Level 3 Project Study Plan

2013 Chagrin River Environmental Monitoring

(1) Objectives

In late May 2012, the Jackson Valley Wastewater Treatment Plant (WWTP), Quail Hollow WWTP, Creekside WWTP, and Woodland Glen WWTP in the Chagrin River watershed were decommissioned. Following decommissioning, the flows from these facilities were redirected to the Northeast Ohio Regional Sewer District's (NEORSD) Easterly WWTP via the SOM Relief Sewer (SOMRS). These facilities did not consistently meet their National Pollutant Discharge Elimination System (NPDES) permit limits, and by removing these discharges and conveying them to NEORSD, the water quality in the streams downstream of the decommissioned WWTPs is expected to improve. The purpose of this study is to evaluate fish and macroinvertebrate communities, stream habitat, and water chemistry downstream of each decommissioned WWTP, as well as two sites on the Chagrin River mainstem at river mile (RM) 26.70, upstream of Wiley Creek, and RM 22.60, downstream of Pepper-Luce Creek. Results from this study will be compared to data collected during the *2009 Pepper Pike/Moreland Hills Baseline Assessment Study* and the *2012 Chagrin River Environmental Monitoring* study to illustrate spatial and temporal trends.

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 NEORSD 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].

(2) Point/Nonpoint Sources

Point Sources	Nonpoint Sources
Storm Sewer Outfalls	Urban runoff
Septic Tanks	Spills
	Agriculture

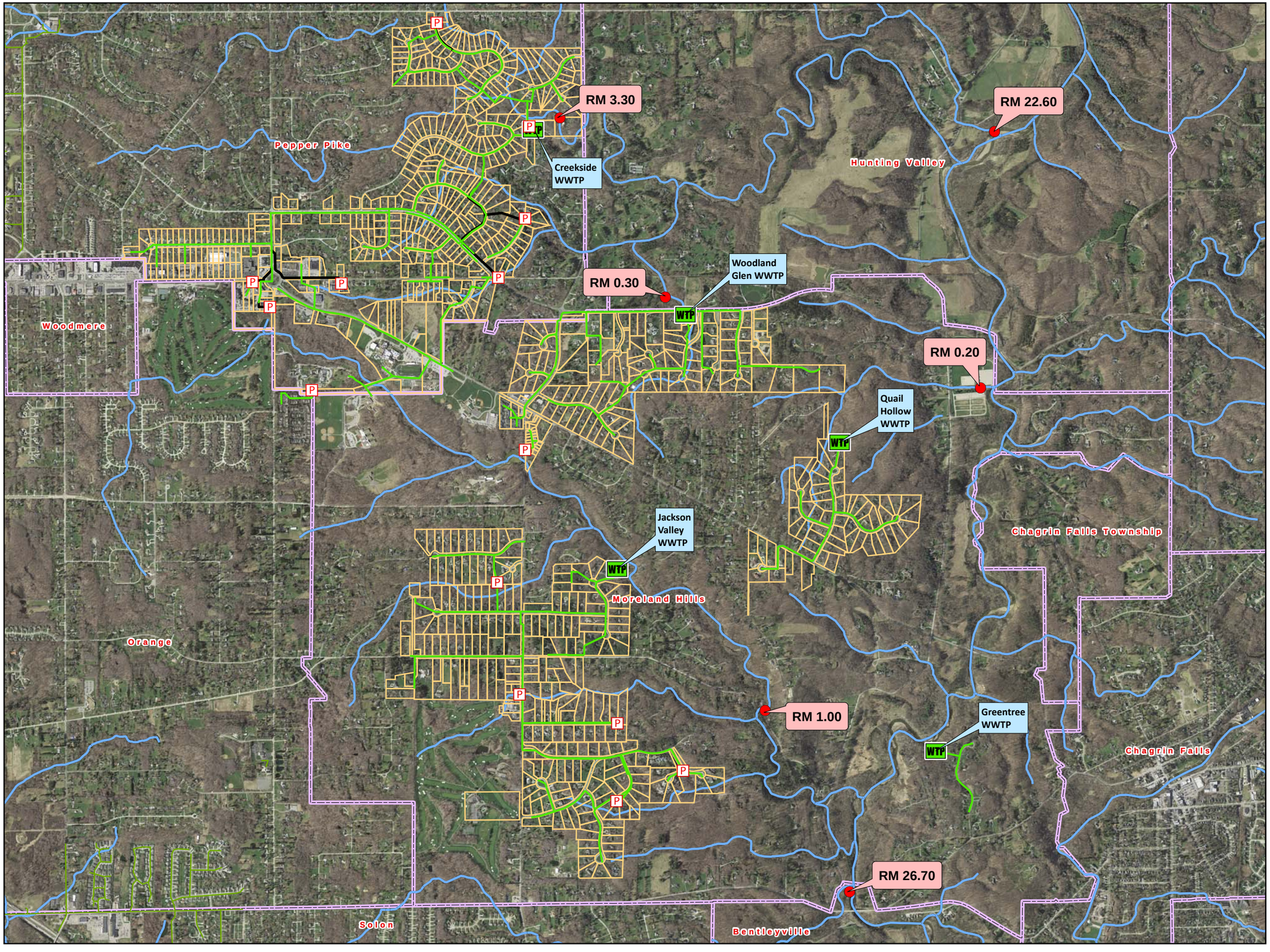
[1] See appendix H for a list of all references.

