2018 Fish Tissue Contaminants Monitoring WP for the Upper Wabash Basin

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SIGNATURE PAGE

2018 Fish Tissue Contaminants Monitoring Work Plan for the Upper Wabash Basin

Indiana Department of Environmental Management
Office of Water Quality
Watershed Assessment and Planning Branch
Indianapolis, Indiana
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Reviews and Approvals

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Work Plan Organization

This Sampling and Analysis Work Plan is an extension of the existing Watershed Assessment and Planning Branch, March 2017 "Quality Assurance Project Plan (QAPP) for Indiana Surface Water Programs", and serves as a link to the existing QAPP and an independent QAPP for the project. Per the United States Environmental Protection Agency (U.S. EPA) 2006 QAPP guidance (U.S. EPA 2006), this Work Plan establishes criteria and specifications pertaining to a specific water quality monitoring project that are usually described in the following four sections as QAPP elements:

Section I. Project Management/Planning

- Project Objectives
- Project/Task Organization and Schedule
- Background and Project/Task Description
- Data Quality Objectives (DQOs)
- Training and Staffing Requirements

Section II. Measurement/Data Acquisition

- Sampling Procedures
- Analytical Methods
- Sample and Data Acquisition Requirements
- Quality Control (QC) Measures Specific to the Project

Section III. Assessment/Oversight

- External and Internal Checks
- Audits
- Data Quality Assessments (DQAs)
- Quality Assurance/Quality Control (QA/QC) Review Reports

Section IV. Data Validation and Usability

- Data Handling and associated QA/QC activities
- QA/QC Review Reports

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LIST OF ACRONYMS

AIMS:	Assessment Information Management System
ALUS:	Aquatic Life Use Support
AU:	Aquatic Uses
BSS:	Biological Studies Section
CAS:	Chemical Abstract Service
CFR:	Code of Federal Regulations
CPR:	Cardio-Pulmonary Resuscitation
CRQL	Contract Required Quantitation Limit
CWA:	Clean Water Act
DELT	Deformities, eroded fins, lesions, and tumors
DFW	Division of Fish and Wildlife
DQA:	Data Quality Assessment
DQO:	Data Quality Objective
EDI:	Electronic data import
FCA:	Fish Consumption Advisory
HUC:	Hydrologic Unit Code
IAC:	Indiana Administrative Code
IC:	Indiana Code
IDNR:	Indiana Department of Natural Resources
ISDH:	Indiana State Department of Health
IUPAC:	International Union of Pure and Applied Chemistry
MDL:	Method Detection Limit
NA:	Not applicable
ng/kg:	Nanograms per kilogram
NPDES:	National Pollutant Discharge Elimination System
PAH:	Polycyclic (or polynuclear) Aromatic Hydrocarbons
PCB:	Polychlorinated biphenyl
PFD:	Personal Floatation Device
QA:	Quality Assurance
QA/QC:	Quality Assurance/Quality Control
QAPP:	Quality Assurance Project Plan
QC:	Quality Control
RFP:	Request for Proposals
SOP:	Standard Operating Procedure
TMDL:	Total Maximum Daily Load
µg/kg:	micrograms per kilogram
U.S. EPA:	United States Environmental Protection Agency
WAPB:	Watershed Assessment and Planning Branch
WQMS:	Indiana Water Quality Monitoring Strategy
WW:	Wet Weight

DEFINITIONS

Bioaccumulate	To accumulate a substance, such as a toxic chemical, in various tissues of a living organism.
Co-jurisdictional waters	According to 312 IAC 5-2-47, the Indiana waters of Lake Michigan, the Ohio River, the Wabash River (where it forms the Indiana-Illinois border), and the Great Miami River.
Composite Sample	A fish tissue sample comprised of two or more individual organisms of the same species collected at a particular site, of similar size (smallest individual within the composite is no less than 75% of the total length of the largest individual), and analyzed as a single sample.
Contaminant	A biological, chemical, physical, or radiological substance which, in sufficient concentration, can adversely affect living organisms through air, water, soil, or food.
Dry weight	The weight of the sample, corrected for the moisture content.
Emerging Contaminant	New compounds or molecules that were not previously known or that just recently appeared in the scientific literature; contaminants of emerging interest which were known to exist but for which the environmental contamination issues were not fully realized or apprehended; and emerging issues about “old” (legacy) contaminants (i.e., situations where new information is jostling our understanding of environmental and human health risks related to “old” contaminants) (Sauvé 2014).
Fillet	The flesh of the fish, which is composed of the skeletal muscles and fat, as opposed to the bones and internal organs.
Hydrologic Unit Code (HUC)	A numbering system for watersheds, based on the area of land that drains into a hydrologic feature such as a stream, river, or lake.
Legacy Contaminant	Pollutants, often used or produced by industry, which remain in the environment long after they were first introduced (Smith 2009).
Piscivorous	A carnivorous animal which eats primarily fish.
Replicate Sample	Two or more composite samples containing the same species, of similar length, from a particular site, and having a relative difference between the average lengths of individuals within any composite sample of less than 10 percent (U.S. EPA 2000c, 6.1.2.7).

Total Length	A measurement from the anterior-most part of the fish to the longest caudal fin ray when the lobes of the caudal fin are compressed dorsoventrally (U.S. EPA 2000c).
Water of the state	As defined by IC 14-8-2-307, a lake; reservoir; marsh; waterway; other water that is under public ownership, jurisdiction, or lease; or that has been used by the public with the acquiescence of any or all riparian owners.
Wet weight	The “as-is” weight, which includes the solid and liquid portion of the sample.

I PROJECT MANAGEMENT/PLANNING

Project Objective
The main objective of the fish tissue contaminants monitoring project is to generate results for use as ecological indicators in support of the Performance Partnership Agreement (PPA), CWA 305(b) reporting, and CWA 303(d) listing of impaired waters for the Upper Wabash Basin. Sampling for this project includes collecting fish tissue samples from 38 sites from the Upper Wabash River Basin and having them analyzed at Pace Analytical Laboratory and AXYS Laboratory..

In addition, the Indiana Department of Natural Resources (IDNR) Division of Fish and Wildlife (DFW) will collect fish tissue samples, to be processed by the IDEM OWQ Watershed Assessment and Planning Branch (WAPB), from the Indiana waters of southern Lake Michigan during their 2018 planned studies.

Data collected during fish tissue monitoring will be used for the following purposes:

- Generate polychlorinated biphenyls (PCBs) and mercury (Hg) results for use as ecological indicators in support of the Performance Partnership Agreement (PPA), CWA § 305(b) reporting, and § 303(d) listing of impaired waters. (Primary objective)
- Gather PCBs and Hg data to be used by the Interagency Fish Consumption Advisory Workgroup to support the issuance, modification, or removal of fish consumption advisories on specific Indiana water bodies by the Indiana State Department of Health (ISDH).
- Develop tools for regional assessment and classification of bioaccumulating contaminants in Indiana waters (Table 4-14).
- Provide supporting data toward understanding risks to piscivorous wildlife (Tables 4-14).
- Evaluate contaminant trends in fish.

Project/Task Organization and Schedule
In 2018, tributaries to the Upper Wabash River basin in Indiana are the regions of central focus. These are the target basins for monitoring and assessment within the Office of Water Quality WQMS for fish tissue contaminants monitoring. For the purpose of this project, the tributaries to the Upper Wabash River Basin are defined as all streams, rivers, reservoirs, and natural lakes discharging to or within the defined watershed boundaries of the Upper Wabash Basin River, Salamonie River, Mississinewa River, Eel River, Tippecanoe River, Wildcat Creek, and the Middle Wabash River. In addition, fish tissue samples from the Indiana waters of southern Lake Michigan, near Michigan City, will be collected by the IDNR DFW and submitted for analysis to the analytical services contract laboratory (IDOA 2017) by IDEM OWQ WAPB personnel. Sampling by IDEM OWQ WAPB for the target basins portion of this project will begin in July and continue through October. All fish collections submitted by the IDNR will be on their own schedule, and following their own sampling protocols and standard operating procedures (SOPs). Sample selection and sample processing by the IDNR is further explained in the Background and Project/Task Description section of the work plan. Deadlines and Time Frames for Sampling Activities
Site reconnaissance activities for all listed tentative sites will begin in January and conclude by the beginning of the sampling season. Reconnaissance activities will be conducted in the office and through physical site visits if needed. The office activities will include preparation and review of site maps and aerial photographs, identification of potential access routes, and property owner searches, when necessary. Landowner permission is required when access to a site is located on private property. Physical site visits will include property owner visits (if necessary), as well as confirmation, and documentation of access routes and equipment needs. The Sampling Design and Site Locations section of this work plan contains more detailed information about site selection.

Fish tissue collection activities will begin in July and end in October 2018. The annual monitoring program target is for approximately 35-45 sites from the target basins to be sampled once during the course of the sampling season. Fish tissue samples will be collected from the 40 sites listed in Table 2, including 39 Upper Wabash River basin sites (twenty-eight stream or river sites, and eleven lakes or reservoirs) and one site from the Indiana waters of southern Lake Michigan. The total number of composite fish tissue samples collected is expected to be about 175. These samples will be prepared from approximately 800 individual captured fish.

Fish collected and prepared for individual or composite fish tissue samples will be stored at approximately -80°C in a freezer in the WAPB laboratory room 125, 124, or building 41 laboratory at the Western Select Properties office building (2525 N. Shadeland Ave, Indianapolis, IN 46219) until relinquished to the contract analytical services laboratory for analysis. Prepared samples will not be sent to the laboratory until all sampling for the year has been completed.

