

Level 3 Project Study Plan

2013 Nine-Mile Creek Environmental Monitoring

(1) Objectives

Nine-Mile Creek's drainage area includes the communities of South Euclid, University Heights, Cleveland Heights, East Cleveland, Cleveland and Bratenahl. Nine-Mile is culverted from Lake Shore Boulevard to east of Belvoir Road at the border between the cities of Cleveland and Cleveland Heights. Upstream of this location, the creek is open, and the "Nela Park" Branch, which enters the culverted mainstem of Nine-Mile Creek south of Belvoir is also open.

Future construction projects in the Nine-Mile Creek watershed are anticipated to improve its water quality. The Northeast Ohio Regional Sewer District (NEORS D) intends to conduct assessments prior to the beginning of these projects.

The purpose of this study is to collect general watershed monitoring baseline data in order to assess the biological health of Nine-Mile Creek and collect data prior to the completion of the Capital Improvement Project of construction of the relief sewer at East 140th Street and Hayden Avenue, which should eliminate or reduce sanitary sewage to Combined Sewer Overflow (CSO) 211 and a reduction or elimination of sanitary sewage to CSO 212. These flow reductions should benefit the Districts long-term CSO Control Plan's goal of four or fewer overflows per year.

NEORS D will assess water chemistry and habitat, along with the fish and benthic macroinvertebrate communities. Fish and macroinvertebrate community health will be evaluated through the use of Ohio EPA's Index of Biotic Integrity (IBI), Modified Index of Well-Being (MIwb), and Invertebrate Community Index (ICI). An examination of the specific characteristics of the biological communities will be used in conjunction with water quality data, the NEORS D Macroinvertebrate Field Sheet, and Qualitative Habitat Evaluation Index (QHEI) results in order to identify impacts to the communities. Results will be compared to historic data to show temporal as well as spatial trends. Water chemistry data will also be compared to the Ohio Water Quality Standards to determine attainment of applicable uses (Ohio EPA, 2009b)¹.

¹ See appendix H for a list of all references.

2013 Project Study Plans

(3) Parameters Covered

Fish specimens will be identified to species level, weighed, counted and examined for the presence of external anomalies including DELTs (deformities, eroded fins, lesions and tumors). An Ohio EPA Fish Data Sheet (Appendix A) will be completed during each assessment. Quantitative fish sampling is expected to be conducted at all locations.

Macroinvertebrate community assemblages will be collected from each location. Third Rock Consultants, LLC will identify and enumerate the specimens collected from each site. All specimens will be identified to the lowest practical taxonomic level as recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987b)¹. The NEORSD Macroinvertebrate Field Sheet (Appendix A) will be completed at each site during sampler retrieval or when qualitative sampling is conducted.

Stream habitat will be measured by scoring components of the QHEI at all locations, including the substrate, instream cover, channel morphology, riparian zone, bank erosion, pool/glide and riffle/run quality and gradient. The HHEI will be conducted at those sites with drainage areas less than one square mile listed under PSPs with general watershed monitoring, as per the NEORSD's Stormwater Program. Examples of the Ohio EPA field sheets for the QHEI and the HHEI can be found in Appendix A.

Water chemistry samples will be collected at each electrofishing/macroinvertebrate sampling site included in the study. Water chemistry samples will be analyzed by NEORSD's Analytical Services Division. Appendix B lists the parameters to be tested along with the detection limits and practical quantitation limits. Field measurements for dissolved oxygen, pH, temperature, conductivity and turbidity will also be performed. A Surface Water Condition Sampling Field Data Form will be completed at each site during each sampling event (Appendix A).

Benthic and water column chlorophyll *a* samples may be collected from stream locations. Chemical and physical water quality parameters to be measured in conjunction with the chlorophyll *a* samples include total phosphorus, dissolved reactive phosphorus, nitrate+nitrite, ammonia, alkalinity, turbidity and suspended solids. In the Cuyahoga River, YSI 6600EDS data sondes may be installed at RMs 16.20, 10.75, 10.10, and 7.00 around the time that this sampling is conducted to more frequently monitor dissolved oxygen, temperature, conductivity, and pH.

¹ See Appendix H for a list of all references.

(4) Field Collection and Data Assessment Techniques

Field collections for fish will be conducted at all stream locations. Sampling will be conducted using longline or boat electrofishing techniques and will consist of shocking all habitat types within a sampling zone. Headwater and wading sites, which are 0.15 and 0.20 kilometers in length, respectively, will be surveyed by moving from downstream to upstream. Boat sites, which are 0.50 kilometers in length, will be surveyed by moving from upstream to downstream. The stunned fish will be collected and placed into a live well for later identification. The longline and boat electrofishing zones will be assessed one to three times during the field season (June 15 - October 15).

Fish will be identified to the species level, weighed, counted, and examined for the presence of external anomalies including DELTs. Fish easily identified (commonly collected from year to year) will be returned to the site from which they are collected. Fish species difficult to identify will be brought back to the laboratory for verification by NEORSD Level 3 Fish Qualified Data Collectors (QDC). If necessary, vouchers will be sent to The Ohio State University 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.

Macroinvertebrate sampling will be conducted using quantitative and qualitative sampling techniques. Quantitative sampling will be done using a modified Hester-Dendy multi-plate artificial substrate sampler (HD) that is colonized for a six-week period. Multiple HD samplers will be installed at one or all sampling locations in case samplers are lost due to vandalism, burial, etc. and for the purposes of providing a replicate sample. Qualitative sampling will be conducted using a D-frame dip net when HD samplers are retrieved. The NEORSD Macroinvertebrate Field Sheet will be completed during each HD retrieval. Ronald Maichle of NEORSD, a Level 3 QDC for Benthic Macroinvertebrate

Biology, may identify specimens in the replicate sample to the lowest practical taxonomic level as recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987b).

Macroinvertebrate voucher specimens for both quantitative and qualitative sampling will be collected as described in section (14). Macroinvertebrate community assemblages collected will be shipped to Third Rock Consultants, LLC (Lexington, KY) for identification and enumeration. Third Rock Consultants, LLC will identify specimens to the lowest practical taxonomic level as recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987b).

A detailed description of the sampling and analysis methods utilized in the fish community and macroinvertebrate surveys, including calculations of the IBI, MIwb and ICI, can be found in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987a) and *III* (1987b).

The QHEI, as described in Ohio EPA's *Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)* (2006) will be used to assess aquatic habitat conditions at each sample location.

The HHEI as described in Ohio EPA's *Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams* (2012) will be used, when necessary, to conduct use attainability analyses and to classify the actual and expected biological conditions in primary headwater habitat streams.

Water chemistry sampling will occur across a variety of flow conditions. Techniques used for water chemistry sampling and chemical analyses will follow the *Surface Water Field Sampling Manual* (Ohio EPA, 2013). Chemical water quality samples from each site will be collected with at least one 4-liter disposable polyethylene cubitainers with disposable polypropylene lids and two 473-mL plastic bottles. Bacteriological samples will be collected in a sterile plastic bottle preserved with sodium thiosulfate. All water quality samples will be collected as grab samples. One duplicate sample and one field blank will be collected at randomly selected sites at a frequency of not less than 5% of the total samples collected for this study plan. The acceptable percent RPD will be based on the ratio of the sample concentration and detection limit (Ohio EPA, 2013):
Acceptable % RPD = $[(0.9465X - 0.344) * 100] + 5$, where X = sample/detection limit ratio. Those RPDs that were higher than acceptable may indicate potential problems with sample collection and, as a result, the data will not be used for comparison to the water quality standards. Acid preservation of the samples, as specified in the NEORSD laboratory's standard operating procedure for each parameter, will occur in the field. Appendix B lists the analytical method, method

detection limit and practical quantitation limit for each parameter analyzed. Field analyses include the use of either a YSI-556 MPS Multi-Parameter Water Quality Meter or YSI 600XL sonde to measure dissolved oxygen (DO), water temperature, conductivity and pH; and when necessary, a Hanna HI 98129 meter to measure pH and a Hach HQ30d meter with LDO101 probe to measure DO. Field turbidity will be measured using either a Hach 2100P Portable Turbidimeter or Hach 2100Q Turbidimeter. Specifications for these meters have been included in Appendix C.

Benthic and water column chlorophyll *a* samples may be collected if time and resources allow. Sampling methods will follow those detailed in the NEORSD *Chlorophyll a Sampling and Field Filtering Standard Operating Procedure* (SOP-EA001-00). A Chlorophyll *a* Sampling Field Sheet will be completed for each site (Appendix D). Water chemistry grab samples will be collected at the same time using the methods discussed previously and will be analyzed for nutrients, turbidity, alkalinity and suspended solids. Additionally in the Cuyahoga River, approximately 24-hours prior to each chlorophyll *a* sampling event, YSI 6600 EDS data sondes may be deployed at RMs 16.20, 10.75, 10.10 and 7.00. If installed, each data sonde will record, at fifteen-minute intervals, dissolved oxygen concentration, pH, temperature, and conductivity from the time the data sonde is deployed until the time it is retrieved. These data sondes will be placed in the stream by inserting each one into a 4.5-inch PVC pipe with holes drilled into the sides of the lower third of the pipe to allow water to pass through it. The data sondes will remain in the river for approximately 24-hours or longer following collection of the chlorophyll *a* samples.

Where possible, data assessment will include an analysis of temporal and spatial trends in the collected data. Species assemblages and individual metrics will be analyzed. Graphs that show current and historic QHEI, IBI, MIwb and ICI scores and how these scores compare to attainment status of biocriteria will be prepared. Water chemistry data collected will be compared to Ohio water quality standards to determine whether any excursions from the applicable water quality criteria have occurred. It will also be used to determine any relationships among individual parameters and chlorophyll *a* concentrations. Comparisons between water quality and biological community health will only be made if at least three water quality samples have been collected from that site.

(5) Stream Flow Measurement

Stream flow will be recorded for all locations during each electrofishing pass utilizing data from the United States Geological Survey (USGS) gauge station nearest the stream location, if applicable.

Stream flow will be measured with a Marsh-McBirney FloMate Model 2000 Portable Flow Meter or an Aquaflo Probe Model 6900, which measure flow in feet per second, when HD samplers are installed and retrieved. The specifications for the flow meters can be found in Appendix C.

(7) Schedule

One to three electrofishing surveys will be conducted at each site between June 15 and October 15, 2013. Surveys will be conducted at least three weeks apart. Specific dates have not been scheduled. River flow and weather conditions will be assessed weekly to determine when each electrofishing pass will be conducted.

Artificial substrate samplers will be installed at stream locations once between June 15 and August 19, 2013, and retrieved six weeks later. Qualitative macroinvertebrate sampling will be conducted one time at all sites. Specific dates have not been scheduled. River flow and weather conditions will be assessed weekly to determine when the HD sampler installations and retrievals and qualitative sampling will be conducted.

QHEI, and if necessary, HHEI habitat evaluations will be conducted one time between June 15 and October 15, 2013. QHEI evaluations will be conducted around the same time as one of the electrofishing surveys.

Water chemistry samples will be collected a minimum of three times from stream locations between June 15 and October 15, 2013.

Benthic and water column chlorophyll *a* samples may be collected at least one time from stream locations between June 15 and October 15, 2013. These samples will be collected under low-flow conditions.

(8) QA/QC

Quality assurance and quality control of sampling and analysis methods for habitat, fish, and macroinvertebrate evaluations will follow Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volumes II* (1987a) and *III* (1987b), *Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)* (2006) and *Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams* (2012).

Electrofishing equipment will be used according to the guidelines listed in the operation and maintenance manual provided by Smith-Root, Inc. Malfunctioning equipment will not be used to collect data. Proper steps will be taken to correct any problems as soon as possible, whether by repairing in the field, at the

NEORSD Environmental & Maintenance Services Center, or by contacting the supplier or an appropriate service company.

Fish species difficult to identify will be brought back to the laboratory for verification by Level 3 Fish QDC's, and if necessary, sent to The Ohio State University 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.

All macroinvertebrate community assemblages from stream locations, except for the replicate sample, will be collected and shipped to Third Rock Consultants, LLC for identification and enumeration. All specimens will be identified to the lowest practical taxonomic level as recommended in Ohio EPA's *Biological Criteria for the Protection of Aquatic Life, Volume III* (1987b). All macroinvertebrate specimens will be returned to NEORSD. At least two voucher specimens of each species, when available, will be separated into individual vials and kept as described in section (14). The remaining specimens for each site will be returned in a single container labeled with the site number and collection method and date. All specimens and accompanying chain-of-custody documentation will be retained by NEORSD and stored at the Environmental & Maintenance Services Center for a period not less than ten years.

Water samples obtained for chemical analyses will be collected, preserved (see Section 4), labeled and then placed on ice inside the field truck. The field truck will remain locked at all times when not occupied/visible. Sampling activities, including sample time and condition of surface water sampled, will be entered in a field log book and on the Surface Water Condition Sampling Field Data Form. 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 are on file with Ohio EPA. The Quality Assurance Officer at Analytical Services will send updates, revisions and any information on document control to Ohio EPA as needed.

For benthic and water column chlorophyll *a* sampling, three filtrations will be performed for each sample. A field filtration blank will be submitted for every 20 samples.

June 12, 2013

Calibration of YSI 6600EDS data sondes will be done according to the YSI Environmental Operations Manual. The conductivity will be calibrated first using a 1.413 mS/cm standard. Second, the pH will be calibrated using two different buffers (7 and 10 s.u.). The DO will be calibrated last with an acceptable error of 0.2 mg/L.

