Quality Assurance Project Plan (QAPP) for Public Health Nuisance Sampling Cedar Creek and Crane Creek, Lucas and Ottawa Counties, Ohio - 2021

Ohio EPA
Division of Surface Water
April 2021

Quality Assurance Project Plan (QAPP) for Public Health Nuisance Sampling Cedar Creek and Crane Creek, Lucas and Ottawa Counties, Ohio - 2021

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Prepared by:

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Director, Ohio Environmental Protection Agency

A1 – Title and Approval

Quality Assurance Project Plan for Public Health Nuisance Sampling Cedar Creek and Crane Creek, Lucas and Ottawa Counties, Ohio – 2021.

Brian W Hall _____ Date: 5/7/2021
Brian Hall, Assistant Chief

_____ Date: 05/05/2021
Mari Piekutowski, AMS Manager

Audrey Rush for QA position _____ Date: 05/06/2021
_____, DSW Quality Assurance Coordinator (vacant)

John Weaver _____ Date: 05/06/2021
John Weaver, NWDO District Water Quality Supervisor

Thomas Poffenbarger _____ Date: 5/6/21
Tom Poffenbarger, NWDO District Water Quality Engineer

A2 – Table of Contents

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A3 – Distribution List

This QAPP will be distributed to the following division management and staff and saved on the Division of Surface Water (DSW) collaboration site.

Table 1 — Distribution List.

Name/Title	Contact Email/Phone	
DSW Central Office		
Tiffani Kavalec, Environmental Administrator	tiffani.kavalec@epa.ohio.gov	(614) 644-3538
Brian Hall, Asst. Environmental Administrator	brian.hall@epa.ohio.gov	(614) 644-2033
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DSW Northwest District Office		
John Weaver, Environmental Supervisor (Project Leader)	john.weaver@epa.ohio.gov	(419) 373-3023
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DES		
Jennifer Kraft, Environmental Manager	jennifer.kraft@epa.ohio.gov	(614) 644-3020
Steve Roberts, Environmental Supervisor	steven.roberts@epa.ohio.gov	(614) 644-4225
USGS		
Christopher Kephart, Hydrologist	ckephart@usgs.gov	(614) 430-7780