Records of all composite samples collected will be entered into the project field sample record book by the IDEM OWQ WAPB fish tissue sampling crew leader. This is an activity that will be done in the field at the time of sampling. This book is kept at the IDEM OWQ WAPB Western Select Properties field office in the custody of the project manager or sampling crew leader.

All accounts of the sampling event, sample collection crew, samples collected, preparation of samples, species, number of individuals composited in the sample, individual fish lengths, and individual fish weights are to be entered into the Assessment Information Management System (AIMS) Project: "***2018 Fish Tissue***." This ongoing data entry is conducted by the project manager, sampling crew chief, or any other staff person specifically designated by the project manager or sampling crew chief. Data entry must be completed before shipment of samples to the analytical services contract laboratory.

Fish tissue samples are sent to the contract laboratory for analysis by specified analytical sets from August through December as needed. Analytical reports for samples are to be received by a WAPB quality assurance officer 60 days after samples are received by the lab. The assigned WAPB chemist will review the lab reports and appropriately assign DQA levels and flags to the data.

Background and Project/Task Description

Fish tissue and sediment contaminants monitoring has been regularly conducted since the early 1970s. First by the Indiana State Board of Health and then by IDEM. Fish tissue contaminant monitoring was first incorporated into the rotating basin methodology in 1997. The program currently follows a five-year rotating basin schedule, as described in the 2017-2021 WQMS (IDEM 2017b). A 23-site sampling network subset ("core" sites) of Fixed Station Program sites (IDEM, 2001) began operating in the late 1970s in cooperation with the U.S. EPA. Prior to 1997, fish tissue samples were collected at these 23 "core" sites on a biennial basis. Post 1997, sampling has been conducted at these sites once every five years according to the WQMS rotating basin methodology.

In addition to the 23 "core" sites, other sites are targeted based on historical environmental problems, water body access, use for fishing, date of last sampling event, potential contaminant sources, and recommendations for monitoring by other agencies and entities. Sampling targets approximately 35-45 sites annually, including any "core" sites in the target basin (see Table 2), with an average of 3-5 composite or individual fish tissue samples collected per site. In addition to these sites, samples from other agencies are accepted that were collected, prepared, and preserved using the same techniques used by WAPB. Fish tissue samples are also sometimes collected by other offices or agencies for analysis under our laboratory services contract (IDOA 2017) in support of specific projects such as mercury fate and transport; trends and status; and natural resource damage assessments. Samples are prepared using the whole fish or from the edible portion (skin-on or skin-off fillets) of fish. Whether whole fish or fillets are used is dependent on the size and species of fish retrieved. Typically, whole fish are only used when processing noncarp minnow species, or fish less than or equal to four inches in length.

In addition to determining Aquatic Life Use Support (ALUS) attainment, another major objective of Indiana's fish tissue monitoring is to provide data in support of Indiana's Fish Consumption Advisory (FCA). The FCA provides the fish consumer with information about the risks associated with consuming potentially contaminated fish caught in Indiana. This program helps consumers make informed decisions regarding the size and species of fish, and how often to eat sport caught and commercially bought fish. Each year, after analytical results are received, members of the Indiana Interagency FCA Workgroup, comprised of ISDH, IDEM, and IDNR, meet to discuss the findings of recent fish monitoring data and develop the updated state-wide FCA. Indiana's FCAs are issued by ISDH. IDEM collects and manages the majority of the data used to make decisions on FCAs for the state. IDNR has been instrumental in the collection of fish tissue samples from Lake Michigan and a number of inland lakes, where special studies are conducted by their agency. Fish tissue samples are collected throughout Indiana from public waters (waters of the State).

Indiana's sport fish consumption advisories are currently based on concentrations of mercury and PCBs found in the edible portions of fish tissue. During the last three decades, more than 5,700 fish tissue samples have been analyzed for PCBs, organochlorine pesticides, and metals of concern (Table 9). Of those, the majority contained quantifiable levels of mercury. Criteria for PCBs and mercury assessments in the Indiana FCA were developed from recommendations by the Great Lakes Sport Fish Advisory Task Force; in 1993 for PCBs (Anderson 1993); and in 2007 for mercury (McCann 2007). Currently PCBs and mercury are the only two bioaccumulating fish tissue contaminants causing FCA listings.

Bioaccumulating contaminants in sediments are strongly associated with levels of contaminants found in fish, and can aid in determining the potential origins and extent of contamination. Surficial (surface or top layer) sediment sampling, in the past, was conducted in conjunction with fish tissue sampling in order to establish possible contaminant sources. Contaminants found in surficial sediments only represent contaminant presence. They do not give a measure of the total load of the contaminant in the waterbody. Sediment sampling targets depositional areas for fine silt and organic deposits. Three or more grab samples of surficial deposits are taken using a Ponar dredge (lakes and deep river pools) or scooped with a stainless steel ladle (shallow wadeable waters). While sediment sampling has not been conducted as part of this program since 2003 (due to staffing priorities, analytical services contract execution timing, and the lack of progress with sediment contaminant criteria development by U.S. EPA), the OWQ WAPB retains the ability to sample this media on an as-needed basis. Sediment sampling will not be further discussed in this work plan.

Data Quality Objectives (DQO)

The Data Quality Objectives (DQO) process is a planning tool for data collection activities. It provides a basis for balancing decision uncertainty with available resources. The DQO is required for all significant data collection efforts for a project and is a seven step systematic planning process used to clarify study objectives, define the appropriate types of data, and establish decision criteria to base the final use of the data. The DQO process for the Fish Tissue Contaminant Monitoring Program is identified in the following seven steps.

1. State the Problem

Indiana is required to assess all waters of the state to determine their designated use attainment status**. "**Surface waters of the state are designated for full-body contact recreation and will be capable of supporting a well-balanced, warm water aquatic community" [327 IAC 2-1-3] and [327 IAC 2-1.5-5]. This project will gather data on bioaccumulating contaminants in fish for the purpose of assessing the designated use attainment status of streams and lakes sampled for federal purposes as required for 305(b) and 303(d) list development, human health risks associated with fish consumption, and fate and wildlife impacts of contaminants in fish.

2. Identify the Decision

The primary goals of this project are to:

- Determine the aquatic life use impairment for fish consumption based on concentrations of total PCBs and mercury for the 305(b)/303(d) Integrated Report on water quality in the State of Indiana. Sites not attaining aquatic life use support for fish consumption will be listed in the Section 303(d) List of Impaired Waterbodies for Indiana.
- Provide supporting data to the ISDH for the issuance, modification, or removal of FCA's on waters of the state. See Table 1 for decision rules concerning total PCB and total mercury.

Table 1: Criteria for Decision Making Using Fish Tissue

Parameter	IDEM Derived Criteria values for 303(d) ALUS* Determination	Indiana Fish Consumption Advisory decision levels (µg/kg wet weight)
Total PCB	>20 (µg/kg wet wt.) for any single sample	>50 - 1900 limited consumption >1900 No consumption
Total mercury	>300 (µg/kg wet wt.) (Fish tissue trophic level consumption weighted arithmetic mean concentration in edible portions for a sampling event.)	>50 – 950 limited consumption for sensitive populations @ >950 NO consumption @ >160 limited consumption for the general population

**** ALUS=Aquatic Life Use Support***
@Sensitive populations include women under age 50, women who are pregnant, breastfeeding or planning to become pregnant, people with compromised immune systems, and children under the age of 18.

A number of legacy contaminants bioaccumulating organochlorine compounds, metals, and semi-volatile organic compounds; and other emerging contaminants may be determined on select samples from the targeted sites. The determination is based on the annual budget, regional trends in emerging contaminants, and historical site knowledge.

3. Identify the Input to the Decision
Field activities are required to collect whole or edible portions of representative fish species tissue samples. These samples are needed to address the necessary decisions previously described. Sampling activities will take place at targeted sites where public access is available, bridge easements, or for which permission to access has been granted by the necessary landowners or property managers. Historical data will not be used in the calculation of predicted stream mileages supporting or non-supporting aquatic life use, however historical data will be provided to ISDH for issuance of the FCA. Collection procedures for fish tissue samples will be described in detail under Section II, Measurement/Data Acquisition.

4. Define the Boundaries for the Study
For the purpose of this program, the Upper Wabash River Basin (Figure 1) is geographically defined as within the borders of Indiana contained by the 8-digit Hydrologic Unit Codes (HUC) 05120101, 05120102, 05120103, 05120104, 05120105, 05120106, and 05120107. The Upper Wabash Basin located in north-central Indiana drains approximately 6918 square miles within Indiana borders. Using the 2011 National Land Cover Database for the Conterminous United States, predominant land uses are cropland (77%), urban (9%) forest (9%), and pasture (4%) (Homer 2015).

The Great Lakes Basin (Figure 2), specifically the geographic area defined as within the borders of Indiana contained by the 8-digit HUC 04040001, drains into the southern portion of Lake

Michigan. This sub-basin, is located in the northwest corner of Indiana, drains approximately 512 square miles. Predominant land uses are urban (36%), cropland (17%), forest (17%), and wetland (12%) (Homer 2015).

The target area for sampling is defined as any waters of the state within the geographic boundaries of Indiana. Figures 1-2 and Table 2 list the sampling sites selected in the tributaries to the Upper Wabash River basin and the Indiana waters of southern Lake Michigan, respectively.

