Ohio Environmental Protection Agency

Quality Assurance Project Plan (QAPP) for the Probabalistic Headwater Survey 2023

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Division of Surface Water
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Quality Assurance Project Plan (QAPP) for the Statewide Probabilistic Headwater Survey, 2023

Version 2.0

August 2023

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Section A

A1. Title and Approval

Quality Assurance Project Plan for the 2023 Probabilistic Headwater Study conducted by Ohio EPA Division of Surface Water (DSW).

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Erin Sherer, DSW Assistant Chief

Date: 08/09/2023
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Melinda Harris, Standards and Technical Support Manager

BenjaminARich — Date: 8/16/2023
Ben Rich, Assessment and Modeling Unit Supervisor

Katherine K. Harris — Date: 8/21/2023
Katherine Harris, DSW Quality Assurance Coordinator

Bill Zawiski — Date: 8-17-23
Bill Zawiski, NEDO District Water Quality Supervisor

Kristopher Barnswell — Date: 8/16/2023
Kristopher Barnswell, PhD, NWDO District DSW Manager

Joe Miller — Date: 8/17/2023
Joseph Miller, SWDO District DSW Manager

Rachel Secrest — Date: 08/15/2023
Rachel Secrest, SEDO Water Quality Supervisor

Date: 08/09/2023
Chloe Welch, CDO District DSW Manager

List of Acronyms - (Glossary of Terms can be found ***here***)

AMLER	Abandoned Mine Land Economic Revitalization
CWA	Clean Water Act
DES	Division of Environmental Services
DQO	Data Quality Objective
DOC	Dissolved Organic Carbon
DSW	Division of Surface Water
EA3	Ecological Assessment and Analysis Application
ECBP	Eastern Corn Belt Plain
EOLP	Erie Ontario Lake Plain
EPA	Environmental Protection Agency
FEG	Fish Evaluation Group
HELP	Huron Erie Lake Plain
HUC	Hydrological Unit Code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
ID	Identification
IJC	International Joint Commission
IP	Interior Plateau
IR	Integrated Report
ITS	Information Technology Services
Mlwb	Modified Index of Well-being
NASQAN	National Stream Quality Accounting Network
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
PCS	Permit Compliance System (US EPA)
OAC	Ohio Administrative Code
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QHEI	Qualitative Habitat Evaluation Index
pH	Potential Hydrogen
RL	Reporting Limit
SOP	Standard Operating Procedure
SOCC	State of Ohio Computer Center
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSD	Technical Support Document
USGS	United States Geological Survey
WAP	Western Alleghany Plateau
WAU	Watershed Assessment Unit
WPCLF	Water Pollution Control Loan Fund
WQ	Water Quality
WQBELS	Water-Quality-Based Effluent Limits
WQS	Water Quality Standards
WRRSP	Water Resource Restoration Sponsor Program
WWTP	Wastewater Treatment Plant

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A3. Distribution List

The approved QAPP will be distributed to the management and staff listed in Table 1 along with any subsequent revisions. The QAPP will also be saved on the DSW collaboration site and posted on the DSW webpage.

Table 1 — Distribution List

Name/Title	Contact Email/Phone	
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Jennifer Kraft, Environmental Manager	***jennifer.kraft@epa.ohio.gov***	(614) 644-3020
Steve Roberts, Environmental Supervisor	***steven.roberts@epa.ohio.gov***	(614) 644-4225
Kristin Sowards, Sample Receiving Coordinator	***kristin.sowards@epa.ohio.gov***	(614) 644-4243

A4. Project Organization and Communication

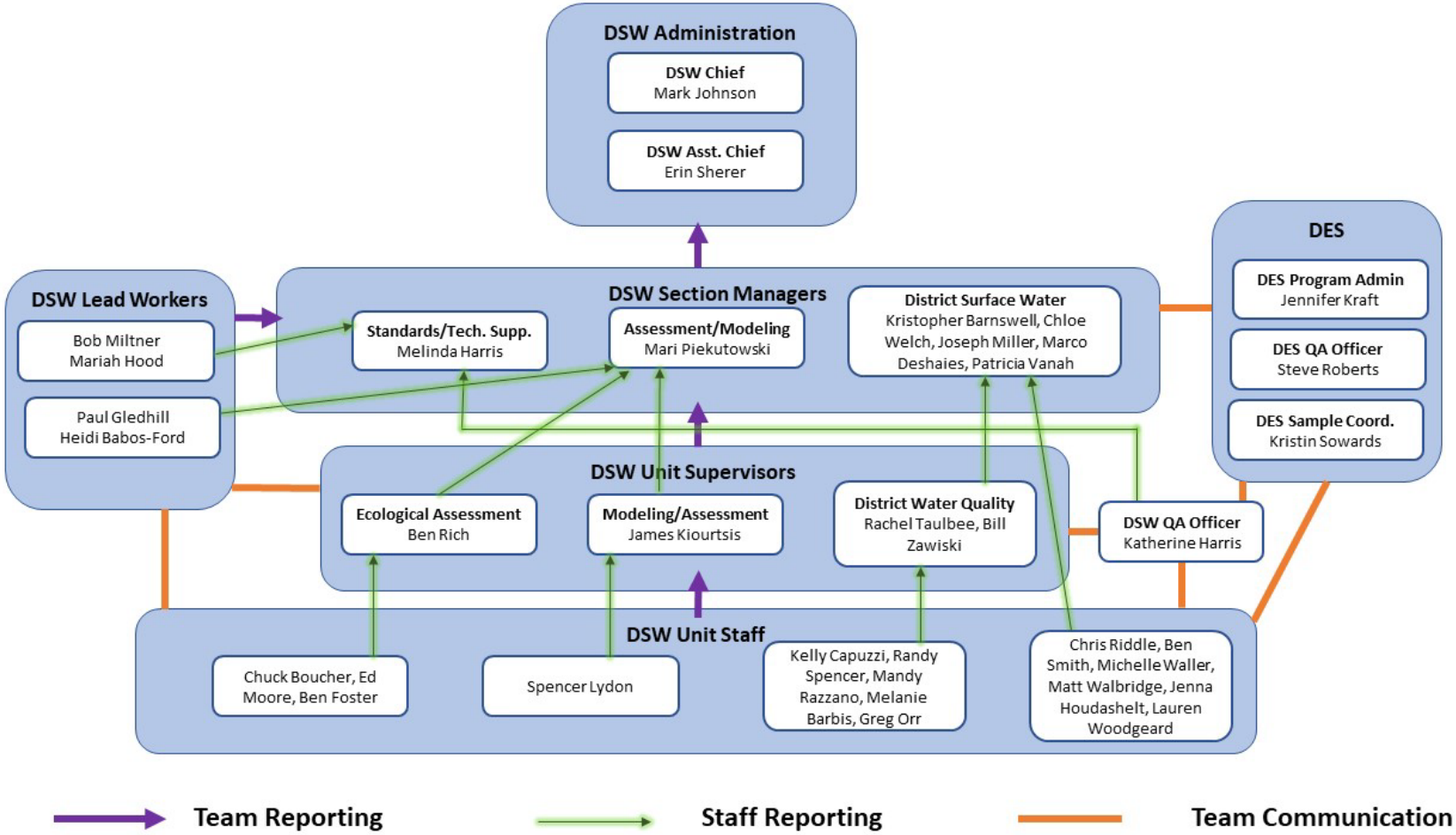
Table 2 identifies the project participants and their specific roles and responsibilities. Figure 1 provides an organizational chart showing the relationships and lines of communication among all project participants.

Table 2 — Roles and Responsibilities.

Individual(s) Assigned:	Responsible for:	Authorized to:
Division of Surface Water		
Mark Johnson & Erin Sherer Chief & Assistant Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Mari Piekutowski Assessment, Modeling and TMDL Section Manager	Overall management of monitoring section.	Assign staff; approve plans; edit reports.
Melinda Harris Standards and Tech Support Section Manager	Quality management (QAPPs, SOPs); staff training; water quality standard rules.	Approve plans and edit reports.
James Kiourtsis Modeling Supervisor	Supporting modeling field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Bob Miltner Standards and Tech Support Lead Worker	Water quality standard criteria development and rule updates.	Help plan study. Review project actions and documents in relation to listed responsibilities.
Kate Harris QA Officer	DSWs quality management program.	Develop and implement field QA/QC guidelines. Track field QA/QC and staff training.
Mariah Hood Standards and Tech Support Lead Worker	Water quality standard criteria development and rule updates.	Help plan study. Make recommended beneficial use changes.
Ben Rich Ecological Assessment Unit Supervisor	Supporting biological field crews with supplies, equipment and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Heidi Babos-Ford Ecological Assessment Unit Lead Worker	Assist with property access, track project progress, managing data and compiling information for Integrated Report.	Provide landowner information for access consent. Upload fish, bug and chemistry data into EA3. Review and comment on reports. Write assigned Integrated Report sections.
Charles Boucher Ecological Assessment Unit Fish Crew Leader	Assist with property access, fish population and stream habitat assessments.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Ed Moore Ecological Assessment Unit Bug Crew Leader	Assist with property access, macroinvertebrate population assessments.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Ben Foster Ecological Assessment Unit Bug Crew Leader	Macroinvertebrate population assessments.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.

