Quality Assurance Project Plan (QAPP) for Eighteenmile Creek Beneficial Use Impairment Assessment Niagara County, New York

May 2007

Prepared for:

Prepared for:

NIAGARA COUNTY SOIL AND WATER CONSERVATION DISTRICT
4487 Lake Avenue
Lockport, NY 14094

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Table of Contents

Section **Page**

Table of Contents (cont.)

Section **Page**

Appendix

List of Tables

List of Figures

Figure **Page**

List of Abbreviations and Acronyms

AOC	Area of Concern
ASP	Analytical Services Protocol
BUI	Beneficial Use Impairments
COC	chain-of-custody
CPR	cardiopulmonary resuscitation
DGPS	Differential Global Positioning Systems
DOT	United States Department of Transportation
DUSR	Data Usability Summary Report
EDD	electronic data deliverable
E & E	Ecology and Environment, Inc.
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
EPL	Experimental Pathology Laboratories
GIS	geographic information system
LCS	laboratory control sample
MDL	method detection limit
mg/kg	milligram per kilogram
MS/MSD	matrix spike/matrix spike duplicate
MSB	matrix spike blank
NCSWCD	Niagara County Soil and Water Conservation District
NELAP	National Environmental Laboratory Accreditation Program

List of Abbreviations and Acronyms (cont.)

NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PE	performance evaluation
PPE	personal protection equipment
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RAP	Remedial Action Plan
RPD	relative percent difference
SDG	sample delivery group
SOP	Standard Operating Procedure
SPDES	State Pollutant Elimination System
TOC	total organic carbon
TRV	toxicity reference value
µg/Kg	microgram per kilogram

Distribution List

Party	Affiliation and Title	Revision	Date Sent
Eighteenmile Creek QAPP Original Distribution			
Marcia Meredith Galloway	E & E QA Director		January , 2007
Kris Erickson	E & E Project Manager		January , 2007
Victor DiGiacomo	NCSWCD Project Manager		January , 2007
Barbara Belasco	EPA Project Officer		January , 2007
Donna Ringel	EPA QA Officer		January , 2007
Marie Christine	Pace Analytical		January , 2007
William Elzinga	MACTEC		January , 2007
Jeff Wolf	EPL		January , 2007
Field Team Leader	Sean Meegan		January , 2007
Eighteenmile Creek QAPP Distribution Draft Final			
Marcia Meredith Galloway	E & E QA Director	Response to com-ments	April 2007
Kris Erickson	E & E Project Manager		April 2007
Victor DiGiacomo	NCSWCD Project Manager		April 2007
Barbara Belasco	EPA Project Officer		April 2007
Donna Ringel	EPA QA Officer		April 2007
Eighteenmile Creek QAPP Final Distribution			
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Barbara Belasco	EPA Project Officer	1	May 2007
Donna Ringel	EPA QA Officer	1	May 2007
Marie Christine	Pace Analytical	1	May 2007
William Elzinga	MACTEC	1	May 2007
Jeff Wolf	EPL	1	May 2007
Field Team Leader	Sean Meegan	1	May 2007

1 Project Management

This Quality Assurance Project Plan (QAPP) has been prepared by Ecology and Environment, Inc. (E & E) for the Niagara County Soil and Water Conservation District (NCSWCD) in support of the Eighteenmile Creek Beneficial Use Impairment Assessment located in Niagara County, New York.

This QAPP has been prepared in accordance with "United States Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans," final, EPA QA/R-5 (March 2001) and EPA Region 2 Guidance for the Development of QAPP for Environmental Monitoring Projects (April 2004); and also incorporates New York State Department of Environmental Conservation (NYSDEC) requirements. This QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance/quality control (QA/QC) procedures that will be employed by E & E to ensure that all technical data generated for the Eighteenmile Creek Beneficial Use Impairment Assessment are accurate, representative, and ultimately capable of withstanding judicial scrutiny. These activities will be implemented under the requirements of E & E's comprehensive QA program as documented in the corporate Quality Management Plan (QMP).

The QAPP is formatted to address the four major sections listed in the EPA QAPP guidance document: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability.

1.1 Project Organization

The organizational chart for the project work is presented on Figure 1-1. The QA Director independently reports to the NCSWCD Project Manager on all QA/QC issues. The specific names and contact information for the current project team are provided in Table 1-1. The roles and specific QA responsibilities of key project personnel are described below.

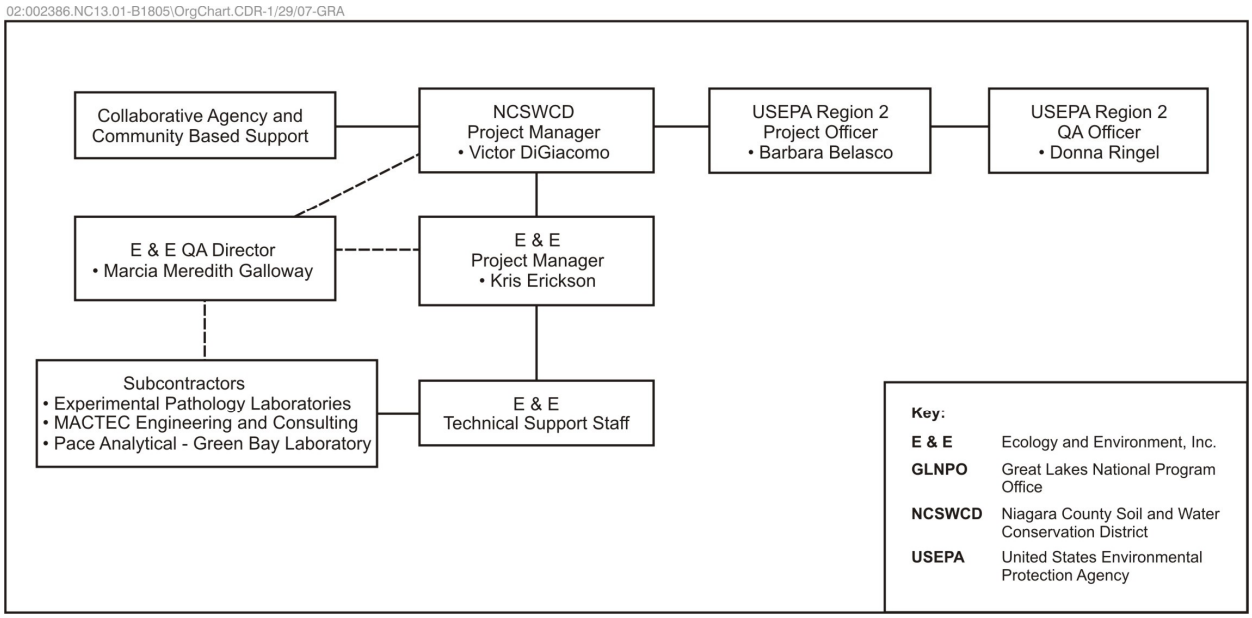

Figure 1-1 Eighteenmile Creek BUI Assessment Project Organization Chart

Project Manager

The Project Manager is responsible for QA/QC functions for all task-specific operations on the Eighteenmile Creek Beneficial Use Impairment Assessment project, and the overall quality of E & E's performance on the NCSWCD contract.

The Project Manager will also be responsible for the overall quality of work performed under project activities as it relates to the following specific roles:

- Overseeing day-to-day performance including all technical and administrative operations;
- Interfacing frequently with the NCSWCD Project Manager;
- Tracking schedules and budgets and management of mobilization and contract closeout activities;
- Selecting and monitoring technical support staff; and
- Reviewing and approving all final reports and other work products.

Table 1-1 Project Organization, Eighteenmile Creek Beneficial Use Impairment Assessment

Key Team Member	Contact Information	
NCSWCD Project Manager	Victor F. DiGiacomo	716-434-4949
EPA Region 2 Project Officer	Barbara Belasco	212-637-3848
E & E QA Director/Program QA Officer	Marcia Meredith Galloway	716-684-8060
E & E Project Manager	Kris Erickson	716-684-8060
E & E Task Manager	Sean Meegan	716-684-8060
E & E Project Chemist	Rebecca Humphrey	716-684-8060
Subcontractors		
Experimental Pathology Laboratories – (Pathology of fish livers)	Jeffrey C. Wolf, DVM, DACVP Experimental Pathology Laboratories 22866 Shaw Road Sterling, Virginia 20166	703-471-7060 ext. 242 703-471-8447 fax jwolf@epl-inc.com
Pace Analytical – Green Bay – (Chemical Analysis)	Mary Christie Pace Analytical – Sales 205 Seagull Dr. Mosinee, WI 54455 Pace Analytical – Green Bay 1241 Bellevue Street, Suite 9 Green Bay, WI 54302 Pace Analytical – MN 1700 Elm Street, Suite 200 Minneapolis, MN 55414	Pace Sales 715-693-1953 715-573-1953 cell 715-693-1954 fax Pace Analytical – Green Bay 920-469-2436 920-469-8827 fax
MACTEC Engineering and Consulting	William J. Elzinga MACTEC Engineering and Consulting 3199 Riverport Tech Center Drive St. Louis, Missouri 63043	314-209-5900 314-209-5929 fax

QA Director/Project QA Officer

The QA Officer is responsible for oversight of all QA/QC activities for NCSWCD projects. The QA Officer will remain independent of day-to-day, direct project involvement but will have the responsibility for ensuring that all project and task-specific QA/QC requirements are met. The QA Officer will have direct access to corporate executive staff, as necessary, to resolve any QA/QC problems, disputes, or deficiencies. The QA Officer's specific duties include:

- Reviewing and approving the QAPP;
- Conducting field and laboratory audits in conjunction and keeping written records of the audits;
- Coordinating with the NCSWCD Project Manager, field team, and laboratory management to ensure that QA objectives appropriate to the project are set and that laboratory and field personnel are aware of these objectives; and
- Recommending, implementing, and/or reviewing actions taken in the event of QA/QC failures in the laboratory or field.

Project Chemist

The Project Chemist is responsible for data validation and verification, generation of Data Usability Summary Reports (DUSRs), and independent assessment of the hard copy and electronic analytical data. The Project Chemist will report nonconformance with QC criteria (including an assessment of the impact on data quality objectives) to the appropriate managers.

Technical Support Staff

The technical support staff for this program will be drawn from E & E's pool of corporate resources. The technical support staff will implement project and field tasks, analyze data, and prepare reports/support materials. All support personnel assigned will be experienced professionals who possess the degree of specialization and technical competence necessary to perform the required work effectively and efficiently.