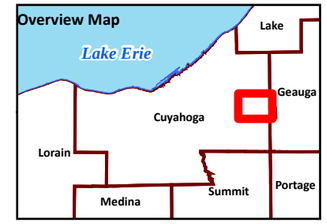
(6) Sample Locations

The following water chemistry, stream habitat, electrofishing and macroinvertebrate sample locations, listed from upstream to downstream, will be surveyed during the 2013 field season. Benthic macroinvertebrate and water chemistry samples are collected near the midpoint of each electrofishing zone, indicated by RM, unless otherwise noted. GPS coordinates are recorded at the downstream end of each electrofishing zone.

Location	Latitude	Longitude	River Mile	Location Information	USGS HUC 8 Number-Name	Purpose
Chagrin River	41.4250	-81.4176	26.70	Chagrin River Upstream of Willey Creek	04110003-Ashtabula-Chagrin	Background data for fish, macroinvertebrates, habitat, and water chemistry
37855 Jackson Road	41.4360	-81.4242	1.00	Wiley Creek Downstream of Jackson Valley WWTP	04110003-Ashtabula-Chagrin	Evaluate Wiley Creek fish, macroinvertebrates, habitat, and water chemistry post decommissioning of Jackson Valley WWTP
3780 Chagrin River Road	41.4553	-81.066	0.10	Un-named tributary to Chagrin River Downstream of Quail Hollow WWTP	04110003-Ashtabula-Chagrin	Evaluate Un-named Creek fish, macroinvertebrates, habitat, and water chemistry post decommissioning of Quail Hollow WWTP
South Woodland Road, West of Windrush Drive	41.4610	-81.4318	0.30	Un-named tributary to Pepper-Luce Creek Downstream of Woodland Glen WWTP	04110003-Ashtabula-Chagrin	Evaluate Un-named Creek fish, macroinvertebrates, habitat, and water chemistry post decommissioning of Woodland Glen WWTP
3226 S.O.M. Center Road	41.4719	-81.4401	3.30	Pepper-Luce Creek Downstream of Creekside WWTP	04110003-Ashtabula-Chagrin	Evaluate Pepper-Luce Creek fish, macroinvertebrates, habitat, and water chemistry post decommissioning of Creekside WWTP
Chagrin River	41.4707	-81.4053	22.60	Chagrin River Downstream of Pepper-Luce Creek	04110003-Ashtabula-Chagrin	Evaluate WWTP decommissioning on fish, macroinvertebrates, habitat, and water chemistry on the Chagrin River.

The map below shows the location of previously decommissioned WWTP's that may be influencing the water quality at each sample location.





Chagrin River Environmental Monitoring

- Study Site
- WTP Wastewater Treatment Plant
- P Pump Station
- Rain Gauges
- Stream
- NEORSD CSO Comnbined Sewer
- NEORSD CSO Responsibility Sewer
- NEORSD Intercommunity Relief Sewer
- NEORSD INTERCEPTOR
- Local Combined Sewer
- Local Culverted Stream
- Local Sanitary Sewer
- Local Storm Sewer
- Area Tributary to the District
- Community Boundary

N

0.35

Miles

(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 Aquaflow 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.