Individual(s) Assigned:	Responsible for:	Authorized to:
Kelly Capuzzi Southeast District Office Headwater Crew Leader	Assist with property access, fish and salamander populations, stream habitat assessment and chemistry sampling	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Randy Spencer Southeast District Office Headwater sampler	Assist with property access, fish and salamander populations, stream habitat assessment and chemistry sampling	Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Mandy Razzano Northeast District Office Headwater Crew Leader	Assist with property access, fish and salamander populations, stream habitat assessment and chemistry sampling	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Melanie Barbis and Greg Orr Northeast District Office Headwater Sampler	Assist with property access, fish and salamander populations, stream habitat assessment and chemistry sampling	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Kristopher Barnswell, Joseph Miller, Chloe Welch, Marco Deshaies, Patricia Vanah, District Surface Water Section Managers	Implementing division goals at the district level. Supporting water quality field crews with supplies, equipment, and training.	Review documents and reports; suggest changes and edits; obtain approvals and signatures; develop budgets; conduct field audits.
Rachel Secrest and Bill Zawiski District Water Quality Unit Supervisors	Supporting water quality field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Chris Riddle, Ben Smith, Josh Clifton, Michelle Waller, Matt Walbridge, Jenna Houdashelt, Lauren Woodgeard, Sharon Finley District Water Quality staff	Assist with property access, surface water samples, validation, and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Spencer Lydon, Paul Gledhill Modeling Section	Assist with property access, surface water samples, validation, and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Division of Environmental Services		
Jennifer Kraft Program Administrator	Overall administration of laboratory activities.	Help solve laboratory information management system problems. Develop analytical methods and SOPs.
Steve Roberts QA Officer	DES quality management program.	Oversee data completeness, validation, and delivery.
Kristin Sowards Sample Receiving Coord.	Intake of laboratory samples, coordination with field staff	Help solve daily sample scheduling and sample submission issues.

Figure 1— Organization Chart.



A5. Problem Definition & Background

Ohio is a water-rich state, bordered on the south by the Ohio River and the north by Lake Erie. There are an estimated 21,000 miles of named streams and over 115,000 miles of unnamed headwater streams throughout the state. These water bodies, as well as thousands of acres of lakes and wetlands, are rich in biodiversity and contribute to the quality of life of Ohio's citizens. The Federal Clean Water Act (CWA) mandates that all states report on the overall condition of aquatic resources. Ohio Environmental Protection Agency's (Ohio EPA) Division of Surface Water (DSW) conducts comprehensive watershed surveys to characterize waters, identify trends over time, recognize emerging problems, determine effectiveness of water management programs, help direct remediation efforts where they are most needed and responds to emergencies such as natural disasters and spills.

Ohio EPA defines a headwater stream as a stream that drains up to 20 square miles (mi^2) of land and a primary headwater stream as a stream that drains up to one mi^2 of land. Headwater and primary headwater streams are important for the overall health of watersheds, forming the "capillaries" of the state's stream network. Headwater streams are also critical in the assimilation of pollutants and storage of runoff and flood waters. Headwater streams provide critical habitat for native fauna well adapted to unique headwater stream conditions. Properly determining the biological integrity of headwater streams is a key factor in assessing and protecting them under the federal CWA.

While Ohio EPA has conducted water quality surveys in headwater streams throughout the state, there is a data gap for headwater streams which are often overlooked due to their small size. The biological and habitat monitoring methods initially developed by Ohio EPA in the 1980s and 1990s are often not appropriate for assessing the biological integrity of smaller headwater streams. Larger headwater streams often have the pool depth and habitat to support fish communities but as the drainage area is reduced, the vertebrate biological community shifts from fish to salamanders. Since 1999, research has been conducted to determine appropriate methods for classifying primary headwater streams and in 2002, Ohio EPA released a series of technical reports:

- ***Ohio EPA Primary Headwater Habitat Initiative Data Compendium, 1999-2000 Habitat, Chemistry, and Stream Morphology Data*** (Ohio EPA, 2002a)
- ***Ohio's Primary Headwater Streams Macroinvertebrate Assemblages*** (Ohio EPA, 2002b)
- ***Ohio's Primary Headwater Streams Fish and Amphibian Assemblages*** (Ohio EPA, 2002c)

The first version of the primary headwater field manual was also released in 2002 and most recently updated in 2020:

- ***Field Methods for Evaluating Primary Headwater Streams in Ohio (Version 4.1)*** (Ohio EPA, 2020)

The 2023 probabilistic headwater survey will be used to gather more data from headwater streams that are overlooked in traditional water quality surveys and will also help to refine the existing tools that Ohio EPA uses to assess the biological integrity of streams. Because of the sheer number of unassessed headwater streams in Ohio, a probabilistic survey design is the best method for making unbiased assessments of the condition of an entire resource across large geographic areas.

A6. Project Description

The 2023 probabilistic headwater survey includes 150 sites from streams with a drainage area of one to 3.1 mi^2 from each of the five ecoregion boundaries that Ohio EPA's biocriteria are based on (Figure 2, Appendix 2). These ecoregions include the Interior Plateau (IP), the Eastern Corn Belt Plain (ECBP), the Erie Ontario Lake Plain (EOLP) the Huron Erie Lake Plain (HELP) and the Western Alleghany Plateau (WAP). The 150 base sites were randomly chosen using version 5.0 of the ***spsurvey R package*** developed by USEPA. The spsurvey is an R package used for spatial probability survey design and analysis. An additional 300 over-draw sites were also randomly chosen that will be used to replace a base site if there are access issues or if the stream no longer exists due to anthropogenic activity. Human-caused impacts to headwater streams can include stream relocation, culverting, mining, impoundments, and alterations in flow.

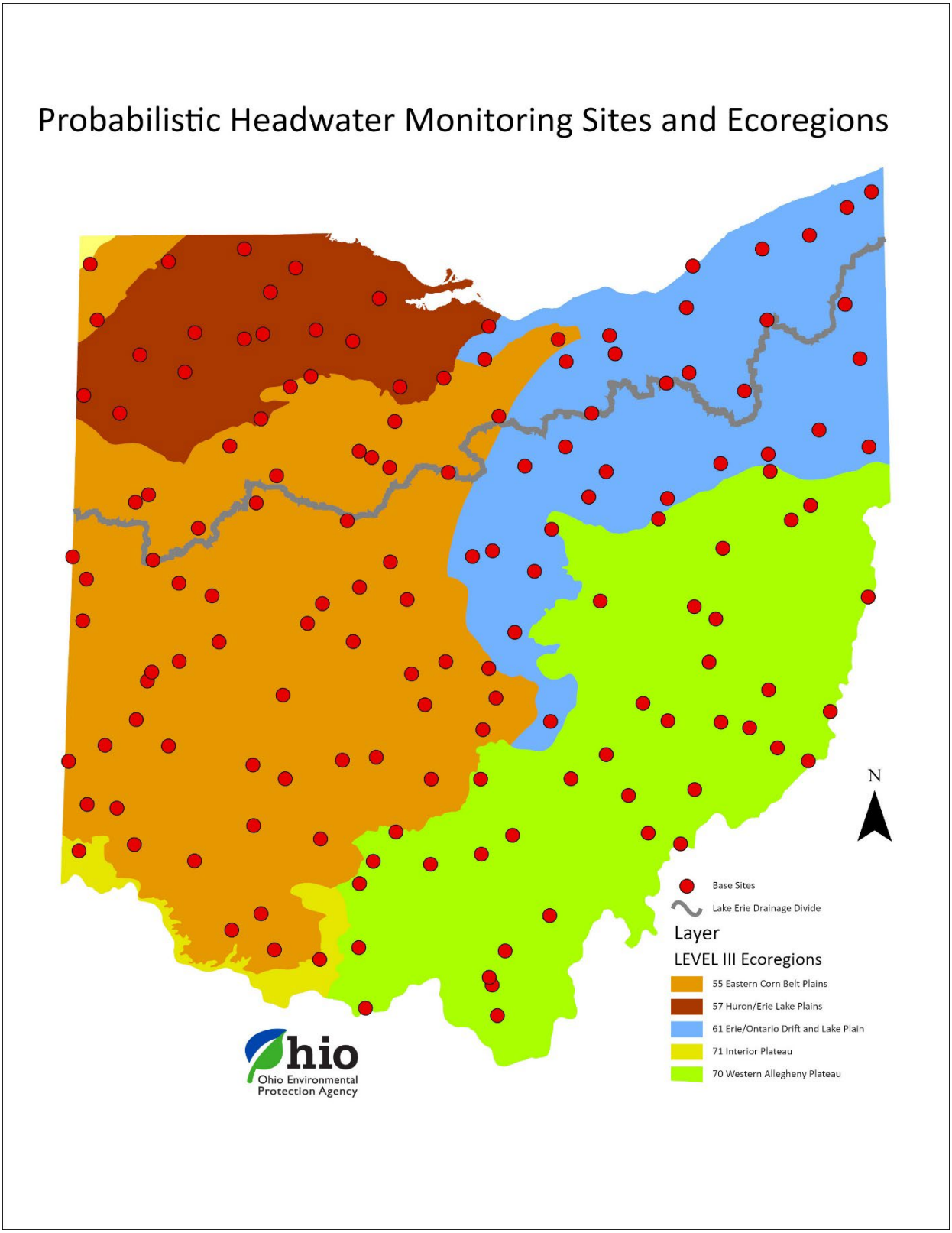
Biological and habitat assessments will be conducted at all base sites following the ***Volume III. Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities*** (Ohio EPA, 2015), ***Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)*** (Ohio EPA, 2006) and ***Field Methods for Evaluating Primary Headwater Streams in Ohio (Version 4.1)*** (Ohio EPA, 2020).