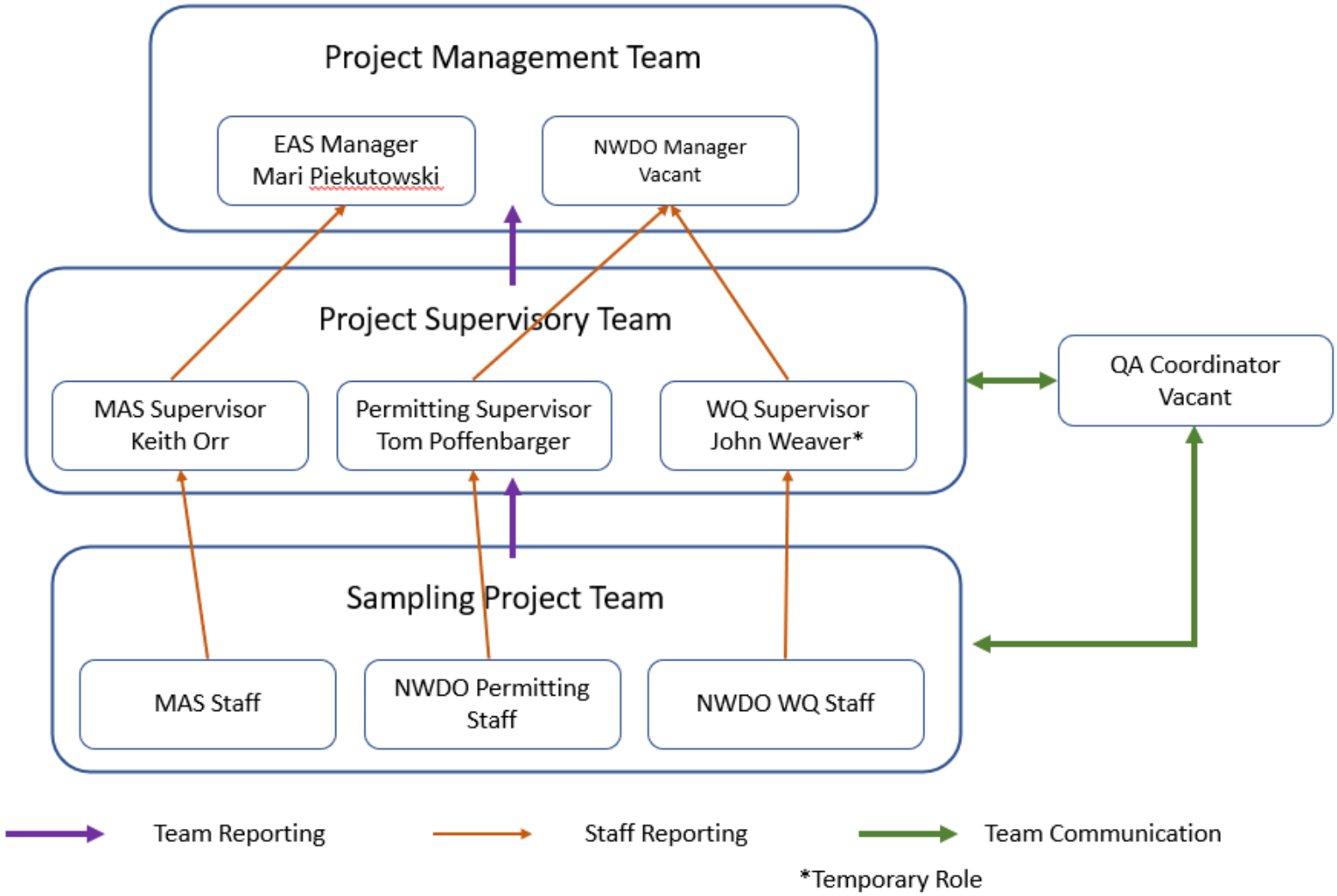
A4 – Project Organization and Communication

Table 2 — Roles and Responsibilities.

Individual(s) Assigned:	Responsible for:	Authorized to:
Division of Surface Water		
Tiffani Kavalec/Brian Hall DSW Chief/Assistant Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Mari Piekutowski Assessment & Modeling Section Manager	Overall management of monitoring section.	Assign staff; approve plans; edit reports.
Audrey Rush Standards and Tech Support Section Manager	Quality management (QAPPs, SOPs); staff training; water quality standard rules.	Approve plans and edit reports.
(vacant) Standards and Tech Support QA Officer	DSWs quality management program.	Develop and implement field QA/QC guidelines. Track field QA/QC and staff training. Review and approve QAPP.
District Section Managers District Surface Water	Implementing division goals at the district level.	Review documents and reports; suggest changes and edits; obtain approvals and signatures.

Individual(s) Assigned:	Responsible for:	Authorized to:
District Compliance Supervisors	NPDES permit related issues.	Obtain wastewater and storm water permit information needed for planning and reporting. Review documents and reports; suggest changes and edits; obtain approvals and signatures.
Northwest District Water Quality Unit Supervisor	Supporting water quality field crews with supplies, equipment and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Northwest District Water Quality Unit	Water data collection, validation and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data.
Keith Orr Modeling & Assessment Unit Supervisor	Supporting modeling field crews with supplies, equipment and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Modeling & Assessment Unit Staff	Dissolved oxygen surveys, stream flow measurements and chemistry sampling.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Sarah Becker Ecological Assessment Unit Lead Worker	Track project progress, managing data and compiling information.	Help plan study. Provide landowner information for access consent. Upload fish, bug and chemistry data into EA3. Review and comment on reports.
Division of Environmental Services		
Jennifer Kraft Program Administrator	Overall administration of lab activities.	Help solve lab information management system problems. Develop analytical methods and SOPs.
Steve Roberts QA Officer	DES quality management program.	Oversee data completeness, validation and delivery.
USGS		
Christopher Kephart Hydrologist, Microbiology	Microbial Source Tracking analysis and assistance with results interpretation	Oversee and complete sample analysis for MST markers. Provide assistance with interpreting MST results including data analysis and presentation and technical writing.

