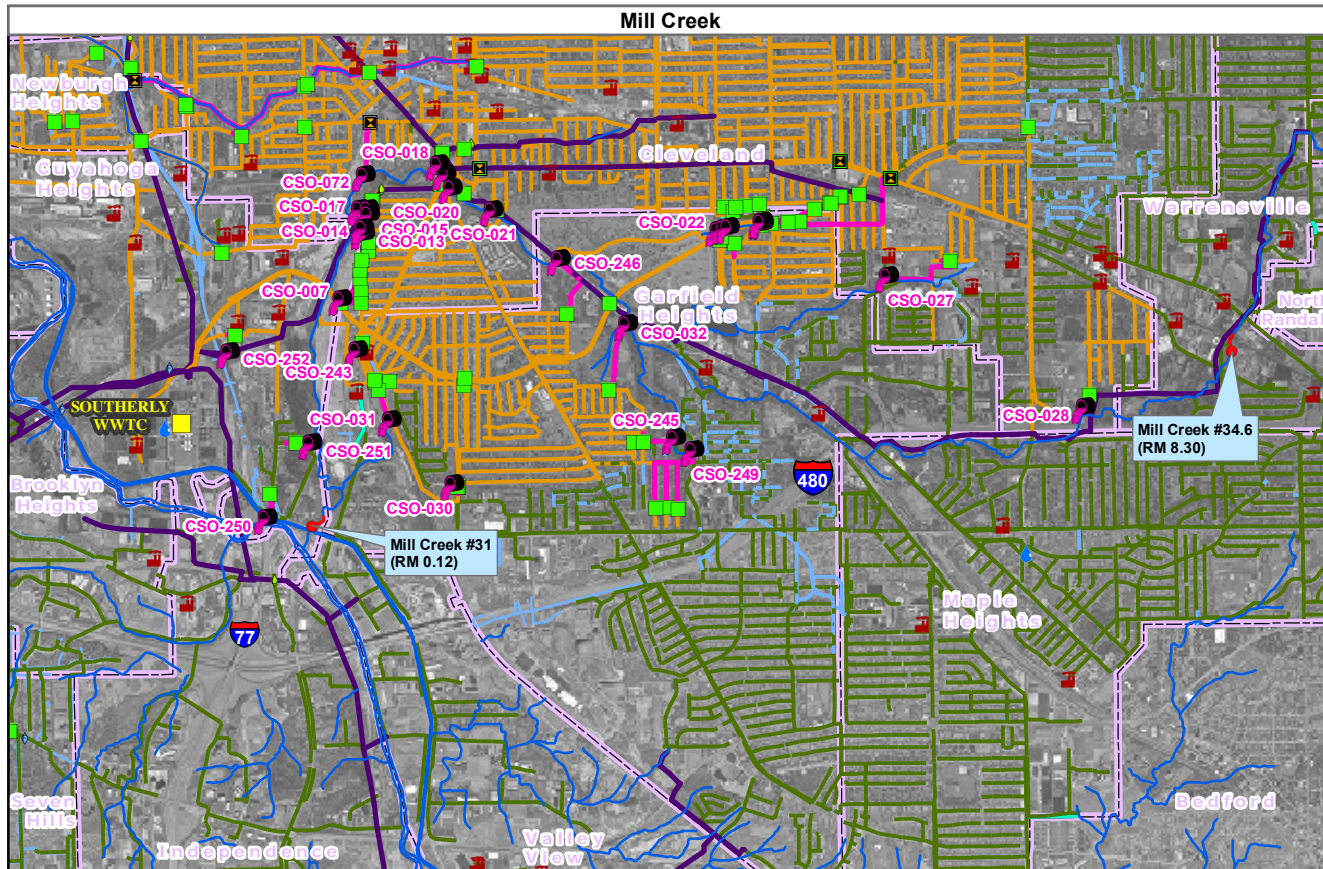


Benthic Macroinvertebrate Sampling Upstream and Downstream of NEORS D CSO Area

- Fish, Macroinvertebrate, Habitat, and Water Sample Site
- CSO Outfalls
- Automated Regulators
- Manual Control Device
- Hydro Brake
- Regulator
- Wastewater Treatment Facility
- WQIS Industries
- ◆ Flow Monitor
- ◆ Level Monitor
- ◆ Remote Level Monitor
- Rain Gauges
- Stream
- Interceptor Sewer
- (ICRS) Intercommunity Relief Sewer
- CSO Control Sewer
- CSO Responsibility Sewer
- Local Combined Sewer
- Local Sanitary Sewer
- Local Storm Sewer
- Local Culverted Stream
- Local Force Main
- Community Boundary