Once the sondes are removed from the river, the accuracy of the data that has been collected will be checked by comparing readings taken by the sondes to known standards. If the measurements taken at this time meet quality control goals, all of the data collected since the last calibration will be considered accurate. The acceptable differences for pH and conductivity will be ± 0.3 with pH 7 buffer and $\pm 10\%$ of the conductivity standard, respectively (EPA New England- Region 1, 2005). The acceptable difference for DO will be ± 0.2 mg/L. If the measurements do not meet quality control goals, best professional judgment will be used to decide if any of the data collected during that period may still be accurate. For example, the data collected from the four locations may be plotted on the same graph, and if it appears that the data points are following similar trends, they may be considered accurate. If any data that do not meet quality control goals are used, a rationale for their inclusion will be provided when the data are submitted.

(9) Work Products

Within one year of completion of the project, fish data (species, numbers, weights, pollution tolerances, the incidence of DELT anomalies, IBI and MIwb scores), macroinvertebrate data (types and numbers of macroinvertebrates collected and ICI scores), habitat data (QHEI raw data and scores) and water chemistry results will be submitted to the Ohio EPA. Additionally, reports summarizing, interpreting, graphically presenting and discussing the IBI, MIwb, ICI and QHEI scores, chlorophyll *a* results, and any excursions from water quality standards may be prepared for internal use.

(10) Qualified Data Collectors

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

Name	Address	Email Address	Phone Number	QDC Specialty(s)
John W. Rhoades ¹	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	rhoadesj@neorsd.org	216-641-6000	QDC - 00008 CWQA/FCB/SHA/ BMB
Cathy Zamborsky	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	zamborskyc@neorsd.org	216-641-6000	QDC - 00009 CWQA/SHA
Seth Hothem	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	hothems@neorsd.org	216-641-6000	QDC - 00010 CWQA/FCB/SHA
Tom Zablontny	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	zablontnyt@neorsd.org	216-641-6000	QDC - 00018 CWQA/FCB/SHA
Ron Maichle	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	maichler@neorsd.org	216-641-6000	QDC - 00145 CWQA/SHA/BMB
Francisco Rivera	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	riveraf@neorsd.org	216-641-6000	QDC - 00262 CWQA/SHA
Jillian Novak	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	novakj@neorsd.org	216-641-6000	QDC - 00512 CWQA/SHA
Jonathan Brauer	4747 East 49 th Street Cuyahoga Heights, Ohio 44125	brauerj@neorsd.org	216-641-6000	QDC - 00663 SHA
Bert Remley ²	2526 Regency Road, Suite 180 Lexington, Kentucky 40503	bremley@thirdrockconsultants.com	859-977-2000	QDC - 00837 BMB
¹ NEORSD Lead Project Manager				
² Benthic Macroinvertebrate Identification				

The following is a list of persons not qualified as Level 3 QDCs who may be involved in the project. Prior to the start of sampling, the project managers will explain to each individual the proper methods for sampling. 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.

Name	Address	Email Address	Phone Number
Nick Barille	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	barillen@neorsd.org	216-641-6000
Joseph Carbonaro	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	carbonaroj@neorsd.org	216-641-6000
Mark Colvin	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	colvinm@neorsd.org	216-641-6000
Tim Dobriansky	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	dobrianskyt@neorsd.org	216-641-6000
Kyle Frantz	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	frantzk@neorsd.org	216-641-6000
Donna Friedman	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	friedmand@neorsd.org	216-641-6000
Rae Grant	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	grantr@neorsd.org	216-641-6000

Name	Address	Email Address	Phone Number
Mark Matteson	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	mattesonm@neorsd.org	216-641-6000
Denise Phillips	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	phillipsd@neorsd.org	216-641-6000
Brandy Reischman	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	reischmanb@neorsd.org	216-641-6000
Frank Schuschu	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	schuschuf@neorsd.org	216-641-6000
Eric Soehnlén	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	soehnlene@neorsd.org	216-641-6000
William Stanford	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	stanfordw@neorsd.org	216-641-6000
Wolfram von Kiparski	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	vonkiparskiw@neorsd.org	216-641-6000
Rachel Dannemiller Co-Op	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	dannemillerr@neorsd.org	216-641-6000
Jana Nagle Co-Op	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	naglej@neorsd.org	216-641-6000
Shane Page Co-Op	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	pages@neorsd.org	216-641-6000
Ian Reider Co-Op	4747 East 49 th Street Cuyahoga Hts., Ohio 44125	reideri@neorsd.org	216-641-6000

(11) Contract laboratory contact information

All bacteriological and/or chemical sample analysis will be completed by NEORSD's Analytical Services Division. Evidence of NEORSD's Analytical Services current accreditation and method dates can be found in Appendix E. The contact information for NEORSD's Analytical Service Division is:

NEORSD Analytical Services
 Mr. Mark Citriglia
 4747 E. 49th Street
 Cuyahoga Heights, Ohio 44056
 citrigliam@neorsd.org
 216-641-6000

Any fish that is not positively identified in the field, or at NEORSD, will be sent to The Ohio State University Museum of Biological Diversity for verification by the Curator and/or Associate 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

June 12, 2013

Identification of macroinvertebrates for stream locations will be completed by Third Rock Consultants LLC (Lexington, Kentucky) (Appendix F). Benthic macroinvertebrates will be identified to the lowest practical level as recommended by Ohio EPA (1987b). Third Rock Consultants LLC contact information:

Ms. Marcia Wooton
Third Rock Consultants LLC
2526 Regency Road, Suite 180
Lexington, Kentucky 40503
mwooton@thirdrockconsultants.com
859-977-2000

- (12) Copy of ODNR collector's permit

See Appendix G.

- (13) Digital 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).

Print/Signature: John W. Rhoades / Date: _____

- (14) Voucher Specimen Statement

NEORSD will maintain a benthic macroinvertebrate and fish voucher collection which includes two specimens, or appropriate photo vouchers, of each species or taxa collected during the course of biological sampling from any stream within the NEORSD's service area. When benthic macroinvertebrates from multiple 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. When fish specimens from multiple surface waters are collected within the same year, 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 specimens or photo vouchers to the Director upon request. This collection will be stored at the NEORSD laboratory in the Environmental and Maintenance Services Center.

Print/Signature: John W. Rhoades / Date: _____

(15) Sample Location Statement

I attest that I will make available any and all sampling location information, including but not limited to; the name of the water body sampled, sampling location latitude and longitude, sampling location river mile where possible, general location information, the U.S. geological survey HUC 8 number and name, and the purpose for data collection at each sampling location.

Print/Signature: John W. Rhoades / Date: _____

(16) Additional L3 Data Collector Statement

The Lead Project Manager for all stream locations is approved for all project data types.

Print/Signature: John W. Rhoades / Date: _____

(17) 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.

Print/Signature: John W. Rhoades / Date: _____

Print/Signature: Cathy Zamborsky / Date: _____

Print/Signature: Seth Hothem / Date: _____

Print/Signature: Tom Zablony / Date: _____

Print/Signature: Ron Maichle / Date: _____

Print/Signature: Jillian Novak / Date: _____

Print/Signature: Jonathan Brauer / Date: _____

Print/Signature: Francisco Rivera / Date: _____

Appendix A



FISH DATA SHEET

Sheet ID For Office Use Only

[Empty box for Sheet ID]

New Station

(requires lat/long & county)

Mix Zone

Page ___ of ___

Station ID _____ River Code _____ RM _____ Date _____ Time _____

Stream _____ Location _____

Comments _____

Lat _____ Long _____ County _____ ALP _____ Time Fished _____

Crew _____ Netter _____ Others _____ Sampler Type _____

Distance _____ Flow _____ Temp. C _____ Secchi _____ Source _____ Project _____

Fins Code Number Weighed Total Counted Total Weight

Weights Counts

DELT ANOMALIES
Deformities, Erosions, Lesions, Tumors
Multiple DELTs on one fish

1										D	E	L	T	M	*
	V	10x													
2										D	E	L	T	M	*
	V	10x													
3										D	E	L	T	M	*
	V	10x													
4										D	E	L	T	M	*
	V	10x													
5										D	E	L	T	M	*
	V	10x													
6										D	E	L	T	M	*
	V	10x													
7										D	E	L	T	M	*
	V	10x													
8										D	E	L	T	M	*
	V	10x													
9										D	E	L	T	M	*
	V	10x													

* A-anchor worm; B-black spot; C-licees; F-fungus; N-blind; P-parasites; S-emaciated, W-swirled scales Y-popeye; Z-other

NEORSD Macroinvertebrate Field Sheet

Stream: _____ River Mile: _____ Year: _____

Location: _____ Project: _____

Drainage Area (mi²): _____ Latitude (°N)/Longitude (°W): _____

Hester-Dendy Deployment Information

Install Date: _____ Crew (QDC Circled): _____

Current at HD (fps): _____ Depth (cm): _____ Pictures Obtained: Yes No

Reinstall Date: _____ Crew (QDC Circled): _____

Current (fps): _____ Depth (cm): _____ Reason: _____

Reinstall Date: _____ Crew (QDC Circled): _____

Current (fps): _____ Depth (cm): _____ Reason: _____

Sampling/Retrieval Information

Sampling Method: Hester-Dendy Dipnet Surber Core Other: _____

Sample ID: HD: _____ Qualitative: _____ Other: _____

Sampling Date: _____ Crew (QDC Circled): _____

HD Condition- Current (fps): _____ Depth (cm): _____ Water Temp: _____ °F / °C

Number of HD Blocks Obtained: _____ Remarks: _____

Disturbed: Yes No Comments: _____

Debris: Yes No Comments: _____

Silt/Solids: None Slight Moderate Heavy

Dipnet- Time Sampled (min): _____ X Number of Crew: _____ = Total (min): _____

Habitats Sampled: Pool Riffle Run Margin Backwater

River Sampling Conditions

Flow Condition: Flood Above Normal Normal Low Interstitial Intermittent Dry

Current Velocity: Fast Moderate Slow Non-detect

Channel Morphology: Natural Channelized Channelized (Recovered) Impounded

Bank Erosion: Extensive Moderate Slight None

Riffle Development: Extensive Moderate Sparse Absent

Riffle Quality: Good Fair Poor Embedded: Yes No

Water Clarity: Clear Murky Turbid Other: _____

Water Color: None Green Brown Grey Other: _____

Canopy over HD: Open 75 % 50 % 25 % Closed

Comment Section: _____

OEPA Comment Field Codes: _____

Samples Analyzed By: _____ QDC #: _____ Date: _____

Physical Characteristics

Substrate Characteristics

	Pool Units	Riffle Units	Run Units
Bedrock			
Boulder			
Rubble			
Coarse Gravel			
Fine Gravel			
Sand			
Silt			
Clay/Hardpan			
Detritus			
Peat			
Muck			
Other			
Macrophytes			
Algae			
Artifacts			
Compaction (F,M,S)			
Depth (Avg)			
Width (Avg)			

Predominant Land Use (Left, Right or Both)

Forest	Urban	Open Pasture
Shrub	Residential/Park	Closed Pasture
Old Field	Mining/Construction	
Rowcrop	Wetland	
Industrial	Other	

Predominant Riparian Vegetation

Left	Right	Type
_____	_____	Large Trees
_____	_____	Small Trees
_____	_____	Shrubs
_____	_____	Grass/Weeds
_____	_____	None

Margin Habitat

Margin Quality:	Good	Fair	Poor
Undercut Banks	Root Mats	Tree Roots	
Grass	Water Willow	Woody Debris	
Shallows	Clay/Hardpan	Macrophytes	
Rip Rap	Bulkhead		
Other	_____		

Biological Characteristics

Riffle:

Predominant Organism: _____
 Other Common Organisms: _____
 Density: High Moderate Low
 Diversity: High Moderate Low

Run:

Predominant Organism: _____
 Other Common Organisms: _____
 Density: High Moderate Low
 Diversity: High Moderate Low

Pool:

Predominant Organism: _____
 Other Common Organisms: _____
 Density: High Moderate Low
 Diversity: High Moderate Low

Margin:

Predominant Organism: _____
 Other Common Organisms: _____
 Density: High Moderate Low
 Diversity: High Moderate Low

Other Notable Collections: _____

V= Very Abundant; A= Abundant; C= Common; R= Rare

Overall Amount (V= >151; A= 150-101; C= 100-11; R= 10-1)

/	Porifera, Bryozoa
/ /	Turbellaria, Oligochaeta, Hirudinea
/	Isopoda, Amphipoda
/	Decapoda, Hydracarina
	Ephemeroptera
	Baetidae
/ /	Heptageniidae, Leptohephidae, Caenidae
	Other _____
/	Zygoptera, Anisoptera
	Plecoptera
	Hemiptera
/	Megaloptera, Neuroptera
	Trichoptera
	Hydropsychidae
/	Hydroptilidae, Leptoceridae
	Other _____
	Coleoptera
	Elmidae
	Other _____
	Diptera
	Chironomidae
	Other _____
/	Gastropoda, Bivalvia
	Other _____

Field Narrative Rating: E VG G MG F P VP

Stream & Location: _____ RM: _ _ Date: _ / _ / _

Scorers Full Name & Affiliation: _____ Northeast Ohio Regional Sewer District

River Code: - - STORET #: _____ Lat./Long.: _____ /8 Office verified location []

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present Check ONE (Or 2 & average)

Substrate assessment grid with categories: BEST TYPES, OTHER TYPES, ORIGIN, QUALITY. Includes checkboxes for BLDR/SLABS, BOULDER, COBBLE, GRAVEL, SAND, BEDROCK, etc.

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts

Instream Cover assessment grid with categories: UNDERCUT BANKS, OVERHANGING VEGETATION, SHALLOWS, ROOTMATS, POOLS, ROOTWADS, BOULDERS, OXBOWS, BACKWATERS, AQUATIC MACROPHYTES, LOGS OR WOODY DEBRIS. Includes AMOUNT checkboxes.