Field Support

Field operations will be supported by MACTEC Engineering and Consulting, Inc. MACTEC will provide field equipment for the fish collection and will work under the direction of E & E's Field Team Leader. The field procedures are described in Section 2 and additional support documentation is provided in Appendix A.

Laboratories

Laboratory analyses of will be completed by several different facilities. The fish will be prepared in the field. Fish livers will be sent to Experimental Pathology Laboratories (EPL) and the fish will be sent to Pace Analytical – Green Bay. The Green Bay laboratory will process the fish tissue and do the Polychlorinated Biphenyls (PCBs) analysis. The sample extract will be shipped to the Pace Analytical Minneapolis laboratory for dioxin analysis. Pace Analytical is certified by both the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) for environmental analysis of water, solid and hazardous wastes, and air and National Environmental Laboratory Accredita-

tion Program (NELAP). Appendix C includes detailed information on Pace Analytical procedures.

There is no certification for the fish pathology laboratory. Appendix B includes detailed information on EPL procedures which demonstrate their expertise in this field.

EPL and Pace Analytical-Green Bay will assign a project manager. The laboratory Project Manager QA duties include:

- Reviewing the QAPP to verify that analytical operations will meet project requirements;
- Reviewing receipt of all sample shipments and notifying the E & E Project Manager and Project Chemist of any discrepancies within one day of receipt;
- Rapidly notifying the E & E Project Manager and Project Chemist regarding laboratory nonconformance with the QAPP or analytical QA/QC problems affecting project samples; and
- Coordinating with the E & E Project Manager and Project Chemist, and laboratory management to implement corrective actions approved by NCSWCD.

Stakeholders

Other government organizations, private companies and the community groups that have interest in the project area are considered stakeholders. The groups are responsible for sharing historical data and participating in project planning to ensure project objectives are coordinated with other related aspects of work at the site. The United States Army Corps of Engineers and New York State Department of Environmental Conservation (NYSDEC) are the primary government stakeholders. The stakeholders will be provided with copies of all technical deliverables and project plans.

1.2 Problem Definition/Background

1.2.1 Problem Definition

In 1987, the International Joint Commission (IJC) identified 43 Areas of Concern (AOC) in the Great Lakes Basin where the beneficial uses of the water were considered impaired. Eighteenmile Creek was identified as one of the 29 United States Areas of Concern. The creek has been polluted by past industrial and municipal discharges, the disposal of waste, and the use of pesticides. Fish consumption restrictions exist because of PCB and dioxins found in fish flesh. The health of the benthos has been impaired by PCBs and metals in sediments. PCB and metal contamination prevents open lake disposal of dredged sediment material. Bird and animal health is likely impaired by PCBs, dioxins, DDT and its metabolites, and dieldrin found in fish flesh.

Currently, two of the beneficial uses identified by the IJC (the existence of fish tumors and other deformities and the status of fish and wildlife populations) are classified as "unknown" for the Eighteenmile Creek AOC. Additionally, the status of bird or animal deformities or reproductive problems is currently classified as "likely" for the Eighteenmile Creek Area of Concern. The NYSDEC was the lead agency during the development of the Remedial Action Plan (RAP) and was the lead agency for the management of the RAP for Eighteenmile Creek until December 31, 2004. However, due to budget issues, and the lack of a dedicated position in the NYSDEC to progress the implementation of the RAP, substantial progress was not made towards the de-listing of this AOC. The Niagara County Soil and Water Conservation District (NCSWCD) assumed management of the RAP in 2005, per funding support of the Great Lakes National Program Office. NCSWCD has been involved in re-invigorating investigative, remedial activities, and public education/outreach activities within the Eighteenmile Creek AOC. NCSWCD has developed this project to assist in determining the status of these two "unknown" and one "likely" beneficial uses and consequently make progress towards the de-listing of Eighteenmile Creek as an AOC.

The purpose of this investigation is to initiate evaluation of contamination within portions of the Eighteenmile Creek AOC ecosystem. Similar field investigations and sampling will occur within Oak Orchard Creek in Orleans County, New York. Oak Orchard Creek has been recommended by the NYSDEC as a suitable control creek by which to compare and contrast fish and wildlife survey results. Both creeks are tributaries to Lake Ontario, are of similar size and surrounding geography, are subject to water level fluctuations due to changes in lake water levels, and contain hydro-electric dams some distance from the confluences of the creeks with the lake. Oak Orchard Creek is not listed as an AOC.

The overall objective is to evaluate the status of three beneficial use impairments and to make progress in understanding the degree of impairment for these three beneficial uses. If the degree of impairment is found to be negligible, this assessment may ultimately lead to the de-listing of Eighteenmile Creek. Alternatively, any of the three beneficial uses listed above are found to be impaired, the results of this investigation will provide the framework for further ecosystem-based studies and a long-term monitoring program for the site.

Specific objectives are to:

- Assess the prevalence of tumors or other deformities in AOC fish.
- Assess the status of fish and wildlife populations in the AOC by conducting seasonal fish and wildlife population surveys within the AOC and Oak Orchard Creek.

- Assess the status of bird or animal deformities and/or reproductive impairment in wildlife populations in the AOC.

1.2.2 Background

Eighteenmile Creek, located in the heart of Niagara County is surrounded by six residential townships. Many citizens own creek-front property from the start of its headwaters in the town of Lockport to its discharge to Lake Ontario in Olcott, New York. The creek is used extensively for fishing, boating, and recreation. The projected sampling location is primarily in a rural/residential area. Sediment contamination in the area upstream of the project area has impacted residential properties adjacent to the creek.

PCBs contaminate the sediments of Eighteenmile Creek and within the AOC. PCBs are factors in restrictions on fish and wildlife consumption, bird and animal deformities, or reproductive problems and degradation of benthos. A surface sediment sample taken in the 1994 Olcott Harbor Sediment Sampling from the AOC contained PCBs at a concentration greater than the NYSDEC guidance for screening of contaminated sediments. Ten of 15 fish flesh samples from the creek contained PCBs at levels above the Food and Drug Administration action level of 2.0 milligrams per kilogram (mg/kg). Additionally, a surface sediment sample taken in 2005 by the NYSDEC upstream of project area (Flintkote Site) contained PCBs at 49 mg/kg.

Sources and potential sources of PCBs to Eighteenmile Creek have been identified as industrial and municipal wastewater discharges, combined sewer overflows, inactive hazardous waste sites, the New York Barge Canal discharge, contaminated sediments already present in the creek and an unknown source between Olcott Street and North Transit Road. Extensive progress has been made by monitoring discharges and updating State Pollutant Elimination System (SPDES) permits for industrial and municipal wastewater dischargers and de-listing inactive hazardous waste sites. NYSDEC conducted a sediment study in the area of the unknown source of PCBs located between Olcott Street and North Transit Road in August of 2005. NYSDEC expects a full remediation plan to be in place by 2008 for this entire area.

Samples were collected for PCB screening using grab samples at 80 locations throughout the study area. A total of 80 samples and three duplicates were collected. Concentrations ranged from 59 µg/kg to 4300 µg/kg and 29 samples were non-detect. Comparison of PCB screening results to PCB confirmation samples at other sites, indicate the screening results need to be corrected by a factor of 6.5 to be comparable to the confirmation results. A total of 12 cores were collected in areas for PCB confirmation. Three samples were collected at various depths. The concentrations in the core samples range from 12 µg/kg to 69000 µg/kg and only six samples were non-detect.

The PCB results show that PCBs are present in all areas of Eighteenmile Creek. The core sample results show a general decrease in concentration with depth. The results indicate that the sediment is entirely contaminated with PCBs and only the native material in the creek bed is free of PCB contamination. The positive PCB results were corrected for an average total organic carbon (TOC) concentration and compared to NYSDEC criteria. Most of the positive PCB results exceeded PCB screening criteria. The results show a relatively uniform concentration of PCBs except at areas close to the Flintkote property and in the area near the intersection of Old Niagara and Plank Road. The results indicate the potential for an additional source of PCBs in an area north of the waste water plant.

The surface samples from all 12 cores also were analyzed for select metals. The metals results were compared to NYSDEC TAGM 4046 standards. All metal concentrations were near or exceeded TAGM criteria. The highest metals were found in core 2 and core 12, but the concentrations were relatively uniform throughout the study area. The results indicate that metals continue to be source of concern in the creek and need to be evaluated relative to background concentrations in other areas.

Currently supported by numerous stakeholders, the NCSWCD, United States Army Corps of Engineers, and Niagara County are in the preliminary stages of developing a Comprehensive Watershed Management Plan for Eighteenmile Creek. It is apparent that the recovery and management of the creek will be better focused once there has been an evaluation of the three aforementioned Beneficial Use Impairments (BUIs). This would progress efforts of implementing the RAP for the Eighteenmile Creek AOC. The RAP's mission is to restore the chemical, physical and biological integrity of the AOC ecosystem. Locating upstream sources of contamination to the AOC will aid in this mission and make progress towards the overall goal of de-listing Eighteenmile Creek as an AOC. Similarly, determinations on the BUIs will provide for the justification and objectives of future projects to aid in the de-listing of Eighteenmile Creek as an AOC. Should the results indicate impairment this investigation will provide direction for future monitoring activities.

1.3 Project Description

The project has three main tasks as described in sections 1.3.1 through 1.3.3.

1.3.1 Fish Community Surveys/Analysis of Fish Tumors and Deformities

Fish surveys will be conducted to document fish species composition at selected sampling locations within both of the creeks. In order to characterize the fish communities (taxonomic composition, general population structure of dominant taxa, etc.) of each study reach, sampling will be conducted on a seasonal basis during both spring (April/May) and summer seasons (July). The approach for this assessment will be to characterize resident fish communities during the spring

spawning season (seasonally high water periods), and under summer low-flow conditions. Summer sampling will provide additional supporting information that can be used to evaluate spawning success and recruitment as indicated by the presence of young of the year specimens within collections. Survey reach locations will be determined in the field during an initial field reconnaissance and then will be maintained for all survey efforts. Reach locations will be selected based on several factors including:

- Accessibility;
- Variability in habitat (water depths, submergent plant growth, etc.); and
- Geographic location in the creek.

The approach will involve selecting three locations in each creek that are accessible, represent a diversity of habitats, and are distributed throughout the lower creek systems. This process will ensure that fish data collected will be representative of a variety of habitats and locations throughout each creek of interest.

Estimates of abundance, size distributions, and biomass by species will be calculated and presented. The fish sampling will be completed to describe the existing fish communities as indicated above, and to collect the fish for tissue and liver analyses described below.