1" = Unknown
Not to Scale



Appendix B

Parameter	Test	Detection Limit
Alkalinity	EPA 310.2	5 mg/L
COD	EPA 410.4	1 mg/L
Hex Chrome	SM 3500	10 ug/L
Mercury	EPA 245.2	0.05 ug/L
NH3	EPA 350.1	0.01 mg/L
NO2	EPA 354.1	0.01 mg/L
NO3	EPA 353.2	0.01 mg/L
Soluble-P	SoIPO4	0.01 mg/L
Total-P	EPA 365.2	0.01 mg/L
BOD	EPA 405.1 (5 Day)	2 mg/L
TDS	EPA 160.1	1 mg/L
Ag	EPA 200.7	1 µg/L
Al	EPA 200.7	5 µg/L
As	EPA 200.7	2 µg/L
Be	EPA 200.7	0.5 µg/L
Ca	EPA 200.7	50 µg/L
CaCO3	EPA 200.7	1 µg/L
Cd	EPA 200.7	1 µg/L
Co	EPA 200.7	1 µg/L
Cr	EPA 200.7	1 µg/L
Cu	EPA 200.7	1 µg/L
Fe	EPA 200.7	1 µg/L
K	EPA 200.7	50 µg/L
Mg	EPA 200.7	20 µg/L
Mn	EPA 200.7	1 µg/L
Mo	EPA 200.7	2 µg/L
Na	EPA 200.7	20 µg/L
Ni	EPA 200.7	1 µg/L
Pb	EPA 200.7	3 µg/L
Sb	EPA 200.7	5 µg/L
Se	EPA 200.7	5 µg/L
Sn	EPA 200.7	10 µg/L
TMET	EPA 200.7	(sum of Cr+Cu+Ni+Zn)
Ti	EPA 200.7	10 µg/L
TI	EPA 200.7	10 µg/L
V	EPA 200.7	1 µg/L
Zn	EPA 200.7	1 µg/L
TS	EPA 160.3	1 mg/L
TSS	EPA 160.2	1 mg/L
Turbidity	SM 2130B	0.1 NTU
pH	EPA 150.1	1-14 s.u.