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

Channel Morphology assessment grid with categories: SINUOSITY, DEVELOPMENT, CHANNELIZATION, STABILITY. Includes checkboxes for HIGH, MODERATE, LOW, NONE.

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

Bank Erosion and Riparian Zone assessment grid with categories: EROSION, RIPARIAN WIDTH, FLOOD PLAIN QUALITY, CONSERVATION TILLAGE, URBAN OR INDUSTRIAL, MINING / CONSTRUCTION.

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

Pool / Glide and Riffle / Run Quality assessment grid with categories: MAXIMUM DEPTH, CHANNEL WIDTH, CURRENT VELOCITY. Includes checkboxes for > 1m, 0.7-1m, etc.

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: [] NO RIFFLE [metric=0]

Riffle / Run Quality assessment grid with categories: RIFFLE DEPTH, RUN DEPTH, RIFFLE / RUN SUBSTRATE, RIFFLE / RUN EMBEDDEDNESS. Includes checkboxes for BEST AREAS > 10cm, etc.

6] GRADIENT (ft/mi) [] VERY LOW - LOW [2-4] [] MODERATE [6-10] [] HIGH - VERY HIGH [10-6] %POOL: [] %GLIDE: [] %RUN: [] %RIFFLE: []

A/ SAMPLED REACH

Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

METHOD **STAGE**

- | | |
|----------------------------------|--|
| <input type="checkbox"/> BOAT | 1st -sample pass- 2nd |
| <input type="checkbox"/> WADE | <input type="checkbox"/> HIGH <input type="checkbox"/> |
| <input type="checkbox"/> L. LINE | <input type="checkbox"/> UP <input type="checkbox"/> |
| <input type="checkbox"/> OTHER | <input type="checkbox"/> NORMAL <input type="checkbox"/> |
| | <input type="checkbox"/> LOW <input type="checkbox"/> |
| | <input type="checkbox"/> DRY <input type="checkbox"/> |

DISTANCE

- 0.5 Km
- 0.2 Km
- 0.15 Km
- 0.12 Km
- OTHER

CLARITY

- | | | |
|---------------------------------------|--------------------------|--------------------------|
| 1st --sample pass-- 2nd | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> < 20 cm | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> 20-<40 cm | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> 40-70 cm | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> > 70 cm/ CTB | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> SECCHI DEPTH | <input type="checkbox"/> | <input type="checkbox"/> |

_____ meters

CANOPY

- > 85%- OPEN
- 55%-<85%
- 30%-<55%
- 10%-<30%
- <10%- CLOSED

- | | |
|--------------|------|
| 1st _____ cm | pass |
| 2nd _____ cm | |

C/ RECREATION

AREA DEPTH
POOL: >100ft² >3ft

B/ AESTHETICS

- NUISANCE ALGAE
- INVASIVE MACROPHYTES
- EXCESS TURBIDITY
- DISCOLORATION
- FOAM / SCUM
- OIL SHEEN
- TRASH / LITTER
- NUISANCE ODOR
- SLUDGE DEPOSITS
- CSOs/SSOs/OUTFALLS

D/ MAINTENANCE

- PUBLIC / PRIVATE / BOTH / NA
- ACTIVE / HISTORIC / BOTH / NA
- YOUNG-SUCCESSION-OLD
- SPRAY / SNAG / REMOVED
- MODIFIED / DIPPED OUT / NA
- LEVEED / ONE SIDED
- RELOCATED / CUTOFFS
- MOVING-BEDLOAD-STABLE
- ARMOURED / SLUMPS
- ISLANDS / SCOURED
- IMPOUNDED / DESICCATED
- FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

E/ ISSUES

- WWTP / CSO / NPDES / INDUSTRY
- HARDENED / URBAN / DIRT&GRIME
- CONTAMINATED / LANDFILL
- BMPs-CONSTRUCTION-SEDIMENT
- LOGGING / IRRIGATION / COOLING
- BANK / EROSION / SURFACE
- FALSE BANK / MANURE / LAGOON
- WASH H₂O / TILE / H₂O TABLE
- ACID / MINE / QUARRY / FLOW
- NATURAL / WETLAND / STAGNANT
- PARK / GOLF / LAWN / HOME
- ATMOSPHERE / DATA PAUCITY

F/ MEASUREMENTS

- \bar{x} width
- \bar{x} depth
- max. depth
- \bar{x} bankfull width
- bankfull \bar{x} depth
- W/D ratio
- bankfull max. depth
- floodprone x² width
- entrench. ratio

Legacy Tree:

Stream Drawing:

SITE NAME/LOCATION _____

_____ SITE NUMBER _____ RIVER BASIN _____ DRAINAGE AREA (mi²) _____

LENGTH OF STREAM REACH (ft) _____ LAT. _____ LONG. _____ RIVER CODE _____ RIVER MILE _____

DATE _____ SCORER _____ COMMENTS _____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: NONE / NATURAL CHANNEL RECOVERED RECOVERING RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check ONLY two predominant substrate TYPE boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.)

TYPE	PERCENT	TYPE	PERCENT
<input type="checkbox"/> <input type="checkbox"/> BLDR SLABS [16 pts]	_____	<input type="checkbox"/> <input type="checkbox"/> SILT [3 pt]	_____
<input type="checkbox"/> <input type="checkbox"/> BOULDER (>256 mm) [16 pts]	_____	<input type="checkbox"/> <input type="checkbox"/> LEAF PACK/WOODY DEBRIS [3 pts]	_____
<input type="checkbox"/> <input type="checkbox"/> BEDROCK [16 pt]	_____	<input type="checkbox"/> <input type="checkbox"/> FINE DETRITUS [3 pts]	_____
<input type="checkbox"/> <input type="checkbox"/> COBBLE (65-256 mm) [12 pts]	_____	<input type="checkbox"/> <input type="checkbox"/> CLAY or HARDPAN [0 pt]	_____
<input type="checkbox"/> <input type="checkbox"/> GRAVEL (2-64 mm) [9 pts]	_____	<input type="checkbox"/> <input type="checkbox"/> MUCK [0 pts]	_____
<input type="checkbox"/> <input type="checkbox"/> SAND (<2 mm) [6 pts]	_____	<input type="checkbox"/> <input type="checkbox"/> ARTIFICIAL [3 pts]	_____

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock **(A)** Substrate Percentage Check **(B)**

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: **TOTAL NUMBER OF SUBSTRATE TYPES:**

2. Maximum Pool Depth (Measure the maximum pool depth within the 61 meter (200 ft) evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check ONLY one box):

<input type="checkbox"/> > 30 centimeters [20 pts]	<input type="checkbox"/> > 5 cm - 10 cm [15 pts]
<input type="checkbox"/> > 22.5 - 30 cm [30 pts]	<input type="checkbox"/> < 5 cm [5 pts]
<input type="checkbox"/> > 10 - 22.5 cm [25 pts]	<input type="checkbox"/> NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS _____ **MAXIMUM POOL DEPTH (centimeters):**

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) (Check ONLY one box):

<input type="checkbox"/> > 4.0 meters (> 13') [30 pts]	<input type="checkbox"/> > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
<input type="checkbox"/> > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	<input type="checkbox"/> ≤ 1.0 m (≤ 3' 3") [5 pts]
<input type="checkbox"/> > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]	

COMMENTS _____ **AVERAGE BANKFULL WIDTH (meters):**

HHEI Metric Points

Substrate Max = 40

A + B

Pool Depth Max = 30

Bankfull Width Max=30

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream ☆

<u>RIPARIAN WIDTH</u>		<u>FLOODPLAIN QUALITY</u>	
L	R	L	R
(Per Bank)		(Most Predominant per Bank)	
<input type="checkbox"/> <input type="checkbox"/>	Wide >10m	<input type="checkbox"/> <input type="checkbox"/>	Mature Forest, Wetland
<input type="checkbox"/> <input type="checkbox"/>	Moderate 5-10m	<input type="checkbox"/> <input type="checkbox"/>	Immature Forest, Shrub or Old Field
<input type="checkbox"/> <input type="checkbox"/>	Narrow <5m	<input type="checkbox"/> <input type="checkbox"/>	Residential, Park, New Field
<input type="checkbox"/> <input type="checkbox"/>	None	<input type="checkbox"/> <input type="checkbox"/>	Fenced Pasture
		<input type="checkbox"/> <input type="checkbox"/>	Conservation Tillage
		<input type="checkbox"/> <input type="checkbox"/>	Urban or Industrial
		<input type="checkbox"/> <input type="checkbox"/>	Open Pasture, Row Crop
		<input type="checkbox"/> <input type="checkbox"/>	Mining or Construction

COMMENTS _____

FLOW REGIME (At Time of Evaluation) (Check ONLY one box):

<input type="checkbox"/> Stream Flowing	<input type="checkbox"/> Moist Channel, isolated pools, no flow (Intermittent)
<input type="checkbox"/> Subsurface flow with isolated pools (Interstitial)	<input type="checkbox"/> Dry channel, no water (Ephemeral)

COMMENTS _____

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check ONLY one box):

<input type="checkbox"/> None	<input type="checkbox"/> 1.0	<input type="checkbox"/> 2.0	<input type="checkbox"/> 3.0
<input type="checkbox"/> 0.5	<input type="checkbox"/> 1.5	<input type="checkbox"/> 2.5	<input type="checkbox"/> >3

STREAM GRADIENT ESTIMATE

Flat (0.5 ft/100 ft)
 Flat to Moderate
 Moderate (2 ft/100 ft)
 Moderate to Severe
 Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? - Yes No QHEI Score _____ (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

- WWH Name: _____ Distance from Evaluated Stream _____
- CWH Name: _____ Distance from Evaluated Stream _____
- EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: _____ NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____

County: _____ Township / City: _____

MISCELLANEOUS

Base Flow Conditions? (Y/N): _____ Date of last precipitation: _____ Quantity: _____

Photograph Information: _____

Elevated Turbidity? (Y/N): _____ Canopy (% open): _____

Were samples collected for water chemistry? (Y/N): _____ (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N) _____ If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): _____ (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) _____ Voucher? (Y/N) _____ Salamanders Observed? (Y/N) _____ Voucher? (Y/N) _____

Frogs or Tadpoles Observed? (Y/N) _____ Voucher? (Y/N) _____ Aquatic Macroinvertebrates Observed? (Y/N) _____ Voucher? (Y/N) _____

Comments Regarding Biology: _____

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW 

NEORSD Surface Water Condition Sampling Field Data Form

Stream: _____ Date: _____ Collectors: _____

Gage Station and ID: _____ Daily Mean Discharge: _____ ft³/sec

Was this sample taken during or following a wet weather event? YES / NO

Water Quality Meters Used: _____

Time (hrs): _____ River Mile (Site): _____

Weather: Clear Partly Cloudy Overcast Light Rain/Showers Heavy Rain
Steady Rain Heavy Snow Melt Other: _____

Flow: Dry Intermittent Minimal Baseline/Normal Elevated Flood

HD Status: OK Buried Out of Water H-D was Reset
Unknown (river too high) Missing Not Installed Flow: _____ fps

Color: Clear Muddy Tea Milky Other: _____

Odor: Normal Petroleum Anaerobic Sewage Chemical Other: _____

Surface Coating: None Foam Oily Scum Other: _____

Field Parameters: Conductivity (µmhos/cm): _____ Temperature (°C): _____

Dissolved Oxygen (mg/L): _____ pH (s.u.): _____

Turbidity (NTU): _____

General Comments: _____

Time (hrs): _____ River Mile (Site): _____

Weather: Clear Partly Cloudy Overcast Light Rain/Showers Heavy Rain
Steady Rain Heavy Snow Melt Other: _____

Flow: Dry Intermittent Minimal Baseline/Normal Elevated Flood

HD Status: OK Buried Out of Water H-D was Reset
Unknown (river too high) Missing Not Installed Flow: _____ fps