A targeted effort to sample and collect fish within Eighteenmile Creek and Oak Orchard Creek will occur during the summer season community fish surveys. Selected fish specimens (longer than 250 mm in length) will be retained for gross body observations, and for performing tissue analyses to evaluate constituent uptake and ecological risks. Specifically, complete gross external and internal body observations and histo-pathological examinations will be conducted on approximately 120 fish livers (60 from each creek) of brown bullheads or other Ictalurids or Castastomids. In addition tissue chemistry analyses of whole fish will be subsampled from the above-referenced 120 fish for bioaccumlative chemicals (PCBs and dioxin, see Section 2.2.1.3).

1.3.2 Wildlife Population Surveys

Wildlife population surveys will also be completed within the Eighteenmile Creek AOC and a total area of similar size in Oak Orchard Creek to document species assemblages of wildlife populations. Species of particular interest will be those that are water dependent, or are in contact with the water, for hunting/foraging, swimming, loafing, etc. The surveys will document wildlife species composition within determined sampling reaches that represent a variety of available habitat types. Wildlife surveys are expected to occur during each season (winter 2007, spring 2007, summer 2007, and fall 2007) and will focus on birds, mammals, and amphibians. Bird species will be surveyed within each creek system at a mini-

mum of 6 separate surveys between the winter of 2007 and fall of 2007. Additional efforts for both amphibians and birds will include spring/early summer surveys following methods developed by the Marsh Monitoring Program established by Bird Studies Canada and Environment Canada with support from the United States Great Lakes Protection Fund, the EPA, and the Great Lakes 2000 Cleanup Fund.

1.3.3 Status of Bird or Animal Deformities or Reproductive Impairment

To assess this impairment, EPA indicates that the concentrations of PCBs and other bioaccumulative contaminants in adult fish and the process of bioaccumulation should be investigated. The current investigation will rely on the analysis of histological, pathological, and contaminant data in bullheads to assess the prevalence of deformities and potential for bioaccumulation within Eighteenmile Creek. For comparison, the same information will be collected from the background area, Oak Orchard Creek. Fish survey efforts will be similar across both creeks to minimize effort bias between creeks when evaluating survey results. To evaluate potential reproductive effects on birds and mammals, the bullhead contaminant data will be used to estimate exposure and risk for fish-eating wildlife using standard wildlife exposure models, exposure parameters, and toxicity reference values (TRVs; for reproductive effects). Exposure and risk will be calculated for the great blue heron (*Ardea herodias*) and mink (*Mustela vison*) because these two species prey heavily on forage fish such as bullheads and are known to use the AOC and background area. Exposure parameters and TRVs will be taken from EPA (1993), Sample et al. (1996), and other reputable sources. Lastly, the project team will evaluate the findings of the bioaccumulation study for Eighteen Mile Creek conducted by the United States Army Corps of Engineers, Buffalo District to help understand the process of bioaccumulation at the site.

1.3.4 Use of Study Results to Evaluate Beneficial Use Impairments

As described in Section 1.2.1, three BUIs are being evaluated as part of the current investigation:

- Existence of fish tumors and other deformities (status unknown);
- Status of fish and wildlife populations (status unknown); and
- Status of bird or mammal deformities or reproductive impairment (status likely).

The data generated by the activities described in Sections 1.3.1 to 1.3.3 will be used in a weight-of-evidence approach to determine the status of these three BUIs. For each type of data collected, the results for lower Eighteenmile Creek will be compared with background to identify impairment, or the lack thereof. In

those cases where data collected for this study can be used to address more than one BUI, it is listed below under each BUI to which it applies.

1.3.4.1 Existence of Fish Tumors and Other Deformities

Two lines of evidence will be examined to evaluate the status of this BUI:

- Prevalence and severity of external tumors and other deformities in bullheads from the AOC compared with background; and
- Prevalence and severity of liver tumors in bullheads from the AOC compared with background.

1.3.4.2 Status of Fish and Wildlife Populations

The status of fish, bird, mammal, and amphibian populations in the AOC will be evaluated as described in the following subsections.

Fish Populations

Four lines of evidence will be examined to evaluate possible impairment in fish populations in the AOC:

- Diversity, abundance, biomass, and condition of fish species in the AOC compared with background;
- Concentrations of PCBs and dioxins/furans in bullheads from the AOC compared with background. If the PCBs and dioxin/furan concentrations are above background, then the concentrations will be compared to appropriate literature values and other related scientific studies to determine the potential significance of the concentration levels.
- Prevalence and severity of external tumors and other deformities in bullheads from the AOC compared with background; and
- Prevalence and severity of liver tumors in bullheads from the AOC compared with background.

Bird Populations

Two lines of evidence will be examined to evaluate possible impairment of bird populations in the AOC:

- Diversity and abundance of birds at the AOC compared with background; and
- Risk of reproductive impairment to fish-eating birds from PCBs and dioxins/furans in forage fish compared with background. Risk will be calculated using the bullhead analytical data collected for this study and exposure parameters and toxicity reference values from EPA (1993) and other reputable

sources (e.g., Sample et al. 1996) for the great blue heron, a representative fish-eating bird that is likely to use the AOC.

Mammal Populations

Two lines of evidence will be examined to evaluate possible impairment of mammal populations in the AOC:

- Diversity and abundance of mammals at the AOC compared with background; and

- Risk of reproductive impairment to fish-eating mammals from PCBs and dioxins/furans in forage fish compared with background. Risk will be calculated using the bullhead analytical data collected for this study and exposure parameters and toxicity reference values from EPA (1993) and other reputable sources (e.g., Sample et al. 1996) for the mink, a representative fish-eating mammal that is likely to use the AOC.

Amphibian Populations

Only a single line of evidence will be examined to evaluate the possible impairment of amphibian populations at the AOC:

- Diversity and abundance of amphibians at the AOC compared with background.

1.3.4.3 Status of Bird or Mammal Deformities or Reproductive Impairment

Two lines of evidence will be used to determine the status of this BUI:

- Risk of reproductive impairment to fish-eating birds and mammals from PCBs and dioxins/furans in forage fish compared with background. Risk will be calculated using the bullhead analytical data collected for this study and exposure parameters and toxicity reference values from EPA (1993) and other reputable sources (e.g. Sample et al. 1996) for the great blue heron and mink, representative fish-eating wildlife species that are likely to use the AOC.

- In addition, it is possible that dead or disabled birds, mammals, and amphibians may be found at the AOC and background area that can be examined for deformities and other abnormalities. If available, such information will be collected and used in the overall weight-of-evidence approach.

Project milestones are scheduled to include:

- Project Start 1/2007

- QAPP Submittal 1/2007

- Field Reconnaissance of Study Areas 4/2007
- Wildlife Surveys 2/2007 – 10/2007
- Fish Community Surveys 5/2007, 7/2007
- Preparation of Semi-Annual Report 6/2007
- Targeted Fish Collection 7/2007
- Data Review and Analysis 7/2007 – 11/2007
- Draft Report Preparation 12/2007 – 2/2008
- Review and Approval of Final Report 4/2008
- Project End 5/2008

1.4 Quality Objectives and Criteria

The specific objectives of this project are provided in Section 1.2.1. The objectives for each type of data are presented in Section 1.3.4. General quality objectives for the Eighteenmile Creek BUI Assessment are summarized in Table 1-2. Acceptance and performance criteria for field and analytical QC samples are outlined in Section 2.4. Table 1-3 summarizes the samples collected and reporting limits for the chemical analysis of fish tissue. Appendix B and C of this QAPP provides detailed acceptance and performance criteria for analytical methods.

1.4.1 Data Assessment Definitions

Acceptance and performance criteria are often specified in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Numerical acceptance criteria cannot be assigned to all PARCC parameters, but general performance goals are established for most data collection activities. Numerical goals for analytical methods are presented in Section 2.4. Data assessment procedures throughout the QAPP clearly outline the steps to be taken, responsible individuals, and implications if QA objectives are not met. PARCC parameters are briefly defined below.

Table 1-2 General Data Quality Objectives, Eighteenmile Creek Projects

Data Collection Activity	Quality Objectives	Standards[a]	Acceptability/ Performance Criteria[b]
Historical Data Collection	To incorporate all existing data that meets quality objectives for the RAP. Data must be geo-referenced.	■ EPA or NYSDEC sampling and analytical procedures	■ Data are generated using EPA or NYSDEC sampling and analytical methods or alternative methods approved under a RAP project. ■ Data must be from the original source. ■ Data must be geo-referenced or able to be digitized into a GIS system.
Sampling and Analysis	To have samples and analytical results that accurately represents the conditions present at the site or in the fish tissue. Data must be of sufficient quality to meet all regulatory requirements and allow assessment of impacts by comparison to background values. Data must present results to allow comparison of PCBs in tissue from reference sites. Field surveys must be documented and comply with this QAPP and standard industrial practice.	■ See Appendices B and C of the QAPP ■ Literature sources for levels of PCBs in Fish Tissue	■ Data must be collected under an approved QAPP. ■ Data must meet the acceptance and performance criteria documented in Section 2 of this QAPP. ■ Reporting limits should be comparable literature values from related studies. ■ ■ Data must be compared to data collected in reference area.
Mapping	To relate project work locations to existing local benchmarks.	■ DGPS data	■ Relation of all survey points to existing/known benchmarks. ■ Accurate horizontal coordinates (±3 feet for DGPS locations).
Field Records	To document all field activities and to allow accurate representation field events in the final report. Records must be capable of withstanding legal scrutiny.	■ Section 2 of the QAPP ■ Appendix A of the QAPP	■ Consistency between field and laboratory data. ■ Clear and legible documentation for sample collection and equipment decontamination for final report. ■ Clear and legible documentation for field observations as documented on the attached forms.
Outside Records	To use the most current reference values, reports, or data from outside sources in data assessments and recommendations for the site.	None	■ All versions of data or standards must be the most current values available. ■ Data or standards must be accurately incorporated into the final report.

Notes:

[a] Major standards.
[b] Major or noteworthy acceptability criteria. All performance criteria must be verified using procedures listed in the QAPP.

Key:

EPA = Environmental Protection Agency.
NYSDEC = New York State Department of Environmental Conservation.
GIS = Geographic Information System.
QAPP = Quality Assurance Project Plan.

Table 1-3 Summary of Tissue Chemistry Data Collected

Analyte	Sample	Method Detection Limit (µg/Kg)	Reporting Detection Limit (µg/Kg)
PCBs	16 Total Bullhead Fish (8 from AOC and 8 from background)	19	50
PCBs	10 Archived Bullhead Fish (5 from AOC and 5 from back-ground)	19	50
Dioxin and Furan	4 Total Bullhead Fish (2 from AOC and 2 from background)	0.00013 to 0.00076	0.001 to 0.010

Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value, usually stated in terms of standard deviation or coefficient of variation. It also may be measured as the relative percent difference (RPD) between two values. Precision includes the interrelated concepts of instrument or method detection limits and multiple field sample variance. Sources of this variance are sample heterogeneity, sampling error, and analytical error.