Chemistry and field parameters will be collected at all base sites in accordance with Ohio EPA's *Division of Surface Water's Field Sampling Manual: for Water Quality Parameters and Flows, Version 8.0*. released in 2021, or more current version when available which can be found at this link: ***https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/technical-bulletins*** (Ohio EPA, 2021). Each base location will have "at point" field parameters measured with a calibrated water quality sonde such as a YSI® Pro Series meter or equivalent. The field data will be logged electronically or recorded in writing on a lab sample submission form. A summary of the field measurements is listed in Table 3. Additionally, water samples will be collected to analyze for neonicotinoid insecticides. These samples will be collected in a 500 mL Nalgene jar and shipped to a U.S. EPA laboratory for analysis. U.S. EPA will be using LC Multiresidue Pesticide kits to analyze for neonicotinoids.

Table 3 – Field parameters that will be collected for the 2023 probabilistic headwater survey.

Parameter	PCS	RL	Units
Temperature	00010	0.001	C
Dissolved Oxygen	00300	0.01	mg/L
Oxygen Saturation	00301	0.001	%
Specific Conductivity	00095	0.01	µS/cm
pH	00400	0.1	SU

Figure 2— Probabilistic Headwater Monitoring Sites and Ecoregions.



A7. Data Quality Objectives

DSW will be sampling 150 headwater sites ranging in size from 1.0 to 3.1 mi^2. This document serves as the project study plan (PSP) and quality assurance project plan (QAPP) for the probabilistic headwater survey. The data quality objectives (DQOs) for the study outlined in the PSP are as follows:

1. Conduct a physical habitat survey using the following methods:
    a. Qualitative Habitat Evaluation Index (QHEI)
    b. Headwater Habitat Evaluation Index (HHEI)
2. Conduct a biological survey of the vertebrate community (fish and salamanders) and the macroinvertebrate community using the following methods:
    a. Taxonomic evaluation of salamanders present including classification by life stage (egg, larvae, juveniles, and adults) using the visual encounter survey (VES) technique as well as observations during fish and macroinvertebrate sampling.
    b. The fish community will be assessed using electrofishing techniques from a zone of 125 meters to 200 meters. Fish will be sorted by species and counted to generate an Index of Biotic Integrity (IBI) score.
    c. The macroinvertebrate community will be assessed at each site using the Ohio EPA qualitative sampling method and the Headwater Macroinvertebrate Field Evaluation Index (HMFEI).
3. Monitor for field parameters at each location during the habitat and biological survey including temperature, pH, specific conductance, and dissolved oxygen.
4. Water samples will be collected at least two times during the survey, and will include field and chemical parameters listed in Appendix 3.

Following completion of the survey, a summary report will be completed by Ohio EPA regarding the existing characteristics of the headwater streams in the probabilistic survey. Data collected will be used to make use designation recommendations for streams that are currently undesignated in the Ohio WQS. Habitat and chemical data will be used to determine stressors to the biological community and general recommendations will be made to protect or restore the biological integrity of those headwater streams.

A8. Special Training/Certification

All staff who conduct biological, habitat and surface water sampling, receive initial training by experienced staff in the proper techniques required, usually a supervisor or veteran employee. Mandatory refresher training is completed on an annual basis for all samplers.

A9. Documents and Records

Microsoft® SharePoint is used as a library for documents. Access is through Ohio EPA's Intranet collaboration site.

Examples of documents posted to this location include the following.

Pre-sampling documents:

- Property access forms
- Draft and final QAPP versions

Project documents:

- Changes to sites, staff, parameters
- Data summaries
- QAPP addendums

Changes in project leadership or major actions which might affect the DQOs require an updated QAPP and signoff sheet. The study team leader shall retain copies of all management reports, memoranda, and all significant correspondence between team members.

The original chain of custody is delivered to DES along with the samples and retained according to Agency retention policy. A copy of the form may be kept by the sample collector as well. After samples are analyzed and the results are approved by the DES QA Officer the data is released to Sample Master® and subsequently uploaded to DSW's EA3. The sample collector reviews laboratory sheets for completeness and accuracy, validates field QC, adds comments and completes edits if necessary and approves the sheet. All data approved in EA3 is sent to U.S. EPA's Water Quality Exchange.

Original fish, QHEI, HHEI, HMFEI and qualitative data sheets will be retained at the Groveport Field Office. Data from the field sheet is manually entered into the EA3 database using the appropriate data entry screen.

Section B. Data Generation and Acquisition

B1. Sampling Process and Design

Water chemistry samples will be collected at least two times from each sampling location throughout the field sampling season from May to October 2023. Habitat (QHEI, HHEI) and biological sampling (IBI, HMFEI, qualitative macroinvertebrate sample) will occur from June 15 to early October 2023.

B2. Field Sampling Methods

Surface Water

Inorganic surface water chemical parameters will be analyzed from surface grab samples collected at every site listed in Appendix 2. Physical water quality measurements will be taken with a multimeter probe each time a sample is collected and during biological surveys. Analytical methods and laboratory reporting levels for chemical and physical parameters for samples collected within the study are listed in Appendix 3.

Surface water grab samples will be collected and preserved using appropriate methods as outlined in the *Surface Water Field Sampling Manual*. Samples are delivered by field staff or via courier to Ohio EPA's DES for analyses. Field measurements of dissolved oxygen, pH, temperature and conductivity will be made using a properly calibrated YSI® Pro Series meter or equivalent.

Laboratory reporting limits are adequate to evaluate most pollutants. Potential exceptions include nitrate-nitrite and ammonia. It is common for nitrogen to become depleted during the summer in aquatic environments. In instances where a value is needed to calculate a mean concentration and the result is below reporting limit (RL), the reported "value" will be used in the calculation.

Biological and Habitat Assessments

Assessment zones for the probabilistic headwater survey will be established by the Field Crew Leader to provide representative sampling reaches to meet the data quality objectives of the projects. Assessment zones may be moved slightly for purposes of access or to avoid areas that are impounded as long as the drainage area falls within the range of one to 3.1 mi^2.

The assessment zones will be surveyed using the following methods:

1. Prior to any upstream disturbance, the sampling zone will be approached from the downstream direction whenever possible to assure that the site is not initially disturbed prior to setting up the sampling reach.
2. The Field Crew Leader will confirm the location of the stream reach for conducting the assessment. Where necessary, the evaluation zone may be adjusted to meet the data quality objectives for the survey and to also follow Ohio EPA sampling procedures.
3. Sampling will occur only during baseflow conditions. If there are temporary conditions such as high-water, elevated turbidity or severe drought, assessment activities will be postponed and rescheduled. Should site conditions indicate a permanent or long-lasting condition such as site safety hazards, stream channel modifications, or barriers to access that make it impractical or impossible to conduct the site assessment, conditions will be documented, and the site will be considered for replacement with an overdraft site.
4. Each sampling zone will be photographed, and a GPS point will be collected from the center location of the sampling zone.
5. Field water quality measurement data will be collected within the assessment zone before the site is disturbed with biological or habitat sampling activities.
6. Assessment of the biological communities will be conducted using the protocols described in Section 7.0 of the Ohio EPA *Field Manual for Ohio's Primary Headwater Habitat Streams* (Ohio EPA, 2020) for fish, amphibians, and macroinvertebrates.
7. Habitat assessments will be conducted using the Headwater HHEI (Ohio EPA, 2020) for all locations in the study.

Water Quality Sonde Deployments/Nutrient Site Evaluation

All the stream assessment sites are designated as nutrient sites. Continuous multi-parameter measurement sondes will be deployed during stable, baseflow conditions for this assessment. Ideally, one sonde survey will be carried out at each nutrient assessment site, as site conditions allow. Water quality sondes will be placed at select locations indicated as a nutrient site on Appendix 2 to evaluate diel measurements of dissolved oxygen, pH, temperature, and conductivity. The goal of each sonde deployment is to capture about 48 continuous hours of hourly measurements. Sestonic and benthic chlorophyll-α samples are to be collected during each sonde deployment, as site conditions allow. All sampling, analysis and procedures adhere to those specified in the Surface Water Field Sampling Manual – Appendix II for water quality parameters and flows. Section F of Surface Water Field Sampling Manual – Appendix II outlines equipment preparation, deployment, equipment retrieval, data management, quality control testing, and maintenance.

Temperature

Continuous temperature measurements will be recorded at all the stream assessment sites in Appendix 2 using Onset HOBO Water Temperature Pro v2 Data Loggers. At each assessment site, these temperature-only loggers will be deployed in a pool within the sampling reach. The sampling will be conducted in accordance with procedures outlined in the Surface Water Field Sampling Manual Section G, Standard Operating Procedure for Continuous Temperature Data Logger Deployments. The loggers are accurate to approximately 0.2°C with an expected drift of approximately 0.1°C per year. Accuracy of the logger will be tested against a calibrated thermometer prior to deployment, ensuring the readings are within the accuracy range provided by the manufacturer. A stream temperature datapoint will be collected every 30 minutes from May 1 through August 31 to determine the temperature regime for the streams during this time.