Color: Clear Muddy Tea Milky Other: _____

Odor: Normal Petroleum Anaerobic Sewage Chemical Other: _____

Surface Coating: None Foam Oily Scum Other: _____

Field Parameters: Conductivity (µmhos/cm): _____ Temperature (°C): _____

Dissolved Oxygen (mg/L): _____ pH (s.u.): _____

Turbidity (NTU): _____

General Comments: _____

Sample ID: _____

Sample ID: _____

Appendix B

Parameter	Additional Name	Test	Minimum Detection Limit	Practical Quantitation Limit
Alkalinity		EPA 310.2	3.7 mg/L	10 mg/L
Chemical Oxygen Demand	COD	EPA 410.4	4.1 mg/L	10 mg/L
Mercury	Hg	EPA 245.1	0.006 µg/L	0.050 µg/L
Ammonia *	NH ₃	EPA 350.1	0.005 mg/L	0.020 mg/L
Nitrite + Nitrate	NO ₂ + NO ₃	EPA 353.2	0.008 mg/L	0.020 mg/L
Total Kjeldahl Nitrogen	TKN	EPA 351.2	0.23 mg/L	0.50 mg/L
Dissolved Reactive Phosphorus	DRPhos	EPA 365.1	0.005 mg/L	0.010 mg/L
Total Phosphorus	Total-P	EPA 365.1	0.001 mg/L	0.010 mg/L
Chlorophyll <i>a</i>	Chlorophyll <i>a</i>	EPA 445.0	0.3 µg/L	1.5 µg/L
Chloride	Chloride by IC	EPA 300.0	0.050 mg/L	5.000 mg/L
Sulfate	Sulfate by IC	EPA 300.0	0.065 mg/L	5.000 mg/L
Biological Oxygen Demand	BOD	SM 5210 ¹	2 mg/L	
Silver	Ag	EPA 200.8	0.066 µg/L	1.00 µg/L
Aluminum	Al	EPA 200.8	1.98 µg/L	10.0 µg/L
Arsenic	As	EPA 200.8	0.52 µg/L	2.00 µg/L
Barium	Ba	EPA 200.8	0.17 µg/L	1.00 µg/L
Beryllium	Be	EPA 200.8	0.13 µg/L	1.00 µg/L
Calcium	Ca	EPA 200.8	82.60 µg/L	250.0 µg/L
Cadmium	Cd	EPA 200.8	0.22 µg/L	1.00 µg/L
Cobalt	Co	EPA 200.8	0.13 µg/L	1.00 µg/L
Chromium	Cr	EPA 200.8	0.26 µg/L	1.00 µg/L
Copper	Cu	EPA 200.8	0.11 µg/L	1.00 µg/L
Iron	Fe	EPA 200.8	3.96 µg/L	10.00 µg/L
Potassium	K	EPA 200.8	27.00 µg/L	250.0 µg/L
Magnesium	Mg	EPA 200.8	16.40 µg/L	250.0 µg/L
Manganese	Mn	EPA 200.8	0.56 µg/L	2.00 µg/L
Molybdenum	Mo	EPA 200.8	0.11 µg/L	1.00 µg/L
Sodium	Na	EPA 200.8	15.60 µg/L	250.0 µg/L
Nickel	Ni	EPA 200.8	1.96 µg/L	4.00 µg/L
Lead	Pb	EPA 200.8	0.17 µg/L	1.00 µg/L
Antimony	Sb	EPA 200.8	0.15 µg/L	1.00 µg/L
Selenium	Se	EPA 200.8	2.46 µg/L	5.00 µg/L
Tin	Sn	EPA 200.8	0.17 µg/L	1.00 µg/L
Titanium	Ti	EPA 200.8	0.72 µg/L	2.00 µg/L
Thallium	Tl	EPA 200.8	0.16 µg/L	1.00 µg/L
Vanadium	V	EPA 200.8	1.84 µg/L	4.00 µg/L
Zinc	Zn	EPA 200.8	4.80 µg/L	10.00 µg/L
Total Metals	Total Metals (calc.)	EPA 200.8	µg/L =(Cr µg/L)+(Cu µg/L)+(Ni µg/L)+(Zn µg/L)	
Hardness	Hardness (calc.)	SM 2340 B ¹	CaCO ₃ mg/L =(2.497*Ca mg/L)+(4.118*Mg mg/L)	
Total Solids	TS	SM 2540 B ¹	1.0 mg/L	5.0 mg/L
Total Suspended Solids	TSS	SM 2540 D ¹	0.5 mg/L	1.0 mg/L
Total Dissolved Solids	TDS	SM 2540 C ¹	1.0 mg/L	5.0 mg/L
Turbidity **		EPA 180.1	0.1 NTU	0.2 NTU
<i>Escherichia coli</i>	<i>E. coli</i>	EPA 1603	1 colony	--
Field Parameter		Test	(Value Reported in)	
pH		EPA 150.1 ¹	s.u.	
Conductivity		SM 2510A ¹	µs/cm	
Dissolved Oxygen	DO	SM 4500-0 G ¹	mg/L	
Temperature	Temp	EPA 1701.1 ¹	°C	
Turbidity **		EPA 180.1	NTU	

* NOTE: Listed MDL/PQL is for undistilled samples. Any samples that are required to be distilled will have aMDL = 0.010 mg/L, PQL = 0.100 mg/L.

** Turbidity will either be completed in the field or at the laboratory.

¹ Standard Methods for the Examination of Water and Wastewater, 19th Edition

Appendix C



Y S I Environmental

YSI 556 Multiparameter System

Versatile, multiparameter handheld instrument

Rugged and reliable, the YSI 556 MPS (Multiprobe System) combines the versatility of an easy-to-use, easy-to-read handheld unit with all the functionality of a multiparameter system.



The 556 has multiple language capabilities and graphing!

Pure
Data for a
Healthy
Planet.®

A rugged, cost-effective multiparameter handheld system designed for the field!

- Simultaneously measures dissolved oxygen, pH, conductivity, temperature, and ORP
- Field-replaceable electrodes
- Compatible with EcoWatch® for Windows® data analysis software
- Stores over 49,000 data sets, time and date stamped, interval or manual logging
- Three-year warranty on the instrument; one-year on the probes
- GLP assisting, records calibration data in memory
- Available with 4, 10, and 20-m cable lengths
- IP-67, impact-resistant, waterproof case
- Easy-to-use, screw-on cap DO membranes
- RS-232 interface for PC connection

Options to Fit Your Applications!

- **Battery Options** – The unit is powered by alkaline batteries or an optional rechargeable battery pack with quick-charge feature.
- **Optional Barometer** – Internal barometer can be user-calibrated and displayed along with other data, used in dissolved oxygen calibrations, and logged to memory for tracking changes in barometric pressure. (Choose 556-02)
- **Optional Flow Cell** - The 5083 flow cell can be used for ground water applications or anytime water is pumped for sampling.
- **Carrying Case** – The instrument comes standard with YSI 5061, a soft-sided carrying case with enough space for the 556, a 20-meter cable, and calibrating supplies. An optional 5080 hard-sided carrying case is also available.
- **Confidence Solution®** - Quality assurance ensured. Quickly check conductivity, pH, and ORP readings with one solution.



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ISO 9001
ISO 14001

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CE

YSI Incorporated
Who's Minding
the Planet?™

5563 MPS Sensor Specifications

Dissolved Oxygen (% saturation)	Sensor Type Range Accuracy Resolution	Steady state polarographic 0 to 500% air saturation 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 0.1% air saturation
Dissolved Oxygen (mg/L)	Sensor Type Range Accuracy Resolution	Steady state polarographic 0 to 50 mg/L 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 0.01 mg/L
Temperature	Sensor Type Range Accuracy Resolution	YSI Temperature Precision™ thermistor -5 to 45°C ± 0.15°C 0.1°C
Conductivity	Sensor Type Range Accuracy Resolution	4-electrode cell with autoranging 0 to 200 mS/cm ± 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) 0.001 mS/cm to 0.1 mS/cm (range-dependent)
Salinity	Sensor Type Range Accuracy Resolution	Calculated from conductivity and temperature 0 to 70 ppt ± 1.0% of reading or ±0.1 ppt, whichever is greater 0.01 ppt
pH (optional)	Sensor Type Range Accuracy Resolution	Glass combination electrode 0 to 14 units ±0.2 units 0.01 units
ORP (optional)	Sensor Type Range Accuracy Resolution	Platinum button -999 to +999 mV ± 20 mV 0.1 mV
Total Dissolved Solids (TDS)	Sensor Type Range Resolution	Calculated from conductivity (variable constant, default 0.65) 0 to 100 g/L 4 digits
Barometer (optional)	Range Accuracy Resolution	500 to 800 mm Hg ± 3 mm Hg within ± 10°C temperature range from calibration point 0.1 mm Hg

YSI 556 Instrument Specifications

Size	11.9 cm width x 22.9 cm length (4.7 in. x 9 in.)
Weight with batteries	2.1 lbs. (916 grams)
Power	4 alkaline C-cells; optional rechargeable pack
Cables	4-, 10-, and 20-m (13.1, 32.8, 65.6 ft.) lengths
Warranty	3-year instrument; 1-year probes and cables
Communication Port	RS-232 Serial
Data Logger	49,000 data sets, date and time stamp, manual or logging, with user-selectable intervals

556 Ordering Information (Order all items separately)

556-01	Instrument (with 5061 large, soft-sided carrying case)
556-02	Instrument with barometer option (with 5061 carrying case)
5563-4	4-m cable and DO/temp/conductivity
5563-10	10-m cable and DO/temp/conductivity
5563-20	20-m cable and DO/temp/conductivity
5564	pH Probe for any 5563 cable
5565	pH/ORP Probe for any 5563 cable
6118	Rechargeable battery pack kit (includes battery, adapter, charger)
614	Ultra clamp, C-clamp mount
616	Charger, cigarette lighter
4654	Tripod (small tripod for instrument)
5060	Small carrying case, soft-sided (fits instrument and 4-m cable)
5065	Form-fitted carrier with shoulder strap
5080	Small carrying case, hard-sided (fits instrument, 4-m cable, flow cell, batteries, membrane kit, calibration bottles)
5083	Flow cell
5085	Hands-free harness
5580	Confidence Solution® (insure probe accuracy with a simple field-check for conductivity, pH, and ORP)



The 5080 carrying case with 556, 5563-4 cable, and 5083 flow cell.



YSI 600XL and 600XLM Sondes

Measure multiple parameters simultaneously

The YSI 600XL and YSI 600XLM compact sondes measure eleven parameters simultaneously:

Temperature	TDS
Conductivity	pH
Specific Conductance	ORP
Salinity	Depth or Level
Resistivity	Rapid Pulse™ DO (% and mg/L)



The YSI 600XL and 600XLM

Connect with Data Collection Platforms

Either sonde can easily connect to the YSI 6200 DAS (Data Acquisition System), YSI EcoNet™ or your own data collection platform, via SDI-12 for remote and real-time data acquisition applications.

Economical Logging System

The YSI 600XLM is an economical logging system for long-term, *in situ* monitoring and profiling. It will log all parameters at programmable intervals and store 150,000 readings. At one-hour intervals, the instrument will log data for about 75 days utilizing its own power source. The 600XL can also be utilized in the same manner with user-supplied external power.

- Either sonde fits down 2-inch wells
- Horizontal measurements in very shallow waters
- Stirring-independent Rapid Pulse® dissolved oxygen sensor
- Field-replaceable sensors
- Easily connects to data collection platforms
- Available with detachable cables to measure depth up to 200 feet
- Compatible with YSI 650 Multiparameter Display System
- Use with the YSI 5083 flow cell for groundwater applications

Pure
Data for a
Healthy
Planet.®

Economical, multiparameter
sampling or logging in a
compact sonde

Sensor performance verified*

The 6820 VZ and 6920 VZ sondes use sensor technology that was verified through the US EPA's Environmental Technology Verification Program (ETV). For information on which sensors were performance-verified, turn this sheet over and look for the ETV logo.





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contact YSI Environmental.

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ISO 9001
ISO 14001

Yellow Springs, Ohio Facility

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*Sensors with listed with the ETV logo were submitted to the ETV
program on the YSI 6000SLDs. Information on the performance
characteristics of YSI water quality sensors can be found at www.
ysi.com or call YSI at 800-897-4151 for the ETV verification
report. Use of the ETV name or logo does not imply approval or
contribution of this product nor does it make any explicit or
implied warranties or guarantees as to product performance.

YSI incorporated
Who's Minding
the Planet?

YSI 600XL & 600XLM Sensor Specifications

	Range	Resolution	Accuracy	
Dissolved Oxygen % Saturation 6562 Rapid Pulse™ Sensor* ETV	0 to 500%	0.1%	0 to 200%: ±2% of reading or 2% air saturation, whichever is greater; 200 to 500%: ±6% of reading	
Dissolved Oxygen mg/L 6562 Rapid Pulse™ Sensor* ETV	0 to 50 mg/L	0.01 mg/L	0 to 20 mg/L: ± 0.2 mg/L or 2% of reading, whichever is greater; 20 to 50 mg/L: ±6% of reading	
Conductivity* 6560 Sensor* ETV	0 to 100 mS/cm	0.001 to 0.1 mS/cm (range dependent)	±0.5% of reading + 0.001 mS/cm	
Salinity	0 to 70 ppt	0.01 ppt	±1% of reading or 0.1 ppt, whichever is greater	
Temperature 6560 Sensor* ETV	-5 to +50°C	0.01°C	±0.15°C	
pH 6561 Sensor* ETV	0 to 14 units	0.01 unit	±0.2 unit	
ORP	-999 to +999 mV	0.1 mV	±20 mV	
Depth & Level	Medium Shallow Vented Level	0 to 200 ft, 61 m 0 to 30 ft, 9.1 m 0 to 30 ft, 9.1 m	0.001 ft, 0.001 m 0.001 ft, 0.001 m 0.001 ft, 0.001 m	±0.4 ft, ±0.12 m ±0.06 ft, ±0.02 m ±0.01 ft, 0.003 m

* Report outputs of specific conductance (conductivity corrected to 25° C), resistivity, and total dissolved solids are
also provided. These values are automatically calculated from conductivity according to algorithms found in *Standard
Methods for the Examination of Water and Wastewater* (cd 1989).

YSI 600XL & 600XLM Sonde Specifications

Medium		Fresh, sea or polluted water
Temperature	Operating Storage	-5 to +50°C -10 to +60°C
Communications		RS-232, SDI-12
Software		EcoWatch*
Dimensions	Diameter Length Weight	1.65 in, 4.19 cm 1.65 in, 4.9 cm 16 in, 40.6 cm 21.3 in, 54.1 cm 1.3 lbs, 0.59 kg 1.5 lbs, 0.69 kg
Power	External Internal (600XLM only)	12 V DC 4 AA-size alkaline batteries

YSI model 5083
flow cell and
600XL. This is an
ideal combination
for groundwater
applications.



HI 98129

Combo pH/EC/TDS/Temperature Tester with Low Range EC



Description

The HI 98129 Combo waterproof tester offer high accuracy pH, EC/TDS and temperature measurements in a single tester! No more switching between meters for your routine measurements. The waterproof Combo (it even floats) has a large easy-to-read, dual-level LCD and automatic shut-off. pH and EC/TDS readings are automatically compensated for the effects of temperature (ATC). This technologically advanced tester has a replaceable pH electrode cartridge with an extendable cloth junction as well as an EC/TDS graphite electrode that resists contamination by salts and other substances. This gives these meters a greatly extended life. Your tester no longer needs to be thrown away when the pH sensor is exhausted.