Figure 1 — Organization Chart



A5 – Background

In 2016, Ohio EPA conducted a nuisance investigation on Cedar Creek and Crane Creek in Lucas and Ottawa Counties, Ohio. Nuisance conditions were verified on Cedar Creek downstream of Wildacre Road in Curtice, Ohio. As a part of negotiated Director's Final Findings and Orders, Ohio EPA has agreed to further sample Cedar and Crane Creeks.

In 2017, Ohio EPA conducted a water quality survey that included Cedar and Crane Creeks. This survey collected data on chemistry, biology, sediment, and bacteria in the watershed. Evaluations of these streams included sampling two locations upstream of the sites where the 2016 nuisance investigation occurred. Sampling downstream of the nuisance investigation was limited to biological sampling only due to the presence of the lacustuary zone.

Three separate issues will be explored as a part of this sampling. These are:

(1) continued presence or absence of a public health nuisance and evaluation of the source of the contaminants.

(2) attainment or non-attainment of recreational uses.

(3) nutrient contributions to the receiving waters from HSTS systems.

It is important to note, failure to document a nuisance at this time does not supersede the results of the prior investigation, as the criteria for a nuisance were met at that time. It is also important to understand that the attainment status of any given sampling location is determined independently from the evaluation of nuisance conditions at another location. The presence of a nuisance at any given location would result in a failure to meet the recreational use designation at that location. A nuisance may be found upstream or downstream of a listed sampling location. Such a nuisance may not impact the recreational use attainment of a given sampling location but may result in Ohio EPA pursuing abatement of that nuisance. It is feasible that more than one nuisance is discovered as a part of this sampling effort. A nuisance condition on a waterbody that is in full recreational use attainment is still subject to abatement.

Ohio EPA has developed and implemented COVID-19 Standard Operating Procedures (SOPs) for water quality sampling. These SOPS are available upon request.

A6 – Project Description

The study area encompasses Cedar Creek from river mile 9.59 (Billman Road) to river mile 5.56 (Decant Road) and Crane Creek from river mile 10.98 (Reiman Road) to river mile 7.45 (Opfer-Lentz Road). Individual sites selected are listed in Appendix 2. Sample parameters are detailed in Appendix 3.

A7 – Data Quality Objectives

The data collected during this project fulfills multiple objectives:

- Evaluate nuisance conditions and sources of contaminants across the study area.
- Evaluate recreational use attainment at the sample locations listed in Appendix 2.
- Explore influence of HSTS on nutrient concentrations and loads

Evaluation of Public Health Nuisance

Where a public health nuisance exists, the Ohio EPA can require the abatement of these nuisance conditions under the authority of Ohio Revised Code (ORC) 6117.34 for an unincorporated community and 6111.04 for an incorporated community. In Ohio Administrative Code (OAC) 3745-1-04(F) and (G), a public nuisance is defined as:

> *The following general water quality criteria shall apply to all surface waters of the state including mixing zones. To every extent practical and possible as determined by the director, these waters shall be:*
>
> *(F) Free from public health nuisances associated with raw or poorly treated sewage reaching surface waters of the state. A public heath nuisance shall be deemed to exist when the conditions set forth in paragraph (F)(1) of this rule are demonstrated.*
>
> *(1) An inspection conducted by, or under the supervision of, Ohio EPA or a sanitarian registered under Chapter 4736. of the Revised Code documents both of the following:*
>
> *(a) Odor, color or other visual manifestations of raw or poorly treated sewage.*
>
> *(b) Water samples exceed one thousand thirty E. coli counts per one hundred milliliters in two or more samples when five or fewer samples are collected, or in more than twenty per cent of the samples when more than five samples are taken.*
>
> *(2) Paragraph (F)(1) of this rule may be used by the appropriate authorities to document the existence of unsanitary conditions as described in section 6117.34 of the Revised Code, but does not preclude the use of other evidence of unsanitary conditions for the purposes described in section 6117.34 of the Revised Code.*
>
> *(G) For the purposes of applying paragraph (F) of this rule the collection of water samples shall adhere to all of the following specifications:*
>
> *(1) The samples shall be collected when flow is representative of steady state dry weather conditions, i.e., base flow or delayed flow.*
>
> *(2) The samples shall be collected at least two hours apart.*
>
> *(3) The samples shall be collected over a time period not to exceed thirty days.*

Any samples collected more than thirty days apart shall not be used collectively to determine a nuisance. It is feasible that sets of samples collected across adjacent or overlapping thirty-day windows will provide inconsistent results. The presence of a nuisance at any time would meet the rule requirements and would result in a determination of nuisance conditions. Evaluation of nuisance conditions will occur only when an appropriate number of samples that meet the rule requirements are collected. It is possible this project will not allow for further evaluation of nuisance conditions.

In addition to the evaluation of nuisance conditions via the presence of *E. coli*, water samples will be shipped to the USGS Ohio Water Microbiology Laboratory for evaluation of potential sources of fecal contamination through analysis of host-associated microbial source tracking (MST) markers. These data

will be used to help evaluate the source(s) of the nuisance, including the differentiation of human from animal sources.

Evaluation of Recreation Use Attainment

Escherichia coli (E. coli) is used as an indicator to determine attainment/non-attainment of recreational uses as codified in OAC 3745-1-07. Water quality for primary contact recreation must meet a 90-day geometric mean (126 colony counts per 100 ml) and a statistical threshold not to be exceeded more than ten percent of the time (410 colony counts per 100 ml).

A minimum of five samples will be collected within a 90-day window at each site listed in Appendix 2. This data will be used to determine recreational use attainment.

Nutrient Evaluation

Ohio EPA established the presence of a nuisance condition on Cedar Creek in 2016. While chemical sampling of the creeks was done in 2017, that sampling occurred upstream of the nuisance sites. This project will allow for bracketed sampling of selected nutrients along both creeks. This data will allow Ohio EPA to explore nutrient load sources along the length of the study area.

Nutrient parameters will be collected 5 to 6 times over the sampling index period (June 15-September 30) at all sites; and 10 to 12 times at modeling focus sites. Parameters collected during sampling include the following: ammonia (NH3), total kjeldahl nitrogen (TKN), nitrate+ nitrite (NO3+NO2), nitrite (NO2), total phosphorus (TP), ortho-phosphorus (orthoP), pH, conductivity, temperature, dissolved oxygen (DO), biological oxygen demand 5 (BOD5). The BOD5 parameter will only be collected when feasible for the Division of Environmental Services to accept.

A8 – Special Training/Certification

Staff involved in environmental monitoring must complete training specific to their area of expertise. Annual refresher training is mandatory, and all trainings are internally documented. Supervisors should also conduct routine field audits.

A9 – Documents and Records

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

Examples of documents posted to this location include:

Pre-sampling documents:

- Property access forms
- Draft and final QAPP versions

Project documents:

- Data files
- Project photos will be moved to and stored in the Lynx® Photo Manager®. All files will be retained by Ohio EPA in accordance with established retention schedules.

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

Samples will be delivered to Ohio EPA DES or an approved contract laboratory. The original chain of custody form is delivered along with the samples. An electronic copy of the form is kept by sampling staff. Sample runs are released from Sample Master® and subsequently uploaded to DSW's Ecological Assessment and Analysis Application (EA3). The sample collector reviews lab sheets for completeness and accuracy, validates field quality control (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. MST samples will be shipped or delivered to the USGS Ohio Water Microbiology Laboratory for receipt at the OWML within 24 hours of sample collection. An analytical services request form for each sample will be delivered with the samples. Once reviewed, sample results will be uploaded to the USGS National Water Information System (NWIS) at which point will be publicly available via web interface at https://waterdata.usgs.gov/oh/nwis/qw/.