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 $\pm$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 $\pm$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 49th Street Cuyahoga Hts., Ohio 44125	rhoadesj@neorsd.org	216-641-6000	QDC - 00008 CWQA/FCB/SHA/ BMB
Cathy Zamborsky	4747 East 49th Street Cuyahoga Hts., Ohio 44125	zamborskyc@neorsd.org	216-641-6000	QDC - 00009 CWQA/SHA
Seth Hothem	4747 East 49th Street Cuyahoga Hts., Ohio 44125	hothems@neorsd.org	216-641-6000	QDC - 00010 CWQA/FCB/SHA
Tom Zablotny	4747 East 49th Street Cuyahoga Hts., Ohio 44125	zablotnyt@neorsd.org	216-641-6000	QDC - 00018 CWQA/FCB/SHA
Ron Maichle	4747 East 49th Street Cuyahoga Hts., Ohio 44125	maichler@neorsd.org	216-641-6000	QDC - 00145 CWQA/SHA/BMB
Francisco Rivera	4747 East 49th Street Cuyahoga Hts., Ohio 44125	riveraf@neorsd.org	216-641-6000	QDC - 00262 CWQA/SHA
Jillian Novak	4747 East 49th Street Cuyahoga Hts., Ohio 44125	novakj@neorsd.org	216-641-6000	QDC – 00512 CWQA/SHA
Jonathan Brauer	4747 East 49th 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 49th Street Cuyahoga Hts., Ohio 44125	barillen@neorsd.org	216-641-6000
Joseph Carbonaro	4747 East 49th Street Cuyahoga Hts., Ohio 44125	carbonaroj@neorsd.org	216-641-6000
Mark Colvin	4747 East 49th Street Cuyahoga Hts., Ohio 44125	colvinm@neorsd.org	216-641-6000
Tim Dobriansky	4747 East 49th Street Cuyahoga Hts., Ohio 44125	dobrianskyt@neorsd.org	216-641-6000
Kyle Frantz	4747 East 49th Street Cuyahoga Hts., Ohio 44125	frantzk@neorsd.org	216-641-6000
Donna Friedman	4747 East 49th Street Cuyahoga Hts., Ohio 44125	friedmand@neorsd.org	216-641-6000
Rae Grant	4747 East 49th Street Cuyahoga Hts., Ohio 44125	grantr@neorsd.org	216-641-6000

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

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 Zablotny / Date: _____

Print/Signature: Ron Maichle / Date: _____

Print/Signature: Jillian Novak / Date: _____

Print/Signature: Jonathan Brauer / Date: _____

Print/Signature: Francisco Rivera / Date: _____

Appendix A

OhioEPA **FISH DATA SHEET**

Sheet ID For Office Use Only

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**_____

DELT ANOMALIES
Deformities, **E**rosions, **L**esions, **T**umors
Multiple DELTs on one fish

	Fins Code	Number Weighed	Total Counted	Total Weight	Weights	Counts	D	E	L	T	M	*
1												
	V	10x										
2												
	V	10x										
3												
	V	10x										
4												
	V	10x										
5												
	V	10x										
6												
	V	10x										
7												
	V	10x										
8												
	V	10x										
9												
	V	10x										

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

	Fins Code	Number Weighed	Total Counted	Total Weight	Weights Counts											
10								D	E	L	T	M	*
	V	10x														
11								D	E	L	T	M	*
	V	10x														
12								D	E	L	T	M	*
	V	10x														
13								D	E	L	T	M	*
	V	10x														
14								D	E	L	T	M	*
	V	10x														
15								D	E	L	T	M	*
	V	10x														
16								D	E	L	T	M	*
	V	10x														
17								D	E	L	T	M	*
	V	10x														
18								D	E	L	T	M	*
	V	10x														
19								D	E	L	T	M	*
	V	10x														
20								D	E	L	T	M	*
	V	10x														
21								D	E	L	T	M	*
	V	10x														

NEORSD Macroinvertebrate Field Sheet

Stream: _____ River Mile: _____ Year: _____

Location: _____ Project: _____

Drainage Area (mi^2): _____ Latitude (ºN)/Longitude (ºW): _____

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: _____ ºF / ºC

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, Leptohyphidae, Caenidae
	Other _____
/	Zygoptera, Anisoptera
	Plecoptera
	Hemiptera
/	Megaloptera, Neuroptera
	Trichoptera
	Hydropsychidae
/	Hydroptilidae, Leptoceridae
	Other _____
	Coleoptera
	Elimidae
	Other _____
	Diptera
	Chironomidae
	Other _____
/	Gastropoda, Bivalvia
	Other _____