The EC/TDS conversion factor is user selectable as is the temperature compensation coefficient (β). Fast, efficient, accurate and portable, the Combo pH, EC/TDS and temperature tester brings you all the features you've asked for and more!

Specifications

Range	pH	0.00 to 14.00 pH
Range	EC	0 to 3999 $\mu\text{S}/\text{cm}$
Range	TDS	0 to 2000 ppm
Range	Temperature	0.0 to 60.0°C / 32 to 140.0°F
Resolution	pH	0.01 pH
Resolution	EC	1 $\mu\text{S}/\text{cm}$
Resolution	TDS	1 ppm
Resolution	Temperature	0.1°C / 0.1°F
Accuracy	pH	± 0.05 pH
Accuracy	EC/TDS	$\pm 2\%$ F.S.
Accuracy	Temperature	$\pm 0.5^\circ\text{C}$ / $\pm 1^\circ\text{F}$
Temperature Compensation		pH: automatic; EC/TDS: automatic with β adjustable from 0.0 to 2.4% / °C
Calibration	pH	automatic, 1 or 2 points with 2 sets of memorized buffers (pH 4.01 / 7.01 / 10.01 or 4.01 / 6.86 / 9.18)
Calibration	EC/TDS	automatic, 1 point
TDS Conversion Factor		adjustable from 0.45 to 1.00
pH Electrode		HI 73127 (replaceable; included)
Environment		0 to 50°C (32 to 122°F); RH max 100%
Battery Type / Life		4 x 1.5V / approx. 100 hours of continuous use; auto-off after 8 minutes of non-use
Dimensions		163 x 40 x 26 mm (6.4 x 1.6 x 1.0")
Weight		100 g (3.5 oz.)



HQ30d Portable pH, Conductivity, Dissolved Oxygen (DO), ORP, and ISE Multi-Parameter Meter



Product #: HQ30D53000000 Quantity
 USD Price: \$790.00

★★★★★ 5/5

[Read 1 review](#) [Write a review](#) [Follow this product](#)

Portable meter measures critical water quality parameters - without the need for multiple instruments

Single input channel for flexible measurement of pH, Conductivity, Dissolved Oxygen (DO), BOD, ORP, Ammonia, Ammonium, Fluoride, Chloride, Sodium, and temperature - any INTELLiCAL™ smart probe.

Intuitive user interface for ample operation and accurate results

Guided calibration and check standard routines reduce calibration errors. Stabilization alerts and visual measurement lock ensure that you can trust the accuracy of the results.

Trust your measurements - INTELLiCAL™ smart probes store all calibrations in the probe

Calibration history allows quick and easy change out of probes without re-calibrating. The HQd™ smart system records serial numbers, current calibration data, user ID, sample ID, time, and date automatically in the data log for complete GLP traceability.

Designed for demanding conditions

Rugged, waterproof (IP67) meter provides worry-free, reliable operation in lab or field environments.

Convenient kit includes everything you need to start testing

Meter kit includes: 4 AA batteries, quick-start guide, user manual, and documentation CD

Specifications

AC and USB Operation	optional
Automatic Buffer Recognition	Color-coded: 4.01, 7.00, 10.01 pH; IUPAC: 1.670, 4.005, 7.000, 10.012, 12.45 DIN: 1.09, 4.65, 6.33 User-defined custom buffer sets
Barometric Pressure Measurement	For automatic compensation of DO when using an LDO or LBOD probe
Battery Requirements	4 AA
Benchtop	with stand
BOD5/CBOD resolution	Available when used with Hach WIMS BOD Manager software
Cable resistance correction	Digital - not needed
Calibration curves display	Calibration summary data logged and displayed
Calibration Intervals/Alerts/Reminder	2 hours to 7 days
Compliance	CE, WEEE
Conductivity Accuracy	± 0.5 % from (1 µS/cm - 200 mS/cm)
Conductivity measurement	5 different stability modes
Conductivity Measurement Range	0.01 µS/cm to 200 mS/cm
Conductivity resolution	0.01 µS/cm with 2 digits
Custom Calibration Standards	User-defined standard sets
Data Export	Download via USB connection to PC or flash stick. Automatically transfer entire data log or as readings are taken
Data Memory	500 results
Digital (Intelligent) electrode inputs	2
Dimensions (H x W x D)	7.8 in x 3.7 in x 1.4 in (197 mm x 95 mm x 36 mm)
Display	Display readings from one or two probes Simultaneous readings from two probes (HQ40d only) pH, pH, mV, temperature Conductivity, Conductivity, TDS, salinity, resistivity, temperature LDO: dissolved oxygen, pressure, temperature LBOD: dissolved oxygen, pressure, temperature ORP/Redox: mV, temperature Sodium, Sodium, mV, temperature
Display Lock Function	Continuous measurement or press to read mode available with averaging function for LDO measurement
Display Type	240 x 160 pixel Display readings from one or two probes pH, pH, mV, temperature Conductivity, Conductivity, TDS, salinity, resistivity, temperature LDO: dissolved oxygen, pressure, temperature ORP/Redox: mV, temperature Sodium, Sodium, mV, temperature
DO Measurement Range	0.01 to 20 mg/L (0 to 200%)
DO Resolution	0.01 mg/L
Fixed Buffer Selection	IUPAC standards (DIN 19268) or Technical buffer (DIN 19267) or 4-7-10 series or user defined
Inputs	M12 digital (1) for INTELLiCAL probes
Interface Languages	13**
Internal Data Storage	500
IP Rating	IP67
Languages	English, French, German, Italian, Spanish, Danish, Dutch, Polish, Portuguese, Turkish, Swedish, Czech, Russian
mV Accuracy	± 0.1 mV
mV Measurement at Stable Reading	5 (auto) stabilization settings
mV Resolution	0.1 mV
Operating Error Messages	Text messages displayed
Operating Humidity	00 % relative humidity (non-condensing)
Operating Interface	Keypad
Operating Temperature	5 to 45 °C
ORP Electrode Calibration	Preddefined ORP standards (including Zobell's solution)
Outputs	USB to PC / flash stick
PC Data Transfer Software	included
pH Measurement at stable reading	5 stabilization settings
Printer	Optional accessory
Salinity Resolution	0.01 ppt
Warranty	3 years
Water Resistance	Meter Casing: 1 meter submersion for 30 minutes (IP67)
Weight	0.74 lbs. (0.335 kg)

2100P and 2100P IS Portable Turbidimeter

Turbidimetry

Features and Benefits

Laboratory Quality in a Portable Unit

The Hach 2100P and 2100P IS Portable Turbidimeters offer a level of performance previously possible only with laboratory instruments. Microprocessor-controlled operation and Hach's unique Ratio™ optics bring great accuracy, sensitivity, and reliability to field and in-plant testing.

Two Models for Specific Requirements

- **2100P Turbidimeter**—Get fast, accurate turbidity testing in the field or the lab, over a wide range of samples. Compliant with USEPA Method 180.1 design criteria.
- **2100P IS Turbidimeter**—Designed to meet international standards that mandate measurement using an LED light source.

Two-detector Optical System

The two-detector optical system compensates for color in the sample, light fluctuation, and stray light, enabling analysts to achieve laboratory-grade performance on a wide range of samples, even under difficult, onsite conditions.



The Hach 2100P and 2100P IS Portable Turbidimeters bring laboratory-level performance on-site, offering fast, accurate results and the ease-of-use analysts demand in the field.

With a measurement range of 0 to 1000 NTU and a resolution of 0.01 NTU, the 2100P turbidimeter is ideal for regulatory monitoring, process control or field studies.

Specifications*

	2100P	2100P IS
Measurement Method	Nephelometric Ratio	
Regulatory	Meets EPA Method 180.1	Meets EN ISO 7027
Light Source	Tungsten lamp	Light-emitting diode (LED) @ 860 nm
Range		
<i>Automatic Range Mode</i>	0 to 1000 NTU	0 to 1000 FNU
<i>Manual Range Selection</i>	0 to 9.99, 0 to 99.9 and 0 to 1000 NTU	0 to 9.99, 0 to 99.9 and 0 to 1000 FNU
Accuracy	±2% of reading plus stray light	
Repeatability	±1% of reading, or 0.01 NTU, whichever is greater	±1% of reading, or 0.01 FNU, whichever is greater
Resolution	0.01 on lowest range	
Signal Averaging	Selectable on/off	
Power Requirement	4 AA alkaline batteries or optional battery eliminator	
Battery Life, Typical	300 tests with signal average mode off 180 tests with signal average mode on	
Operating Temperature	0 to 50°C (32 to 122°F)	
Sample Required	15 mL (0.5 oz.)	
Sample Cells	60 x 25 mm (2.36 x 1 in.) borosilicate glass with screw caps	
Dimensions	22.2 x 9.5 x 7.9 cm (8.75 x 3.75 x 3.12 in.)	
Weight	0.5 kg (1.1 lb.); shipping weight 2.7 kg (6 lb.)	
Warranty	2 years	

*Specifications subject to change without notice.

DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage



Be Right™

2100Q and 2100Q is Portable Turbidimeter



The Hach 2100Q and 2100Q is Portable Turbidimeters offer unsurpassed ease of use and accuracy in turbidity measurement. Only Hach offers this unique combination of advanced features, such as assisted calibration and simplified data transfer, and measurement innovation, giving you accurate results every time.

Features and Benefits

Easy Calibration and Verification

Hach 2100Q and 2100Q is Portable Turbidimeters provide confidence your measurements are right every time. On-screen assisted calibration and verification save you time and ensure accuracy. With an easy-to-follow interface, complicated manuals are not needed to perform routine calibrations. Single-standard RapidCal™ calibration offers a simplified solution for low level measurements.

Simple Data Transfer

Data transfer with the optional USB + Power Module is simple, flexible, and doesn't require additional software. All data can be transferred to the module and easily downloaded to your computer with a USB connection, providing superior data integrity and availability. With two different module options, you can customize connectivity and power to meet your unique needs.

Accurate for Rapidly Settling Samples

The Hach 2100Q Portable Turbidimeter incorporates an innovative Rapidly Settling Turbidity™ mode to provide accurate, repeatable measurements for difficult to measure, rapidly settling samples. An exclusive algorithm that

calculates turbidity based on a series of automatic readings eliminates redundant measurements and estimating.

Convenient Data Logging

Up to 500 measurements are automatically stored in the instrument for easy access and backup. Stored information includes: date and time, operator ID, reading mode, sample ID, sample number, units, calibration time, calibration status, error messages and the result.

Optical System for Precision in the Field

The two-detector optical system compensates for color in the sample, light fluctuation, and stray light, enabling analysts to achieve laboratory-grade performance on a wide range of samples, even under difficult site conditions.

Two Models for Specific Requirements

- 2100Q Turbidimeter—Compliant with USEPA Method 180.1 design criteria.
- 2100Q is Turbidimeter—Compliant with ISO 7027 design criteria.

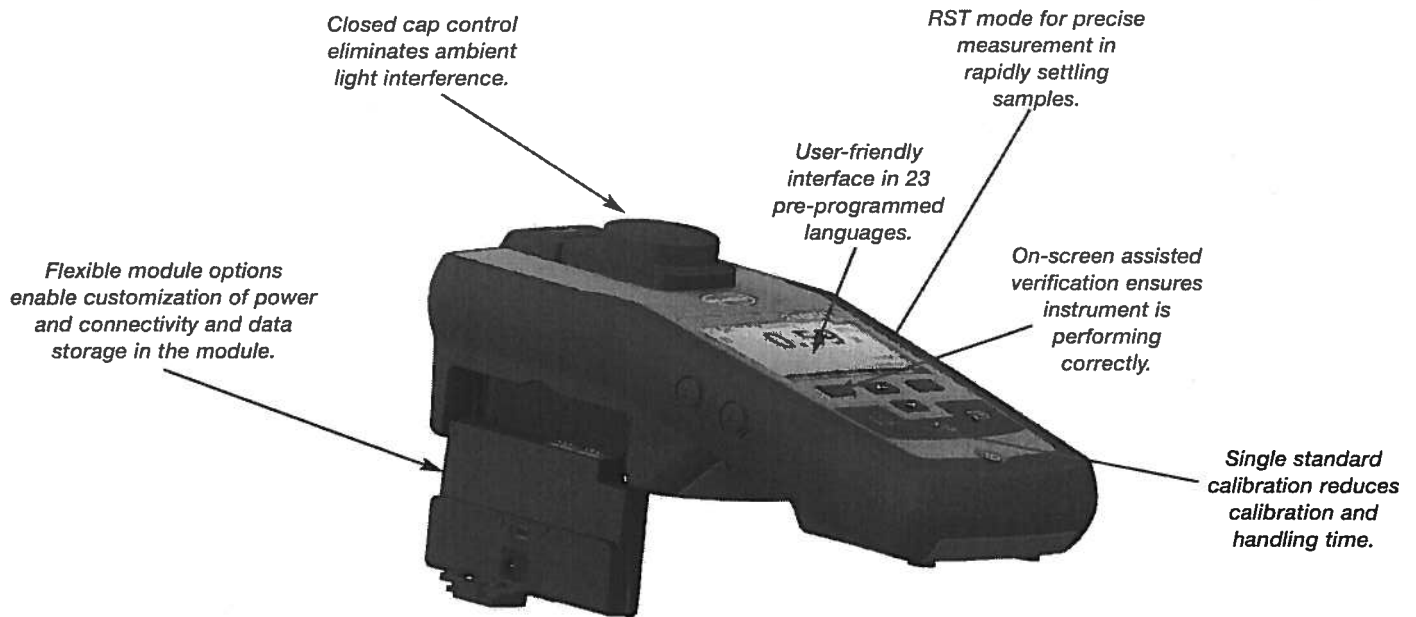
DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage



Be Right™



Key Features



Specifications*

Measurement Method

Ratio turbidimetric determination using a primary nephelometric light scatter signal (90°) to the transmitted light scatter signal.