Water-Detection

Continuous temperature and water-detection measurements will be recorded at all of the stream assessment sites in Appendix 2 using Onset HOBO TidbiT MX Temperature 400' Data Logger. These temperature and water-detection measurements will be collected in glides within the sampling reach. The sampling will be conducted in accordance with procedures outlined in the Surface Water Field Sampling Manual Section G, Standard Operating Procedure for Continuous Temperature Data Logger Deployments. The loggers are accurate to approximately 0.2°C with an expected drift of approximately 0.1°C per year. Water conductivity level of 100 µS/cm or greater is necessary for reliable detection of water. The water conductivity circuit may not reliably detect water that has frozen around the electrodes, i.e. below 0°C (32°F). Accuracy of the logger will be tested against a calibrated thermometer prior to deployment, ensuring the readings are within the accuracy range provided by the manufacturer. A stream temperature datapoint will be collected every 30 minutes from May 1 through August 31 to determine the temperature regime and presence of water for the streams during this time.

B3. Sample Handling and Custody

Sample Master® software is used by field staff to create sample orders and DES to manage laboratory information. A guidance manual for use of the software is in Appendix IV of the *Surface Water Field Sampling Manual.* The sample collector logs into the system and places an order by selecting the appropriate project, stations to be sampled, and test group(s) to be analyzed. The program creates a chain of custody form and container labels for each site.

B4. Analytical Methods

The analytical methods to be used in this study are provided in Appendix 3 along with the preservatives, holding times, and reporting limits. SOPs for the analytical methods are maintained by DES and are available upon request.

B5. Quality Control

Surface Water Chemistry

Ten percent of the total number of water samples will be submitted to the laboratory as field quality control samples. About five percent will be duplicates, including replicates if natural variability is a concern, and about five percent will be blanks, including field blanks and equipment

blanks. Data will be validated based on the results of the field quality control samples as outlined in Appendix IV in the *Surface Water Field Sampling Manual.* The laboratory will validate data according to the requirements defined in the applicable analytical method (see Appendix 3). Field instruments will be calibrated according to manufacturer guidelines. Field instruments utilizing electrochemical sensors must be calibrated daily.

Water Quality Sonde Deployments

Sondes will be calibrated according to manufacturer specification prior to deployment. A calibration record is kept for all sondes at the Groveport Field Office (GFO). After each deployment, sondes undergo a precision quality control check, for more details see section F and Appendix II of the *Surface Water Field Sampling Manual*. All field quality control requirements and data validation methods are detailed in the Surface Water Field Sampling Manual.

Temperature Data

Battery-life and quality assurance of water temperature loggers will be tested prior to deployment and upon retrieval. QA of the loggers will be tested by a method called herd calibration. This is done by placing groupings of the loggers into a homogenized water bath and recording the temperature every minute for approximately 15 to 20 minutes. The deviation of each individual logger should be within 0.5°C from the group average. Loggers that fail the QA test during the pre-deployment test will not be deployed.

Upon receipt of temperature data, the data will go through an initial review process to flag/remove anomalous data. Anomalous data could be a result of a malfunction of the probe or an indication that the probe was not reading accurate information which could occur if the probe was not continuously submerged underwater, became buried under fine sediment, etc. Methods employed will take advantage of the ContDataQC R package developed by Tetra Tech, Inc. (***https://github.com/leppott/ContDataQC***). Data will be evaluated in a manner consistent with Ohio EPA's Standard Operating Procedure for the Analysis of Continuous Temperature Data for Determining Coldwater Habitats. See Appendix II, Section G of the *Surface Water Field Manual* for guidelines.

B6. Instrument/Equipment Testing, Inspection and Maintenance

All instruments/equipment will be inspected prior to each use. All field meters are serviced annually by a factory certified service provider to ensure they are operating within specifications. Parts are repaired or replaced at this time if necessary.

B7. Instrument Calibration and Frequency

The appropriate calibration procedure, as specified in the instrument's user manual, must be followed. All calibration solutions used will be checked for expiration dates before utilized. All equipment is assigned a logbook that will detail the equipment's calibration and maintenance history. For more details see Section D and Appendix II of the *Surface Water Field Sampling Manual*.

B8. Inspection/Acceptance of Supplies

Supplies and consumables will be inspected upon receipt by the field sampling teams. Nearly all supplies utilized for this project are maintained and used during Ohio EPA's normal business operations. The field team leaders will be responsible for ensuring that all sample containers and all

needed supplies and consumables are available in advance of all field work. It will be their responsibility to maintain and replenish stock when needed. Consumable supplies include, but are not limited to: sample containers, acid preservatives, Lugol's iodine solution, ethyl alcohol, buffers, filters and miscellaneous supplies such as distilled water, disposable gloves, and towels. Field personnel will confirm that all reagents are within applicable shelf life.

B9. Data Acquisition Requirements for Non-Direct Measurements

Data collected for this project and other data previously collected by Ohio EPA will be used to develop data summaries for each site.

B10. Data Management

The data management process is shared by DSW and DES. DES uses Sample Master® software to manage laboratory information and DSW uses the EA3 to manage data. These programs are linked together to allow the transfer of information between the two systems. EA3 software is used to assign a permanent six-digit station ID number to each sampling location and to create a project name to associate locations so data can subsequently be exported and assessed in groups.

Field measurements are collected instantaneously using a multi-parameter meter and saved in an internal file storage system. These files are downloaded to the manufacturer's software, exported to Microsoft Excel® and then uploaded to Sample Master® so field data can be associated with chemistry data in the database. Sample collector(s) will access the USGS streamflow web page and record gage height and discharge readings closest to the actual sample collection time and add it to the sample metadata in Sample Master®.

Field and chemistry data tabulated in Sample Master® are eventually uploaded into EA3. Then, in EA3, the sample collector will review each data sheet for accuracy, validate field QC, add comments, and complete edits, if necessary, before approving the sheet. This data is then available for use. All agency files are ultimately backed up and housed in the State of Ohio Computer Center (SOCC).

The study team leader will maintain the project file in a dedicated folder on SharePoint. The expectation is to have a complete record of all decisions about modifications of data collection, validation, or interpretation between the QAPP signoff and data approval. To achieve this, the study team leader will need to be included on emails or otherwise receive summaries of all actions that meet the above description. Project photos should all be filed in the Agency's Lynx photo management system.

Section C. Assessment and Oversight of Data Collection

C1. Assessment and Response Actions

Assessments

Periodic assessment of field sites, field equipment, and laboratory equipment is necessary to ensure that data obtained meets project needs. This is an ongoing process that continues every day during project implementation, as well as on larger scale assessments that take place less frequently (*e.g.*, annually). The assessments generally focus on readiness and consistency of implementation but also are looking for continual improvement opportunities.

Daily assessments (for each day of project activities, as applicable) include assessment of field

equipment and supplies, laboratory equipment and supplies, completeness of the day's samples and associated field notes, future needs, etc.

Response Actions

Despite best preparations, assessments may find situations requiring corrective actions. Small day-to-day level assessment findings are often addressed by the individual doing the assessment in the field or in the laboratory and are common enough to the process to not necessitate a formal response.

When more significant situations arise, staff are aware that a more formal response may be necessary.

For issues that arise at DES, corrective actions may result in changes to the analytical reporting via data qualifiers and comments, for more information see Appendix IV of the *Surface Water Field Sampling Manual* if:

- QC data are outside the warning or acceptable windows for precision and accuracy,
- Blanks contain target analytes above acceptable levels,
- Undesirable trends are detected in spike recoveries or relative percent difference (RPD) between duplicates,
- There are unusual changes in detection limits,
- Deficiencies are detected by the laboratory and or project QA officers during any internal or external audits or from the results of performance evaluation samples, or
- Inquiries concerning data quality are received.

Corrective action implementation will be determined by the likelihood that the situation may affect the quality of the data.

Field corrective actions will be brought to the attention of the study team for consideration as to their impact on the data, their potential interest to other sampling teams/subcontractors, any future considerations for process improvement, and for their potential inclusion in project related reports.

Laboratory corrective actions will follow regular laboratory procedures and SOPs. Any laboratory corrective action with the potential to affect data quality will be conveyed to the study team leader by the laboratory.

Reporting and Resolution of Issues

Any audits or other assessments that reveal findings of practice or procedure that do not conform to the written QAPP will be corrected as soon as possible. The study team and QA coordinator will be notified regarding deviations.

Data Completeness

Success of the project will be judged by the resulting data fulfilling the needs outlined in the data objectives. Potential data gaps will be monitored as the project progresses and the project schedule

will be revised to fill these gaps where they are determined to be significant or to potentially impact the fulfillment of project objectives.

Reports to Management

The study team leader or district supervisor will receive regular updates from field staff throughout the sampling season and will report to division management during Senior Management Team meetings. Any problems that jeopardize completion of the project will lead to memorandum and consultation with program management and quality assurance staff.

Section D. Data Validation and Usability

D1. Data Review, Validation and Verification Requirements

Data verification will be conducted by the study team with assistance from other DSW staff. This process will confirm that sample results received are congruent with samples submitted and parameters requested from the laboratory. The process will also result in summaries of any differences between initial sampling and methods planned in the QAPP and results reported and available. Differences may result from samples not being collected (due to weather, scheduling, etc.), samples not being submitted (due to accidents like broken containers, or delays resulting in being past holding times, etc.), problems at the laboratory (methods changing, containers or equipment breaking), or other reasons. It is also possible that additional sampling would take place because of field observations/conditions. Documenting deviations from the QAPP is the responsibility of the study team leader.

The DES laboratory does the initial validation on all data and may qualify data based on laboratory QA/QC alone or with feedback from the sampler (regarding specific sampling procedures, variable sampling matrix, conditions, blank contamination, duplicate agreement, matrix spike recovery, etc.). The data user can evaluate the data given their knowledge of sampling conditions, expected variability given location and matrix, data uses, etc.