Field Narrative Rating: E VG G MG F P VP

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: ____

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

Scorers Full Name & Affiliation: Northeast Ohio Regional Sewer District

River Code: _ _ _-_ _ _-_ _ _ *STORET #:* _ _ _ _ _ _ _ *Lat./ Long.:* (NAD 83 - decimal °) _ _ . _ _ _ _ _ /8_ . _ _ _ _ _ *Office verified location* ☐

1] *SUBSTRATE* Check *ONLY* **Two** substrate *TYPE BOXES*; estimate % or note every type present

Check ONE (*Or 2 & average*)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]	____	____	☐ ☐ HARDPAN [4]	____	____
☐ ☐ BOULDER [9]	____	____	☐ ☐ DETRITUS [3]	____	____
☐ ☐ COBBLE [8]	____	____	☐ ☐ MUCK [2]	____	____
☐ ☐ GRAVEL [7]	____	____	☐ ☐ SILT [2]	____	____
☐ ☐ SAND [6]	____	____	☐ ☐ ARTIFICIAL [0]	____	____
☐ ☐ BEDROCK [5]	____	____			

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☐ 3 or less [0]

ORIGIN		QUALITY	
☐ LIMESTONE [1]	SILT	☐ HEAVY [-2]	
☐ TILLS [1]		☐ MODERATE [-1]	
☐ WETLANDS [0]		☐ NORMAL [0]	
☐ HARDPAN [0]		☐ FREE [1]	
☐ SANDSTONE [0]	EMBEDDEDNESS	☐ EXTENSIVE [-2]	
☐ RIP/RAP [0]		☐ MODERATE [-1]	
☐ LACUSTURINE [0]		☐ NORMAL [0]	
☐ SHALE [-1]		☐ NONE [1]	
☐ COAL FINES [-2]			

Substrate ____ *Maximum 20*

Comments

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 (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

____ UNDERCUT BANKS [1]	____ POOLS > 70cm [2]	____ OXBOWS, BACKWATERS [1]
____ OVERHANGING VEGETATION [1]	____ ROOTWADS [1]	____ AQUATIC MACROPHYTES [1]
____ SHALLOWS (IN SLOW WATER) [1]	____ BOULDERS [1]	____ LOGS OR WOODY DEBRIS [1]
____ ROOTMATS [1]		

AMOUNT

Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20 ____

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

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20 ____

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

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐ ☐ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☐ ☐ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ MINING / CONSTRUCTION [0]
	☐ ☐ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10 ____

5] *POOL / GLIDE AND RIFFLE / RUN QUALITY*

MAXIMUM DEPTH Check **ONE** (*ONLY!*)

☐ > 1m [6]
☐ 0.7-<1m [4]
☐ 0.4-<0.7m [2]
☐ 0.2-<0.4m [1]
☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (*Or 2 & average*)

☐ POOL WIDTH > RIFFLE WIDTH [2]
☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply

☐ TORRENTIAL [-1]
☐ VERY FAST [1]
☐ FAST [1]
☐ MODERATE [1]
☐ SLOW [1]
☐ INTERSTITIAL [-1]
☐ INTERMITTENT [-2]
☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current Maximum 12 ____

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (*Or 2 & average*). ☐ **NO RIFFLE [metric=0]**

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8 ____

6] *GRADIENT* (ft/mi)

DRAINAGE AREA (mi^2)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: ____ **%GLIDE:** ____
%RUN: ____ **%RIFFLE:** ____

Gradient Maximum 10 ____

A] SAMPLED REACH

Check ALL that apply

METHOD

- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE

1st -sample pass- 2nd	
☐ HIGH	☐
☐ UP	☐
☐ NORMAL	☐
☐ LOW	☐
☐ DRY	☐

DISTANCE

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

_____ meters

CLARITY

1st --sample pass-- 2nd	
☐ < 20 cm	☐
☐ 20-<40 cm	☐
☐ 40-70 cm	☐
☐ > 70 cm/ CTB	☐
☐ SECCHI DEPTH	☐

CANOPY

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

pass 1st _____ cm

pass 2nd _____ cm

C] RECREATION

POOL: ☐ >100ft² ☐ >3ft (AREA / DEPTH)