Accuracy

Accuracy measures the bias of the measurement system. Sources of this error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis. Data interpretation and reporting may also be significant sources of error. Typically, analytical accuracy is assessed through the analysis of spiked samples and may be stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Blank samples are also analyzed to assess sampling and analytical bias (i.e., sample contamination). Background measurements similarly assess measurement bias. The number of samples collected will impact the confidence of the statistical data evaluation. Archive samples will be collected for analysis if additional samples are required.

Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter variation at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with proper design of the measurement program. Sample/measurement locations may be biased (judgmental) or unbiased (random or systematic). Representativeness of the sampling scheme will be determined with evaluation of the historical data and statistical evaluation of the results compared to the reference site.

Completeness

Completeness is defined as the percentage of measurements performed which are judged to be valid. Although a quantitative goal must be specified, the completeness goal is the same for all data uses—that a sufficient amount of *valid* data be generated. A completeness goal of 90% is established for this project.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set may be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze samples. Historical data will be evaluated to ensure the methods and reporting limits are comparable to the proposed sampling. Data will only be evaluated if it is determined to be comparable.

1.5 Special Training/Certification

E & E training requirements for the Eighteenmile Creek BUI Assessment activities are as follows:

- E & E employees that participate in on-site activities must have completed the 40-hour health and safety training program and the cardiopulmonary resuscitation (CPR)/first aid certification course. To continue such participation, each employee must successfully complete a minimum of eight hours of refresher training, annually;

- Use of appropriate scientific disciplines to successfully complete field surveys and fish pathology as outlined in Appendices to the QAPP. Field personnel with appropriate degrees and experience must be used for this portion of the project.

- All personnel shipping samples must complete the United States Department of Transportation (DOT) hazardous materials transportation training and certification, including training in specific International Air Transport Association regulations (air shipments).

All project personnel will be provided for the QAPP for review prior to project start-up. The field team will hold a project kick-off meeting prior to start of sampling to review procedures. The laboratory supervisor and project manager will oversee the implementation of the QAPP in the laboratory.

1.6 Documentation and Records

The E & E Program QA Officer will approve the QAPP and maintain the most current approved version of the document. The E & E Project Manager is respon-

sible for providing the most current copy of the QAPP and other planning documents to the project team members.

In addition to the QAPP and other planning documents, the primary documentation for the project includes field datasheets, geographic information system (GIS) based mapping, and analytical data packages. Requirements for data recordation on field datasheets are similar across the different surveys types, although given the nature of the various sampling efforts there will be differences in the types of data recorded and the labeling of observation stations and samples (e.g., fish vs. mammals vs. birds, vs. fish health, etc.). The field datasheets are standard for these types of surveys. Requirements for analytical data packages are also described below. The remainder of the QAPP describes additional project documentation and record requirements for QA/QC assessments, data validation, data management, and other areas.

1.6.1 Field Documentation

Fish Community and Wildlife Surveys

Field data entry will be conducted using data sheets (see Appendix A). Data will be subsequently entered into a project database. Entries will be made in ink, signed or initialed, and dated. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed or initialed and dated by the sampler. The photographs, if any are taken, will be numbered and a brief description regarding the photograph will be noted. Data collected for the different surveys are summarized in Section 2.2.

Analytical Fish Sample Identification

Samples will be identified using the format described below. There will be two types of fish tissue samples collected for laboratory analyses: fish tissue chemistry (whole body) and liver histo-pathology. Each sample will be labeled, chemically preserved (as required), and sealed immediately after collection. To minimize handling of sample containers, labels will be completed prior to sample collection as practicable. The sample label will be completed using waterproof ink and will be firmly affixed to sample containers and protected with clear tape. The sample label will give the following information:

- Date of collection;
- Location of collection (Eighteenmile Creek [EMC] vs. Oak Orchard Creek [OOC], stream reach number);
- Unique sample number;
- Analyses requested; and

- Preservation.

Each sample will be referenced by sample number on respective data sheets and on the chain-of-custody (COC) record.

Individual samples will be identified by a unique alphanumeric code. Normal field samples (non-quality-control) will be numbered according to the following convention:

EMC-###-BB-LP-TC-D

EMC - Three letter code for site name (OOC)
- Sequential sample number
BB - Species collected (BB – brown bullhead, OSP – other species [to be cross-referenced to survey datasheet)
LP - Liver pathology
TC - Tissue Chemistry (added to string for those samples selected for PCBs tissue chemistry analysis)
D - Dioxin (added to string for those samples selected for dioxin tissue analysis).

Photographs

The use of photography will be employed to record field sampling activities and to support documentation of gross visual fish observations. Section 2.__ provides details on photographic procedures for gross fish observations. The following information will be noted on the pertinent datasheets concerning photographs:

- Date, time, location, and direction photograph was taken;
- Description of the photograph taken;
- Sequential number of the digital photo; and
- Camera system used.

1.6.2 Laboratory Data Reporting

The data packages for all analytical services must be consistent with NYSDEC Analytical Services Protocol (ASP) (July 2005) for the tissue samples. The analytical data reporting requirements are outlined in the scope of work provided in Appendix C. The laboratory will provide an electronic data deliverable that matches all data reported on the hard copy analytical report. Electronic data report requirements are described in Section 2.10.

The analytical summary report will include the sample aliquot analyzed, final extract volume, and dilution factor. The analytical summary data report also will

include the laboratory reporting limit and method detection limit (MDL) for all target compounds. These limits will be corrected for percent moisture and all dilution factors. Any compounds found less than the reporting limit, but greater than the MDL will be reported and qualified with a "J" flag as estimated.

QC reports will provide a summary report or batch identifier clearly linking all QC results to actual field sample results. QC summary reports will include the laboratory control limits and flag any result reported outside control limits. The case narrative must include an explanation of all QC results reported outside control limits. The laboratory must provide copies of any nonconformance or corrective action forms associated with data in the laboratory report.

For fish pathology, EPL will prepare a separate technical report that details the findings of the samples received.

1.6.3 Record Retention

All records related to the project must be stored in secure areas consistent with requirements in E & E's QMP. All records related to the analytical effort will be maintained at the laboratory in lockable filing cabinets for at least one year, except those stored in the computer. All records must be maintained in a secure area for a period of six years after the end of the calendar year in which the final report is issued.

2 Data Generation and Acquisition

This section of the QAPP contains descriptions of all aspects of the implementation of field, laboratory and data handling procedures to meet the requirements of the Eighteenmile Creek BUI Assessment activities.

2.1 Sampling Process Design

The purpose of the sampling described in this section is to collect data necessary to evaluate the status of three BUIs within the Eighteenmile Creek AOC. The BUIs in question are:

- Prevalence of fish tumors and other deformities (status unknown);
- Status of fish and wildlife populations (status unknown); and
- Status of bird or animal deformities or reproductive problems (likely).

In order to assess the status of the BUIs listed above, a set of integrated and interrelated sampling and analytical processes have been developed to:

- Characterize the habitats within the Eighteenmile Creek AOC and Oak Orchard Creek study areas;
- Identify the fish and wildlife species that occur within the study areas and gain knowledge with regard to species community composition, relative abundance, and diversity;
- Collect brown bullheads (or other bottom-dwelling fish if the bullhead is not available) for gross external and internal visual observations for lesions, tumors, ulcers, etc.; liver pathology; and tissue chemistry (PCBs and dioxin) to determine the presence of potentially bioaccumlative chemicals within the study area ecosystems and food chains;
- Quantify and report differences between the Eighteenmile Creek AOC and Oak Orchard Creek; and

- Use the weight-of evidence approach described in Section 1.3.4 to determine the status the three BUIs being evaluated.

Table 2-1 Summary of Data and Analyses Collected at Sampling Locations

Fish and Wildlife Surveys	Field /Analytical Data Collection
Fish Community Surveys	Date, Fish Species, Number, Reach Location, etc.
Targeted Fish Collection	Date, Fish Species, Number, Reach Location, etc. Gross External and Internal Visual Observations, Photographs Liver Pathology and Whole Body Tissue Chemistry Sample Processing and Packaging
Wildlife Surveys	Date, Species, Number, Location, Survey Type, Point Locations (Lat, Long)

Field Data Collection

The specifics for field data collection are provided in Section 2.2; each collection and recordation activity for each data collection effort is critical to the data quality objectives for this project. The samples will be collected at areas with Eighteenmile Creek AOC as shown in Figure 2-1 and the reference area Oak Orchard Creek as shown on Figure 2-2. The specific sampling locations will be determined as field locations by differential Global Positioning Systems (DGPS) as noted below.

Latitude/Longitude Location: These data will assist in developing BUI Assessment field data collection maps to document locales, points, and areas of surveys. A DGPS capable of ascertaining horizontal locations with < 5 meters of accuracy will be utilized. To achieve this accuracy, it is important that the DGPS is in good working order and are obtaining strong satellite signals. The field team will be responsible for checking the satellite signal strength for the DGPS system prior to recording this data and for ensuring that the system records equivalent horizontal locations. Any problems with signal strength shall be recorded in the field boring log. If problems are noted, the field team should provide a qualitative description of the sampling location utilizing any available, permanent landmarks.

2.2 Sampling Methods

2.2.1 Fish Sampling Methodology

2.2.1.1 Community Surveys

Fish community surveys will be conducted in the Eighteenmile Creek AOC and within similar habitats of similar total area in Oak Orchard Creek. Similar sampling methods and effort will be used for both of these creeks. The fish surveys will document fish species composition at selected sampling sites, as well as estimates of abundance, size distributions, and biomass by species. Three reaches of stream will be identified in the field that include habitats representative of each

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Figure 2-1
Eighteenmile Creek Study Area

Figure 2-2
Oak Orchard Creek Study Area

of the creeks from the downstream ends of the hydro-electric dams to the confluences with Lake Ontario. It is currently assumed that marina areas will not be sampled rather more natural habitats will be the target of sampling efforts. Reach lengths will also be determined in the field, but will fall likely within the range of 500 – 1,000 feet.