Regulatory

2100Q: Meets EPA Method 180.1
2100Q is: Meets ISO 7027

Light Source

2100Q: Tungsten filament lamp
2100Q is: Light-emitting diode (LED) @ 860 nm

Range

0 to 1000 NTU (FNU)

Accuracy

±2% of reading plus stray light from 0 to 1000 NTU

Repeatability

±1% of reading, or 0.01 NTU (FNU), whichever is greater

Resolution

0.01 NTU on lowest range

Stray Light

<0.02 NTU (FNU)

Signal Averaging

Selectable on/off

Detector

Silicon photovoltaic

Reading Modes (user selectable)

Normal (Push to Read)
Signal Averaging
Rapidly Settling Turbidity

Data Logger

500 records

Power Requirement

110-230 Vac, 50/60 Hz (with Power or USB+Power Module)
4 AA alkaline batteries
Rechargeable NiMH (for use with USB+Power Module)

Operating Conditions

Temperature: 0 to 50°C (32 to 122°F)
Relative Humidity: 0 to 90% @ 30°C,
0 to 80% @ 40°C, 0 to 70% @ 50°C, noncondensing

Storage Conditions

-40 to 60°C (-40 to 140°F), instrument only

Languages

English, French, German, Italian, Spanish, Portuguese (BR), Portuguese (PT), Bulgarian, Chinese, Czech, Danish, Dutch, Finnish, Greek, Hungarian, Japanese, Korean, Polish, Romanian, Russian, Slovenian, Swedish, Turkish

Interface

Optional USB

Instrument Enclosure Rating

IP67 (closed lid, battery compartment excluded)

Protection Class

Power Supply: Class II

Certification

CE certified

Sample Required

15 mL (0.3 oz.)

Sample Cells

60 x 25 mm (2.36 x 1 in.) borosilicate glass with screw cap

Dimensions

22.9 x 10.7 x 7.7 cm (9.0 x 4.2 x 3.0 in.)

Weight

527 g (1.16 lb) without batteries
618 g (1.36 lb) with four AA alkaline batteries

Warranty

1 year

*Specifications subject to change without notice.

Marsh-McBirney Flo-Mate™ Portable Velocity Flow Meter



The Flo-Mate 2000 is a hand held, battery powered point velocity meter. It is lightweight yet rugged with no moving parts, water resistant with data storage/recall capabilities and fixed period averaging.

Features and Benefits

Flo-Mate—the Industry Standard for Over 35 Years

Determine volumetric flow in rivers, streams, irrigation ditches, sanitary pipes, or wherever water flows. Check the calibration of existing flow meters, as well as performance of weirs and flumes. Features that make Flo-Mate your clear choice of velocity meters include instantaneous readout, lightweight, rugged field construction with no moving parts, water resistant enclosure, and battery operation.

Flo-Mate's proven electromagnetic velocity sensor assures you of unsurpassed accuracy and dependability.

When the sensor is placed in flowing water, its magnetic field creates a voltage. This voltage is sensed by electrodes embedded in the sensor and is transmitted through the cable to the meter. The voltage amplitude, representing the rate of water flowing around the sensor, is electronically processed and displayed on the instrument panel. Turbulent/noisy flows are also easily metered with Flo-Mate's two user-selectable data averaging features—Fixed Period Averaging or Time Constant Mode.

Applications

- Streams & Rivers
- Weir/Flume/Flow Meter Calibration
- Sewers
- Mining Channels
- Irrigation Channels
- Most Open Channels

Features That Make the Difference

- Instantaneous readout of flow velocity
- Ideal for performance verification of flumes, weirs and other primary devices
- Check calibration of existing flow meters
- Proven electromagnetic sensor
- Water resistant electronics
- Lightweight — only 3.5 pounds
- Data Storage/Recall
- Rugged case made of high impact molded materials
- Measures low flows
- Direct replacement for USGS type mechanical meters
- Adjustable filter modes: Time constant or fixed period averaging
- System self-check function
- Battery saver mode/auto shut-off
- Battery powered—rechargeable or disposable
- Bar graph displays timing information
- Optional disconnectable sensor available

DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage



Be Right™

WW

E

C

Specifications and Ordering Information

FLO-MATE FLOW METER VELOCITY MEASUREMENT

Range

-0.5 to +20 ft./s (-0.15 to 6 m/s)

Zero Stability

±0.05 ft./s

Accuracy

±2% of reading plus zero stability

Method

Electromagnetic

Output

Display: 3 1/2 digit

Materials

Sensor: Polyurethane
Cable: Polyurethane jacket
Electronic Case: High impact molded plastic—NEMA 4X

Environmental

Sensor: 0 to 72°C (32 to 160°F)
Electronics: 0 to 50°C (32 to 122°F)

Power Requirements

Batteries: Two D Cells
Alkaline Battery Life: 25-30 continuous ON hours

Weight

With sensor and 20 ft. of cable:
1.6 kg (3.5 lbs.)
Without sensor: 1.1 kg (2.5 lbs.)

Engineering Specifications

- The flow meter shall be capable of providing an instantaneous readout of flow velocity.
- The method of velocity measurement shall be electromagnetic.
- The range of velocity measurement shall be -0.15 to 6 m/s (-0.5 to +20 ft./s).
- The flow meter shall measure low flows.
- The flow meter shall be capable of storage and recall of up to 19 data points while profiling in the field.
- The flow meter shall have an external charging capability.
- The flow meter shall have adjustable filter modes of time constant or fixed period average.
- The flow meter shall have a system self-check function.
- The flow meter shall have a battery saver mode/auto shut-off.
- The flow meter shall be battery powered using rechargeable or disposable batteries.
- The flow meter shall have a bar graph that displays timing information.
- The flow meter shall have an optional disconnectable sensor available.
- The flow meter shall have no moving parts.
- The flow meter shall be water resistant.
- The flow meter shall be portable.
- The weight of the flow meter shall be no greater than 1.1 kg (2.5 lbs.) without the sensor and no greater than 1.6 kg (3.5 lbs.) with the sensor and 20 feet of cable.
- The flow meter shall be the Marsh-McBirney Flo-Mate Portable Velocity Flow Meter.

		Sensor Cable Connector	Sensor	Sensor Cable
Flo-Mate	Model 2000-	—	—	—
No Sensor Connector		1		
Sensor with Disconnect		5		
Open Channel Velocity Sensor-Std			1	
20 Ft. Cable (Std)				0
Cable as needed Max Cable 100 Ft.				9

Accessories

- 75002** Standard Wading Rod Kit, English—consists of four 2-foot long sections marked in tenth foot increments, double end hanger, and base plate.
- 75002M** Standard Wading Rod Kit, Metric—same as 75002 but marked in metric units.
- 75013** Top-Setting Wading Rod Kit, English—permits convenient setting of sensor. Marked in tenth foot increments.
- 75013M** Top-Setting Wading Rod Kit, Metric—same as 75013 but marked in metric units.
- 75003** Suspension Cable Kit - consists of a 15 lb. Finned weight, and hanger. Specify length of stainless steel cable required.

NOTE: Additional cable cannot be added after order is entered. Contact factory for lengths greater than 100 ft.

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In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time.

At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

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E-mail: site@flow-tronic.com
www.flow-tronic.com



Be Right™

Digital Handheld Water Velocity Meters

Global Water's FP111, FP211 and FP311 Flow Probes are highly accurate water velocity instruments for measuring flows in open channels and partially filled pipes. The water velocity probe consists of a protected water turbo prop positive displacement sensor coupled with an expandable probe handle ending in a digital readout display. The water flow meter incorporates true velocity averaging for the most accurate flow measurements.

Each flow probe has the unique Turbo-Prop propeller sensor, which uses the most accurate positive displacement technique available for velocity sensing. The Turbo-Prop is designed to shed debris and is protected inside a 2 inch diameter housing. The probe housing may be placed directly on the bottom of a pipe or streambed for measuring low flows down to 2 inches in depth. The flow meter propeller rotates freely on its bearing shaft with no mechanical interconnections for minimal friction.

The water velocity computer receives an electrical signal from the propeller, amplifies the signal, and converts the reading to feet or meters per second. The large LCD screen displays average, minimum, and maximum water velocity readings. The water velocity computer has a water-resistant housing and incorporates a unique four-button operation for changing functions and resetting the display. The water velocity computer is powered by a non-replaceable battery that will last approximately five years with normal use.

The Flow Probe handle can telescope from 3.7 feet to 6 feet in length (FP111), 5.5 feet to 15 feet (FP211), or 2.5 feet to 5.5 feet (FP311). The handle is constructed of anodized aluminum for light weight and long life. All three meters have a Swivel Head option that allows you to rotate the flow probe's turbo prop to +/- 90 degrees from it's standard position. This option lets the flow probe take water velocity measurements in hard to measure areas

The Global Water Flow Probe Alignment Fin is designed to help orient the flow probe parallel to flow when the end of the probe can't be seen well due to the depth or cloudiness of the water. This significantly reduces the chance for error that can occur when measuring water flow other than directly parallel to the direction of flow.



Stormwater

Surface water

Wastewater



- Records 30 data sets
- Rain-proof digital computer
- Highly accurate easy flow monitoring
- Lightweight, rugged, and reliable
- Telescoping handle with staff gauge
- Padded carrying case for easy storage
- CE Certified
- Used by water professional worldwide since 1990



Flow probe prop housing with optional alignment fin.



Flow probe digital readout display

Specifications

Velocity Meter	
Range	0.3-19.9 FPS (0.1-6.1 MPS)
Accuracy	0.1 FPS
Averaging	True digital running average. Updated once per second.
Display	LCD, Glare and UV Protected
Control	4 button
Datalogger	30 sets, MIN, MAX, and AVG
Features	Timer, Low battery warning
Sensor Type	Protected Turbo-Prop propeller with magnetic pickup.
Weight	Instrument: 2 lbs. (0.9 kg) (FP111), 3 lbs. (1.4 kg) (FP211), 2.8 lbs. (1.3 kg) (FP311) Shipping: 13 lbs. (5.9 kg) (FP111), 23 lbs. (10.4 kg) (FP211), 19 lbs. (8.6 kg) (FP311)
Expandable Length	3.7 to 6 ft (1.1 to 1.8 m) (FP111); 5.5 to 15 ft (1.7 to 4.6 m) (FP211); 2.5 to 5.5 ft (0.76 to 1.7 m) (FP311)
Materials	Probe: PVC and anodized aluminum with stainless steel water bearing Computer: ABS/Polycarbonate housing with polyester overlay
Power	Internal Lithium Battery, Approx 5 year life with typical use, Non-Replaceable
Auto Shutoff	After 5 minutes of inactivity
Operating Temperature	-4° to 158° F (-20° to 70° C)
Storage Temperature	-22° to 176° F (-30° to 80° C)
Carrying Case	The Flow Probe is shipped in a padded carrying case.
Certificates	CE
For Ordering information and Options; please visit www.globalw.com/products/flowprobe.html	

Appendix D

NEORSD Chlorophyll a Sampling Field Sheet

Stream: _____
 Location: _____
 RM: _____
 Lat/Long: _____

Collectors: _____
 Date: _____
 Time: _____

Number of Rocks: _____

Total Area Scraped: _____ cm²

Diameter of individual scrape

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____
- 8 _____
- 9 _____
- 10 _____
- 11 _____
- 12 _____
- 13 _____
- 14 _____
- 15 _____
- 16 _____
- 17 _____
- 18 _____
- 19 _____
- 20 _____
- 21 _____
- 22 _____
- 23 _____
- 24 _____
- 25 _____

Area of individual scrape

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____
- 8 _____
- 9 _____
- 10 _____
- 11 _____
- 12 _____
- 13 _____
- 14 _____
- 15 _____
- 16 _____
- 17 _____
- 18 _____
- 19 _____
- 20 _____
- 21 _____
- 22 _____
- 23 _____
- 24 _____
- 25 _____

Total: _____

Diameter to Area Conversion	
Diameter (cm)	Area (cm ²)
1.6	2.011
1.7	2.27
1.8	2.545
1.9	2.835
2.0	3.142
2.1	3.464
2.2	3.801
2.3	4.155

Total Sample Volume _____ ml

Filter 1 LABLynx ID _____
 Vol _____ ml

Filter 2 LABLynx ID _____
 Vol _____ ml

Filter 3 LABLynx ID _____
 Vol _____ ml

Water Column Chlorophyll Sample	
Filter 1	LABLynx ID _____ Vol _____ ml
Filter 2	LABLynx ID _____ Vol _____ ml
Filter 3	LABLynx ID _____ Vol _____ ml

Flow: None Low Normal Elevated High

Turbidity: Clear Low Moderate* High*

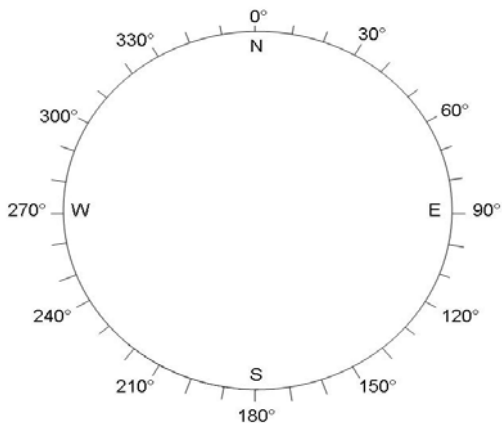
*Explain _____

Sky: Overcast Cloudy Partly Cloudy Mostly Clear Clear

Canopy: Open Mostly Open Partly Closed Closed

Riparian None Narrow L R Moderate L R Wide L R

Downstream Channel Direction



Clinometer

Left Bank _____°

Right Bank _____°

Left Bank _____°

Right Bank _____°

Left Bank _____°

Right Bank _____°

Stream Widths

_____m _____m _____m

Record two most predominate substrates with an X, and check all present.