NEORS D Surface Water Condition Sampling Field Data Form

Date: _____ Time: _____ Site (RM): _____

Flow: Low Medium High _____fps

USGS 04208000 Cuyahoga River @ Independence, OH Flow Gage: _____ft³/sec*

HD Status: OK Buried Out of Water Missing

Clarity: Clear Murky Turbid Other: _____

Color: None Green Brown Grey Other: _____

Was this sample taken during or following a wet weather event? Yes/No

If yes, when and how much rain occurred? _____

General Comments: _____

Date: _____ Time: _____ Site (RM): _____

Flow: Low Medium High _____fps

USGS 04208000 Cuyahoga River @ Independence, OH Flow Gage: _____ft³/sec*

HD Status: OK Buried Out of Water Missing

Clarity: Clear Murky Turbid Other: _____

Color: None Green Brown Grey Other: _____

Was this sample taken during or following a wet weather event? Yes/No

If yes, when and how much rain occurred? _____

General Comments: _____

YSI 556 Meter Specifications

14.1 Sensor Specifications

<i>Dissolved Oxygen</i>	
Sensor Type:	Steady state polarographic
Range: % air sat'n mg/L	<ul style="list-style-type: none"> ▪ 0 to 500% air saturation ▪ 0 to 50 mg/L
Accuracy: % air sat'n mg/L	<ul style="list-style-type: none"> ▪ 0 to 200% air saturation: ±2% of the reading or 2% air saturation; whichever is greater ▪ 200 to 500% air saturation: ±6% of the reading ▪ 0 to 20 mg/L: ±2% of the reading or 0.2 mg/L; whichever is greater ▪ 20 to 50 mg/L: ±6% of the reading
Resolution: % air sat'n mg/L	<ul style="list-style-type: none"> ▪ 0.1% air saturation ▪ 0.01 mg/L
<i>Temperature</i>	
Sensor Type:	YSI Precision™ thermistor
Range:	-5 to 45°C
Accuracy:	±0.15°C
Resolution:	0.01°C
<i>Conductivity</i>	
Sensor Type:	4-electrode cell with auto-ranging
Range:	0 to 200 mS/cm
Accuracy:	±0.5% of reading or ±0.001 mS/cm; whichever is greater—4 meter cable ±1.0% of reading or ±0.001 mS/cm; whichever is greater—20 meter cable
Resolution:	0.001 mS/cm to 0.1 mS/cm (range-dependent)
<i>Salinity</i>	
Sensor Type:	Calculated from conductivity and temperature
Range:	0 to 70 ppt
Accuracy:	±1.0% of reading or 0.1 ppt; whichever is greater
Resolution:	0.01 ppt

Marsh-McBirney Model 2000 Portable Flowmeter

SPECIFICATIONS

Velocity Measurement

Method

Electromagnetic

Zero Stability

± 0.05 ft/sec

Accuracy

± 2% of reading + zero stability

Range

-0.5 to +19.99 ft/sec

-0.15 m/sec to +6 m/sec

Power Requirements

Batteries

Two D Cells

Battery Life Continuous ON hours

Alkaline 25-30

NiCad 10-15 per charge

External Power Supply (Optional)

120 V, 1 W or 220 V, 1 W

Water Resistant Electronic Case

Submersible

One Foot for 30 Seconds

Outputs

Display

3¹/₂ Digit

Signal Output Connector (Optional)

Analog 0.1 V = 1 ft/sec or 1 m/sec

2 V = Full Scale

Materials

Sensor

Polyurethane

Cable

Polyurethane jacket

Electronic Case

High Impact Molded Plastic

Weight

3 lb 9 oz with case and 20 ft of cable

2 lb 10 oz without sensor and cable

Temperature

Open-Channel-Velocity Sensor

32° F to 160° F (0° C to 72° C)

Full-Pipe Sensor (S/S Insertion Tube)

32° F to 160° F (0° C to 72° C) @ 250 psi

Electronics

32° F to 122° F (0° C to 50° C)M

Appendix C

Standard Operating Procedures

Laboratory Processing of Benthic Samples

Upon arrival at the laboratory, the Hester-Dendy (H-D), Surber, and qualitative samples were logged in and accounted for. Prior to sorting and identification, each sample was rinsed on a No. 60 (0.250 mm openings) U.S. Standard Testing Sieve to remove the preservative and the H-D plates were scraped to remove the organisms. Sorting of each H-D and Surber sample was conducted in a white enamel pan first under a magnifier lamp and finally under a compound dissecting scope. If necessary, a Folsom sample splitter was used to subsample the H-Ds and Surbers until a more manageable number of organisms was achieved. Prior to splitting, the sample was pre-picked to remove any large and/or rare taxa. In all a minimum of 250 organisms in representative proportions were removed from the fractionated samples. Organisms were sorted to higher taxonomic levels (generally Class or Order level) and preserved separately in labeled vials containing 70% ethyl alcohol. To assure a consistent level of quality and sorting efficiency, senior EA personnel checked all samples. The qualitative samples contained very little detrital matter and therefore were simply rinsed prior to identification.

Macroinvertebrate identifications were made to the lowest practical taxonomic level using the most current literature available (see attached list of taxonomic literature). Whenever possible, the level of identifications followed those recommended by Mr. Jeffery DeShon of the Ohio EPA (pers. comm., 1998). Chironomidae larvae were cleared in warm 10% potassium hydroxide and mounted in CMC-10 prior to identification. Generally, 100 chironomids from any single sample were mounted for identification. For all sample types, specimens were enumerated, coded and recorded on a standard laboratory bench sheet for data processing.

Data Analyses

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 (Ohio EPA 1987). The ICI consists of ten individually scored structural community metrics:

1. Total number of taxa
2. Total number of mayfly taxa
3. Total number of caddisfly taxa
4. Total number of dipteran taxa
5. Percent mayflies
6. Percent caddisflies
7. Percent Tanytarsini midges
8. Percent other dipterans and non-insects
9. Percent tolerant organisms
10. Total number of qualitative EPT taxa.