Upon approval in EA3, field and laboratory data cannot be revised without intervention from database administrators in the Agency's Office of Information Technology Services (ITS).

D2. Validation and Verification Methods

In addition to verifying data completeness, the study team will oversee data validation for the project that will include confirmation of sample holding times, proper preservatives, sample containers, analysis methods, QA/QC results (including assessment of results for blanks, spikes, and duplicates), etc. This will be an ongoing effort, with QA reviews managed on a calendar year basis.

The study team will make final decisions regarding validity and usability and will evaluate the sample collection, analysis, and data reporting processes to determine if the data is of sufficient quality to meet the project objectives. Data validation involves all procedures used to accept or reject data after collection and prior to use. These include screening, editing, verifying, and reviewing. Data validation procedures ensure that objectives for data precision and bias will be met, that data will be generated in accordance with the QAPP and SOPs, and that data are traceable and defensible. The process is both qualitative and quantitative and is used to evaluate the project.

The laboratory QA staff will conduct a systematic review of the analytical data for compliance with the established QC criteria using batch and sample QA/QC information including spike, duplicate, and blank results. All technical holding times will be reviewed, the laboratory analytical instrument performance will be evaluated, and results of initial and continuing calibration will be reviewed and evaluated.

Field QC sample results will be evaluated using procedures available in Section I of the *Surface Water Field Sampling Manual*. Much of this work is facilitated by a centralized automated QC data evaluation Excel® file. Use of this file is explained in the document "QC Tracking and Data Qualification" available in SharePoint in DSW Quality Management/Documents/DSW Procedures.

For most DSW chemical water quality data, data validation is generally confined to evaluation of blank results, duplicate/replicate results, paired parameter results (Table 4) and confirming that samples were properly preserved/prepared (including filtration, etc. - if indicated by the method). Standards for evaluation of analytical results of those QC sample types and general field samples are described in Appendix IV, Section A of the *Surface Water Field Sampling Manual*.

Table 4 – Paired Parameter Comparisons

Parameter 1	Parameter 2
Total Organic Carbon (TOC)	Dissolved Organic Carbon (DOC)
TKN	Ammonia
Conductivity (Lab)	Conductivity (Field)
Total Phosphorus	Dissolved Phosphorus

D3. Reconciliation with Data Quality Objectives

For most situations, issues can be addressed with acknowledgement of factors captured in the sample metadata which can confirm, explain, and document the data quality concern. Significant, persistent, or unresolved issues will be brought to the attention of the project study team, division QC personnel, and Ecological Assessment Unit and/or DSW management for further evaluation. This combination of personnel will assess how to best label affected data for storage in the EA3 database and how to eliminate or limit any similar problems going forward. Consideration will also be given on how best to memorialize data limitations or anomalies as the data is transferred to other databases, including the US EPA WQ Portal, so that future users of the sampling data are aware of any data quality issues or limitations.

Appendix 1 – Summary of Sampling Effort

Type of Sample	# of sites	passes/frequency
Biology		
Fish/Salamanders	150	1/ watershed survey cycle
Macroinvertebrate	150	1/ watershed survey cycle
Water Quality		
Inorganic Samples	150	Two samples from May to October
Neonicotinoid Samples	150	Two samples from May to October
Nutrient (sonde deployment & chlorophyll-α)	150	≥1/ watershed survey cycle
Temperature Dataloggers	150	1/ watershed survey cycle
Temperature/Water-Detection Dataloggers	150	1/ watershed survey cycle

Appendix 2 – Streams and Sampling Locations

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
1	304340	Greenfield Creek (airport trib)	0.9	3.07	050302040401	Fairfield	39.74706	-82.65589
2	304341	Ransoms Run (Kokosing River Trib)	1.09	1.42	050400030307	Knox	40.37766	-82.387409
4	304344	Wysong Run	0.1	1.44	050800020303	Montgomery	39.76328	-84.44584
5	201726	Opossum Run	5.0	1.57	050302040904	Morgan	39.48977	-81.91062
6	200595	Aylworth Creek (RM 0.6)	0.9	2.6	041100010606	Lake	41.65468	-81.16939
7	304397	Dunlap Creek	2.2	1.31	050600010102	Hardin	40.64569	-83.84587
9	204002	WF EF Duck Creek	1.4	1.5	050302010801	Noble	39.77304	-81.42440
12	304387	Worthington Ditch	4.8	2.94	050600012101	Madison	40.09375	-83.32591
13	304346	Trib to WB Black River (0.90/21.32)	0.2	2.52	041100010504	Lorain	41.21763	-82.21956
17	304380	Trib to to SF Licking River(RM 23.25)	2.82	2	050400060405	Licking	39.99196	-82.62717
18	304349	Trib to Crab Run (2.86/0.92)	0.2	1.37	050400020701	Wayne	40.67035	-82.10142
19	304399	Trib to Eightmile Creek (RM 2.3)	0.5	2.4	041000040202	Mercer	40.64077	-84.47784
20	203745	Trib to Mud Creek	0.1	3.0	050800011101	Darke	40.07467	-84.65563
21	J02H30	EB Sunday Creek	13.2	2.2	050302040701	Morgan	39.642743	-82.017617
22	F01G12	Sawyer Brook	0.15	2.6	041100020106	Geauga	41.37541	-81.15360
23	304390	Kiser Ditch	0.28	3.02	050800010603	Shelby	40.31939	-84.24484
24	Q01S03	Town Run (16.91)	0.95	2.1	050902030103	Hamilton	39.27240	-84.44895
25	304394	Mud Run	1.7	2.78	050400050302	Guernsey	40.01361	-81.48166
27	304400	Trib to Morrison Creek (RM 3.27)	2.42	1.26	041000111102	Seneca	41.11466	-83.09738
28	304386	Dews Run	4.13	1.16	050600030803	Fayette	39.62250	-83.38245
29	304352	Trib to Plum Creek (RM 15.7)	1.1	1.22	041100010107	Lorain	41.23788	-81.97119
30	304401	Woods Ditch (trib Flatrock RM 28.18)	1.65	1.5	041000071205	Pauling	41.06001	-84.76510

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
31	304406	Trib to Broken Sword Creek (2.96)	0.38	1.25	041000110302	Wyandot	40.79192	-83.14880
32	304402	Beech Fork	3.1	2.72	050600021406	Adams	38.87070	-83.285897
33	304504	Middle Fork Snow Fork (Sycamore	3.2	2.9	050302040503	Hocking	39.553885	-82.20359
35	304466	Trib to Dismal Creek(RM 0.15)	0.20	1.20	050800011001	Darke	40.15901	-84.75083
36	304392	Paxton Branch	2.5	2.27	050800020603	Preble	39.59997	-84.79580
38	304359	Trib Ashtabula River (0.81/16.98)	1.4	1.74	041100030104	Ashtabula	41.81383	-80.72381
41	303322	Buhrs Run	0.17	2.0	050302010603	Monroe	39.66319	-81.12740
42	304463	Trib to Beaverdam Creek (RM 1.42)	0.2	1.78	050400011703	Tuscarawas	40.46681	-81.40391
44	304384	Trib to Big Walnut Creek(RM 5.28)	0.4	1.75	050600011603	Franklin	39.84680	-82.95695
45	304360	Trib to Willow Creek (RM 7.32)	0.01	1.4	041100010403	Lorain	41.31894	-81.98964
46	304410	Trib to Lost Creek (RM 8.17)	3.45	1.9	041000060601	Defiance	41.36464	-84.70960
47	304411	Mile Run	4.65	2.65	041000110905	Wyandot	40.97845	-83.12962
48	304458	Trib to Upper Twin Creek (RM 0.37)	0.2	1.01	050902010205	Scioto	38.63258	-83.25154
50	R05S50	Indian Trail Creek	7.26	2.62	050400011003	Holmes	40.58662	-81.73835
52	304403	Trib to WF Honey Creek (RM 9.78)	2.09	2.37	050800012002	Champaign	40.08575	-84.03066
53	W02L01	Painter Creek	0.8	2.61	050901030202	Lawrence	38.73153	-82.61556
54	304366	Girard Creek (Squaw Creek)	5.3	3.02	050301030704	Trumbull	41.22058	-80.66477
55	S99Q06	Trib to Rocky Ford Creek (RM	7.6	2.38	041000100103	Hancock	41.11069	-83.66906
56	304405	Indiancamp Creek	1.2	2.97	050902020902	Clermont	39.21431	-84.1383
57	304453	Barnes Run	1.51	1.05	050302011005	Monroe	39.61258	-80.97484
59	304415	Trib to Sandusky River (78.75)	0.75	2.12	041000110702	Wyandot	40.83483	-83.25624
61	304416	Trib to Katotawa Creek (RM 2.07)	0.35	1.82	050400020603	Ashland	40.87446	-82.2268
62	304417	Trib to Ai Creek (RM 9.01)	1.6	2.4	041000090701	Fulton	41.65763	-83.93004
64	304457	Trib to Stony Creek (RM 1.10)	1.0	2.25	050600021005	Ross	39.21608	-82.91787