	Riffle	Run	Reach
Boulder/Slabs	_____	_____	_____
Bedrock	_____	_____	_____
Boulder/Slabs	_____	_____	_____
Cobble	_____	_____	_____
Gravel	_____	_____	_____
Sand	_____	_____	_____
Silt	_____	_____	_____
Hardpan	_____	_____	_____
Detritus	_____	_____	_____
Artificial	_____	_____	_____

Substrate Origin

Limestone Tills Rip-rap
 Sandstone Shale Wetlands
 Lacustrine Hardpan Coal Fines

Silt

Heavy Moderate Normal None

Embeddedness

Extensive Moderate Normal None

Notes: _____

Length of Reach: _____m

Stream Drawing

Appendix E

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

OFFICE OF FIELD OPERATIONS
BUREAU OF LABORATORIES



Certifies that

68-03670

NORTHEAST OHIO REGIONAL SEWER DISTRICT ANALYTICAL SERVICES
4747 EAST 49TH STREET
CUYAHOGA HEIGHTS, OH 44125

Having duly met the requirement of
The Act of June 29, 2002 (P.L. 596, No. 90)
dealing with Environmental Laboratory Accreditation
(27 Pa. C.S. §§4101-4113) and the
National Environmental Laboratory Accreditation Conference Standard

is hereby approved as an

Accredited Laboratory

As more fully described in the attached Scope of Accreditation

Expiration Date: **11/30/2013**
Certificate Number: **006**

A handwritten signature in black ink, appearing to read "Aaren S. Alger".

Aaren S. Alger, Chief
Laboratory Accreditation Program
Bureau of Laboratories

Continued accreditation status depends on successful ongoing participation in the Program
Certificate not transferrable Surrender upon revocation
To be conspicuously displayed at the Laboratory
Not valid unless accompanied by a valid Scope of Accreditation
Shall not be used to imply endorsement by the Commonwealth of Pennsylvania
Customers are urged to verify the laboratory's current accreditation status
PA DEP is a NELAP recognized accreditation body

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 006-002 expiration date November 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

TNI Code:

(216) 641-6000

Northeast Ohio Regional Sewer District Analytical Services
4747 East 49th Street
Cuyahoga Heights, OH 44125

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
ASTM D4839-03		Total organic carbon (TOC)	NELAP	PA	11/17/2010
EPA 1000.0		Pimephales promelas	NELAP	PA	1/8/2009
EPA 1002.0		Ceriodaphnia dubia	NELAP	PA	1/8/2009
EPA 160.4		Residue, volatile	NELAP	PA	10/22/2008
EPA 1600		Enterococci	NELAP	PA	11/22/2010
EPA 1603		E. coli (Enumeration)	NELAP	PA	11/29/2007
EPA 1631		Mercury	NELAP	PA	3/31/2008
EPA 1664	A	Oil and grease	NELAP	PA	11/29/2007
EPA 180.1		Turbidity	NELAP	PA	12/31/2007
EPA 200.7	4.4	Aluminum	NELAP	PA	11/29/2007
EPA 200.7	4.4	Antimony	NELAP	PA	11/29/2007
EPA 200.7	4.4	Arsenic	NELAP	PA	11/29/2007
EPA 200.7	4.4	Barium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Beryllium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Cadmium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Calcium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Chromium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Cobalt	NELAP	PA	11/29/2007
EPA 200.7	4.4	Copper	NELAP	PA	12/31/2007
EPA 200.7	4.4	Iron	NELAP	PA	11/29/2007
EPA 200.7	4.4	Lead	NELAP	PA	11/29/2007
EPA 200.7	4.4	Magnesium	NELAP	PA	11/17/2010
EPA 200.7	4.4	Manganese	NELAP	PA	11/29/2007
EPA 200.7	4.4	Molybdenum	NELAP	PA	11/29/2007
EPA 200.7	4.4	Nickel	NELAP	PA	11/29/2007
EPA 200.7	4.4	Potassium	NELAP	PA	12/31/2007
EPA 200.7	4.4	Selenium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Silver	NELAP	PA	11/29/2007
EPA 200.7	4.4	Sodium	NELAP	PA	12/31/2007
EPA 200.7	4.4	Thallium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Tin	NELAP	PA	11/29/2007
EPA 200.7	4.4	Titanium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Vanadium	NELAP	PA	11/29/2007
EPA 200.7	4.4	Zinc	NELAP	PA	12/31/2007
EPA 245.1	3	Mercury	NELAP	PA	11/29/2007
EPA 300.0	2.1	Bromide	NELAP	PA	11/22/2010
EPA 300.0	2.1	Chloride	NELAP	PA	11/22/2010
EPA 300.0	2.1	Fluoride	NELAP	PA	11/22/2010
EPA 300.0	2.1	Nitrate as N	NELAP	PA	11/22/2010
EPA 300.0	2.1	Nitrite as N	NELAP	PA	11/22/2010



The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 006-002 expiration date November 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

TNI Code:

(216) 641-6000

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 300.0	2.1	Orthophosphate as P	NELAP	PA	11/22/2010
EPA 300.0	2.1	Sulfate	NELAP	PA	11/22/2010
EPA 3005	A	Preconcentration under acid	NELAP	PA	11/29/2007
EPA 3010	A	Hot plate acid digestion (HNO ₃ + HCl)	NELAP	PA	11/29/2007
EPA 3015		Microwave-assisted acid digestion	NELAP	PA	11/29/2007
EPA 310.2		Alkalinity as CaCO ₃	NELAP	PA	9/20/2012
EPA 325.2		Chloride	NELAP	PA	11/17/2010
EPA 350.1		Ammonia as N	NELAP	PA	11/29/2007
EPA 351.2		Kjeldahl nitrogen, total (TKN)	NELAP	PA	11/17/2010
EPA 353.2		Nitrate as N	NELAP	PA	11/29/2007
EPA 353.2		Total nitrate-nitrite	NELAP	PA	11/17/2010
EPA 365.1		Orthophosphate as P	NELAP	PA	11/29/2007
EPA 365.1		Phosphorus, total	NELAP	PA	10/22/2008
EPA 410.4		Chemical oxygen demand (COD)	NELAP	PA	11/29/2007
EPA 420.4		Total phenolics	NELAP	PA	11/17/2010
EPA 445		Chlorophyll A	NELAP	PA	11/22/2010
EPA 6010	B	Aluminum	NELAP	PA	11/29/2007
EPA 6010	B	Antimony	NELAP	PA	11/29/2007
EPA 6010	B	Arsenic	NELAP	PA	11/29/2007
EPA 6010	B	Barium	NELAP	PA	11/29/2007
EPA 6010	B	Beryllium	NELAP	PA	11/29/2007
EPA 6010	B	Cadmium	NELAP	PA	11/29/2007
EPA 6010	B	Calcium	NELAP	PA	11/29/2007
EPA 6010	B	Chromium	NELAP	PA	11/29/2007
EPA 6010	B	Cobalt	NELAP	PA	11/29/2007
EPA 6010	B	Copper	NELAP	PA	12/31/2007
EPA 6010	B	Iron	NELAP	PA	11/29/2007
EPA 6010	B	Lead	NELAP	PA	11/29/2007
EPA 6010	B	Magnesium	NELAP	PA	11/29/2007
EPA 6010	B	Manganese	NELAP	PA	11/29/2007
EPA 6010	B	Molybdenum	NELAP	PA	11/29/2007
EPA 6010	B	Nickel	NELAP	PA	11/29/2007
EPA 6010	B	Potassium	NELAP	PA	12/31/2007
EPA 6010	B	Selenium	NELAP	PA	11/29/2007
EPA 6010	B	Silver	NELAP	PA	11/29/2007
EPA 6010	B	Sodium	NELAP	PA	12/31/2007
EPA 6010	B	Thallium	NELAP	PA	11/29/2007
EPA 6010	B	Tin	NELAP	PA	11/29/2007
EPA 6010	B	Titanium	NELAP	PA	11/29/2007
EPA 6010	B	Vanadium	NELAP	PA	11/29/2007
EPA 6010	B	Zinc	NELAP	PA	12/31/2007
EPA 7470		Mercury	NELAP	PA	11/29/2007
Enterolert		Enterococci (Enumeration)	NELAP	PA	11/22/2010
Lachat 10-204-00-1X		Cyanide	NELAP	PA	11/17/2010
O1A 1677		Available cyanide	NELAP	PA	11/29/2007
SM 2540 B		Residue, total	NELAP	PA	11/29/2007
SM 2540 C		Residue, filterable (TDS)	NELAP	PA	11/29/2007



The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 006-002 expiration date November 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

TNI Code:

(216) 641-6000

Matrix: Non-Potable Water

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
SM 2540 D		Residue, nonfilterable (TSS)	NELAP	PA	11/29/2007
SM 2540 F		Residue, settleable	NELAP	PA	11/29/2007
SM 2550 B		Temperature, deg. C	NELAP	PA	10/22/2008
SM 3500-Cr B	20/21	Chromium VI	NELAP	PA	11/29/2007
SM 4500-CN- C/E		Total cyanide	NELAP	PA	11/29/2007
SM 4500-CN- G		Amenable cyanide	NELAP	PA	11/29/2007
SM 4500-Cl E		Total residual chlorine	NELAP	PA	11/29/2007
SM 4500-Cl- C		Chloride	NELAP	PA	11/19/2012
SM 4500-H+ B		pH	NELAP	PA	11/29/2007
SM 4500-NO2- B		Nitrite as N	NELAP	PA	11/29/2007
SM 4500-Norg B		Kjeldahl nitrogen, total (TKN)	NELAP	PA	10/22/2008
SM 4500-P B		Preliminary treatment of phosphate samples	NELAP	PA	1/22/2013
SM 4500-P E		Orthophosphate as P	NELAP	PA	1/22/2013
SM 4500-S D		Sulfide	NELAP	PA	11/22/2010
SM 5210 B		Biochemical oxygen demand (BOD)	NELAP	PA	11/29/2007
SM 5210 B		Carbonaceous BOD (CBOD)	NELAP	PA	11/29/2007
SM 9222 D		Fecal coliform (Enumeration)	NELAP	PA	11/29/2007
SM 9223 Colilert MPN or QT		E. coli (Enumeration)	NELAP	PA	11/29/2007
SM 9223 Colilert MPN or QT		Total coliform (Enumeration)	NELAP	PA	11/22/2010

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 245.1	3	Mercury	NELAP	PA	11/22/2010
EPA 3051		Microwave digestion of solids (HNO3 only)	NELAP	PA	11/17/2010
EPA 6010	B	Aluminum	NELAP	PA	11/22/2010
EPA 6010	B	Arsenic	NELAP	PA	11/22/2010
EPA 6010	B	Barium	NELAP	PA	11/22/2010
EPA 6010	B	Beryllium	NELAP	PA	11/22/2010
EPA 6010	B	Boron	NELAP	PA	11/22/2010
EPA 6010	B	Cadmium	NELAP	PA	11/22/2010
EPA 6010	B	Calcium	NELAP	PA	11/22/2010
EPA 6010	B	Chromium	NELAP	PA	11/22/2010
EPA 6010	B	Cobalt	NELAP	PA	11/22/2010
EPA 6010	B	Copper	NELAP	PA	11/22/2010
EPA 6010	B	Iron	NELAP	PA	11/22/2010
EPA 6010	B	Lead	NELAP	PA	11/22/2010
EPA 6010	B	Magnesium	NELAP	PA	11/22/2010
EPA 6010	B	Manganese	NELAP	PA	11/22/2010
EPA 6010	B	Metals by ICP/AES	NELAP	PA	1/22/2013
EPA 6010	B	Molybdenum	NELAP	PA	11/22/2010
EPA 6010	B	Nickel	NELAP	PA	11/22/2010
EPA 6010	B	Potassium	NELAP	PA	11/22/2010
EPA 6010	B	Selenium	NELAP	PA	11/22/2010
EPA 6010	B	Silver	NELAP	PA	11/22/2010



The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

Laboratory Scope of Accreditation

Attached to Certificate of Accreditation 006-002 expiration date November 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

TNI Code:

(216) 641-6000

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	B	Sodium	NELAP	PA	11/22/2010
EPA 6010	B	Thallium	NELAP	PA	11/22/2010
EPA 6010	B	Titanium	NELAP	PA	11/22/2010
EPA 6010	B	Vanadium	NELAP	PA	11/22/2010
EPA 6010	B	Zinc	NELAP	PA	11/22/2010



The Pennsylvania Department of Environmental Protection Laboratory Accreditation Program is a NELAP recognized Accreditation Body. Customers are urged to verify the laboratory's current accreditation standing.