Surveys will be conducted to determine the assemblages of representative fish communities during the spring and mid-summer months within the creeks. Two survey events will occur at each of the creeks during the same time frame. Fall surveys will not be completed in order to avoid conflict with salmonid migrations from Lake Ontario to lake tributaries. Both Eighteenmile and Oak Orchard creeks are major destinations for seasonal anglers during the salmonid runs from the lake to the creeks. Both creeks are visited by thousands of anglers every fall season from other parts on New York, from Pennsylvania and Ohio, and portions of Ontario, Canada. Additionally, much is known about the sport fishery (e.g., salmonid stocking programs - brown trout, steel head, etc.), compared to the warm water species that are considered to spend a majority of their life spans within the creeks (vs. the lake).

The proposed gear types will include electrofishing, hoop netting, and potentially bag seining and back pack electrofishing. Electrofishing will be the primary gear type and will be used at selected locations along the shoreline within each study reach. Electrofishing shall be performed using a boat-mounted Smith Root pulsed DC electrofishing for 15 minute durations at each location. At locations lacking sufficient depth for boat-mounted electrofishing, a battery powered Smith Root backpack electrofishing unit or bag seine may be used. Fish immobilized during each electrofishing run will be dip-netted and put into aerated live wells for processing. All sampling areas will be mapped using DGPS.

Hoop nets (one-meter diameter) will be used opportunistically within each sampling reach to collect additional fish specimens. Fish collected by netting shall be removed from net cod ends, and placed in an aerated live well for processing. Net set time and run times shall be recorded for each net location, in order to calculate catch per unit effort. Additionally ancillary information that shall be recorded for net samples shall include water depth, in-stream habitat characteristics, and relative water flow characteristics.

At the end of each electrofishing run (or subsequent to retrieval of nets), fish will be processed by identifying each specimen, recording length (total length—TL) and weight (grams) using a digital top-loading scale. Identification of specimens contained in the samples will be to the lowest practicable taxonomic level using one or more of the following taxonomic keys:

- Smith, L. 1985. *The Inland Fishes of New York State*. The New York State Department of Environmental Conservation. Albany, NY.

■ Kraft, C. E., D. M. Carlson, and M. Carlson. 2006. *Inland Fishes of New York (Online)*, Version 4.0. Department of Natural Resources, Cornell University, and the New York State Department of Environmental Conservation.

Batch processing of samples may be performed if the number of specimens of the same species in a given sample exceeds 50. In such circumstances, 50 specimens of a given species shall be processed as stated above (individual length and weight measurements), thereafter the species/size category count will be estimated by sub-sampling. A sub-sample of 30 individuals will be weighed and the total sample will be weighed. The number of individuals in the whole sample will be estimated from the ratio of the total sample weight to the sub-sample weight total and the count within the sub-sample.

All collected fish (except those retained for tissue analysis) shall be released back into the source water body unharmed.

The data collected will be used to generate a species list for each creek, a population estimate, and a 95% confidence interval for each species. The goal will be to generate probability-of-capture estimates based upon capture patterns. The capture probability estimate is a measure of sampling efficiency. In addition, Fulton's Condition Factor will be calculated. The condition factor compares the length and weight relationship of individual fish to assess their physical condition. Also, the total biomass density for each species at each sampling location will be calculated as the product of the estimated fish population and the mean weight of the sub-sampled fish divided by the surface area of the sampled reach. The results of the community surveys for Eighteenmile Creek and the control site will be compared to evaluate community-level differences in diversity and abundance between the two creeks, and will factor into impairment analyses.

Field Data Collection

Field data collection activities will be recorded using project specific field data sheets; similar information will be collected in the field during the targeted fish collection activities. For each sampling event, the following field data will be recorded:

- General Sample Identification
  - Date
  - Start time, Stop time
  - Weather, field team members
  - Sample collection method
  - Sample location
  - Sample identification
  - Sample collectors

- Water Quality
  - Water body
  - Temperature
  - Dissolved oxygen
  - pH
  - Conductivity

- Biological Data
  - Species common name
  - Length
  - Weight
  - Status/condition (live, dead, moribund)
  - DELT (disease, erosion, lesions, tumors – see additional datasheet for gross body observations for brown bullhead)
  - Batched fish (length category, count, and weight)

Water Quality

In-situ water quality data, including pH, dissolved oxygen, and conductivity will be measured at each fish sampling location during each event. Water quality measurements will be recorded on field data sheets. Water quality instruments will be subject to calibration prior to and following each field sampling event. Additionally, water quality instruments shall be properly maintained while in the field to ensure their accuracy.

2.2.1.2 Targeted Fish Collection for Analysis of Fish Tumors and Deformities

Annex 2 of the Great Lakes Water Quality Agreement between the United States and Canada called for the identification of the most severely degraded AOCs within the Great Lakes basin and the development of RAPs to restore impaired beneficial uses within these areas. Annex 2 specifically lists fourteen discrete BUIs for AOCs, including "fish tumors or other deformities." As defined by International Joint Commission (1991) guidelines, the fish tumors or other deformities BUI occurs:

> "*. . . when the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of neoplastic or pre-neoplastic liver tumors in bullheads or suckers*."

The fish tumors or other deformities BUI has been identified in 14 of the 31 AOCs located within or partially within the United States. In U.S. AOCs, this BUI is most often related to the brown bullhead catfish (*Ameiurus nebulosus*) (Rafferty and Grazio, 2006). Therefore, the ability to accurately and consistently identify tumors or other deformities in brown bullhead is critical for proper assessment and monitoring of the status of this BUI.

To determine the prevalence of tumors gross visual external and internal observations and histo-pathological examinations will be conducted to identify potential lesions and neoplasms. The histo-pathological work will involve the examination of the fish livers. This type of examination is a reliable tool for evaluating tissue damage resulting from contaminated sediments and environmental pollution. The target fish species, brown bullhead, will be collected within the three reaches where the fish community surveys will be conducted within the Eighteenmile Creek AOC and Oak Orchard creeks. The latter of which has been identified as a potential control site because of its similarity in geography, size and as a tributary to Lake Ontario. Both creeks are affected by lake-level fluctuation in Lake Ontario and contain hydro-electric dams. Lake Ontario tributaries are subject to spring and fall migrations of cold water species from the lake. In order to maximize the probability of capturing individual fish that are residents to each creek, fish collection for identifying the prevalence of tumors or other deformities will occur in mid-summer. Similar field collection procedures employed for the fish community surveys will also be utilized for the collection of brown bullhead.

A total of approximately sixty (60) adult brown bullheads will be collected within identified sampling reaches from both creeks (total of 120 fish) to evaluate the presence of tumors and deformities. The sample size was determined based on recommendations of a minimum of 30-50 brown bullhead randomly selected from each sampling location. A slightly larger subsample will increase the statistical power of the study. The recommendation is from Section 5.4 of the Field Manual for Assessing Internal and External Anomalies in Brown Bullhead (*Ameiurus nebulosus*) (Rafferty and Grazio, 2006) ; see Appendix A. The recommendations were developed as part of a series of workshops on the "Development of Standardized Criteria for the Assessment of Brown Bullhead Lesions and Deformities in Areas of Concern". The workshops are cosponsored by: Pennsylvania Sea Grant, United States Environmental Protection Agency Great Lakes National Program Office, and Pennsylvania Department of Environmental Protection (see http://seagrant.psu.edu/publications).

In addition, the Recommended Protocols for Fish Pathology Studies in Puget Sound (EPA 1987). The protocol contains a thorough, useful discussion on selecting sample size for fish pathology studies where the goal it to determine if a greater prevalence of lesions exists at a test site compared with a reference site. According to the protocol, a sample size of 60 fish from each site will provide an 80 percent probability of detecting a lesion prevalence of 10 percent at the test site when lesion prevalence in the reference site is close to zero percent. The objective is directly comparable to this study and the value of 60 samples was chosen.

The primary collection method will be electrofishing, however, the prevalence of deeper water habitats and lower-than-anticipated numbers of fish collected via

electro-shocking, may require the use of hoop nets. If an insufficient number of fish are collected, sampling may include: bag seines, and/or angling. If an insufficient number of brown bullhead is collected, other Ictalurids (yellow bullhead) and possibly Catastomids (white sucker) will be collected for analysis.

Subject fish will be kept alive during electrofishing runs, up to the point of processing individual fish. The literature indicates that fish that die prior to being assessed should neither be grossly assessed or necropsied due to the potential for the development of post-mortem lesions (Rafferty and Grazio, 2006). Gross internal, external, and liver and fish tissue sample processing will occur streamside after each electrofishing/sampling run in order to minimize the possibility of fish mortality.

Gross internal and external visual observations will follow the procedures outlined in Section 5.3 of the Field Manual for Assessing Internal and External Anomalies in Brown Bullhead (*Ameiurus nebulosus*) (Rafferty and Grazio, 2006) ; see Appendix A. A datasheet for visual observations and necropsy will be developed similar to the Fish Health Data Sheet in Rafferty and Grazio (Appendix A). Photographs will be taken of all fish exhibiting tumors, lesions, or other deformities, with the appropriate labeling (sample collection date, location, species, etc.) shown next to the fish for photo-documentation.

For preparing the livers for histo-pathological examination, livers will be excised in toto from each fish and laid flat on a cutting surface. Five transverse slabs, each less than 1 cm thick, will be trimmed from each liver. The slabs will be located approximately equidistant from one another, except that one or more of the slabs may be oriented to include any macroscopic liver lesion(s) that might be present. The slabs will be placed immediately into the fish's labeled individual container of 10% neutral buffered formalin. There will be sufficient formalin in each container so that the volume of fixative is at least 10 times the volume of the tissues. Portions of any non-hepatic tissues that have macroscopic abnormalities (those that are amenable to sampling) may also be placed in the same formalin container; these specimens will be trimmed so that they are no wider than 1 cm in at least one dimension, and they should contain some of the adjacent normal tissue if possible. Such specimens may be placed into labeled tissue cassettes to facilitate subsequent identification. No other tissues will be collected routinely unless specified by protocol amendment. The additional samples could be used for analysis under a future project but is not considered within the scope of the existing project.

Unless otherwise specified, all histo-pathological procedures will be performed according to EPL® Standard Operating Procedures. At EPL, each of the five liver slabs will be trimmed transversely (i.e., perpendicular to the long axis of the tissue as submitted) to provide at least one flat surface for microtoming, and so that the trimmed specimen can be placed into a standard tissue cassette. The remain-

ing liver tissues will be retained in the animal's individual formalin container. Liver slabs with obvious lesions will be trimmed so that a portion of the lesion(s), and, if possible, a portion of adjacent unaffected tissue, will be evident in the single microtomed section to be produced from each slab. Excluded from this requirement are lesions that are clearly parasitic in origin based on macroscopic observation. Specimens in cassettes will be processed to paraffin-embedded sections on glass slides according to routine methods, and the slides will be stained with hematoxylin and eosin prior to coverslipping. Non-hepatic tissues may be retained in the animal's individual formalin container and not processed to slides unless specified by protocol amendment or other written directive from the Study Director. Similarly, as above, these tissues may be collected for future analysis under a different project.