Section B – Data Generation and Acquisition

B1 – Sampling Process and Design

Sampling will occur across stream reaches meant to encompass areas from upstream to downstream of the areas of influence from the unsewered communities. In addition to the listed sampling locations, additional samples may be collected at pipes discharging to the creeks to evaluate the presence of *E. coli*.

A summary of the planned sampling effort is shown in Appendix 1. A detailed list of sampling sites and the type of sampling at each is shown in Appendix 2.

B2 – Sampling Methods

Bacteria

Water samples will be collected into appropriate containers, cooled to 4°C, and transported to a contract lab within six hours of sample collection. All samples will be analyzed for *E. coli* bacteria using U.S. EPA-approved methods.

Surface Water Chemistry

Field measurements of dissolved oxygen, pH, temperature and conductivity will be collected using YSI® water quality meters at the same time and location that all grab samples for surface water chemistry are collected. Surface water grab samples will be collected and preserved using appropriate methods as outlined in the *Surface Water Field Sampling Manual 2019 (to be replaced by 2021 Manual, expected publication date April 2021) (Ohio EPA 2019)*. Samples are delivered to Ohio EPA - DES for analyses within the applicable holding time.

MST Markers

Samples will be collected at all 12 sites during 10 sampling events made by Ohio EPA staff. Samples will be collected in bleach-sterilized 1-L bottles and stored on ice and in the dark. Samples should be sealed in bags and separated from bagged ice to prevent ice melt from potentially contaminating samples. Samples must be received by the OWML within 24 hours of sample collection. For 3 of the 10 sampling events, samples will be analyzed to determine concentrations of MST markers for human, waterfowl (gulls, Canada geese, etc.), canine, ruminant, cattle, pig, horse, and poultry fecal sources. These 3 sampling events should include at least 1 sampling event during dry weather and another event during wet weather. For the remaining 7 sampling events, samples will be analyzed to determine concentrations of MST markers for human and any other sources determined to be significant based on results from the 3 events analyzed for all sources.

Stream Discharge (Flow) Measurements

At modeling assessment sites, a streamflow stage to discharge relationship curve will be developed. The district office will measure stage relationships at each of these sites upon every site visit. Modelers will measure stream flows at various stages. Streamflow methods carried out will adhere to the Surface Water Field Sampling Manual.

At some of these modeling assessment sites a stilling well with a level logger will be installed in order to better characterize the streamflow. This will occur only at sites where the ability to install a stilling well is within the public right-of-way. The determination of site appropriateness will occur after a field reconnaissance trip to the study area. Stilling well and level logger deployments will follow standard methods used by the DSW modeling unit.

B3 – Sample Handling and Custody

Sample Master® software is used by DES to manage lab information. A guidance manual for use of the software is in Appendix IV of the Surface Water Field Manual (2019b). 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 available upon request.

B5 – Quality Control

Surface Water Chemistry

Ten percent of the total water samples will be submitted to the lab 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 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 for Water Quality Parameters and Flows* (2019b). The laboratory will validate data according to the requirements defined in the applicable analytical method (see Appendix 4). Field instruments will be calibrated according to manufacturer guidelines. Field instruments utilizing electrochemical sensors must be calibrated daily, and dissolved oxygen caps for membrane style probes must be replaced every two weeks to ensure the quality measurements.

MST Markers

All analyses performed in the OWML will follow quality assurance and quality control guidelines as described in the standard operating procedures in Francy and others (2017).

The following field quality-control samples and procedures will be included in this study. Additional laboratory measures of quality control will be included at various steps in the MST analytical process.