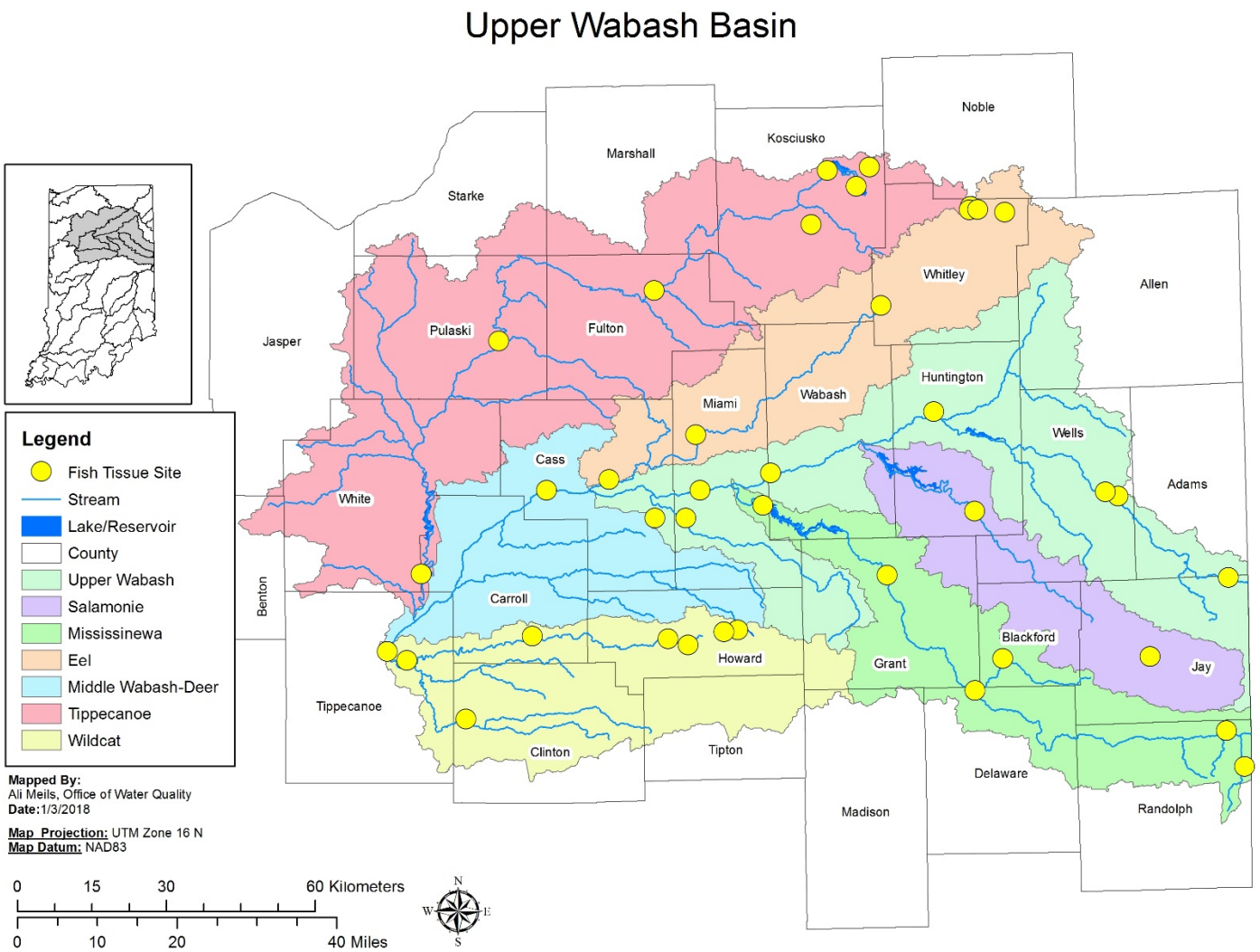

Figure 1: Tentative Target Sites in the Upper Wabash River Basin

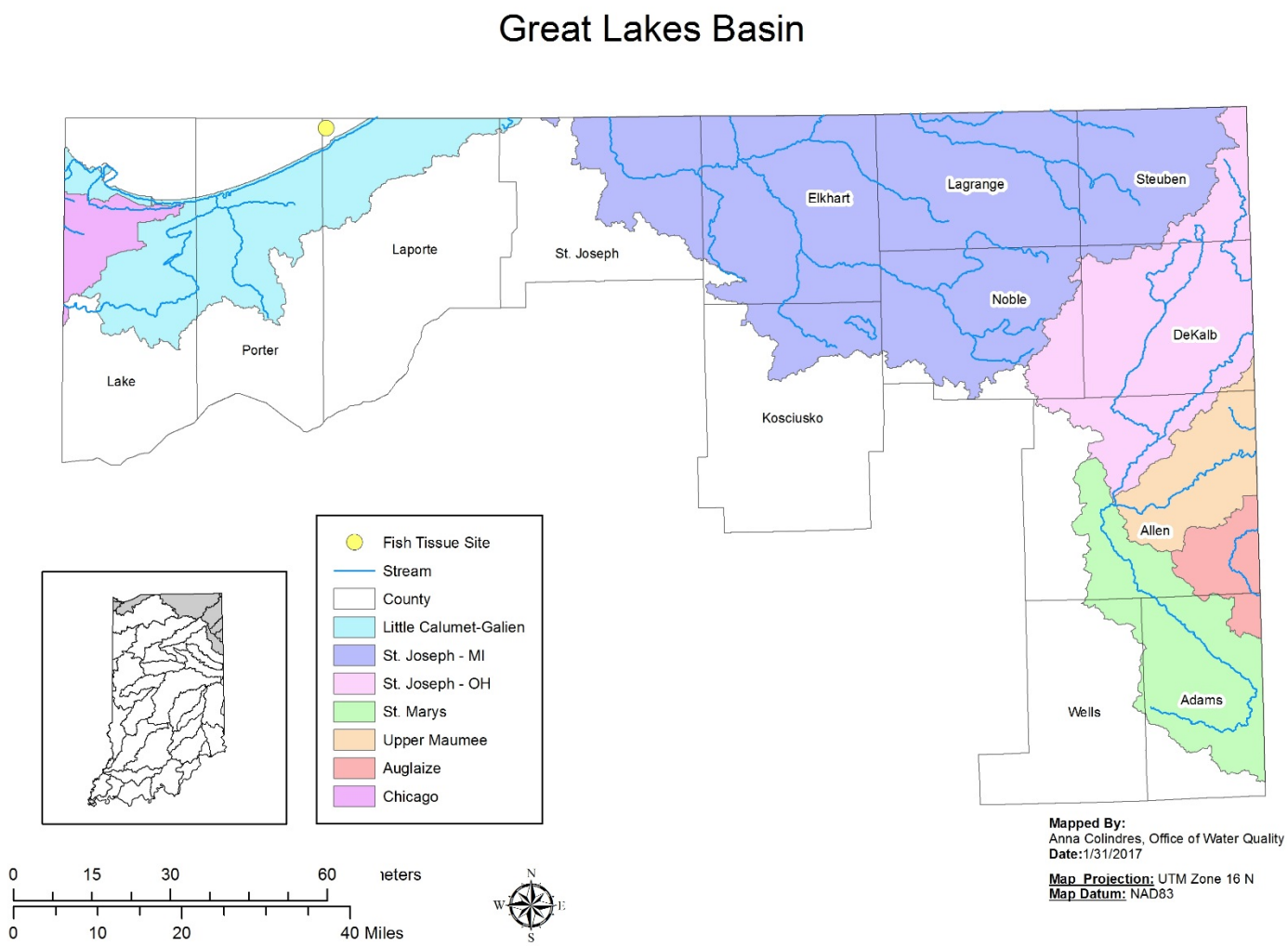

Figure 2: Tentative Target Site in the Indiana Portion of Southern Lake Michigan

Table 2. Tentative Target Sites for the 2018 Fish Tissue Contaminants Monitoring Program

Site ID	Location	County	Waterbody Type	Waterbody	Latitude	Longitude
WTI-01-0102	North Webster, IN	Kosciusko	Lake	Webster Lake	41.32562877	-85.6883275
WAE-01-0016	Tri-Lakes: Cedar Lake, Shriner Lake and Round Lake	Whitley	Lake	Cedar Lake	41.25122048	-85.4475039
WAE-01-0015	Tri-Lakes: Cedar Lake, Shriner Lake and Round Lake	Whitley	Lake	Shriner Lake	41.2449284	-85.4496322
WAE-01-0014	Tri-Lakes: Cedar Lake, Shriner Lake and Round Lake	Whitley	Lake	Round Lake	41.2457357	-85.4291747
WMI-03-0011	C.R. S 100 W, downstream of Hartford City 3M Plant	Blackford	Stream	Big Lick Creek	40.42983272	-85.3892472
WUW-15-0004	C.R. 500 downstream of Grissom Air Force Base - Peru, IN	Miami	Stream	Pipe Creek	40.69265787	-86.1387799
WUW-15-0003	C.R. 500 downstream of Grissom Air Force Base - Peru, IN	Cass	Stream	Little Deer Creek	40.69300113	-86.2123178
WMI060-0016	Near the dam end of the lake	Miami	Reservoir	Mississinewa Lake	40.71416667	-85.9544444
WTI020-0019	Warsaw, IN	Kosciusko	Lake	Winona Lake	41.22305556	-85.8311111
LMM010-0010	Michigan City, IN - Trail Creek	Laporte	Lake	Lake Michigan	41.73544444	-86.9010277
WAW010-0093	Downstream of Greentown, IN	Howard	Lake	Kokomo Waterworks Reservoir Number Two	40.48847222	-86.0183333
WAE020-0007	West of Churubusco, IN	Whitley	Lake	Blue Lake	41.23972222	-85.3644444
WAW020-0004	C.R. 300 W	Howard	Stream	Wildcat Creek	40.47361111	-86.1841666
WUW040-0008	C.R. 700 E	Jay	River	Wabash River	40.56805556	-84.8486111
WAE040-0018	Downstream of Collamar Dam	Whitley	Stream	Eel River	41.07416667	-85.6661111
WAE060-0008	Upstream of Mexico, IN	Miami	River	Eel River	40.84361111	-86.1133333
WAE070-0015	Upstream of Logansport, IN	Cass	River	Eel River	40.76416667	-86.3216666
WAW010-0036	C.R. 400 E	Howard	Stream	Wildcat Creek	40.48555556	-86.0511111