Each of the sections on glass slides will be examined via light microscopy by a board-certified veterinary pathologist who has experience in the evaluation of neoplastic fish diseases. During the initial histo-pathologic evaluation, the pathologist will be aware of the collection site status of each animal, as advocated in Crissman et al., 2004. Unless otherwise specified, proliferative liver lesions (foci of cellular alteration and primary liver neoplasms) will be assessed according to criteria and terminology described in Blazer et al., 2006. If multiple proliferative lesions of a single type are present in one section, these will not be quantified; however, in such instances the term "multiple" will be a component of the diagnosis. In general, non-proliferative lesions will be reported and scored for severity according to the following grading scheme: 1 = minimal, 2 = slight/mild, 3 = moderate, 4 = severe. Altered foci and neoplasms will not be scored for severity, and instead will be reported as "Present". Certain types of non-proliferative lesions that are not amenable to severity scoring may also be reported as "Present". The pathologist will attempt to correlate macroscopic observations made at necropsy or gross trimming with histopathologic diagnoses. Diagnoses will be recorded into an electronic data system for tabulation and reporting. The pathology report will include, but not limited to: a narrative pathology summary (Introduction, Methods, Results, Discussion, Summary and Conclusion sections); Histopathology Incidence Tables (HIT) and Summary Incidence Tables (SIT); and Correlation of Gross and Histopathologic Findings tables.

[See Blazer, Fournie, Wolf, and Wolfe (2006) and Crissman, Goodman, Hildebrandt, Maronpot, Prater, Riley, Seaman, and Thake (2004) for supporting material regarding histo-pathological procedures.]

2.2.1.3 Fish Tissue Chemistry

Eight bullheads (9 to 12 inch length) from both the AOC and background area will be collected for PCB analysis (see Table 1-3). This sample size will be adequate to detect a 50% increase over background with a statistical power and confidence of 90%, assuming a coefficient of variation (CV) of 50% for the fish contaminant data (see Table 2-2). Should the actual CV be greater than this, a com-

parison between the AOC and background area can still be made, but with a lower power and confidence. As a contingency, E & E will collect and archive five additional bullheads from both the AOC and background area. The archived samples will be shipped to laboratory for long-term storage. After the data have been received and evaluated, the analysis of the archived fish tissue will be determined. If the actual CV is considerably larger than assumed, the archived fish can be analyzed to provide a larger sample size, which will counter balance the larger than expected CV. Lastly, two bullhead samples from the AOC and two from the background area also will be measured for dioxins/furans to provide baseline data for this chemical group.

Table 2-2 Relationship Between Measures of Statistical Performance and Number Of Samples Required

Coefficient of Variation (%)	Power (%)	Confidence Level (%)	Number of samples required to identify differences of 30%, 50%, and 100% over background		
			30%	50%	100%
10	90	90	2	1	0
20	90	90	4	2	1
30	90	90	8	4	1
40	90	90	14	6	2
50	90	90	20	**8**	3
60	90	90	28	11	4
70	90	90	38	15	5
80	90	90	49	19	6
90	90	90	61	23	7

Notes:
1. Based on EPA (1989, 1992).

2.2.2 Wildlife Surveys

In addition to the fish sampling efforts described in Section 2.2.1, wildlife surveys will also be completed to determine the presence, relative abundance, and diversity of wildlife populations within the Eighteenmile Creek AOC and Oak Orchard Creek. Field surveys will include observations of mammals, amphibians, and birds and will be conducted during the winter, spring, fall, and winter of 2007. Bird surveys will involve a modified schedule. As with the fish sampling, similar efforts will be applied to, and methods will be standardized across, both study areas to strengthen the comparison of the survey results. Species of particular interest will be those that are water dependent, or are in contact with the water, for hunting/foraging, swimming, etc. The survey will document wildlife species composition within a number of habitat types along and adjacent to each creek. The number of observation locations will be determined during an initial field reconnaissance, and will be based upon the diversity, locations, and frequencies of various habitats (e.g., floodplain forest, fringe wetlands, cattail (*Typha* spp.) islands, inland wetlands, mudflats, nearby uplands, etc.). Selected habitat types and

locations for the amphibian and mammal surveys will be maintained and re-surveyed over the course of the field investigation. Separate datasheets will be developed and completed for each survey type (e.g., birds, mammals, and amphibians).

The data collected for this task will be used to infer the occurrence and relative abundance of each species observed during each season. Standardized methods and effort will allow for comparison between the Eighteenmile Creek AOC and Oak Orchard Creek. The results from the wildlife surveys will be compared to determine what differences may be attributable to the degree of impairment in the AOC.

Birds

Bird occurrence within the principal habitat types will be made through visual observations and by identification of bird calls or songs. Surveys for birds will include point count surveys and focused surveys for marsh dwelling birds, with effort will be placed on surveying water-dependent species that use marsh and bottomland forest habitats.

Point Count Surveys – Point count-style bird surveys will be conducted in the two study areas during each season. . Sampling points will be selected during a field visit based on accessibility, viewing distances, and representative habitat. It is anticipated that 4-6 points will be surveyed in each study area. Following the field visit, a map will be created with the sample points and the location (locations will be mapped using DGPS), access, and habitat of each point will be described in writing.

Each point count survey will be conducted by one observer familiar with the identification of western New York birds by sight and sound. Point counts will be 10 minutes in duration, with the data separated for the first three minutes, the next two minutes, and the last five minutes. Aerial flyovers or foragers will be distinctly indicated on the data sheet for data analysis purposes. Because bird activity is greatest in the morning, the surveys will be conducted and concentrated in the morning hours, approximately in the first five hours after sunrise. Surveys will not be conducted on days with heavy precipitation, fog, or high wind.

Marsh Bird Surveys – two surveys in the two study areas focused on identifying marsh-dwelling birds that are typically nocturnal and somewhat secretive as they are likely to be missed during the morning point count surveys. The Marsh Monitoring Program protocol for avian surveys will be followed (Bird Studies Canada 2006), which includes playing taped recordings of several marsh bird calls and listening for a ten minute period to see if any marsh birds respond. The Marsh Monitoring Program protocol has been an established protocol to survey for marsh birds (and amphibians) in the Great Lakes Basin since 1994 and is spon-

sored by Bird Studies Canada in association with the EPA and Environment Canada.

Mammals

General, qualitative assessments of mammals will be made by a wildlife biologist familiar with local fauna and natural history of Eighteenmile and Oak Orchard creeks. Both sites will be traversed on foot, and all habitats will be evaluated for suitability to harbor various species of mammals. A general habitat map will be developed, so that the habitats present may be equated between the sites. All wildlife survey information will be tallied and reported by habitat type and shown on a map for each study area.

Direct observation of mammals will be noted, as will tracks, dens, scat, and other signs of mammal presence (tree damage, hair, etc.). Survey effort will be equal, or will be standardized by habitat area for each site (i.e., if 18 Mile Creek has equal proportions of 4 broad habitat types, effort in each will be estimated. By way of illustration, if the reference site has non-uniform distribution of habitat availability, say 10% in cattail marsh that takes 90% of the total survey time to inspect observations will be standardized accordingly to effort). Mammal observations made incidental to other site surveys will be noted. It should be noted that the determination of abundance by "sign" can be misleading, since the "signs" of a single or a few active individuals can be encountered on many occasions within a small area. The relative abundance of mammalian species may be estimated from both observation of "signs" and the presence of preferred habitat.

Amphibians

Similar to the bird surveys, amphibian surveys will involve implementing Marsh Monitoring (Bird Studies Canada) methods during the spring and early summer. Additionally there will be a limited amount of temporary trapping for reptiles and amphibians which will be conducted using 5-gallon plastic buckets as pitfall traps (depending on the composition of soils, smaller buckets may have to be used as gravelly or rocky soils may prohibit holes the size to accommodate 5-gallon buckets). The buckets will be buried flush with the ground surface, and two nested buckets will form each trap. Captured individuals will be released alive. Traps will be checked first thing each morning, and before dark. The trap array size will be determined by budget constraints and availability of habitat within which to set up the pitfall traps. As indicated above, equivalent effort will be expended within both study areas to facilitate comparison. Alternatively, any differences in effort will be standardized before evaluating relative differences between sites. It should be noted that this technique under-represents certain taxa that are either less vulnerable to capture, or are capable of escaping (e.g., snakes), but in tandem with other survey techniques utilized should provide a suitable representation of species occurrence.

2.2.3 Equipment Maintenance – Fish Surveys

Preventative maintenance of field equipment, which is performed by field personnel routinely and preceding each field sampling event. Sampling technicians report performance of the equipment after each sampling event. Critical spare parts are kept in stock. At times, it is necessary to perform routine maintenance in the field; therefore, each field instrument is provided with an operating manual and any appropriate maintenance tools. The list of field equipment is provided in Appendix A. A list of field instruments is provided on Table 2-3.

Table 2-3 Field Instruments and Associated Preventative Maintenance

Instrument Probe	Activity	Frequency
Dissolved Oxygen (DO) Meter	Check battery	Daily and replace as needed
	Check to ensure that mechanical zero is set properly	Prior to each use
	Check DO probe membrane	As needed
	Replace membrane	As needed
pH Meter	Battery replacement	As needed
	Probe replacement	As needed
Conductivity Meter	Battery replacement	As needed
	Check loose connections	Daily
Temperature Probe	Check connections	Daily
	Check against calibrated Thermometer	Prior to field use

2.3 Sample Handling and Custody

2.3.1 Sample Handling

All fish samples will be preserved on ice immediately after collection. The samples for fish livers will be prepared as noted in Appendix B and preserved with formalin. The remaining fish tissue will packaged on ice and shipped to the laboratory. The laboratory will either freeze the fish or process immediately. There are no specific holding times for fish tissue. As general guideline tissue can be analyzed within one year of freezing.

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of samples but also prevents any detrimental effects due to the possible hazardous nature of the samples. Regulations for packaging, marking, labeling, and shipping of hazardous materials are promulgated by the DOT in 49 CFR 171 through 177. E & E trains all staff responsible for the shipment of samples in these regulations. Procedures for sample packing and shipping are documented in an E & E standard operating procedure (SOP). Specific procedures for shipment of formalin preserved samples are included in Appendix B.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. Samples will be transported and hand delivered to the laboratory at the end of the sampling day will reduce the need for extensive packaging.