- Four field sequential replicate samples will be collected and analyzed to quantify variability from the sampling and analytical process.
- Two field blank (sterile buffered water) will be collected on site and analyzed as a measure of contamination throughout the sampling and analytical process
- Up to eight known-source samples will be collected throughout the watershed and analyzed to verify the performance of the MST markers in this area. It is anticipated that representative animals from some of the sources to be analyzed will not be present or available in the watershed for collection of known-source samples.

Stream Discharge (Flow) Measurements

Quality assurance methods are carried out during and after streamflow measurements. These are documented in the Surface Water Field Sampling Manual for Water Quality Parameters and Flows.B6 – Instrument/Equipment Testing, Inspection and Maintenance

All instruments/equipment will be inspected prior to each use. All field meters are serviced annually to verify that 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 Appendix II of the *Surface Water Field Sampling Manual for Water Quality Parameters and Flows*. Other equipment used will follow specifications provided in the methods cited.

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. Containers used for MST marker sampling will be provided by USGS. For water samples, bleach-sterilized 1-liter bottles should be sealed until use for sample collection. For known-source samples, USGS will provide a kit of necessary supplies for collection and shipment.

B9 – Data Acquisition

This project consists solely of field sampling. Only samples collected by Ohio EPA will be used in data summaries. Data collected by entities that are not Level 3 credible data certified collectors are not valid for making determinations of impairment. (OAC) 3745-1-04(F) lists parties authorized to evaluate nuisance conditions.

B10 – Data Management

The data management process is shared by the Division of Surface Water (DSW) and Division of Environmental Services (DES). DES uses Sample Master® software to manage lab information and DSW uses the Ecological Assessment and Analysis Application (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-character station ID to each sampling location and to create a project name to associate locations so data can subsequently be exported and assessed in groups. See Appendix IV, Section B of the Surface Water Field Manual for guidelines.

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.

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 in IR reports. All agency files are ultimately backed up and housed in the State of Ohio Computer Center (SOCC).

Level logger and streamflow data will be maintained on network drives accessible to all DSW staff.

All data from analyses at the USGS OWML will be stored in the USGS National Water Information System (NWIS) database. The data will be disseminated via the National Water Information System: Web Interface at ***https://waterdata.usgs.gov/oh/nwis/qw/***.

The project leader will maintain the project file in a dedicated folder on SharePoint. The goal or objective is to have a complete record of all decisions about modifications of data collection, validation or interpretation between the QAPP signoff and project report completion. To achieve this, the project 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 Lynx photo management system.

Section C – Assessment and Oversight of Data Collection

C1 – Assessment and Response Actions

C1.1 – 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.

C1.2 - 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 lab and are common enough to the process, to not necessitate a formal response.

- Laboratory personnel are aware that response may be necessary. Many of these will result in changes to the analytical reporting via data qualifiers and comments, for more information see Appendix IV of the field 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
- 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 to the quarterly reports. Lab corrective actions will follow regular laboratory procedures and SOPs. Any lab corrective action with the potential to affect data quality will be conveyed to the study team by the laboratory.

C1.3 - 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.

C1.4 - 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.

C2 – Reports to Management

The project leader 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.

The results and findings of the project sampling will be used to evaluate the presence or absence of nuisance conditions, evaluate if stream sites meet recreational use goals, and to characterize nutrient concentrations in the stream.

District staff will compile data from the sampling events, including chemistry parameters and e. coli data. Data tables will be provided to management.

The modeling staff will analyze the nutrient sources and loads throughout the study area. This will include calculations of existing conditions and scenarios if HSTS mitigation actions take place. This information will be summarized in a report at the completion of this project.

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 lab. 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 lab (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 project 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.

Upon completion of the MST marker analyses at the OWML, the analyst enters final results into the electronic results spreadsheet. A second analyst checks all calculations and data entry of the analyst performing the work. The results are entered into the OWML Laboratory Information Management System (LIMS).

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.

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. 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 recently clarified DSW procedures available in Section I of the *Surface Water Field Sampling Manual for Water Quality Parameters and Flows*. 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 (defined below) 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 D of the *Surface Water Field Sampling Manual for Water Quality Parameters and Flows*.