Site ID	Location	County	Waterbody Type	Waterbody	Latitude	Longitude
WAW010-0083	Highland Park - Kokomo, IN	Howard	Stream	Kokomo Creek	40.46222222	-86.1363888
WAW020-0005	C.R. 440 W	Howard	Stream	Wildcat Creek	40.45377979	-86.8513923
WAW020-0082	Adams Mill	Carroll	Stream	Wildcat Creek	40.48027778	-86.5069444
WAW040-0035	C.R. 850 W	Clinton	Stream	South Fork Wildcat Creek	40.33055556	-86.6652777
WAW050-0009	Wildcat Creek County Park	Tippecanoe	Stream	Wildcat Creek	40.43722222	-86.8047222
WDE010-0010	Downstream of Logansport, IN	Cass	River	Wabash River	40.745	-86.4705555
WMI010-0018	C.R. 400N	Randolph	River	Little Mississinewa River	40.22416667	-84.8213888
WMI010-0028	C.R. 600 E	Randolph	River	Mississinewa River	40.29	-84.8625
WMI030-0009	Wheeling, IN	Delaware	River	Mississinewa River	40.3725	-85.4563888
WMI060-0003	S.R. 9/37, N of Marion	Grant	River	Mississinewa River	40.58444444	-85.6608333
WSA010-0019	C.R. 75 S	Jay	River	Salamonie River	40.4275	-85.0388888
WSA040-0018	C.R. 900 S	Huntington	River	Salamonie River	40.69777778	-85.4497222
WTI010-0008	South of North Webster, IN	Kosciusko	Lake	Little Barbee Lake	41.29138889	-85.7208333
WTI020-0039	Downstream of Oswego, IN	Kosciusko	River	Tippecanoe River	41.32055556	-85.7902777
WTI050-0019	Menominee State Fishing Area	Fulton	River	Tippecanoe River	41.10611111	-86.21
WTI060-0020	Downstream of Winamac, IN	Pulaski	River	Tippecanoe River	41.01638889	-86.5833333
WTI150-0006	S.R. 18	Carroll	River	Tippecanoe River	40.59416667	-86.7705555
*WUW070-0010	Bluffton, IN	Wells	River	Wabash River	40.72861111	-85.1372222
WUW140-0002	N Rangeline Road, West of Huntington	Huntington	River	Wabash River	40.87972222	-85.5430555
WUW150-0005	Downstream of Wabash, IN	Wabash	River	Wabash River	40.77277778	-85.9352777
WUW160-0009	Downstream of Peru, IN	Miami	River	Wabash River	40.74305556	-86.1047222

*=Historical U.S. EPA CORE Site

5. Develop a Decision Rule

Biological samples will be collected if the flow is not dangerous for staff to enter the stream (e.g., water levels at or below median base flow), and barring any hazardous weather conditions (e.g., thunderstorms or heavy rain in the vicinity); or unexpected physical barriers to accessing the site. The field crew chief makes the final determination as to whether or not a waterbody is safe to enter.

The ALUS decisions will include independent evaluations of biological and chemical data as outlined in Indiana's 2016 Consolidated Assessment and Listing Methodology (CALM, IDEM 2016c). The ALUS decisions include independent evaluations of edible portion fish tissue wet weight concentrations of total PCB and/or mercury. A site will be considered "not supporting" (Table 1) for the aquatic life use of fish consumption when any one sample exceeds the criteria set forth for the List of Impaired Waters under Section 303(d) of the CWA.

The Fish Consumption Advisory classifications are based on the "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory for PCBs" (Anderson 1993) and for mercury (McCann 2007), and is the responsibility of the ISDH. See Table 1 for decision criteria.

6. Specify Tolerable Limits on Decision Errors

Site-specific aquatic life use assessments for fish consumption include program-specific controls to identify analysis errors. These controls include laboratory blanks and duplicates, matrix spikes, laboratory control spikes, ongoing laboratory performance evaluations, and analytical chemistry data qualifiers and flags as specified in the project RFP 16-88 (IDEM 2016b), the analytical services contract (IDOA 2017), the Quality Control Requirements section of the Watershed Assessment and Planning Branch's Quality Assurance Project Plan (QAPP) (IDEM 2017a, pages 170-172), and the OWQ Quality Management Plan (IDEM 2012b, page 38). Analytical chemistry data qualifiers and flags are outlined in Table D3-1 of the WAPB QAPP (IDEM 2017a, page 184) and in Section IV of this Work Plan.

Any data flagged as "estimated" may be used on a case-by-case basis. Fish tissue samples flagged as not meeting minimum quality control requirements will be reanalyzed using the preserved sample material stored at the contract laboratory. All samples will be preserved, as agreed in the analytical services contract, by the laboratory until all sample data for the sampling year are approved by IDEM chemists and the QA officer for the WAP Branch. Once all analytical data has been approved by the chemists, any data from samples exceeding benchmarks for ALUS impairment for fish consumption and for FCAs (Table 1) will be identified and presented. ALUS exceedances are reported to the Integrated Report Coordinator for determination of 303(d) Listing of Impaired Waters. All FCA exceedances are reported to the Indiana Interagency Fish Consumption Advisory Workgroup for FCA considerations. Any data which is "rejected" due to analytical problems or errors will not be used for water quality assessment decisions or in FCA determinations. Further investigation will be conducted in response to consistent "rejected" data to determine the source of error. If there is a trend in consistent "rejected" data IDEM identifies and if corrective action is warranted, the WAPB quality assurance chemist directs the analytical laboratory to make corrections. Field techniques used during sample collection and preparation, along with laboratory procedures will be subject to periodic evaluation by both WAPB QA and field staff.

The sampling design prioritizes targeted lake and river sites based on historical sampling locations, contaminated stream reaches, public access locations, and sampling requests by other program areas. The number of sites and the samples collected from each site are highly variable and based on resources and funds (IDEM 2017a, page 73).

7. Optimize the Design for Obtaining Data

The fish tissue contaminants monitoring program follows a five-year basin rotation design. The rotating basin approach facilitates a more comprehensive estimation of the extent of impairment within the basin.

Sampling may also occur in watersheds outside the targeted basins to support IDEM ALUS assessment, or other agency programs. Other targeted locations may include special studies for other program areas. In

addition, samples are accepted from IDNR DFW that were collected during their study projects. This agency partnership increases sampling efficiency, while also reducing the stress put on biological communities caused by multiple sampling events on the same waterbody. These could include samples from natural lakes, streams, or Indiana waters of Lake Michigan. These locations may not necessarily be in the target basin of the WQMS. IDNR has trained staff handling and processing the fish following the U.S EPA guidance (U.S. EPA 2000c), the Sport Fish Advisory Protocols (Anderson 1993), the IDEM Biological Studies Section Standard Operating Procedures (IDEM 1992b), and the procedures described in this work plan.

The number of sites is determined by the annual fish tissue budget for laboratory analysis. Site selection then follows a tiered strategy. First, sampling at the U.S. EPA historical "core" sites in the basins is prioritized to continue to develop long-term trends. Next, profiles of large river systems within the basins are targeted, as well as sites with known historical contamination (e.g., superfund sites). The remaining sites are selected along major tributaries, public lands (e.g., IDNR property, city parks), unassessed stream reaches, and places of interest as specified by other programs (e.g., permitting, risk assessment, state cleanup). Sites are selected at public access sites when applicable to promote data collection at places with known recreational activity.

Training and Staffing Requirements

Table 3: Roles and Responsibilities for Project Staff

Role	Required Training/Experience	Responsibilities	Training References
Project Manager	-Bachelor of Science Degree in biology, toxicology, or other closely related field plus four years of experience in aquatic ecosystems (Masters Degree with two years aquatic ecosystems experience may substitute) -Database experience -Annually review the Principles and Techniques of Electrofishing -Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	-Establish Project in the AIMS II database -Oversee development of Project Work Plan -Oversee entry and QC of field data -Oversee querying of data from AIMS II database to determine results not meeting aquatic life use Water Quality Criteria -Sample shipments to contract laboratory -Assign analysis tasks to the samples -Track contract laboratory expenditures	-AIMS II Database User Guide -U.S. EPA 2006 QA Documents on developing Work Plans (QAPPs) - U.S. FWS 1998
Field Crew Chief	-Bachelor of Science Degree in biology or other closely related field -At least one year of experience in sampling methodology and taxonomy of aquatic communities in the region -Annually review the Principles and Techniques of Electrofishing	-Completion of field data sheets -Taxonomic accuracy -Overall operation of field crew when remote from central office -Adherence to safety and field SOP by crew members -Ensure field sampling equipment is functioning properly and all equipment loaded into	-IDEM 1992a, IDEM 1992b, IDEM 1992c, IDEM 1992d, IDEM 2008, IDEM 2010b, IDEM 2016a -U.S. EPA, 1994a -Novotny 1974 -Cowx 1990 -Cowx and Lamarque, 1990 U.S. FWS 1998