Scoring criteria for all ten metrics is dependent upon drainage area. The scoring of an individual sample was based on the relevant attributes of that sample compared to equivalent data from 232 reference sites throughout Ohio. Metric scores range from six points for values comparable to exceptional community structure to zero points for values that deviate strongly from the expected range of values based on scoring criteria established by Ohio EPA (1989a). The sum of the individual metric scores resulted in the ICI score for that particular location.

Calculation of the ICI was conducted using a computer program written for the software SAS® by EA in 1994. This program is continuously tested and updated to ensure its accuracy. Although the ICI is most often used to analyze the combination of H-D and qualitative data from a particular location, for this study, the ICI was also calculated for the combination of Surber and qualitative data when H-D data were not available.

The only other statistical comparison used was the relative abundance (or percent composition) of individual taxa from each site and sample type. Relative abundance was calculated for both sample types as:

$$\text{Rel. Abund.(\%)} = 100 \times \frac{\text{\# Individuals of a Taxa}}{\text{Total \# of Individuals in Sample}}$$

All sample processing and data analysis were completed by permanent and full-time EA Engineering, Science, & Technology, Inc. staff working our Deerfield, Illinois office and laboratory. Specific staff members that worked on this project and relevant experience are listed below by task:

<u>Task</u>	<u>EA Personnel</u>	<u>Years of Experience</u>
Login	Sarah Olson	1.5
Sorting	Nick Wood	1
Chironimid Mounting	Paul Hauser	2
	Sarah Olsen	1.5
Identification	Marty Sneen	17
Data Analysis	Matt Poore	1
	Joe Vondruska	22
	Marty Sneen	17

Selected Ohio EPA Reporting Requirements

Item 12-Taxonomic literature

Although EA's taxonomic library contains substantially more references than are listed here, the following list only includes taxonomic literature used to identify the benthos in samples from Big Creek, Doan Brook, Euclid Creek, and Mill Creek.

Bednarik, A.F. and W.P. McCafferty. 1979. Biosystematic revision of the genus Stenonema (Ephemeroptera: Heptageniidae). Canadian Bulletins of Fisheries and Aquatic Sciences 201:1-73.

Bode, R.W. 1983. Larvae of North American Eukiefferiella and Tvetenia (Diptera: Chironomidae). New York State Museum Bulletin 452:1-40.

Bolton, M.J. 1998. Guide to the identification of larval Chironomidae (Diptera) in the temperate eastern Nearctic north of Florida. Ohio EPA, Division of Surface Water,

Ecological Assessment Section, Columbus, Ohio.

Brown, H.P. 1976. Aquatic dryopoid beetles (Coleoptera) of the United States. Water Pollution Control Series 18050 ELDO4/72. 2nd edition. U.S. Environmental Protection Agency, Cincinnati, OH.

Burch, J.B. 1982. Freshwater snails (Mollusca: Gastropoda) of North America. EPA-600/3-82-026. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

Epler, J.H. 1987. Revision of the Nearctic Dicrotendipes Kieffer, 1913 (Diptera: Chironomidae). Evolutionary Monographs No. 9:1-102.

_____. 1995. Identification manual for the larval Chironomidae (Diptera) of Florida. Florida DEP, Division of Water Facilities, Tallahassee, FL.

_____. 2001. Identification manual for the larval Chironomidae (Diptera) of North and South Carolina. North Carolina DENR, Division of Water Quality, Raleigh, NC.

Grodhaus, G. 1987. Endochironomus Kieffer, Tribelos Townes, Synendotendipes new genus, and Endotribelos new genus (Diptera: Chironomidae) of the Nearctic region. Journal of the Kansas Entomological Society 60(2):167-247.

Jezerinac, R.F., G.W. Stocker, and D.C. Tarter. 1995. The crayfishes (Decapoda: Cambaridae) of West Virginia. Bulletin of the Ohio Biological Survey 10(1):1-193.

Klemm, D.J. 1985. Guide to the freshwater Annelida (Polychaeta, naidid, and tubificid Oligochaeta, and Hirudinea) of North America. Kendall/Hunt Publishing Co., Dubuque, IA.