D3 – Reconciliation with Data Quality Objectives

Significant, persistent, or unresolved issues will be brought to the attention of the project study team, division QC personnel 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 WQ Portal, so that future users of the sampling data are aware of any data quality issues or limitations.

Changes to sampling locations may be required due to field observations. These changes will be immediately communicated to the sampling team and management via email. Amendments to this QAPP will be made to reflect these changes prior to project completion.

Appendix 1 – Summary of Sampling Effort

Type of Sample	# of sites	# of passes	Total #*
Bacteria			
E. coli cultures	12	6	72
E. coli cultures (w/ Modeling runs)	12	4	48
Water Quality			
Water Chemistry (ie Nutrients) (C) (district only)	6	6	36
Water Chemistry (ie Nutrients) (C) (district and modeling)	6	10+	60+
Modeling (M)	6	10+	60+
Microbial Source Tracking			
MST Markers (T)	12	10	120

*totals do not include QA/QC samples

Appendix 2 – Streams, sampling locations and sampling types.

Station	Location*	Ecoregion/ALU	River Mile	Drain (mi^2)	Latitude	Longitude	District	District Sampling	Modeling Sampling
Cedar Creek									
S03S44	Billman Road	Huron/Erie Lake Plains	9.55	41.1	41.61	-83.40	NWDO	B, C, T	B, T
S03S36	Rieman Road	Huron/Erie Lake Plains	8.48	42.3	41.62	-83.37	NWDO	B, C, T	B, T, C, M
S03G22	Wildacre Road	Huron/Erie Lake Plains	7.90	42.9	41.62	-83.367	NWDO	B, C, T	B, T
S03S35	Curtice East & West Road	Huron/Erie Lake Plains	7.65	43.0	41.62	-83.363	NWDO	B, C, T	B, T
S03S58	Cousino Road	Huron/Erie Lake Plains	6.65	43.4	41.62	-83.35	NWDO	B, C, T	B, T, C, M
S03S43	Decant Road	Huron/Erie Lake Plains	5.56	44.1	41.63	-83.33	NWDO	B, C, T	B, T
Crane Creek									
S03S71	Reiman Road (ASL: SR 579 bridge)	Huron/Erie Lake Plains	10.98	30.0	41.60	-83.38	NWDO	B, C, T	B, T, C, M
S03G20	Genoa-Clay Center Road	Huron/Erie Lake Plains	9.91	32.0	41.61	-83.36	NWDO	B, C, T	B, T
S03G21	Martin-Williston Road	Huron/Erie Lake Plains	8.83	34.0	41.61	-83.34	NWDO	B, C, T	B, T, C, M
TBD	Martin-Williston road ditch effluent	Huron/Erie Lake Plains	0.01	-	41.61	-83.34	NWDO	B, C, T	B, T, C, M
S03G07	Curtice Road	Huron/Erie Lake Plains	8.24	35.0	41.62	-83.33	NWDO	B, C, T	B, T, C, M
S03S54	Opfer-Lentz Road	Huron/Erie Lake Plains	7.45	36.0	41.62	-83.32	NWDO	B, C, T	B, T

* Sites may be slightly adjusted due to conditions observed in the field.

Acronym Key – Sampling Types	
B	*E. coli* bacteria
C	Water Chemistry
M	Modeling/stream flow
T	MST Markers