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
65	300083	Pawpaw Creek	3.45	2.13	050600011701	Fairfield	39.87328	-82.58998
66	304375	Trib to Jelloway Creek (RM 12.3)	0.33	1.3	050400030402	Knox	40.54804	-82.29860
67	304418	Trib to Jackson Cutoff Ditch (RM 1.28/1.15) adj. Milton Rd	1.33	1.48	041000090507	Wood	41.31848	-83.82498
68	304408	Trib to Brush Creek (RM 6.65)	0.23	3.09	050800011401	Miami	39.91966	-84.39038
70	304370	Trib to Cuyahoga R (RM 36.51) Adams Run	0.05	1.05	041100020405	Summit	41.16814	-81.57074
71	304419	Trib to Cranberry Creek (RM 20.43) at Lugabill Rd	0.34	1.4	041000080601	Allen	40.86914	-83.99216
72	301575	Trib to Anderson Fork(RM 4.54)	2.2	2.9	050902020303	Greene	39.58262	-83.87271
74	304371	Trib to Hugle Run (RM 3.91)	0.95	3.05	050400010601	Stark	40.77081	-81.14966
75	304420	Disher Dish (Trib to Blue Creek at RM 2.9)	1.0	1.4	041000090802	Lucas	41.48897	-83.78776
76	304412	Trib. To Proctor Run (RM5.7)	0.3	2.38	050600012002	Champaign	40.16841	-83.57364
77	304347	Beaver Creek	15.5	2.13	041100010701	Lorain	41.30310	-82.27297
78	304350	Friday Creek	2.3	1.18	050400010801	Carroll	40.57308	-81.04531
79	304391	Trib to Grassy Run(RM 1.85)	0.87	1.2	050600010603	Union	40.30702	-83.29432
80	304385	Trib to Deer Creek (RM 23.02)	1.15	1.06	050600020207	Pickaway	39.63541	-83.20793
81	304379	Simonds Run	1.42	1.50	050400060204	Licking	40.13471	-82.48497
82	304353	Trib to Killbuck Creek(RM 46.0)	4.8	1.25	050400030604	Wayne	40.77972	-82.02291
83	304421	Trib to Saint Marys River (RM 81.14)	1.3	2.51	041000040205	Auglaize	40.67720	-84.41295
84	H11K11	Trib to Salmon Run(RM 1.81)	0.01	1.2	050800020803	Butler	39.42836	-84.69394
85	303573	Dicks Creek (Symmes Cr)	0.3	3.0	050901010802	Jackson	38.85650	-82.53502
86	304354	Trib to Mill Creek(RM 5.32)	0.72	1.42	041100020601	Cuyahoga	41.42860	-81.58086
89	304468	Trib to Rainbow Cr (RM 0.63/6.65)	0.35	2.41	050400041202	Washington	39.50015	-81.56561

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
90	304469	Trib to Clear Fork (RM 4.46)	0.10	2.39	050400050403	Guernsey	40.17467	-81.44121
91	304424	Frink Run	11.7	2.95	041000120506	Seneca	41.16048	-82.84443
92	304436	Trib to Wilson Creek (RM 8.3)	1.08	1.78	050600030301	Clinton	39.53989	-83.67563
93	304355	Yellow Creek	9.35	2.75	041100020402	Summit	41.12635	-81.68272
94	304422	Fivemile Creek	3.05	1.15	041000071209	Pauling	41.2260376	-84.45681
95	304431	Hooker Dapper Ditch	2.69	3.06	050600010801	Crawford	40.77566	-82.83926
96	304470	Trib to Kincaid Creek(0.4/2.62) (Scioto Sunfish Cr)	0.07	1.58	050600021201	Pike	39.12972	-83.28885
97	304472	Middle Fork Laurel Run	4.72	1.72	050600020603	Hocking	39.55096	-82.66640
98	304465	L Wakatomika Creek	10.8	1.66	050400040203	Coshocton	40.26080	-82.04638
99	304432	Mississinewa River	115.57	2.11	051201030102	Darke	40.32490	-84.71891
100	304427	Trib to Sevenmile Creek (RM 18.77)	0.9	1.07	050800020503	Preble	39.66176	-84.62176
101	304476	Paddle Creek	1.6	2.25	050901030104	Lawrence	38.61137	-82.59072
103	304433	Heilman Ditch	1.10	1.34	041000090904	Lucas	41.58581	-83.65554
104	304430	Twin Run	0.81	1.38	050902010902	Brown	39.00291	-83.78447
105	304464	Johnston Run	0.15	2.86	050302010101	Monroe	39.80423	-80.82843
106	304357	Still Fork (Sandy Creek)	15.6	1.67	050400010403	Carroll	40.63399	-80.94224
108	304382	Trib to Rocky Fork (RM 1.85)	0.1	1.37	050600011501	Franklin	40.01817	-82.85023
109	200651	Fleming Falls Creek	1.2	2	050400020201	Richland	40.80046	-82.43778
110	304435	Trib to Tiffin River (RM 49.92)	0.33	1.32	041000060301	Fulton	41.60141	-84.33166
111	304395	Trib to to Olentangy River (RM 22.92)	0.57	1.1	050600011101	Delaware	40.26641	-83.05214
113	R16G53	Tilton Run	0.08	2.8	050400040703	Noble	39.75981	-81.67109
115	304437	Jutte Run	0.2	1.38	051201010103	Mercer	40.41515	-84.80160
116	304477	Trib to Boone Creek (RM 2.3)	0.9	1.17	050800010805	Miami	40.00874	-84.24087

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
117	W01S21	Kimble Creek	1.25	2.77	050901030202	Lawrence	38.75938	-82.62033
118	304362	Trib to Mosquito Creek (RM 23.81)	0.58	1.0	050301030502	Trumbull	41.45589	-80.74617
119	304438	Urie Ditch	2.98	1.8	041000100203	Hancock	41.15268	-83.56820
120	304440	Trib to N. FK. Little Miami River (RM 9.89)	0.07	1.98	050902020102	Clark	39.88499	-83.68586
122	304363	Trib to M. Fk Little Beaver Creek (RM 35.60)	1.14	1.88	050301010402	Mahoning	40.93110	-80.89284
124	V10K53	Cattail Run (Paint Cr)	0.9	2.4	050600031003	Ross	39.332728	-83.09811
127	304393	Trib to Kebler Run(RM 3.68)	0.3	2.6	050600010503	Delaware	40.41738	-83.16237
128	304474	Trib to Paint Creek (RM 26.53)	1.6	1.16	050600030704	Ross	39.21935	-83.21770
129	J01P20	Trib to Somerset Creek (RM 1.84)	0.01	1.4	050302040101	Perry	39.78078	-82.30634
130	304376	Trib to Kokosing River (RM 39.05)	0.21	1.64	050400030202	Knox	40.46208	-82.60855
131	304442	Trib to Maumee River (RM 53.7)	0.47	1.09	041000090203	Henry	41.32054	-84.18581
132	304443	Trib to Brush Creek (RM 1.9)	0.69	2.36	050800011401	Miami	39.96378	-84.37546
133	304473	Davis Creek	1.7	1.53	050302020106	Washington	39.29128	-81.63489
135	304444	Moffitt Ditch	6.4	1.4	041000080503	Hancock	40.98054	-83.82902
137	304459	SF Captina Creek	12.0	2.01	050301060902	Belmont	39.89473	-81.17495
139	304445	Trib to Middle Branch Portage River (RM 3.0)	1.08	1.76	041000100205	Wood	41.32609	-83.54419
141	304446	Sherer Ditch (Trib to Kuebelar Ditch)	026	2.44	041202000300	Erie	41.35882	-82.62683
142	304448	Matthews Creek (Trib to Bear Creek)	1.95	2.7	041000030305	Williams	41.58075	-84.74968
143	304449	Trib to Scioto River (RM 194.65)	0.17	1.1	050600010405	Marion	40.57781	-83.36867
144	304450	Trib to WF Eagle Creek (RM 9.53)	0.2	2.56	050902010701	Brown	38.86172	-83.71960
145	304456	Dunkle Creek	2.5	2.28	050901010203	Vinton	39.3223642	-82.49622
146	304369	Trib to MF Sugar Creek (RM 6.0)	1.43	1.36	050400011102	Wayne	40.66821	-81.68971

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
147	P02S17	Dry Creek	2.74	1.4	041000070703	Pauling	40.99210	-84.56334
150	200616	Trib to Bronson Creek (RM 1.45) dst Hardy Rd	1.02	1.7	041100040601	Ashtabula	41.71047	-80.92128
151	300708	Neals Run	0.1/or 1.0	2.9	050800010306	Logan	40.32625	-83.94065
152	304451	Fagin Run	0.3	2.04	050902011204	Clermont	38.97265	-84.26143
153	304461	Trib to Halfway Run (RM 2.63)	0.1	1.27	050400040902	Washington	39.4408	-81.55478
154	304364	Trib to Conotton Creek	0.15	1.09	50400010803	Carroll	40.49717	-81.25151
155	304428	Trib to E. Br. Mud Run (RM 8.10)	0.32	1.99	041000120501	Huron	41.09040	-82.81700
157	304361	Abram Creek	6.1	1.07	041100010203	Cuyahoga	41.36347	-81.82532
158	304407	Trib to Lost Creek (RM 1.79)	2.0	1.47	041000060601	Defiance	41.34525	-84.60985
159	304429	Trib to Sycamore Creek (RM 23)	2.0	179	041000110902	Crawford	40.93574	-82.94720
160	304478	Trib to Trib to S. Fork Dodson Creek (0.37/0.95/0.38)	1.0	1.38	050902021003	Highland	39.18963	-83.71396
161	304434	Raccoon Run	6.7	1.23	050302040203	Fairfield	39.73079	-82.46692
162	304462	Trib to Wills Creek (16.81)	2.8	1.06	050400050604	Coshocton	40.20193	-81.76256
163	304471	Trib to Mile Creek (RM 8.85)	1.1	1.59	050800010502	Mercer	40.37125	-84.52286
165	303593	Bear Creek	0.05	2.90	050901010708	Lawrence	38.45755	-82.40463
166	304345	Trib to Indian Creek (RM 3.53)	2.05	3.05	041100030201	Ashtabula	41.83986	-80.877438
168	304447	Flat Run	6.45	2.72	050902010904	Highland	39.06812	-83.80076
169	304455	Blair Run	0.3	1.45	050301061208	Monroe	39.81516	-80.82545
170	C04K08	McQueen Run	0.54	2.10	050301011103	Columbiana	40.60250	-80.66937
173	304404	Jamison Creek	4.1	2.02	050400020601	Ashland	40.82912	-82.31026
174	304413	Trib to Bear Creek	1.12	2.31	041000020301	Fulton	41.699028	-84.08533
175	203335	Indigo Creek	4.3	2.6	050600011402	Morrow	40.36459	-82.85459