2.3.2 Sample Custody

Formal sample custody procedures begin when the samples are collected. The laboratory must follow written and approved SOPs for shipping, receiving, logging, and internally transferring samples. Sample identification documents must be carefully prepared so that sample identification and COC can be maintained and sample disposition controlled. Sample identification documents include:

- Field data sheets;
- Sample labels;
- Custody seals; and
- COC records.

The primary objective of COC procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from sampling through completion of all required analyses. A sample is in custody if it is:

- In a team member's physical possession;
- In a team member's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

Field Custody Procedures

The following field custody procedure will be used for collection of samples:

- As few persons as possible should handle samples;
- Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use;
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under COC rules;

- The sample collector will record sample data in the field data sheet; and
- The Field Team Leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

Chain-of-Custody Record

The COC form must be fully completed in duplicate by the field technician designated by the Project Manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), the person completing the COC record should note these constraints. The custody record also should indicate any special preservation techniques necessary or whether samples need to be filtered. Copies of COC records are maintained with the project file.

Custody Seals

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Custody seals are placed over the cap of individual sample bottles by the sampling technician. DOT-approved sample shipping containers are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Upon receipt at the laboratory, the custodian must check and document on a cooler receipt form that seals on boxes and bottles are intact.

2.4 Analytical Method Requirements

Analytical method requirements are documented in on standard operating procedures in Appendix C. SOPs are provided PCBs by Method 8082 and dioxin by Method 1613. Additional SOPs for percent lipid determination and sample preparation also are provided.

2.5 Quality Control

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. No specific field QC samples are required for tissue samples. Laboratory-based QC will consist of standards, replicates, spikes, and blanks. Method QC limits for analyses are provided in Appendix C to this QAPP.

2.5.1 Laboratory Quality Control Analyses

Analytical performance is monitored through QC samples and spikes, such as laboratory method blanks, surrogate spikes, QC check samples, matrix spikes,

matrix spike duplicates, duplicate samples, and duplicate injections (see Table 2-4).

Table 2-4 Laboratory Quality Control Sample Guidelines, Eighteenmile Creek BUI Assessment Study Projects

QC Sample	Description
MB	One per matrix per preparation batch for each analysis.
MSB	One per matrix per preparation batch for each analysis. The MSB must contain all target analytes of concern at the site.
Surrogate Spikes	All samples analyzed for organic methods.
MS/MSD	One per matrix per SDG for each analysis. The spike solution must contain a broad range of the analytes of concern at the site. The overall frequency of MS/MSD on project samples must be at least one set per 20 samples.

Key:

SDG = Sample Delivery Group.
MSB = Matrix Spike Blank.
MS/MD = Matrix Spike/Matrix Duplicate.
MB = Method Blank.
TAL = Target Analyze List.

All QC samples are applied on the basis of a laboratory batch. Batches do not exceed 20 samples excluding associated field and laboratory QC samples. The QC samples associated with sample preparation include method blanks, laboratory control samples (LCSs) (also called matrix spike blanks [MSB] by NYSDEC), matrix spikes, and duplicates. The run batch represents all samples analyzed together in the run sequence. The run sequence is typically limited to 24 hours unless defined differently for the analytical method. The QC samples associated with the run sequence include calibration standards, instrument blanks, and reference standards. Sample delivery group (SDG) is all samples delivered in a seven day period, up to a total of 20 samples. Analytical Criteria are listed in Appendix C.

Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving detection limits or associated QC target criteria. In such instances, data will not be rejected *a priori* but will be examined on a case-by-case basis. The laboratory will report the reason for deviations from these detection limits or noncompliance with QC criteria in the case narrative.

Laboratory Method Blank

Laboratory method blanks serve to demonstrate a contamination-free environment in the laboratory. The goal is for method blanks to be free of contamination. Low-level contamination may be present, but must be less than the level in samples as defined by the method SOP. If contamination is greater, samples are re-

analyzed. If contaminants are present in the method blank but not in project samples, no further action is required. All sources of contamination that are not common laboratory contaminants as defined in the method SOPs must be investigated as part of the corrective action process. Sample results must not be blank subtracted unless specifically required by the analytical method.

Surrogate Standards

Surrogate recoveries must be within QC criteria for method blanks and LCSs to demonstrate acceptable method performance. If surrogate recoveries are outside QC criteria for method blanks or LCSs, corrective action is required and the Project Chemist should be notified. Surrogate recoveries in the samples indicate the method performance on the particular sample matrix. Surrogate recoveries that are outside QC criteria for a sample indicate a potential matrix effect. Matrix effects must be verified based on review of recoveries in the method blank or LCS, sample reanalysis, or evaluation of interfering compounds. Sample clean-up procedures are required by the NYSDEC ASP must be implemented to alleviate potential matrix problems.

Laboratory Control Sample

LCS recoveries must be monitored on control charts for all non-Contract Laboratory Procedure methods. Laboratory QC criteria must be established for each method and matrix using a minimum of 30 points. QC criteria should be updated annually. The LCS recovery must be within the control limits to demonstrate acceptable method performance. Sporadic marginal failures of a few target analytes reported when greater than five target analytes are required are allowed as part of the data review guidance. If LCS recoveries are outside QC criteria for more than a few target analytes, recoveries are significantly low, or the compounds were detected in the samples, then corrective action is required. After corrective action is complete, sample re-analysis is required for failed parameters. If LCS recoveries exceed the QC criteria, and that parameter is not found in any samples, re-analysis is not necessary. For any other deviations from LCS control limits that can not be resolved by sample re-analysis within holding times, the Project Chemist must be notified immediately. If critical samples are affected, the Project Manager may determine that re-sampling is required.

Matrix Spike Sample

MS recoveries are a measure of the performance of the method on the sample being analyzed. Field and trip blanks must not be chosen for spiking. MS recoveries outside the control limits applied to the LCS indicate matrix effects. Sample clean-up procedures may be warranted for samples with severe matrix effects. The laboratory should notify the Project Chemist of these instances to determine an appropriate corrective action. The recovery limits for biota are 43 to 130% as indicated by the laboratory (see Appendix B).

Matrix Spike Duplicate Sample

The MSD sample is commonly prepared in conjunction with the MS sample. The MSD is prepared from a separate portion of the sample and processed with the same additions as the MS. The MSD is prepared for methods that do not typically show concentrations of target analytes above MDLs, such as organic methods. The RPD between the recoveries in the MS and MSD measure the precision of the analytical method on actual project samples. For this project, QC criteria for RPDs are 56% for tissue as provided from the laboratory (see Appendix B).

Duplicate Sample

The duplicate is prepared for methods that typically show concentrations of target analytes above MDLs, such as metals and wet chemistry methods. The RPDs between recoveries in the original and duplicate measure the precision of the analytical method on the actual project samples. For this project, QC criteria for RPDs are 20% for waters and 35% for soils unless the laboratory provides additional statistical criteria.

If all other QC criteria are met, RPD results outside control limits indicate potential matrix effects. The laboratory should investigate significant deviations in the RPD results by observing the sample to determine any visual heterogeneity or reviewing sample chromatograms for matrix interference. If visual observation does not indicate a potential problem, the sample may be reanalyzed. Potential matrix effects are reported in the case narrative.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

All laboratory and field instruments and equipment used for sample analysis must be serviced and maintained only by qualified personnel. Laboratory instrument maintenance procedures will be evaluated to verify that there will be no impacts on analysis of project samples due to instrument malfunction. For example, the laboratory must have duplicate instrumentation and/or major laboratory instruments (e.g., gas chromatograph/mass spectrometer) maintained under service agreements with the manufacturer that require rapid respond by manufacturer-approved service agents.

2.7 Instrument/Equipment Calibration and Frequency

All instruments and equipment used during sampling and analysis will be operated and calibrated according to the manufacturer's guidelines and recommendations, as well as criteria set forth in applicable analytical methodology references. Personnel properly trained in these procedures will perform operation and calibration of all instruments. Documentation of all field maintenance and calibration information will be maintained in the task logbook. Table 2-3 lists monitoring equipment that may be used during fieldwork. All field personnel receive annual

refresher training on the field operation of all health and safety related equipment, which includes calibration procedures.

2.8 Inspection/Acceptance of Supplies and Consumables

Measures are established in E & E's QMP to assure that purchased material, equipment, and services, whether purchased directly or through contractors or subcontractors, conform to procurement documents. Documentation regarding the purchase of material, equipment, and services is prepared, reviewed, and approved in accordance with requirements set forth in the QMP and E & E subcontracting procedures.

Procedures for the procurement, inspection, maintenance and management of equipment and supplies for NCSWCD activities are documented in E & E's Government Property Procurement SOP. All field supplies and equipment will be procured as part of the contract and maintained by the technical team. Supplies and equipment will be inspected on receipt at the site to verify that the correct materials were received.

2.9 Non-Direct Measurements

For data acquired from non-direct measurement sources include the following:

- Physical information such as descriptions of sampling activities and field observations;
- State and local environmental agency files;
- Reference computer databases and literature files; and
- Historical reports on a site and subjective information gathered through interviews.

Data from non-direct measurements will be reviewed and used as indicated in Section 2.2. The primary sources are literature reference values listed in Section 2.2. The data user will verify all literature values against the original source and will not use secondary sources for primary reference values. Section 1.6 discusses field documentation of the measurements listed in Section 2.2.

Historical reports on the site were used to develop the project objectives and are discussed in Section 1.2.

2.10 Data Management

For data collected under this project, the Field Team Leader will review all field data for accuracy. Any field data not provided by the laboratory will be entered into a database or spreadsheet.

The laboratory will provide an electronic data deliverable (EDD) for all analytical reports that is consistent with their standard spreadsheet.

The E & E technical team will process the EDD and review all laboratory and field data to verify the results against the hard copy and check for transcription errors. The Project Chemist will review data against the criteria in this QAPP and add any data qualifiers. Data that will appear on data tables for the report will be generated from EDD. E & E will develop a central data source for all data handling operations.

The central database will be stored in a secure area on E & E's network with access limited to data management specialists designated by the Project Manager. The central database will be electronically linked to E & E's GIS systems, risk assessment programs, and other final data user models and statistical programs. Data users may enter additional electronic data such as risk-based criteria for comparison of results. This data will be stored in separate tables in the database and linked to the actual results. Any data from outside sources will include a description of the data, a reference to the source, and the date updated. Outside data will be checked prior to use verify that current values are used. The central database will be used to create tables for the final report.