Larson, D.J., Y. Alarie, and R.E. Roughley. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region: with emphasis on the fauna of Canada and Alaska. NRC Research Press, Ottawa, Canada.

Maschwitz, D.E. 1976. Revision of the Nearctic species of the subgenus Polypedilum (Chironomidae: Diptera). Doctoral Dissertation, University of Minnesota.

McCafferty, W.P. and R.D. Waltz. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. Transactions of the American Entomological Society 116(4):769-799.

Merritt, R.W. and K.W. Cummins, eds. 1996. An introduction to the aquatic insects of North America. 3rd edition. Kendall/Hunt Publishing Co., Dubuque, IA.

Morihara, D.K. and W.P. McCafferty. 1979. The Baetis larvae of North America

(Ephemeroptera: Baetidae). Transactions of the American Entomological Society 105:139-221.

Needham, J.G. and M.J. Westfall, Jr. 1955. A manual of the dragonflies of North America (Anisoptera) including the Greater Antilles and the provinces of the Mexican border. University of California Press, Berkeley, California.

Pennak, R.W. 1989. Fresh-water invertebrates of the United States. 2nd edition. John Wiley & Sons, New York, NY.

Roback, S.S. 1985. The immature chironomids of the eastern United States VI. Pentaneurini-genus Ablabesmyia. Proceedings of The Academy of Natural Sciences of Philadelphia 137(2):153-212.

Saether, O.A. 1977. Taxonomic studies on Chironomidae: Nanocladius, Pseudochironomus, and the Harnischia complex. Bulletin of the Fisheries Research Board of Canada 196:1-143.

Simpson, K.W. and R.W. Bode. 1980. Common larvae of the Chironomidae (Diptera) from New York State streams and rivers with particular reference to the fauna of artificial substrates. New York State Museum Bulletin 439:1-105.

Wiederholm, T., ed. 1983. Chironomidae of the Holarctic region. Keys and diagnoses. Part 1. Larvae. Entomologica Scandinavica Supplement 19:1-457.

Wiggins, G.B. 1996. Larvae of the North American caddisfly genera (Trichoptera). 2nd edition. University of Toronto Press, Toronto, Canada.

Item 13-Reference Collection

A reference collection was not necessary for identification of these specimens. However, if a reference collection had been needed to verify any specimens, EA maintains a sizable macroinvertebrate voucher collection with over 1800 specimens representing over 700 taxa. If this taxonomic library proved to be insufficient, every reasonable attempt would be made to have the specimen(s) identified or verified by a noted authority.

Item 16-Chironomidae Identification

Chironomidae larvae were cleared in warm 10% potassium hydroxide and mounted in CMC-10 prior to identification. Generally, 100 chironomids from any single sample are mounted for identification. Species level identifications generally follow those suggested by Ohio EPA.

Item 17-Copies of Raw Data

Copies of the laboratory bench sheets are appended to the hard copy of this document.

Item 18-ICI Calculation

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 (Ohio EPA 1987). The ICI consists of ten individually scored structural community metrics:

1. Total number of taxa
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8. Percent other dipterans and non-insects
9. Percent tolerant organisms
10. Total number of qualitative EPT taxa.

Scoring criteria for all ten metrics is dependent upon drainage area. The scoring of an individual sample was based on the relevant attributes of that sample compared to equivalent data from at least 232 reference sites throughout Ohio. Metric scores range from six points for values comparable to exceptional community structure to zero points for values that deviate strongly from the expected range of values based on scoring criteria established by Ohio EPA (1989a). The sum of the individual metric scores resulted in the ICI score for that particular location.

Calculation of the ICI was conducted using a computer program written for the software SAS® by EA in 1994. This program is continuously tested and updated to ensure its accuracy.

Item 20-Statistical Analyses

The only other statistical comparison used was the relative abundance (or percent composition) of individual taxa per site and sample type. Relative abundance was calculated for both sample types as:

$$\text{Rel. Abund.} = \frac{\text{\# Individuals of a Taxa}}{\text{Total \# of Individuals in Sample}}$$

Item 21-Results

Complete results are appended to the hard copy of this document.