Probabilistic Number	Station*	Site Name	River Mile	Area (mi^2)	HUC12	County	Latitude	Longitude
176	304398	Trib to Back Run (RM 0.52)	0.1	1.8	050901030603	Scioto	38.909802	-82.903053
178	304365	Trib to Chagrin (17.7)	0.05	1.1	041100030402	Cuyahoga	41.52003	-81.41026
179	Z01P13	Hardin Creek	3.25	2.80	051201010302	Mercer	40.501749	-84.61862
182	304367	Garden Creek	0.7	2.25	041100040303	Trumbull	41.47974	-80.95029
183	304409	Trib to S. Br. Portage River (24.49)	1.8	2.38	041000100203	Hancock	41.11940	-83.49243
184	304389	Trib to Filmore Jackson Ditch	0.45	1.48	050600020105	Madison	39.86678	-83.45792
189	304356	Trib to SW Branch Vermillion (4.62)	0.8	2.25	041000120103	Huron	41.03521	-82.51751
194	304377	Center Run	4.0	1.26	050400030304	Knox	40.42586	-82.45277
199	304441	Trib to Sugar Creek (2.75/1.77)	0.05	1.78	041000070501	Putnam	40.91751	-84.14970
264	304396	Trib to Polk Run (RM 0.7)	1.2	2.16	050902021402	Hamilton	39.267824	-84.29843
272	302965	Honey Run	0.1	3.0	50902010802	Brown	38.89104	-83.84011
282	V10K55	Porter Hollow	0.7	2.19	050600030703	Ross	39.32393	-83.21786

*All locations will be monitored for fish, macroinvertebrates, salamanders, habitat, and chemistry.

Appendix 3 – List of physical/chemical parameters and reporting limits.

Parameter	Method	Reporting Limit
Oxygen Demand		
Chemical Oxygen Demand (COD)	SM 5220D	20 mg/L
Physical Properties		
Alkalinity	USEPA 310.1	5 mg/L
Acidity*	USEPA 305.1	5 mg/L
Hardness	USEPA 200.7	10 mg/L
Dissolved Oxygen (mg/l and % saturation)	Field Meter/Sonde	0 mg/L 0% sat
pH	Field Meter/Sonde	0 s.u.
Conductivity (Lab)	SM 2510B	1 µS/cm
Specific Conductance	Field Meter/Sonde	1 µS/cm
Temperature	Field Meter/Sonde	0 °C
Total Dissolved Solids	SM 2540C	10 mg/L
Total Suspended Solids	SM 2540D	5 mg/L
Nutrients		
Ammonia-N	USEPA 350.1	0.05 mg/L
Dissolved Organic Carbon	SM 5310C	2 mg/L
Nitrate-Nitrite	USEPA 350.1	0.5 mg/L
Nitrite	USEPA 353.2	0.02 mg/L
Total Kjeldahl Nitrogen (TKN)	USEPA 351.2	0.2 mg/L
Total Phosphorus	USEPA 365.4	0.01 mg/L
Orthophosphate, Dissolved (as P)	USEPA 365.4	0.01 mg/L
Total Organic Carbon	SM 5310C	2 mg/L
Anions		
Chloride	USEPA 325.1	5 mg/L
Sulfate	USEPA 375.2	10 mg/L
Cations		
Aluminum	USEPA 200.7	200 µg/L
Barium	USEPA 200.7	15 µg/L
Calcium	USEPA 200.7	2 mg/L
Iron	USEPA 200.7	50 µg/L
Magnesium	USEPA 200.7	1 mg/L
Manganese	USEPA 200.7	10 µg/L
Potassium	USEPA 200.7	2 mg/L

Parameter	Method	Reporting Limit
Sodium	USEPA 200.7	5 mg/L
Strontium	USEPA 200.7	30 µg/L
Metals		
Zinc	USEPA 200.7	10 µg/L
Arsenic	USEPA 200.8/SM 3113B	2 µg/L
Cadmium	USEPA 200.8/SM 3113B	0.2 µg/L
Chromium	USEPA 200.8	2 µg/L
Copper	USEPA 200.8	2 µg/L
Lead	USEPA 200.8/SM 3113B	2 µg/L
Nickel	USEPA 200.8	2 µg/L
Selenium	USEPA 200.8/SM 3113B	2 µg/L
Pesticides		
Neonicotinoid	USEPA 1699/1694	
*Acidity will be analyzed in samples collected from the WAP ecoregion		

Appendix 4 – Safety Contacts and Hospital Locations

Safety:	
County Wildlife Officers:	
Central District Office	
Delaware (614) 902-4221 Fayette (614) 565-2538 Franklin (614) 902-4212 Highland (937) 205-3020	Knox (614) 400-0731 Licking (614) 400-0744 Madison (614) 309-3465 Pickaway (614) 203-3406
Northeast District Office	
Ashtabula (330) 802-9171 Columbiana (330) 245-3039 Cuyahoga (330) 245-3033 Holmes (330) 245-3045 Lake (330) 245-3034 Lorain (330) 802-9172	Mahoning (330) 245-3038 Portage (330) 245-3040 Stark (330) 245-3041 Summit (330) 245-3042 Trumbull (330) 245-3037
Northwest District Office	
Defiance (419) 429-8381 Erie (419) 429-8382 Fulton (419) 429-8383 Hancock (419) 429-8384 Lorain (330) 802-9172 Lucas (419) 429-8388	Mercer (419) 236-8787 Paulding (419) 429-8390 Putnam (419) 429-8391 Sandusky (419) 429-8393 Seneca (419) 429-8394 Williams (419) 429-8396 Wyandot (419) 429-8398
Southeast District Office	
Athens (740) 541-8266 Belmont (614) 563-1680 Coshocton (740) 502-4586 Gallia (614) 563-1843 Guernsey (614) 563-2355 Hocking (614) 257-7792	Jackson (740) 589-9986 Jefferson (330) 245-3050 Morgan (614) 563-5338 Ross (614) 565-9754 Tuscarawas (614) 230-6347 Washington (740) 412-9184
Southwest District Office	
Brown (513) 646-4014 Clark (937) 206-9321 Clermont (513) 673-1566 Greene (937) 545-6327	Hamilton (513) 446-7028 Miami (937) 470-1917 Montgomery (937) 545-6768

County Sheriff:	
Central District Office	
Delaware (740)-833-2810 Fayette (740)-335-6170 Franklin (614)-525-3360 Highland (937)-393-1421	Knox (740)-397-3333 Licking (740)-670-5555 Madison (740)-852-1332 Pickaway (740)-472-6033
Northeast District Office	
Ashtabula (440)-576-0055 Columbiana (330)-424-7255 Cuyahoga (216)-443-6000 Holmes (330)-674-1936 Lake (440)-350-5517 Lorain (440)-329-3702	Mahoning (330)-480-5030 Portage (330)-297-3682 Stark (330)-430-3800 Summit (330)-643-2122 Trumbull (330)-675-2508
Northwest District Office	
Defiance (419) 784-1155 Erie (419) 625-7951 Fulton (419) 335-4010 Hancock (419) 424-7097 Lorain (440) 329-3702 Lucas (419) 213-4941	Mercer (419) 586-7724 Paulding (419) 399-3791 Putnam (419) 523-3208 Sandusky (419) 332-2613 Seneca (419) 447-3456 Williams (419) 636-3151 Wyandot (419) 294-2362
Southeast District Office	
Athens (740)-593-6633 Belmont (740)-695-7933 Coshocton (740)-622-2411 Gallia (740)-446-1205 Guernsey (740)-439-4455 Hocking (740)-385-2131	Jackson (740)-286-6464 Jefferson (740)-283-8600 Morgan (740)-962-4044 Ross (740)-773-1186 Tuscarawas (330)-339-2000 Washington (740)-373-6623
Southwest District Office	
Brown (937)-378-4435 Clark (937)-328-2560 Clermont (513)-732-7500 Greene (937)-562-4803	Hamilton (513)-946-6400 Miami (937)-332-6835 Montgomery (937)-225-4192
Ohio Emergency Management Agency	
Central District Office	
Delaware (740)-833-2180 Fayette (740)-335-8264 Franklin (614)-794-0213 Highland (937)-393-5880	Knox (740)-393-6772 Licking (740)-522-9031 Madison (740)-852-4200 Pickaway (740)-477-1165