Appendix 3 – List of physical/chemical parameters

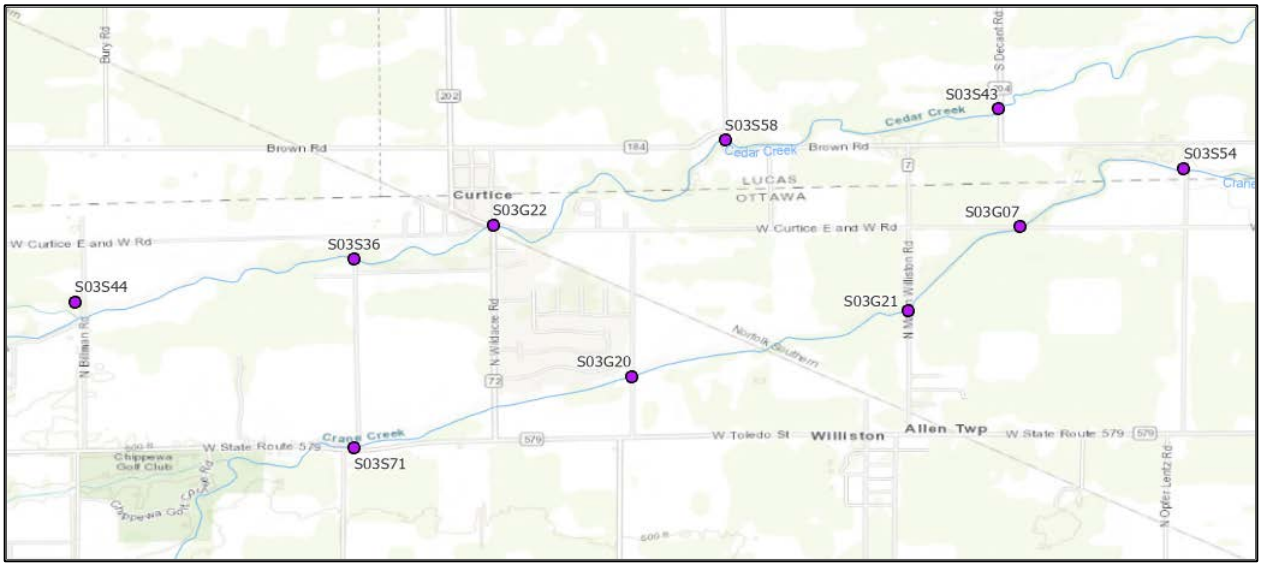
Parameter	Method	Surface Water Reporting Limit	Type of Sample Collected?
Bacteria & Microbial Source Tracking			
Escherichia coliform	SM 9223B	1 MPN/10	B
MST Markers			
HF183/BacR287 (human)	Green and others, 2014	23 copies/reaction	T
GFD (waterfowl)	Green and others, 2012	17 copies/reaction	T
BacCan (canine)	Kildare and others, 2007	29 copies/reaction	T
Rum-2-Bac (ruminant)	Mieszkin and others, 2010	50 copies/reaction	T
CowM2 (cattle)	Shanks and others, 2008	55 copies/reaction	T
Pig-1-Bac (swine)	Mieszkin and others, 2012	13 copies/reaction	T
HorBac (horse)	Tambalo and others, 2012	23 copies/reaction	T
CL (poultry)	Ryu and others, 2014	16 copies/reaction	T
Nutrients			
Ammonia	USEPA 350.1	0.05 mg/L	C
Nitrate-Nitrite	NECi N07-0003	0.1 mg/L	C
Nitrite	USEPA 353.2	0.02 mg/L	C
Total Kjeldahl Nitrogen	USEPA 351.2	0.2 mg/L	C
Total Phosphorus	USEPA 365.4	0.01 mg/L	C
Ortho phosphorus	USEPA 365.4	0.01 mg/L	C
Total Organic Carbon	SM 5310C	2 mg/L	C
Biochemical oxygen demand 5-day	SM 5210B/US EPA 310.1	2 mg/L	C

Appendix 4 – Safety contacts and hospital locations

COUNTY SHERIFF OFFICES	
COUNTY	**PHONE NUMBER**
Lucas	(419) 213-4900
Ottawa	(419) 734-4404

COUNTY HOSPITAL LOCATIONS			
COUNTY	**HOSPITAL NAME**	**ADDRESS**	**PHONE NUMBER**
Lucas	Mercy Health St. Anne Hospital	3404 W. Sylvania Avenue, Toledo, OH 43623	(419) 407-2663

Appendix 5 – Project Area Map



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