Item 25-Electronically Formatted Data

For convenience, the data and text are provided in electronic format as Word 2003® files via email and on the enclosed CD-RW.

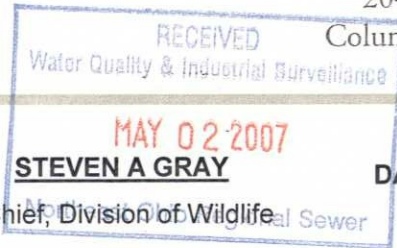
Appendix E



DIVISION OF WILDLIFE

Ohio Department of Natural Resources

Division of Wildlife Headquarters
2045 Morse Road, Bldg. G
Columbus, Ohio 43229-6693
1-800-WILDLIFE



DATE ISSUED

4/27/2007

WILD ANIMAL PERMIT: 156

SCIENTIFIC COLLECTION

JOHN W. RHOADES
4747 EAST 49TH ST.
CUYAHOGA HTS., OH 44125-1011

Chief, Division of Wildlife

Others authorized on permit

YES (SEE ATTACHMENT)

SOCIAL SECURITY NUMBER:

is hereby granted permission to take, possess, and transport at any time and in any manner specimens of wild animals, subject to the conditions and restrictions listed below or any documents accompanying this permit.

This permit, unless revoked earlier by the Chief, Division of Wildlife, is effective
from: 3/16/2007 to: 3/15/2008

This permit must be carried while collecting wild animals and be exhibited to any person on demand.

THIS PERMIT IS RESTRICTED TO THE FOLLOWING:

A. Specific Restrictions:

1. Permittee may collect fish and aquatic macro-invertebrates for survey and inventory purposes. All endangered species are to be release a site of capture.
2. Permittee must consult with Wildlife's Stream Conservation and Environmental Assessment Unit (SCEA) prior to conducting any wild animal work associated with compliance requirements of the Clean Water Act (CWA) Section 401 and/or 404. Contact the unit at 614/265-6308 (Bob Fletcher) or 614/265-6631 (Becky Jenkins).
3. 24 hours prior to setting trap nets or gillnets, contact must be made with the local wildlife officer or nearest district office to advise location and duration of sampling. All vouchers are to be deposited at NEORS.
4. Collection is prohibited in Big Darby, Little Darby, Chagrin river and Fish Creek (Williams County) without explicit written permission from the Division of Wildlife.
5. Permittee must provide an annual report of collecting activities to the Division of Wildlife. Report shall provide species, quantity and locations of collection.

B. Locations of Collecting:

STATEWIDE

C. Equipment and method used in collection:

SEINES, TRAP NETS AND ELECTROSHOCKER.

D. Name and number of each species to be collected:

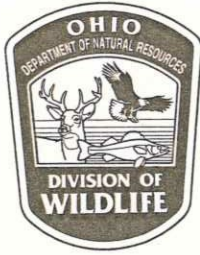
FISH AND MACROINVERTEBRATES AS REQUIRED. ALL FISH (EXCEPT VOUCHER SPECIES) MUST BE RELEASED AT THE COLLECTION SITE.

G. An annual report detailing the date(s), location(s), quantities and species collected must be submitted to the Division of Wildlife by the following February 1st from issued date above.

This permit is not valid for collecting migratory birds, their nests, or eggs unless a current permit from the U.S. Fish and Wildlife Service has been obtained.

F. Additional restrictive documents accompanying this permit?

G. NO ENDANGERED SPECIES MAY BE TAKEN WITHOUT WRITTEN PERMISSION FROM THE CHIEF



ATTACHMENT

This attachment to Scientific Collecting Permit # 156 authorizes the following persons to conduct the activities listed on the permit, within the conditions and restrictions set forth. Each person must carry and exhibit upon request, a copy of the permit and this attachment when conducting any of the listed activities. The person named on the permit assumes full responsibility for the actions of the persons on this list and for completing and submitting all required reports.

<u>Name</u>	<u>Social Security No.</u>
SETH HOTHEM	
THOMAS ZABLOTNY	
CATHERINE ZAMBORSKY	
TIFFANY MOORE	
ELIZABETH TOOT-LEVY	
KATHRYN CRESTANI	
RON MAICHLE	
FRANCISO RIVERIA	