Northeast District Office	
Ashtabula (440)-576-9148 Columbiana (330)-424-9725 Cuyahoga (216)-443-5683 Holmes (330)-674-0989 Lake (440)-350-5499 Lorain (440)-329-5117	Mahoning (330)-740-2200 Portage (330)-297-3607 Stark (330)-451-3900 Summit (330)-643-2558 Trumbull (330)-675-6601
Northwest District Office	
Defiance (419) 782-1130 Erie (419) 627-7617 Fulton (419) 337-9207 Hancock (419) 424-7092 Lorain (440) 329-5117 Lucas (419) 213-6531	Mercer (419) 586-6468 Paulding (419) 399-3500 Putnam (419) 538-7315 Sandusky (419) 334-8933 Seneca (419) 447-0266 Williams (419) 633-5002 Wyandot (419) 294-4916
Southeast District Office	
Athens (740)-594-2261 Belmont (740)-695-5984 Coshocton (740)-622-1984 Gallia (740)-441-2036 Guernsey (740)-432-9292 Hocking (740) 270-9018	Jackson (740)-286-5630 Jefferson (740)-264-4646 Morgan (740)-962-3900 Ross (740)-773-1700 Tuscarawas (330)-308-6671 Washington (740)-373-5613
Southwest District Office	
Brown (513)-748-7788 Clark (937) -521-2176 Clermont (513)-732-7661 Greene (937)-562-5994	Hamilton (513)-263-8200 Miami (937)-332-8560 Montgomery (937)-225-4885
State Highway Patrol:	
Central District Office	
Delaware Patrol Post 1500 Columbus Pike Delaware, OH (740) 548-6011	Granville Patrol Post 3855 Outville Road SW Granville, OH (740) 927-0065
Wilmington Patrol Post 950 Rombach Avenue Wilmington, OH (937) 382-2551	West Jefferson Patrol Post 1485 West Main Street West Jefferson, OH (614) 879-7626
Columbus District Headquarters 2855 West Dublin-Granville Road Columbus, OH (614) 799-9241	Circleville Patrol Post 16395 US Route 23 Ashville, OH (740) 983-2538

Wilmington Patrol Post 950 Rombach Avenue Wilmington, OH (937) 382-2551	
Northeast District Office	
Ashtabula Patrol Post 4860 North Ridge West Ashtabula, OH (440) 969-1155	Canfield Patrol Post 500 South Broad Street Canfield, OH (330) 533-6866
Lisbon Patrol Post 9423 State Route 45 Lisbon, OH (330) 424-7783	Hiram Patrol Post P.O. Box 149 Ravenna, OH (330) 984-0532
Brookpark Facility Patrol Post 5225 West 140th Street Brookpark, OH (216) 265-1677	Canton Patrol Post 4710 Shuffel Road North Canton, OH (330) 433-6200
Chardon Patrol Post 530 Center Street Chardon, OH (440) 286-6612	Akron Patrol Post 108 Fir Hill Street Akron, Ohio (330) 535-2783
Elyria Patrol Post 38000 Cletus Drive North Ridgeville, OH (440) 365-5045	Warren Patrol Post 3424 State Route 422 Southington, OH (330) 898-2311
Northwest District Office	
Bowling Green Post 12891 Middleton Pike Bowling Green, OH (419) 352-2481	Defiance Post 2350 Baltimore Street Defiance, OH (419) 636-7711
Marion Post 2284 Marion-Upper Sandusky Road Marion, OH (740) 383-2181	Sandusky Post 511 Fremont Avenue Sandusky, OH (419) 625-6565
Southeast District Office	
Athens Patrol Post 13600 Della Drive Athens, OH (740) 593-6611	Jackson Patrol Post 10179 Chillicothe Pike Jackson, OH (740) 286-4141

St. Clairsville Patrol Post 51400 National Road St. Clairsville, OH (740) 695-0915	Steubenville Patrol Post 1377 Cadiz Road Wintersville, OH (740) 264-1641
Zanesville Patrol Post 3760 East Pike Zanesville, OH (740) 453-0541	Marietta Patrol Post 27761 State Route 7 Marietta, OH (740) 374-6616
Gallipolis Patrol Post 396 Jackson Pike Gallipolis, OH (740) 446-2433	Chillicothe Patrol Post 201 Hospital Road Chillicothe, OH (740) 775-7770
Cambridge Patrol Post 7051 Glenn Highway Road Cambridge, OH (740) 439-1388	New Philadelphia Patrol Post 2454 East High Avenue New Philadelphia, OH (330) 339-1103
Athens Patrol Post 13600 Della Drive Athens, OH (740) 593-6611	Marietta Patrol Post 27761 State Route 7 Marietta, OH (740) 374-6616
Southwest District Office	
Georgetown Patrol Post 9240 US 68 Georgetown, OH (937) 378-6191	Springfield Patrol Post 4201 Gateway Blvd. Springfield, OH (937) 323-9781
Batavia Patrol Post 1000 Hospital Drive Batavia, OH (513) 732-1510	Xenia Patrol Post 517 Union Road Xenia, OH (937) 372-7671
Cincinnati Metro Post 5791 Creek Road, Cincinnati, OH (513) 777-0387	Piqua Patrol Post 401 West US Route 36 Piqua, OH (937) 773-1131
Dayton Patrol Post 400 Smith Drive Clayton, OH (937) 832-4794	

Hospitals:	
Central District Office	
OhioHealth Grady Memorial Hospital 561 W. Central Avenue Delaware, OH (740) 615-1000	Knox Community Hospital 1330 Coshocton Avenue Mt. Vernon, OH (740) 393-9000
Adena Fayette Medical Center 1430 Columbus Avenue Washington Court House, OH (740) 335-1210	Licking Memorial Hospital 1320 W. Main Street Newark, OH (220) 564-4000
OhioHealth Riverside Methodist Hospital 3535 Olentangy River Road Columbus, OH (614) 566-5000	Madison Health 210 N. Main Street London, OH (740) 845-7000
Highland District Hospital 1275 N. High Street Hillsboro, OH 937-393-6100	OhioHealth Berger Hospital 600 N. Pickaway Street Circleville, OH (740) 474-2126
Northeast District Office	
Ashtabula County Medical Center 2420 Lake Avenue Ashtabula, OH (440) 997-2262	Mercy Health St. Elizabeth Youngstown Hospital 1044 Belmont Avenue Youngstown, OH (330) 746-7211
Cleveland Clinic Lutheran Hospital 1730 W. 25th Street Cleveland, OH (216) 696-4300	Aultman Hospital 2600 6th Street SW Canton, OH (330) 452-9911
Pomerene Hospital 981 Wooster Road Millersburg, OH (330) 674-1015	Summa Health System – Akron Campus 141 N. Forge Street Akron, OH (330) 375-3000
Lake Health West Medical Center 36000 Euclid Avenue Willoughby, OH (440) 953-9600	Trumbull Regional Medical Center 1350 E. Market Street Warren, OH (330) 841-9011
University Hospital 9480 Rosemont Dr Streetsboro, OH 44241 (330) 626-5566	East Liverpool City Hospital 39901 Osbourne Rd Salineville, OH 43945 (330) 385-7200

Mercy Health 3700 Kolbe Rd Lorain, OH 44053 (440) 960-4000	
Northwest District Office	
ProMedica Toledo Hospital 2142 N Cove Blvd Toledo, OH (419) 291-4000	Bryan Hospital 433 W High St Bryan, OH (419) 636-1131
ProMedica Defiance Regional Hospital 1200 Ralston Ave Defiance, OH (419) 783-6955	Mercer County Community Hospital 800 W Main St Coldwater, OH (419) 678-2341
Blanchard Valley Hospital 1900 S Main St Findlay, OH (419) 423-4500	The Bellevue Hospital 1400 W Main St Bellevue, OH (419) 483-4040
Southeast District Office	
Ohio Health O'Bleness Hospital 55 Hospital Drive Athens, OH (740) 593-5551	Genesis Hospital 2951 Maple Avenue Zanesville, OH (740) 454-5880
Coshocton Regional Medical Center 1460 Orange Street Coshocton, OH (740) 622-6411	Adena Regional Medical Center 272 Hospital Road Chillicothe, OH (740) 779-7500
Holzer Emergency Medical Center 100 Jackson Pike Gallipolis, OH (855) 446-5937	WVU Medicine Barnesville Hospital 639 W Main St Barnsville, OH 43713 (740) 425-3941
Southeastern Ohio Regional Medical Center 1341 Clark Street Cambridge, OH (740) 439-8000	Marietta Memorial Hospital 401 Matthew Street Marietta, OH (740) 374-1400
Hocking Valley Community Hospital 601 State Route 664 N Logan, OH (740) 380-8000	Coshocton Regional Medical Center Arrowhead Clinic 6307 E State Rd, Newcomerstown, OH (740)498-5515

Southwest District Office	
Brown County General Hospital 425 Home St. Georgetown, Ohio (937)378-7500	TriHealth Bethesda North Hospital 10500 Montgomery Road Cincinnati, OH (513) 865-1111
Springfield Regional Medical Center 100 Medical Center Drive Springfield, OH (937) 523-1000	Upper Valley Medical Center 3130 N. County Road 25A Troy, OH (937) 440-4000
Mercy Health Clermont Hospital 3000 Hospital Drive Batavia, OH (513) 732-8200	Miami Valley Hospital 1 Wyoming Street Dayton, OH (937) 208-8000
Greene Memorial Hospital 1141 N. Monroe Drive Xenia, OH (937) 352-2000	

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