	-Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	vehicles prior to field sampling activities -Maintaining proper preservation of samples -Hold an active First Aid and CPR certification	
Field Crew Members (continued)	-Complete hands-on training for sampling methodology prior to field sampling activities -Review the Principles and Techniques of Electrofishing -Review relevant safety procedures -Review relevant SOP documents for field and sample processing operations	-Follow all safety and SOP procedures while engaged in field sampling activities -Follow direction of Field Crew Chief while conducting field sampling activities -Hold an active First Aid and CPR certification	-IDEM 1992a, 1992b, 1992c, 1992d, , 2008, 2010b, 2016a -U.S. EPA 1994a -Novotny 1974 -Cowx 1990 -Cowx and Lamarque 1990 -Reynolds 2013 U.S. FWS 1998
Quality Assurance Officer	-Bachelor of Science in chemistry or a related field of study -Familiarity with QA/QC practices and methodologies -Familiarity with the WAPB QAPP and data qualification methodologies	-Ensure adherence to QA/QC requirements of WAPB QAPP -Evaluate data collected by sampling crews for adherence to project Work Plan -Review data collected by field sampling crews for completeness and accuracy -Perform a data quality analysis of data generated by the project -Assign data quality levels based on the data quality analysis -Import data into the AIMS II database -Ensure that field sampling methodology audits are completed according to WAPB procedures	-IDEM 2017a, 2012b -U.S. EPA 2006 documentation on QAPP Development and data qualification -AIMS II Database User Guide

II MEASUREMENT/DATA ACQUISITION

Sampling Design and Site Locations

The fish tissue contaminants monitoring program currently prioritizes targeted lake and river sites based on the following criteria:

- Historical U.S. EPA monitoring program stations (“core” sites)
- Current status of fish consumption advisories or known contaminated stream reaches
- New locations of interest that have never been sampled
- Public access reservoirs and natural lakes

- Locations where there is adequate historical data which can be used to assess trends
- Sampling requests by other programs within and external to the IDEM
- Special studies

Generally, this program targets approximately three to five fish tissue samples from 35-45 sites per year. The number of sites and the samples collected from each site are highly variable and based on available WAPB resources and funds allocated in the laboratory service contract. Table 2 lists the tentative fish tissue sampling sites for the tributaries to the Upper Wabash River Basin and the Lake Michigan Basin. Forty sites are targeted for sampling in the 2018 fish tissue contaminants monitoring program. Fish tissue collections can occur year round, although the most desirable sampling period is from late summer to early fall (i.e., August through October). The lipid content of many species (which is a reservoir for organic pollutants) is generally highest at this time. Also, water levels are typically lower during this time, thus simplifying collection procedures (U.S. EPA 2000c).

Sampling Methods

Fish Collection and Tissue Sample Preparation General Procedures
The following is a general summary of procedures for collection, preparation, and preservation of all fish tissue samples collected for contaminant analysis. An SOP for fish collection and tissue preparation is currently under development.

Step 1. Sample the fish community using electrofishing gear following sampling equipment standard operating procedures (U.S. FWS 1998, IDEM 1992a). In some cases, lakes will be sampled using gill nets (IDEM 1992a).

Step 2. Examine fish collected and select the predetermined number of samples for the site (generally between three and five samples). A sample may be comprised of 1-12 fish (depending on size) of the same species. The preferred total lengths of the smallest and largest individuals of any composite sample should be within 90% of each other. Total lengths as low as 75% will be tolerated in order to obtain an adequate composite sample.

Preferable samples collected from a site consist of: (1) those species collected historically from the site, (2) different size classes of predator species, or (3) Common Carp. In addition, if there are consumption advisories listed on the Indiana Fish Consumption Advisory, those species and size classes should be targeted to support updates to the advisory information.

If a site has no historical samples, representative samples of a bottom feeder such as Common Carp, a predator game fish species (e.g., Largemouth Bass, Channel Catfish or Flathead Catfish), and a panfish commonly consumed by humans (e.g., sunfish species, crappie species, Rock Bass) should be targeted.

In addition, if the site has been targeted based on potential or known contamination, fish species with small home ranges should be targeted to ensure the data results are indicative of the in-stream conditions at the site. All other fish captured during the sampling effort should be released back into the water.

Step 3. Fish selected as samples should be placed in a cooler and covered with ice to euthanize them and to prevent any decomposition from occurring prior to sample processing. Using a piece of label tape, tag the outside of the cooler with site information, including the sample number (AB Number), site location, date, waterbody, and county information.

Step 4. Are samples processed in the field (e.g., because overnight travel necessitates field processing)?

If yes, proceed to Step 6.

If no, proceed to Step 5.

Step 5. Return to the laboratory.

Step 6. In the laboratory, place fish from one site into the laboratory sink, and sort out fish into composite samples by matching total lengths for each species. If samples are processed in the field, fish species should be sorted in the cooler by length, as described above.

Step 7. Complete the Site ID, Event ID, Date and Time, and site location information on the Fish Tissue Contaminant Monitoring Program Field Data Form (Appendix 1).

Step 8. On the Fish Tissue Contaminant Monitoring Program Field Data Form (Appendix 1), fill out the composite sample number (AB Number-Taxon ID-species sample number), the number of fish in the composite sample, the species name, and the preparation method (whole fish, skin-on scaleless fillets, skin-on scales-on fillets, skin-off fillets, beheaded and gutted, etc.). Below is an example of a fish sample composite sample number (AB#####-###-##):

- AB24997-043-01

Step 9. Measure and record the total length in millimeters (to the nearest millimeter) and weight in grams (to the nearest gram) of each fish within a composite sample. Also note any individual fish anomalies, such as deformities, eroded fins, lesions, tumors (DELTs).

Step 10. Are there more composite samples?

Yes, repeat Step 8.

No, proceed to Step 11.

Step 11. Prepare filleting stations by setting out dedicated food grade plastic low density polyethylene cutting boards or covering work station with clean aluminum foil. Set out the fish scale removers, scalpel, fish skinning pliers, and stainless steel fillet knives to be used during filleting. Sharpen knives as necessary to reduce ragged cuts and slippage, which often occurs when the use of pressure increases cutting with dull knives. Staff should wear new nitrile or latex gloves for each site in order to minimize the potential of contaminants transferring from hands to tissue samples.

Step 12. Fish fillet samples will be prepared as **skin-on scaleless** fillets for scaled species and **skin-off** fillets for scaleless species (Anderson 1993; IDEM 1992b). Remove scales from both sides of the fish, back, and belly areas (if necessary). Fillet the fish so as to include all flesh from the back of the head to the tail and from the top of the back down to and including the belly flap area of the fish. Fins, tail, head, viscera, and major bones are to be removed. If sampling at a historically contaminated site or investigating possible source of contamination and the fish sample is to be analyzed whole, the composite sample consisting of these fish does not have to be filleted. Place each fillet from the composite sample into the same stainless steel bucket containing tap water, or ambient water, if processing in the field. The water in the bucket is used to rinse off any soil, scales, or mucous adhering to the sample.

Step 13. Drain off excess water and **double wrap** the fillets in clean aluminum foil to make a package. For whole fish, all individual fish of a composite sample should be double wrapped together if possible. Using a blunt tip black permanent marker, label the outside of the package with the following information:

- Sample number (e.g., AB49005-121-01)
- Number of individuals in the sample
- Species of fish (common name)
- Preparation (e.g., scaleless, skin-on fillets; scaleless, skin-off fillets; scaleless, whole fish)
- Waterbody name
- County
- Location description
- Date of collection (format: 01-March-2015)

- Package count if more than one package per sample (e.g., 1 of 2, 2 of 2)

Example:
AB13201-043-01
3-Common Carp, skin-on fillets, Scaleless
East Fork White River
Martin Co.
Shoals
21 Aug 2017

Step 14. Each foil package will be placed individually into an appropriate size zip-lock type bag or other food grade plastic bag, and sealed. Using a blunt tip black permanent marker, label the outside of the package with the following information:

- Sample number (e.g., AB49005-121-01)
- Package count if more than one package per sample (e.g., 1 of 2, 2 of 2)

Step 15. Tissue samples need to be frozen as soon as possible. Is the processing taking place in the field?

If yes, it may be necessary for field staff to bring dry ice along for overnight field trips. Use a dry ice chest for dry ice storage (The Fish Tissue program has four). Dry ice will be provided by the contracted analytical services laboratory for the project. (However, this needs to be anticipated at least a week in advance so that the contract laboratory can make arrangements for dry ice to be delivered to the Western Select Properties office location before staff depart for the field.) Place the double wrapped and bagged samples in the dry ice chest underneath the dry ice for preservation of tissue material. Upon return to the office, place all processed tissue samples in the chest style analytical grade freezer located in the IDEM Watershed Assessment and Planning Branch laboratory or the upright commercial grade freezer located in building 41.

If no, place double wrapped and bagged samples in the chest style analytical grade freezer located in the IDEM Watershed Assessment and Planning Branch laboratory or the upright commercial grade freezer located in building 41.

Step 16. Are there more composite samples to be processed?

If yes, proceed to Step 12.

If no, proceed to Step 17.

Step 17. Wash all stainless steel buckets, stainless steel filleting knives, scalers, sharpening steels, mass scales, measuring boards, cutting boards, and coolers with ALCONOX® detergent (laboratory quality environmental cleaning product) and a scrub brush. Wipe down countertops with ALCONOX® soaked rag, and throw away used nitrile or latex gloves.

Step 18. Are there more sites to be processed?

If yes, proceed to Step 6.

If no, proceed to Step 19.