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

B] AESTHETICS

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

D] MAINTENANCE

Circle some & *COMMENT*

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

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 H_20 / TILE / H_20 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 x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:

Primary Headwater Habitat Evaluation Form

HHEI Score (sum of metrics 1, 2, 3) : 1

SITE NAME/LOCATION _____

SITE NUMBER _____ RIVER BASIN _____ DRAINAGE AREA (mi^2) _____

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 PHWH 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
☐	BLDR SLABS [16 pts]	0%	☐	SILT [3 pt]	0%
☐	BOULDER (>256 mm) [16 pts]	0%	☐	LEAF PACK/WOODY DEBRIS [3 pts]	0%
☐	BEDROCK [16 pt]	0%	☐	FINE DETRITUS [3 pts]	0%
☐	COBBLE (65-256 mm) [12 pts]	0%	☐	CLAY or HARDPAN [0 pt]	0%
☐	GRAVEL (2-64 mm) [9 pts]	0%	☐	MUCK [0 pts]	0%
☐	SAND (<2 mm) [6 pts]	0%	☐	ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock **0.00%** **(A)** Substrate Percentage Check 0% **(B)**

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 0 **TOTAL NUMBER OF SUBSTRATE TYPES:** 1

HHEI Metric Points

Substrate Max = 40: 1

A + B

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):

- ☐ > 30 centimeters [20 pts]
- ☐ > 22.5 - 30 cm [30 pts]
- ☐ > 10 - 22.5 cm [25 pts]
- ☐ > 5 cm - 10 cm [15 pts]
- ☐ < 5 cm [5 pts]
- ☐ NO WATER OR MOIST CHANNEL [0 pts]

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

Pool Depth Max = 30: 0

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

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

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

Bankfull Width Max=30: 0

This information must also be completed

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

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

COMMENTS _____

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

- ☐ Stream Flowing
- ☐ Subsurface flow with isolated pools (Interstitial)
- ☐ Moist Channel, isolated pools, no flow (Intermittent)
- ☐ Dry channel, no water (Ephemeral)

COMMENTS _____

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

- ☐ None
- ☐ 0.5
- ☐ 1.0
- ☐ 1.5
- ☐ 2.0
- ☐ 2.5
- ☐ 3.0
- ☐ >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: **Wyandot** Township / City: _____

MISCELLANEOUS

Base Flow Conditions? (Y/N): **Y** Date of last precipitation: _____ Quantity: **0.00**

Photograph Information: _____

Elevated Turbidity? (Y/N): **Y** Canopy (% open): **0%**

Were samples collected for water chemistry? (Y/N): **Y** (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) **Y** If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): **Y** (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) **Y** Voucher? (Y/N) **Y** Salamanders Observed? (Y/N) **Y** Voucher? (Y/N) **Y**

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

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 →

Save as pdf Reset Form

NEORSD Surface Water Condition Sampling Field Data Form

Stream: _____ Date: _____ Collectors: _____

Gage Station and ID: _____ Daily Mean Discharge: _____ ft^3/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): _____

Sample ID:

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): _____

Sample ID:

General Comments: _____

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 *a*	Chlorophyll *a*	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]	CaCO3 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
Escherichia coli	*E. coli*	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

YSI 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.

- 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

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!