Laboratory Status Summary

DEP Laboratory ID: 68-03670

EPA Lab Code: OH00300

TNI Code:

(216) 641-6000

Northeast Ohio Regional Sewer District Analytical Services

4747 East 49th Street

Cuyahoga Heights, OH 44125

Matrix: Non-Potable Water

Method	Revision	Analyte	Status	Effective Date
EPA 200.7	4.4	Strontium	Applied	11/7/2012
EPA 200.8	5.4	Aluminum	Applied	11/7/2012
EPA 200.8	5.4	Antimony	Applied	11/7/2012
EPA 200.8	5.4	Arsenic	Applied	11/7/2012
EPA 200.8	5.4	Barium	Applied	11/7/2012
EPA 200.8	5.4	Beryllium	Applied	11/7/2012
EPA 200.8	5.4	Cadmium	Applied	11/7/2012
EPA 200.8	5.4	Chromium	Applied	11/7/2012
EPA 200.8	5.4	Cobalt	Applied	11/7/2012
EPA 200.8	5.4	Copper	Applied	11/7/2012
EPA 200.8	5.4	Lead	Applied	11/7/2012
EPA 200.8	5.4	Manganese	Applied	11/7/2012
EPA 200.8	5.4	Molybdenum	Applied	11/7/2012
EPA 200.8	5.4	Nickel	Applied	11/7/2012
EPA 200.8	5.4	Selenium	Applied	11/7/2012
EPA 200.8	5.4	Silver	Applied	11/7/2012
EPA 200.8	5.4	Thallium	Applied	11/7/2012
EPA 200.8	5.4	Vanadium	Applied	11/7/2012
EPA 200.8	5.4	Zinc	Applied	11/7/2012
SM 5310 C		Total organic carbon (TOC)	Suspended	4/14/2009

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Status	Effective Date
EPA 6010	B	Antimony	Suspended	5/21/2012
EPA 6010		Strontium	Applied	11/7/2012
EPA 6010	B	Tin	Applied	10/22/2008
EPA 6020		Aluminum	Applied	11/7/2012
EPA 6020		Antimony	Applied	11/7/2012
EPA 6020		Arsenic	Applied	11/7/2012
EPA 6020		Barium	Applied	11/7/2012
EPA 6020		Beryllium	Applied	11/7/2012
EPA 6020		Cadmium	Applied	11/7/2012
EPA 6020		Chromium	Applied	11/7/2012
EPA 6020		Cobalt	Applied	11/7/2012
EPA 6020		Copper	Applied	11/7/2012
EPA 6020		Iron	Applied	11/7/2012
EPA 6020		Lead	Applied	11/7/2012
EPA 6020		Magnesium	Applied	11/7/2012
EPA 6020		Manganese	Applied	11/7/2012
EPA 6020		Nickel	Applied	11/7/2012
EPA 6020		Selenium	Applied	11/7/2012
EPA 6020		Silver	Applied	11/7/2012
EPA 6020		Thallium	Applied	11/7/2012
EPA 6020		Vanadium	Applied	11/7/2012
EPA 6020		Zinc	Applied	11/7/2012
EPA 6020-Extended		Molybdenum	Applied	11/7/2012

Appendix F



May 29, 2013

Mr. John Rhoades
Supervisor of Environmental Assessment
Northeast Ohio Regional Sewer District
4747 East 49th Street
Cuyahoga Heights, Ohio 44125

Dear Mr. Rhoades:

This letter is to acknowledge that I am responsible for the identification of benthic macroinvertebrates for the following Northeast Ohio Regional Sewer District Study Plans:

- 2013 Big Creek Environmental Monitoring
- 2013 Chagrin River Environmental Monitoring
- 2013 Cuyahoga River Environmental Monitoring
- 2013 Doan Brook Environmental Monitoring
- 2013 Euclid Creek Environmental Monitoring
- 2013 Green Creek Environmental Monitoring
- 2013 Mill Creek Environmental Monitoring
- 2013 Nine-Mile Creek Environmental Monitoring
- 2013 Shaw Brook Environmental Monitoring
- 2013 West Creek Environmental Monitoring

It is understood that an Ohio Environmental Protection Agency Level 3 Qualified Data Collector Certification for Benthic Macroinvertebrate, with the specialty of identification, is required to perform these tasks and that I am responsible for maintaining my Level 3 QDC Certification during the term of these Study Plans.

In addition, I have not been convicted nor 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.

Sincerely,

A handwritten signature in blue ink that reads "Bert Remley II".

Bert Remley
Senior Taxonomist
859-977-2000
Bremley@thirdrockconsultants.com

Appendix G



DIVISION OF WILDLIFE

Ohio Department of Natural Resources

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

WILD ANIMAL PERMIT: 14-307
SCIENTIFIC COLLECTION

JOHN W. RHOADES
NEORS
4747 EAST 49TH ST.
CUYAHOGA HEIGHTS, OH 44125-1

Scott Zody

Chief, Division of Wildlife

DATE ISSUED

3/25/2013

Others authorized on permit

YES (SEE ATTACHMENT)

SOCIAL SECURITY NUMBER: XXX-XX-7681

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: 3/16/2013 to: 3/15/2014

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

THIS PERMIT IS RESTRICTED TO THE FOLLOWING:

1. Permittee may collect fish, macroinvertebrates, amphibians and mussels for survey and inventory purposes. All endangered species are to be released at site of capture. Dead mussel shells not easily identified, may be collected and taken to NEORS.
2. Common species of fish may be collected and displayed for educational purposes. Fish must be displayed at NEORS or the Greater Cleveland Aquarium or other public educational facility. They may not be maintained at a private residence. Sport fish >6 in. must be immediately released.
3. Permittee must follow guidelines of the Biosecurity Protocol for Herpetofauna Field Work included with permit.
4. 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 614/265-6346 (John Navarro).
5. Twenty-four (24) hours prior to collection, contact must be made with the local wildlife officer or the nearest Wildlife District Office to advise location and duration of sampling. All vouchers are to be deposited at NEORS.
6. Collection is prohibited in the Killbuck, Big Darby, Little Darby, tributaries to and east branch of the Chagrin River above I-90, Fish Creek (Williams County) and Division of Wildlife property without explicit written permission from the Division of Wildlife. Sampling is further restricted in streams that may have federally listed mussels. See the enclosed "USFWS Restricted Streams of Ohio" document for a list of streams and contact information.
7. Permittee must provide an annual electronic report of collecting activities in the Diversity Database Excel spreadsheet format to the Division of Wildlife.

Locations of Collecting

STATEWIDE WITH NOTED EXCEPTIONS

Equipment and method used in collection:

SEINES, TRAP NETS, ELECTROSHOCKER AND HAND COLLECTION.

Name and number of each species to be collected:

FISH, MACROINVERTEBRATES, MUSSELS AND AMPHIBIANS AS REQUIRED. DEAD MUSSEL SHELLS MAY ALSO BE COLLECTED AS NECESSARY FOR IDENTIFICATION. COMMON FISH SPECIES MAY BE KEPT FOR EDUCATIONAL PURPOSES. ALL ENDANGERED SPECIES MUST BE IMMEDIATELY RELEASED.

RESTRICTIVE DOCUMENTS ACCOMPANYING THIS PERMIT? YES

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

Appendix H

References

- Chlorophyll a Sampling and Field Filtering Standard Operating Procedure (SOP-EA001-00)
- EPA New England- Region 1. (2005). *Standard operating procedure for calibration and field measurement procedures for the YSI Model 6-Series Sondes and Data Logger (Including: temperature, pH, specific conductance, turbidity, dissolved oxygen, chlorophyll, rhodamine WT, ORP, and barometric pressure)*(7th Revision). North Chelmsford, MA: The Office of Environmental Measurement and Evaluation, Ecosystem Assessment- Ecology Monitoring Team.
- Ohio Environmental Protection Agency. (1987a). *Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters* (Updated January 1988; September 1989; November 2006; August 2008; January 2013). Columbus, OH: Division of Water Quality Monitoring and Assessment.
- Ohio Environmental Protection Agency. (1987b). *Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities* (Updated September 1989; March 2001; November 2006; and August 2008; February 2013). Columbus, OH: Division of Water Quality Monitoring and Assessment.
- Ohio Environmental Protection Agency. (2006a). *Methods for assessing habitat in flowing waters: using the Qualitative Habitat Evaluation Index (QHEI)*. (Ohio EPA Technical Bulletin EAS/2006-06-1). Columbus, OH: Division of Surface Water; Division of Ecological Assessment Section.
- Ohio Environmental Protection Agency. (2012). *Field Evaluation Manual for Ohio's Primary Headwater Habitat Stream*. Columbus, OH: Division of Surface Water; Division of Ecological Assessment Section.
- Ohio Environmental Protection Agency. (2013). *Surface Water Field Sampling Manual for water chemistry, bacteria, and flows*. Columbus, OH: Division of Surface Water

(2) Point/Nonpoint Sources

Point Sources	Nonpoint Sources
Storm Sewer Outfalls	Urban Runoff
Home Sewage Treatment Systems	Spills
NEORSD-owned CSOs	Agriculture
Sanitary Sewer Overflows	

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. Other factors that may influence ecological conditions during the study include periods of drought and periods of precipitation.

(6) Sampling Locations

The following electrofishing and macroinvertebrate sample locations will be surveyed on Nine-Mile Creek during the 2013 field season. Benthic macroinvertebrate and water chemistry collection sites are located near the mid point of each electrofishing zone, indicated by river mile, unless otherwise noted. GPS coordinates are recorded at the downstream end of each electrofishing zone.

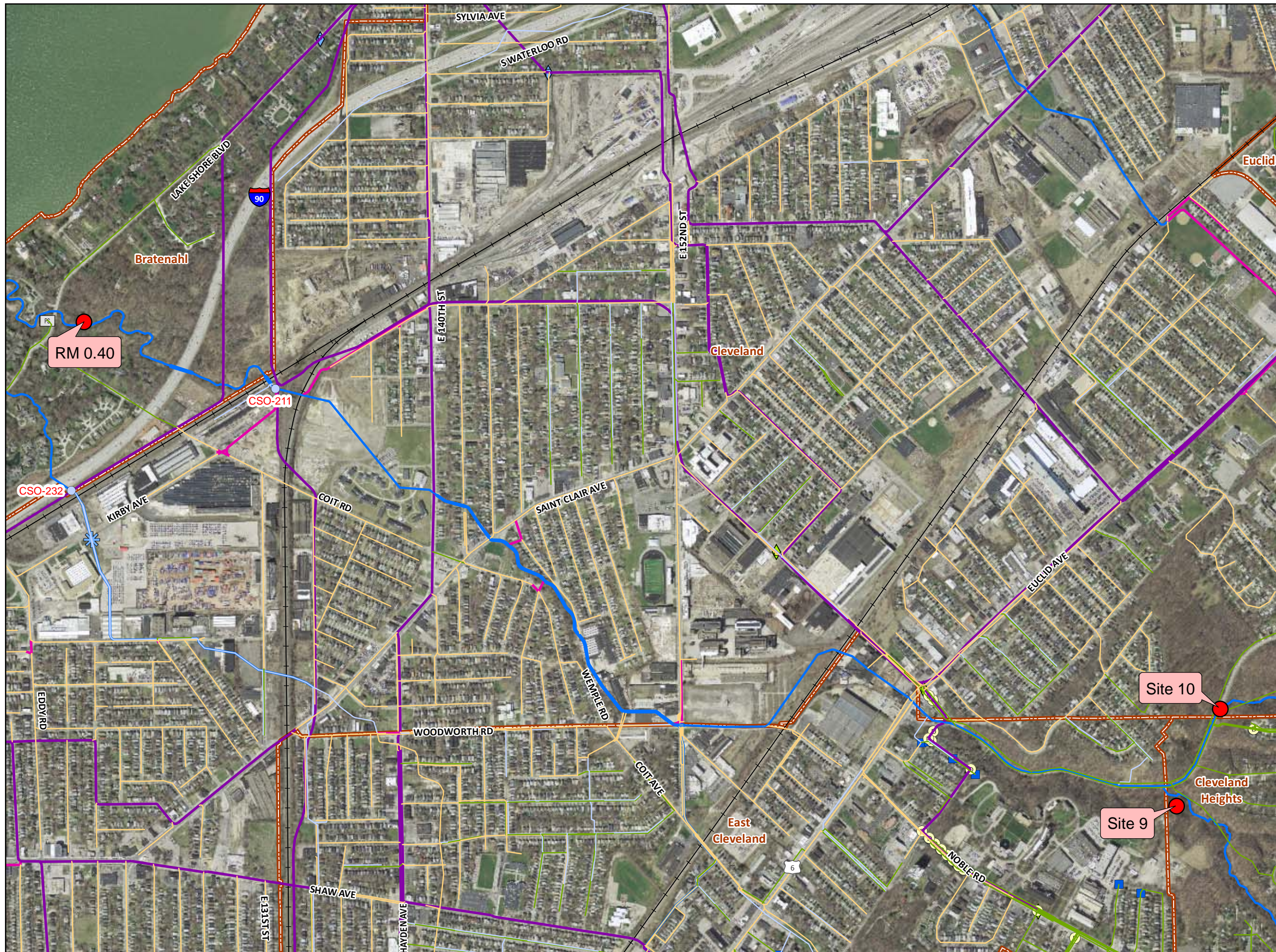
Site Location	Latitude	Longitude	River Mile	Description	Quadrangle	Purpose
Nine-Mile Creek	41.5574565	81.59912283	0.40	Upstream of Lakeshore Boulevard	East Cleveland	Evaluate water chemistry, fish, habitat and macroinvertebrates
Nine-Mile Creek, Nela Park Branch (Site 9)	41.54290983	81.55521750	N/A	South of Belvoir Boulevard on Nela Park Branch	East Cleveland	Evaluate water chemistry, fish, habitat and macroinvertebrates
Nine-Mile Creek (Site 10)	41.54572967	81.55228433	N/A	South of Belvoir Boulevard	East Cleveland	Evaluate water chemistry, fish, habitat and macroinvertebrates

Overview Map



Nine-Mile Creek Environmental Monitoring

- Study Site
- ~ Stream
- CSO Outfall
- Outfalls
- District Facility
- NEORSO CSO Combined Sewer
- NEORSO CSO Responsibility Sewer
- NEORSO Intercommunity Relief Sewer
- NEORSO INTERCEPTOR
- Local Combined Sewer
- Local Culverted Stream
- Local Sanitary Sewer
- Local Storm Sewer



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