Step 19. Put all cleaned processing equipment on the drying racks or in the storage bins with lids. Clean out the sink, mop the floor, and take trash bags full of fish carcasses to the dumpster. Leave the laboratory in the condition found so as not to disrupt the function of other staff programs. If processing samples in the field, sample processing equipment will be put into the storage bins and then replaced back into the truck. Leave the processing area (usually near the boat ramp or nearshore, in the condition found as much as possible, picking up as many fish scales as possible; and leaving no fish waste, such as entrails, filleted fish carcasses, or trash behind.

Step 20. Field sampling crew leader will complete any missing information on the Fish Tissue Contaminants Monitoring Program Field Data Form (Appendix 1); calculate the composite length and weight; and the percent ranges for length and weight on all field data forms. Also, the crew leader should log in all samples processed into the Nalgene® field sample log book.

Step 21. The Fish Tissue Contaminants Monitoring Program Field Data Form (Appendix 1) is ready for entry into the AIMS II database.

Field Staff Precautions for Preventing Contamination of Tissue Samples

- Keep all fish tissue sample preparation supplies away from generators, gasoline, oil containers, etc.
- Dry ice chest containing tissue samples should be positioned in the truck away from generator, gasoline cans, oil, etc.
- Staff are discouraged from applying mosquito repellent containing N,N-diethyl-meta-toluamide (DEET) or other chemical repellents during fish tissue sampling and processing procedures.

Laboratory Shipping, Preparation, and Storage

Once WAPB is prepared to submit a batch of fish tissue samples for analysis (typically in late summer or fall), the Pace Analytical Service Project Manager is contacted. Samples are securely packed in coolers with dry ice (complete with chain of custody form) and are then picked up by a Pace hired courier service during business hours.

The samples are couriered by Pace personnel to their Chicago LabOps Service Center. From Chicago, the samples are shipped to Green Bay, Wisconsin for sample preparation, including maceration. Each shipping step uses same-day or overnight shipping. IDEM requires analysis to be conducted and reported within 60 days from the initial shipping date.

Final samples are divided as follows:

- Polychlorinated dioxins/Furans via EPA Method1613 Rev B (U.S. EPA 1994a) – Minneapolis, MN
- PCB Congeners via EPA Method 1668 Rev B (U.S. EPA 2008)– Minneapolis, MN
- Total PCBs via EPA Method 8082A (U.S. EPA 2007) – Green Bay, WI
- Pesticides via EPA Method 8081A – Green Bay, WI
- PAHs via EPA Method 8270C – Green Bay, WI
- Inorganic metals via EPA Method 6020 – Green Bay, WI
- Low level Hg via EPA Method 1631E (U.S. EPA 2002) – Green Bay, WI
- % Moisture via ASTM D2974-87 – Green Bay, WI
- % Lipids via “Pace Lipid” – Green Bay, WI
- Methyl Hg via EPA Method 1630 (U.S. EPA 2001b) – Duluth, MN
- Perfluorinated alkyl acids via EPA Method 537 Modified – British Columbia, Canada (AXYS Analytical Services Ltd.)

All samples are stored by the laboratories at a maximum temperature of -10°C until written permission for disposal is given from IDEM. Such permission is not given until all laboratory data reports, for a given sample year, have been quality controlled. Excess sample material may be disposed of by the lab in accordance with state and federal regulations.

Analytical Methods

For purposes of this project analytes are arranged into analytical task groups. Tables 4 through 18 list parameters (metals, organochlorine chemical, PCBs, etc.) with their respective test methods and contract required quantitation limits (CRQL) (Pace Analytical, Inc.). Analyses are requested by these tasks. Analytical methods applicable to this project are listed in the professional services contract 19881 (IDOA 2017) and accompanying request for proposal (RFP) 16-88 (IDEM 2016b). In compliance with contract bid requirements, Pace Analytical has submitted a copy of relevant performance evaluation results, pertinent third-party accreditations (e.g., NELAP certificates), SOPs, and QA Manual(s) to WAPB. In addition, WAPB may obtain other QA materials, such as laboratory analyst resumes, on request.

Quality Control and Custody Requirements
Every effort will be made to follow quality assurance protocols as set forth in the "Quality Assurance Project Plan (QAPP) for Indiana Surface Water Quality Program," 2017, Revision 4 (IDEM 2017a). Quality control requirements specific to this project are also listed within the professional services contract 19881 (IDOA 2017) and accompanying RFP 16-88 (IDEM 2016b).

For instance, labs must have and maintain a documented Quality Assurance/Quality Control (QA/QC) Program, capable of demonstrating that data has a specified degree of precision and reliability. An acceptable QA/QC program would be one patterned after a publication such as the "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" (U.S. EPA 1979). Labs must be able to validate each method used and each analysis performed by that method using the QA/QC Program.

QA/QC measures must be documented. All documentation must be maintained and made available for the use of IDEM/OWQ for five years after the expiration date of this Contract. QA/QC documentation must be submitted as required.

Labs must also maintain and document continual evaluation of the accuracy and precision of an analytical procedure, and the ability of individual analysts to meet laboratory performance for a procedure.

Contractors must maintain dedicated original records of sample receiving and handling, bench sheets, instrumental or recorder output sheets, and final reports for this project.

Fish Tissue Field Data Documentation
Fish common name, total length (in millimeters), and mass (in grams) measurements are made on each fish to be included in their respective composite samples. Information on the fishing method and any identified DELTS (deformities, eroded fins, lesions, tumors) will be recorded on the fish tissue sample field data form (Appendix 1). Site maps are marked to show the general or specific areas from which fish were collected. There are no field duplicates collected or field blanks carried during the sampling and sample preparation process for fish tissue.

Analytical Data Reports
A report for each batch of samples (or sample set) consisting of chain-of-custody form (Appendix 2), spreadsheets of results, and the quality control report, will be submitted in electronic (pdf) format in accordance with the contract requirements. In addition, an electronic data import (EDI) file containing lab data and lab QC will be submitted for each sample set. The EDI file will be in compliance with IDEM/OWQ WAPB's EDI format specification (IDEM 2017a, Appendix I). EDI files will be uploaded into the AIMS database. Reports shall meet requirements of DQA Level 4 (see WAPB QAPP) (IDEM 2017a, pp 182-183) and be submitted to the Technical and Logistical Services Section for review.

Field Parameter Measurements/Instrument Testing/Calibration
The mechanical and digital scales used in weighing individual fish are tared between measurements. The scales are also calibrated every five years by the Indiana State Weights and Measures Office by a certified weighmaster to ensure accuracy of the devices.

Table 4: Fish Tissue General Parameters

TASK 1
PERCENT LIPID AND MOISTURE
TARGET PARAMETER LIST (TPL)

PARAMETER	BIOLOGICAL CRQL	BIOLOGICAL UNITS	SEDIMENT CRQL	SEDIMENT UNITS
PERCENT LIPID	0.1	%	NA*	NA*
PERCENT MOISTURE	0.1	%	NA*	NA*.

CRQL Contract Required Quantitation Limit
* NA = Not Applicable
% percentage units

Table 5: Fish Tissue Chemistry Total PCBs

TASK 3
POLYCHLORINATED BIPHENYLS (PCB)
TARGET PARAMETER LIST (TPL)

Preparation 3540C (U.S. EPA 1996a)
Method 8082A (U.S. EPA 2007)

PARAMETER	CAS NUMBER	BIOLOGICAL CRQL	BIOLOGICAL UNITS*	SEDIMENT CRQL	SEDIMENT UNITS**
Total PCBs	1336-36-3	20.0	µg/kg	NA	NA
Aroclor 1016	12674-11-2	50.0	µg/kg	NA	NA
Aroclor 1210	147601-87-4	50.0	µg/kg	NA	NA
Aroclor 1216	151820-27-8	50.0	µg/kg	NA	NA
Aroclor 1221	11104-28-2	50.0	µg/kg	NA	NA
Aroclor 1231	37234-40-5	50.0	µg/kg	NA	NA
Aroclor 1232	11141-16-5	50.0	µg/kg	NA	NA
Aroclor 1240	71328-89-7	50.0	µg/kg	NA	NA
Aroclor 1242	53469-21-9	50.0	µg/kg	NA	NA
Aroclor 1248	12672-29-6	50.0	µg/kg	NA	NA
Aroclor 1250	165245-51-2	50.0	µg/kg	NA	NA
Aroclor 1252	89577-78-6	50.0	µg/kg	NA	NA
Aroclor 1254	11097-69-1	50.0	µg/kg	NA	NA
Aroclor 1260	11096-82-5	50.0	µg/kg	NA	NA
Aroclor 1262	37324-23-5	50.0	µg/kg	NA	NA
Aroclor 1268	11100-14-4	50.0	µg/kg	NA	NA
Aroclor (unspecified)	12767-79-2	50.0	µg/kg	NA	NA

CRQL Contract Required Quantitation Limit
* wet weight basis
NA Not Applicable.
µg/kg micrograms per kilogram

Table 6: Fish Tissue Chemistry PCB Congener Compounds

TASK 3B
POLYCHLORINATED BIPHENYL CONGENERS (PCB)
SOILS, SEDIMENT, AND TISSUES BY CAPILLARY CHROMATOGRAPHY
TARGET PARAMETER LIST (TPL*)*

Method 1668 Rev. B (U.S. EPA 2008)

PARAMETER	CAS NUMBER	BIOTA CRQL	UNITS*	SEDIMENT CRQL	UNITS**
PCB congeners	see below	0.5-20	ng/kg	0.5-20	ng/kg

CRQL Contract Required Quantitation Limit
* wet weight basis
** dry weight basis
ng/kg nanograms per kilogram