3 Assessment and Oversight

E & E's assessment and oversight procedures will be implemented in accordance with the QMP. The QMP outlines general roles and responsibilities for the project team.

3.1 Assessment and Response Actions

E & E's overall assessment activities include management assessments, development of SOPs, and performance evaluations. Management assessments include weekly meetings and conference calls to evaluate project readiness and staff utilization. Assignment of qualified personnel, maintenance of schedules and budgets, and quality of project deliverables are verified as part of these assessments. The development of SOPs and performance evaluations are used to provide trained and qualified personnel for the project.

E & E's technical assessment activities include peer review, data quality reviews, and technical system audits (i.e., laboratory and field). Procedures for assessment and audit of data quality are described in Section 4 of this QAPP. Procedures for peer review and technical assessments are summarized briefly below.

Both overall and direct technical assessment activities may result in the need for corrective action. E & E's approach to implementing a corrective action response program for both field and laboratory situations is summarized briefly below. The E & E QA Officer has stop work authority on all NCSWCD projects that may have negative quality impacts prior to completion of corrective actions.

3.1.1 Peer Review

E & E implements peer review for all project deliverables including work plans, QAPPs, draft and final reports, and technical memoranda. The peer review process provides for a critical evaluation of the deliverable by an individual or team to determine if the deliverable will meet established criteria, quality objectives, technical standards, and contractual obligations. The Project Manager will assign peer reviewers when the publications schedule is established. The publications staff will be responsible for ensuring all peer reviewers participate in the review process and approve all final deliverables. For technical memoranda and other

project documents, the Project Manager will be responsible for obtaining principal review and approval.

3.1.2 Technical Systems Assessments

The entire project team is responsible for ongoing assessment of the technical work performed by the team, identification of nonconformance with the project objectives, and initiation, implementation and documentation of corrective action. Independent performance and systems audits are technical assessments that are a possible part of the QA/QC program. The following describes types of audits conducted, frequency of these audits, and personnel responsible for conducting audits.

Field Audits

Field audits, if performed, are under the direction of the QA Officer. No field audit will be performed for this field program.

Field Inspections

The Project Manager will be responsible for inspecting all field activities to verify compliance of activities with project plans.

Laboratory Audits

The laboratory must implement a comprehensive program of internal audits to verify compliance of their systems with SOPs and QA manuals.

NYSDOH must certify the laboratory and will perform external systems audits at an approximate frequency of once a year. External audits include reviews of analytical capabilities and procedures, COC procedures, documentation, QA/QC, and laboratory organization.

No laboratory audits are planned for this project.

3.1.3 Corrective Action

Corrective actions will be implemented as needed. In conjunction with the QA Officer and Laboratory QA Coordinator, the Project Manager is responsible for initiating corrective action and implementing it in the field and office, and the laboratory project manager is responsible for implementing it in the laboratory. It is their combined responsibility to see that all sampling and analytical procedures are followed as specified and that the data generated meet the prescribed acceptance criteria. Specific corrective actions necessary will be clearly documented in the logbooks or analytical reports.

Field Situations

The need for corrective action in the field may be determined by technical assessments or by more direct means such as equipment malfunction. Once a problem has been identified, it may be addressed immediately or an audit report may

serve as notification to project management staff that corrective action is necessary. Immediate corrective actions taken in the field will be documented in the project logbook. Corrective actions may include, but are not limited to:

- Correcting equipment decontamination or sample handling procedures if field blanks indicated contamination;
- Recalibrating field instruments and checking battery charge;
- Training field laboratory personnel in correct sample handling or collection procedures; and
- Accepting data with an acknowledged level of uncertainty.

After a corrective action has been implemented, its effectiveness will be verified. If the action does not resolve the problem, appropriate personnel will be assigned to investigate and effectively remediate the problem. Corrective actions recommended by NCSWCD personnel will be addressed in a timely manner.

Laboratory Situations

Out-of-control QC data, laboratory audits, or outside data review may determine the need for corrective action in the laboratory. Corrective actions may include, but are not limited to:

- Reanalyzing samples, if holding times permit;
- Correcting laboratory procedures;
- Recalibrating instruments using freshly prepared standards;
- Replacing solvents or other reagents that give unacceptable blank values;
- Training additional laboratory personnel in correct sample preparation and analysis procedures; and
- Accepting data with an acknowledged level of uncertainty.

The laboratory corrective actions must be defined in analytical SOPs. Any deviations from approved corrective actions must be documented and approved by the Project Chemist.

3.2 Reports to Management

For reports to management include the following:

- **Data Usability Summary Report** - A DUSR will be completed by the Project Chemist and provided to the NCSWCD technical staff in the appendix of the report. Impacts on the usability of data will be tracked by adding qualifiers to individual data points as described in Section 4.

- **Project Status Reports** - Project status reports are completed by the Project Manager to document the overall assessment of the project on a monthly basis.

Upon completion of a project sampling effort, analytical and QC data will be included in a comprehensive technical report that summarizes field activities and provides a data evaluation. A discussion of the validity of results in the context of QA/QC procedures will be made and the DUSR will be provided.

Serious data problems will be reported immediately to NCSWCD personnel. Time and type of corrective action (if needed) will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field or modifying laboratory protocol.

4 Data Validation and Usability

E & E will implement procedures for data validation and usability described below.

4.1 Data Review, Validation, and Verification Requirements

All data generated will be reviewed by comparing accuracy and precision results listed Appendices B and C.

- Field data and fish pathology results will be reviewed by internal experts for consistency with literature values. Following the pathology evaluation, the pathologist will compare prevalence results with those of previous studies as reported in the scientific literature. Differences in results may be explainable based upon sample dynamics, and/or the types of differences and frequencies encountered. If the results are substantially different, a histologic slide peer review may be recommended to resolve inconsistencies. Peer review is not currently a component of this investigation. All histopathology data are subject to internal QC verification and QA audit according to EPL SOPs and in accordance with Great Lakes Program guidelines.

- Analytical reporting limits and target compounds and QC summary data for surrogates, method blanks, LCS, and MS/MSD samples will be compared to limits listed in Appendix C.

- Calibration summary data will be checked by the laboratory to verify that all positive results for target compounds were generated under an acceptable calibration as defined by the analytical method. Any deviations will be noted in the case narrative and reviewed by the Project Chemist.

- Field data such as sample identifications and sample dates will be checked against the laboratory report.

- Any raw data files from the field and laboratory will not be reviewed unless there is a significant problem noted with the summary information.

4.2 Validation and Verification Methods

The laboratory is responsible for performing internal data review. The laboratory QA officer must perform review on 10% of the data packages. All levels of laboratory review must be fully documented and available for review if requested or if a laboratory audit is performed.

After receipt from the laboratory, project data will be validated using the following steps:

Evaluation of Completeness

The Project Chemist checks the electronic files for compliance with standard format and the QAPP. If errors in loading are found, the EDD files will be returned to the laboratory. The Project Chemist also verifies that the laboratory information matches the field information and that the following items are included in the hard copy data package:

- COC forms and Sample Summary forms;
- Case narrative describing any out-of-control events and summarizing analytical procedures;
- Data report forms (i.e., Form I);
- QA/QC summary forms; and
- Chromatograms documenting any QC problems.

If the data package is incomplete, the Project Chemist will contact the laboratory, which must provide all missing information within one day.

Evaluation of Compliance

The validation procedures process the electronic data and assign qualifiers if outliers are found. Project chemist will follow E & E SOPs for data review and complete checklists for PCBs. Additional compliance checks on representative portions of the data are briefly outlined below:

- Review chromatograms and other raw data if provided as backup information for any apparent QC anomalies;
- Ensure that all analytical problems and corrections are reported in the case narrative and that appropriate laboratory qualifiers are added;

- For any problems identified, review concerns with the laboratory, obtain additional information if necessary, and check all related data to determine the extent of the error; and

- Non-analytical data on field data sheets will be reviewed as outlined in Section 2.2.

Data Review Reporting

The Project Chemist or reviewer of non-analytical data will perform the following reporting functions:

- Alert the Project Manager to any QC problems, obvious anomalous values, or discrepancies between the field and laboratory data, that may impact data usability;

- Discuss QC problems in a DUSR for each laboratory report;

- Prepare analytical data summary tables of qualified data that summarize those samples and analytes for which detectable concentrations were exhibited including field QC samples; and

- At the completion of all field and laboratory efforts, summarize planned versus actual field and laboratory activities and data usability concerns in the technical report.

4.3 Reconciliation with User Requirements

Any deviations from analytical performance criteria or quality objectives for the project will be documented in the DUSR provided to the data users for the project.

The QA Officer or Project Chemist will work with the final users of the data in performing data quality assessments. The data quality assessment may include some or all of the following steps:

- Data that are determined to be incomplete or not usable for the project will be discussed with the project team. If critical data points are involved which impact the ability to complete project objectives, data users will report immediately to the Project Manager. The Project Manager will discuss resolution of the issue with NCSWCD technical staff and implement necessary corrective actions (for example re-sampling);

- Data that are non-detect but have elevated reporting limits due to blank contamination or matrix interference will be compared to background values. If

reporting limits exceed the background values, then results will be handled as incomplete data as described above; and

- Data that are qualified as estimated will be used for all project decision making. Data assessors comparing to results to background will have to account for the higher level of uncertainty in their statistical analysis.

Part of the assessment process involves comparing analytical results for bullheads background concentrations to determine if the contamination present is site-related (i.e., above background levels)If the PCBs and dioxin/furan concentrations are above background, then the concentrations will be compared to appropriate literature values and other related scientific studies to determine the potential significance of the concentration levels.

In addition to the collecting bullhead analytical data, ecological survey data on fish, bird, and mammal populations will be collected from the site and reference area (see Section 1.3.4). The usability of all data types for making comparisons between the site and reference area will be ensured through careful attention to the following factors:

- Selection of a suitable reference area. The chosen reference area will be highly ecologically similar to the site. It will support, or be capable of supporting, the same plant and animal communities as the site so that differences between the site and reference area due to chemical contamination will not be confounded with habitat effects.

- Scientifically sound, acceptable methods will be used for all data collection activities so that differences between the site and reference area, if identified, can be considered real, not artifacts of sample collection.

- Competent experienced biologists will be involved in all aspects of field work to ensure that only high-quality data are collected.

- Rigorous procedures and checks will be in place to ensure that all project data are accurately recorded and incorporated into the project database.

5 References

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A

Field Procedures and Data Sheets

See CD in back pocket.

B Laboratory Procedures – Fish Pathology

See CD in back pocket.

C Laboratory Procedures – Chemical

See CD in back pocket.