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

YSI incorporated
Who's Minding the Planet?™

5563 MPS Sensor Specifications

Dissolved Oxygen (% saturation)	Sensor Type	Steady state polarographic
	Range	0 to 500% air saturation
	Accuracy	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
	Resolution	0.1% air saturation
Dissolved Oxygen (mg/L)	Sensor Type	Steady state polarographic
	Range	0 to 50 mg/L
	Accuracy	0 to 20 mg/L, ± 2% of the reading or ±0.2 mg/L, whichever is greater; 20 to 50 mg/L, ± 6% of the reading
	Resolution	0.01 mg/L
Temperature	Sensor Type	YSI Temperature Precision™ thermistor
	Range	-5 to 45°C
	Accuracy	± 0.15°C
	Resolution	0.1°C
Conductivity	Sensor Type	4-electrode cell with autoranging
	Range	0 to 200 mS/cm
	Accuracy	± 0.5% of reading or ± 0.001 mS/cm; whichever is greater (4-meter cable) ± 1.0% of reading or ± 0.001 mS/cm; whichever is greater (20-meter cable)
	Resolution	0.001 mS/cm to 0.1 mS/cm (range-dependent)
Salinity	Sensor Type	Calculated from conductivity and temperature
	Range	0 to 70 ppt
	Accuracy	± 1.0% of reading or ±0.1 ppt, whichever is greater
	Resolution	0.01 ppt
pH (optional)	Sensor Type	Glass combination electrode
	Range	0 to 14 units
	Accuracy	±0.2 units
	Resolution	0.01 units
ORP (optional)	Sensor Type	Platinum button
	Range	-999 to +999 mV
	Accuracy	± 20 mV
	Resolution	0.1 mV
Total Dissolved Solids (TDS)	Sensor Type	Calculated from conductivity (variable constant, default 0.65)
	Range	0 to 100 g/L
	Resolution	4 digits
Barometer (optional)	Range	500 to 800 mm Hg
	Accuracy	± 3 mm Hg within ± 10°C temperature range from calibration point
	Resolution	0.1 mm Hg

YSI 556 Instrument Specifications

Size	11.9 cm width x 22.9 cm lenth (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 carrrier 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 V2 and 6920 V2 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.

ETV

To order, or for more info, contact YSI Environmental.

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YSI Nanotech (Japan)
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nanotech@ysi.com

ISO 9001
ISO 14001
Yellow Springs, Ohio Facility

CE

*Sensors with listed with the ETV logo were submitted to the ETV program on the YSI 6600EDS. Information on the performance characteristics of YSI water quality sensors can be found at www.epa.gov/etv, or call YSI at 800.897.4151 for the ETV verification report. Use of the ETV name or logo does not imply approval or certification 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 ETV 6562 Rapid Pulse™ Sensor*		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 ETV 6562 Rapid Pulse™ Sensor*		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* ETV 6560 Sensor*		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 ETV 6560 Sensor*		-5 to +50°C	0.01°C	±0.15°C
pH ETV 6561 Sensor*		0 to 14 units	0.01 unit	±0.2 unit
ORP		-999 to +999 mV	0.1 mV	±20 mV
Depth & Level	Medium	0 to 200 ft, 61 m	0.001 ft, 0.001 m	±0.4 ft, ±0.12 m
	Shallow	0 to 30 ft, 9.1 m	0.001 ft, 0.001 m	±0.06 ft, ±0.02 m
	Vented Level	0 to 30 ft, 9.1 m	0.001 ft, 0.001 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* (ed 1989).

YSI 600XL & 600XLM Sonde Specifications

Medium		Fresh, sea or polluted water
Temperature	Operating	-5 to +50°C
	Storage	-10 to +60°C
Communications		RS-232, SDI-12
Software		EcoWatch*
Dimensions 600XL | 600XLM	Diameter	1.65 in, 4.19 cm | 1.65 in, 4.9 cm
	Length	16 in, 40.6 cm | 21.3 in, 54.1 cm
	Weight	1.3 lbs, 0.59 kg | 1.5 lbs, 0.69 kg
Power	External	12 V DC
	Internal (600XLM only)	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 (ß). 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 µS/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 µS/cm
Resolution	TDS	1 ppm
Resolution	Temperature	0.1°C / 0.1°F
Accuracy	pH	±0.05 pH
Accuracy	EC/TDS	±2% F.S.
Accuracy	Temperature	±0.5°C / ±1°F
Temperature Compensation		pH: automatic; EC/TDS: automatic with ß 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 simple 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: 1.679, 4.005, 7.000, 10.012, 12.45 DIN: 1.09, 4.65, 9323 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 (1µS/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 19266) 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, Sweedish, 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:	90 % relative humidity (non-condensing)
Operating Interface:	Keypad
Operating Temperature:	5 to 45 °C
ORP Electrode Calibration:	Predefined 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

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		
Automatic Range Mode	0 to 1000 NTU	0 to 1000 FNU
Manual Range Selection	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