Table of PCB Congeners and Other Species

Descriptor	CASRN	Current [1]BZ & IUPAC Number	IUPAC Name	Type
CP1_---_--_--	2051-60-7	1	2-Chlorobiphenyl	Congener
CP0_---_--_--	2051-61-8	2	3-Chlorobiphenyl	Congener
CP0_---_--_--	2051-62-9	3	4-Chlorobiphenyl	Congener
---_---_--_--	13029-08-8	4	2,2'-Dichlorobiphenyl	Congener
CP1_---_--_--	16605-91-7	5	2,3-Dichlorobiphenyl	Congener
CP1_---_--_--	25569-80-6	6	2,3'-Dichlorobiphenyl	Congener
CP1_---_--_--	33284-50-3	7	2,4-Dichlorobiphenyl	Congener
CP1_---_--_--	34883-43-7	8	2,4'-Dichlorobiphenyl	Congener
CP1_---_--_--	34883-39-1	9	2,5-Dichlorobiphenyl	Congener
---_---_--_--	33146-45-1	10	2,6-Dichlorobiphenyl	Congener
CP0_---_--_2M	2050-67-1	11	3,3'-Dichlorobiphenyl	Congener
CP0_---_--_--	2974-92-7	12	3,4-Dichlorobiphenyl	Congener
CP0_---_--_--	2974-90-5	13	3,4'-Dichlorobiphenyl	Congener
CP0_---_--_2M	34883-41-5	14	3,5-Dichlorobiphenyl	Congener
CP0_---_PP_--	2050-68-2	15	4,4'-Dichlorobiphenyl	Congener
---_---_--_--	38444-78-9	16	2,2',3-Trichlorobiphenyl	Congener
---_---_--_--	37680-66-3	17	2,2',4-Trichlorobiphenyl	Congener
---_---_--_--	37680-65-2	18	2,2',5-Trichlorobiphenyl	Congener
---_---_--_--	38444-73-4	19	2,2',6-Trichlorobiphenyl	Congener
CP1_---_--_2M	38444-84-7	20	2,3,3'-Trichlorobiphenyl	Congener
CP1_---_--_--	55702-46-0	21	2,3,4-Trichlorobiphenyl	Congener
CP1_---_--_--	38444-85-8	22	2,3,4'-Trichlorobiphenyl	Congener
CP1_---_--_2M	55720-44-0	23	2,3,5-Trichlorobiphenyl	Congener
---_---_--_--	55702-45-9	24	2,3,6-Trichlorobiphenyl	Congener

Table of PCB Congeners and Other Species

Descriptor	CASRN	Current [1]BZ & IUPAC Number	IUPAC Name	Type
CP1_---_--_--	55712-37-3	25	2,3',4-Trichlorobiphenyl	Congener
CP1_---_--_2M	38444-81-4	26	2,3',5-Trichlorobiphenyl	Congener
---_---_--_--	38444-76-7	27	2,3',6-Trichlorobiphenyl	Congener
CP1_---_PP_--	7012-37-5	28	2,4,4'-Trichlorobiphenyl	Congener
CP1_---_--_--	15862-07-4	29	2,4,5-Trichlorobiphenyl	Congener
---_---_--_--	35693-92-6	30	2,4,6-Trichlorobiphenyl	Congener
CP1_---_--_--	16606-02-3	31	2,4',5-Trichlorobiphenyl	Congener
---_---_--_--	38444-77-8	32	2,4',6-Trichlorobiphenyl	Congener
CP1_---_--_--	38444-86-9	33	2,3',4'-Trichlorobiphenyl	Congener
CP1_---_--_2M	37680-68-5	34	2,3',5'-Trichlorobiphenyl	Congener
CP0_---_--_2M	37680-69-6	35	3,3',4-Trichlorobiphenyl	Congener
CP0_---_--_2M	38444-87-0	36	3,3',5-Trichlorobiphenyl	Congener
CP0_---_PP_--	38444-90-5	37	3,4,4'-Trichlorobiphenyl	Congener
CP0_---_--_2M	53555-66-1	38	3,4,5-Trichlorobiphenyl	Congener
CP0_---_--_2M	38444-88-1	39	3,4',5-Trichlorobiphenyl	Congener
---_4CL_--_2M	38444-93-8	40	2,2',3,3'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	52663-59-9	41	2,2',3,4-Tetrachlorobiphenyl	Congener
---_4CL_--_--	36559-22-5	42	2,2',3,4'-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	70362-46-8	43	2,2',3,5-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	41464-39-5	44	2,2',3,5'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	70362-45-7	45	2,2',3,6-Tetrachlorobiphenyl	Congener
---_4CL_--_--	41464-47-5	46	2,2',3,6'-Tetrachlorobiphenyl	Congener
---_4CL_PP_--	2437-79-8	47	2,2',4,4'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	70362-47-9	48	2,2',4,5-Tetrachlorobiphenyl	Congener
---_4CL_--_--	41464-40-8	49	2,2',4,5'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	62796-65-0	50	2,2',4,6-Tetrachlorobiphenyl	Congener
---_4CL_--_--	68194-04-7	51	2,2',4,6'-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	35693-99-3	52	2,2',5,5'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	41464-41-9	53	2,2',5,6'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	15968-05-5	54	2,2',6,6'-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	74338-24-2	55	2,3,3',4-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	41464-43-1	56	2,3,3',4'-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	70424-67-8	57	2,3,3',5-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	41464-49-7	58	2,3,3',5'-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	74472-33-6	59	2,3,3',6-Tetrachlorobiphenyl	Congener
CP1_4CL_PP_--	33025-41-1	60	2,3,4,4'-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	33284-53-6	61	2,3,4,5-Tetrachlorobiphenyl	Congener
---_4CL_--_--	54230-22-7	62	2,3,4,6-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	74472-34-7	63	2,3,4',5-Tetrachlorobiphenyl	Congener
---_4CL_--_--	52663-58-8	64	2,3,4',6-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	33284-54-7	65	2,3,5,6-Tetrachlorobiphenyl	Congener
CP1_4CL_PP_--	32598-10-0	66	2,3',4,4'-Tetrachlorobiphenyl	Congener

Table of PCB Congeners and Other Species

Descriptor	CASRN	Current [1]BZ & IUPAC Number	IUPAC Name	Type
CP1_4CL_--_2M	73575-53-8	67	2,3',4,5-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	73575-52-7	68	2,3',4,5'-Tetrachlorobiphenyl	Congener
---_4CL_--_--	60233-24-1	69	2,3',4,6-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	32598-11-1	70	2,3',4',5-Tetrachlorobiphenyl	Congener
---_4CL_--_--	41464-46-4	71	2,3,4,6-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	41464-42-0	72	2,3,5,5-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	74338-23-1	73	2,3,5,6-Tetrachlorobiphenyl	Congener
CP1_4CL_PP_--	32690-93-0	74	2,4,4,5-Tetrachlorobiphenyl	Congener
---_4CL_PP_--	32598-12-2	75	2,4,4,6-Tetrachlorobiphenyl	Congener
CP1_4CL_--_2M	70362-48-0	76	2,3,4,5-Tetrachlorobiphenyl	Congener
CP0_4CL_PP_2M	32598-13-3	77	3,3,4,4-Tetrachlorobiphenyl	Congener
CP0_4CL_--_2M	70362-49-1	78	3,3,4,5-Tetrachlorobiphenyl	Congener
CP0_4CL_--_2M	41464-48-6	79	3,3,4,5-Tetrachlorobiphenyl	Congener
CP0_4CL_--_2M	33284-52-5	80	3,3,5,5-Tetrachlorobiphenyl	Congener
CP0_4CL_PP_2M	70362-50-4	81	3,4,4,5-Tetrachlorobiphenyl	Congener
---_4CL_--_2M	52663-62-4	82	2,2,3,3,4-Pentachlorobiphenyl	Congener
---_4CL_--_2M	60145-20-2	83	2,2,3,3,5-Pentachlorobiphenyl	Congener
---_4CL_--_2M	52663-60-2	84	2,2,3,3,6-Pentachlorobiphenyl	Congener
---_4CL_PP_--	65510-45-4	85	2,2,3,4,4-Pentachlorobiphenyl	Congener
---_4CL_--_2M	55312-69-1	86	2,2,3,4,5-Pentachlorobiphenyl	Congener
---_4CL_--_2M	38380-02-8	87	2,2,3,4,5-Pentachlorobiphenyl	Congener
---_4CL_--_--	55215-17-3	88	2,2,3,4,6-Pentachlorobiphenyl	Congener
---_4CL_--_--	73575-57-2	89	2,2,3,4,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	68194-07-0	90	2,2,3,4,5-Pentachlorobiphenyl	Congener
---_4CL_--_--	68194-05-8	91	2,2’,3,4’,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	52663-61-3	92	2,2’,3,5,5’-Pentachlorobiphenyl	Congener
---_4CL_--_2M	73575-56-1	93	2,2’,3,5,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	73575-55-0	94	2,2’,3,5,6’-Pentachlorobiphenyl	Congener
---_4CL_--_2M	38379-99-6	95	2,2’,3,5’,6-Pentachlorobiphenyl	Congener
---_4CL_--_--	73575-54-9	96	2,2’,3,6,6’-Pentachlorobiphenyl	Congener
---_4CL_--_2M	41464-51-1	97	2,2’,3,4’,5’-Pentachlorobiphenyl	Congener
---_4CL_--_--	60233-25-2	98	2,2’,3,4’,6’-Pentachlorobiphenyl	Congener
---_4CL_PP_--	38380-01-7	99	2,2’,4,4’,5-Pentachlorobiphenyl	Congener
---_4CL_PP_--	39485-83-1	100	2,2’,4,4’,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	37680-73-2	101	2,2’,4,5,5’-Pentachlorobiphenyl	Congener
---_4CL_--_--	68194-06-9	102	2,2’,4,5,6’-Pentachlorobiphenyl	Congener
---_4CL_--_--	60145-21-3	103	2,2’,4,5’,6-Pentachlorobiphenyl	Congener
---_4CL_--_--	56558-16-8	104	2,2’,4,6,6’-Pentachlorobiphenyl	Congener
CP1_4CL_PP_2M	32598-14-4	105	2,3,3’,4,4’-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	70424-69-0	106	2,3,3’,4,5-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	70424-68-9	107	2,3,3’,4’,5-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	70362-41-3	108	2,3,3’,4,5’-Pentachlorobiphenyl	Congener