HACH®

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

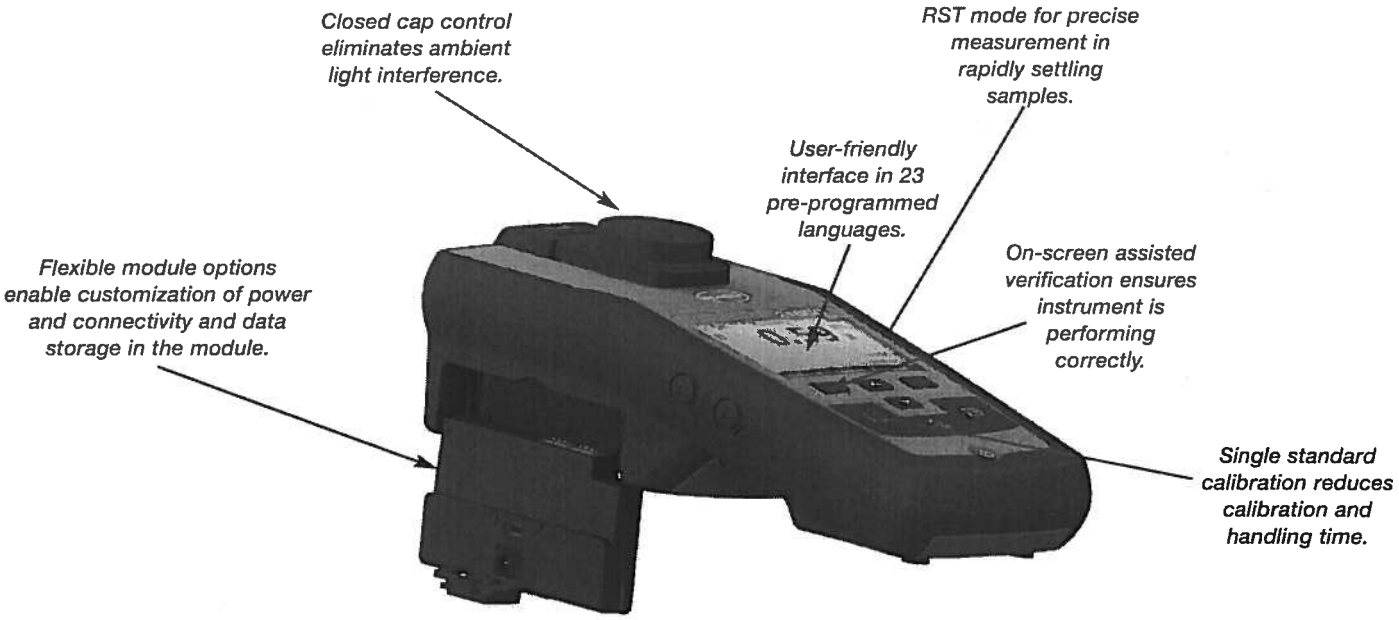
- **2100Q Turbidimeter**—*Compliant with USEPA Method 180.1 design criteria.*
- **2100Q *is* Turbidimeter**—*Compliant with ISO 7027 design criteria.*

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

HACH®

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 x4.2 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*

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

1. The flow meter shall be capable of providing an instantaneous readout of flow velocity.
2. The method of velocity measurement shall be electromagnetic.
3. The range of velocity measurement shall be -0.15 to 6 m/s (-0.5 to +20 ft./s).
4. The flow meter shall measure low flows.
5. The flow meter shall be capable of storage and recall of up to 19 data points while profiling in the field.
6. The flow meter shall have an external charging capability.
7. The flow meter shall have adjustable filter modes of time constant or fixed period average.
8. The flow meter shall have a system self-check function.
9. The flow meter shall have a battery saver mode/auto shut-off.
10. The flow meter shall be battery powered using rechargeable or disposable batteries.
11. The flow meter shall have a bar graph that displays timing information.
12. The flow meter shall have an optional disconnectable sensor available.
13. The flow meter shall have no moving parts.
14. The flow meter shall be water resistant.
15. The flow meter shall be portable.
16. 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.
17. 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.

Lit. No. 2636 Rev 1
L92 Printed in U.S.A.

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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HACH COMPANY
4539 Metropolitan Court
Frederick, MD 21704-9452, U.S.A.
Telephone: 800-368-2723
Fax: 301-874-8459
E-mail: hachflowsales@hach.com
www.hachflow.com

In Europe contact:

Flow-Tronic
Rue J.H. Cool 19a
B-4840 Welkenraedt Belgium
Telephone: +32-87-899799
Fax: +32-87-899790
E-mail: site@flow-tronic.com
www.flow-tronic.com

HACH®

Be Right™

Global Water
a xylem brand

SPECIFICATIONS SHEET

FP-01 1212

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 signifcantly 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

www.globalw.com/products/flowprobe.html
T: 800.876.1172/979.690.5560
globalw@globalw.com

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	

Global Water Instrumentation
2440 Gold River Rd, Ste. 210, Gold River, CA 95670 USA
T: 800.876.1172/979.690.5560
globalw@globalw.com
www.globalw.com

Global Water
a xylem brand

Appendix D

NEORSD Chlorophyll *a* Sampling Field Sheet

Stream:_____ Collectors:_____
Location:_____ Date:_____
RM:_____ Time:_____
Lat/Long:_____

Number of Rocks:_____ Total Area Scraped:_____cm^2

Diameter of individual scrape	Area of individual scrape
1_____	1_____
2_____	2_____
3_____	3_____
4_____	4_____
5_____	5_____
6_____	6_____
7_____	7_____
8_____	8_____
9_____	9_____
10_____	10_____
11_____	11_____
12_____	12_____
13_____	13_____
14_____	14_____
15_____	15_____
16_____	16_____
17_____	17_____
18_____	18_____
19_____	19_____
20_____	20_____
21_____	21_____
22_____	22_____
23_____	23_____
24_____	24_____
25_____	25_____
	Total:_____

Diameter to Area Conversion

Diameter (cm)	Area (cm2)
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*

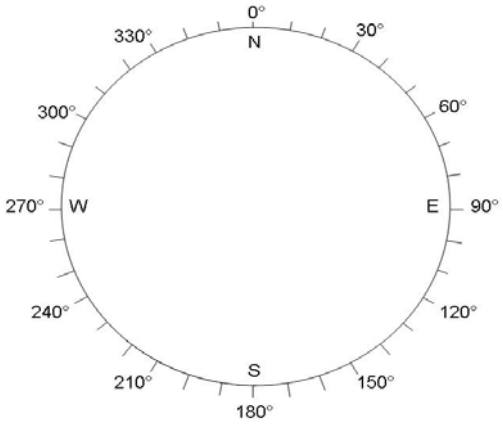
*Explain_____

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

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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**

Continued accreditation status depends on successful ongoing participation in the Program
Certificate not transferable 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

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

1500-FM-LAB0016 Rev. 8/2009

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

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.

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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 (HNO3 + HCl)	NELAP	PA	11/29/2007
EPA 3015		Microwave-assisted acid digestion	NELAP	PA	11/29/2007
EPA 310.2		Alkalinity as CaCO3	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
OIA 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.

www.dep.state.pa.us

Issue Date: 01/24/2013

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

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 Vl	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

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

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.

www.dep.state.pa.us

Issue Date: 01/24/2013

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

Print Date: 01/24/2013

Laboratory Status Summary

DEP Laboratory ID: 68-03670 **EPA Lab Code: OH00300** **TNI Code:** **(216) 641-6000**

Matrix: Solid and Chemical Materials

Method	Revision	Analyte	Status	Effective Date
EPA 6020-Extended		Tin	Applied	11/7/2012
EPA 6020-Extended		Titanium	Applied	11/7/2012

Print Date: 01/24/2013

Appendix F

THIRD ROCK
WWW.THIRDROCKCONSULTANTS.COM

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,

Albert W. 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

Scott Zody
Chief, Division of Wildlife

DATE ISSUED
3/25/2013

Others authorized on permit
YES (SEE ATTACHMENT)

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

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 idenitified, may be collected and taken to NEORSD.
2. Common species of fish may be collected and displayed for educational purposes. Fish must be displayed at NEORSD 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 NEORSD.
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

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE

ATTACHMENT

This attachment to Scientific Collecting Permit # 14-307 authorizes the following persons to conduct the activities listed on the permit, within the conditions and restrictions set forth. Each person must carry and exhibit upon request, a copy of the permit and this attachment when conducting any of the listed activities. The person named on the permit assumes full responsibility for the actions of the persons on this list and for completing and submitting all required reports.

Name	SSN or Driver License
SETH HOTHEM	XXX-XX-6166
THOMAS ZABLOTNY	XXX-XX-6448
JON BRAUER	SJ925295
FRANCISCO RIVERA	XXX-XX-5886
JILLIAN NOVAK	SA294701
RON MAICHLE	XXX-XX-8924

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.

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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