Table of PCB Congeners and Other Species

Descriptor	CASRN	Current [1]BZ & IUPAC Number	IUPAC Name	Type
---_4CL_--_2M	74472-35-8	109	2,3,3’,4,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	38380-03-9	110	2,3,3’,4’,6-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	39635-32-0	111	2,3,3’,5,5’-Pentachlorobiphenyl	Congener
---_4CL_--_2M	74472-36-9	112	2,3,3’,5,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	68194-10-5	113	2,3,3’,5’,6-Pentachlorobiphenyl	Congener
CP1_4CL_PP_2M	74472-37-0	114	2,3,4,4’,5-Pentachlorobiphenyl	Congener
---_4CL_PP_--	74472-38-1	115	2,3,4,4’,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	18259-05-7	116	2,3,4,5,6-Pentachlorobiphenyl	Congener
---_4CL_--_2M	68194-11-6	117	2,3,4',5,6-Pentachlorobiphenyl	Congener
CP1_4CL_PP_2M	31508-00-6	118	2,3',4,4',5-Pentachlorobiphenyl	Congener
---_4CL_PP_--	56558-17-9	119	2,3',4,4',6-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	68194-12-7	120	2,3',4,5,5'-Pentachlorobiphenyl	Congener
---_4CL_--_2M	56558-18-0	121	2,3',4,5',6-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	76842-07-4	122	2,3,3',4',5'-Pentachlorobiphenyl	Congener
CP1_4CL_PP_2M	65510-44-3	123	2,3',4,4',5'-Pentachlorobiphenyl	Congener
CP1_4CL_--_2M	70424-70-3	124	2,3',4',5,5'-Pentachlorobiphenyl	Congener
---_4CL_--_2M	74472-39-2	125	2,3',4',5',6-Pentachlorobiphenyl	Congener
CP0_4CL_PP_2M	57465-28-8	126	3,3',4,4',5-Pentachlorobiphenyl	Congener
CP0_4CL_--_2M	39635-33-1	127	3,3',4,5,5'-Pentachlorobiphenyl	Congener
---_4CL_PP_2M	38380-07-3	128	2,2',3,3',4,4'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	55215-18-4	129	2,2',3,3',4,5-Hexachlorobiphenyl	Congener
---_4CL_--_2M	52663-66-8	130	2,2',3,3',4,5'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	61798-70-7	131	2,2',3,3',4,6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	38380-05-1	132	2,2',3,3',4,6'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	35694-04-3	133	2,2',3,3',5,5'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	52704-70-8	134	2,2',3,3',5,6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	52744-13-5	135	2,2',3,3',5,6'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	38411-22-2	136	2,2',3,3',6,6'-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	35694-06-5	137	2,2',3,4,4',5-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	35065-28-2	138	2,2',3,4,4',5'-Hexachlorobiphenyl	Congener
---_4CL_PP_--	56030-56-9	139	2,2',3,4,4',6-Hexachlorobiphenyl	Congener
---_4CL_PP_--	59291-64-4	140	2,2',3,4,4',6'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	52712-04-6	141	2,2',3,4,5,5'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	41411-61-4	142	2,2',3,4,5,6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	68194-15-0	143	2,2',3,4,5,6'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	68194-14-9	144	2,2',3,4,5',6-Hexachlorobiphenyl	Congener
---_4CL_--_--	74472-40-5	145	2,2',3,4,6,6'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	51908-16-8	146	2,2',3,4',5,5'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	68194-13-8	147	2,2',3,4',5,6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	74472-41-6	148	2,2',3,4',5,6'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	38380-04-0	149	2,2',3,4',5',6-Hexachlorobiphenyl	Congener
---_4CL_--_--	68194-08-1	150	2,2',3,4',6,6'-Hexachlorobiphenyl	Congener

Table of PCB Congeners and Other Species

Descriptor	CASRN	Current [1]BZ & IUPAC Number	IUPAC Name	Type
---_4CL_--_2M	52663-63-5	151	2,2',3,5,5',6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	68194-09-2	152	2,2',3,5,6,6'-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	35065-27-1	153	2,2',4,4',5,5'-Hexachlorobiphenyl	Congener
---_4CL_PP_--	60145-22-4	154	2,2',4,4',5,6'-Hexachlorobiphenyl	Congener
---_4CL_PP_--	33979-03-2	155	2,2',4,4',6,6'-Hexachlorobiphenyl	Congener
CP1_4CL_PP_2M	38380-08-4	156	2,3,3',4,4',5-Hexachlorobiphenyl	Congener
CP1_4CL_PP_2M	69782-90-7	157	2,3,3',4,4',5'-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	74472-42-7	158	2,3,3',4,4',6-Hexachlorobiphenyl	Congener
CP1_4CL_--_2M	39635-35-3	159	2,3,3',4,5,5'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	41411-62-5	160	2,3,3',4,5,6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	74472-43-8	161	2,3,3',4,5',6-Hexachlorobiphenyl	Congener
CP1_4CL_--_2M	39635-34-2	162	2,3,3',4',5,5'-Hexachlorobiphenyl	Congener
---_4CL_--_2M	74472-44-9	163	2,3,3',4',5,6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	74472-45-0	164	2,3,3',4',5',6-Hexachlorobiphenyl	Congener
---_4CL_--_2M	74472-46-1	165	2,3,3',5,5',6-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	41411-63-6	166	2,3,4,4',5,6-Hexachlorobiphenyl	Congener
CP1_4CL_PP_2M	52663-72-6	167	2,3',4,4',5,5'-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	59291-65-5	168	2,3',4,4',5',6-Hexachlorobiphenyl	Congener
CP0_4CL_PP_2M	32774-16-6	169	3,3',4,4',5,5'-Hexachlorobiphenyl	Congener
---_4CL_PP_2M	35065-30-6	170	2,2',3,3',4,4',5-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	52663-71-5	171	2,2',3,3',4,4',6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52663-74-8	172	2,2',3,3',4,5,5'-Heptachlorobiphenyl	Congener
---_4CL_--_2M	68194-16-1	173	2,2',3,3',4,5,6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	38411-25-5	174	2,2',3,3',4,5,6'-Heptachlorobiphenyl	Congener
---_4CL_--_2M	40186-70-7	175	2,2',3,3',4,5',6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52663-65-7	176	2,2',3,3',4,6,6'-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52663-70-4	177	2,2',3,3',4,5',6'-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52663-67-9	178	2,2',3,3',5,5',6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52663-64-6	179	2,2',3,3',5,6,6'-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	35065-29-3	180	2,2',3,4,4',5,5'-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	74472-47-2	181	2,2',3,4,4',5,6-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	60145-23-5	182	2,2',3,4,4',5,6'-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	52663-69-1	183	2,2',3,4,4',5',6-Heptachlorobiphenyl	Congener
---_4CL_PP_--	74472-48-3	184	2,2',3,4,4',6,6'-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52712-05-7	185	2,2',3,4,5,5',6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	74472-49-4	186	2,2',3,4,5,6,6'-Heptachlorobiphenyl	Congener
---_4CL_--_2M	52663-68-0	187	2,2',3,4',5,5',6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	74487-85-7	188	2,2',3,4',5,6,6'-Heptachlorobiphenyl	Congener
CP1_4CL_PP_2M	39635-31-9	189	2,3,3',4,4',5,5'-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	41411-64-7	190	2,3,3',4,4',5,6-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	74472-50-7	191	2,3,3',4,4',5',6-Heptachlorobiphenyl	Congener
---_4CL_--_2M	74472-51-8	192	2,3,3',4,5,5',6-Heptachlorobiphenyl	Congener

Table of PCB Congeners and Other Species				
Descriptor	**CASRN**	**Current [1]BZ & IUPAC Number**	**IUPAC Name**	**Type**
---_4CL_--_2M	69782-91-8	193	2,3,3',4',5,5',6-Heptachlorobiphenyl	Congener
---_4CL_PP_2M	35694-08-7	194	2,2',3,3',4,4',5,5'-Octachlorobiphenyl	Congener
---_4CL_PP_2M	52663-78-2	195	2,2',3,3',4,4',5,6-Octachlorobiphenyl	Congener
---_4CL_PP_2M	42740-50-1	196	2,2',3,3',4,4',5,6'-Octachlorobiphenyl	Congener
---_4CL_PP_2M	33091-17-7	197	2,2',3,3',4,4',6,6'-Octachlorobiphenyl	Congener
---_4CL_--_2M	68194-17-2	198	2,2',3,3',4,5,5',6-Octachlorobiphenyl	Congener
---_4CL_--_2M	52663-75-9	199	2,2',3,3',4,5,5',6'-Octachlorobiphenyl	Congener
---_4CL_--_2M	52663-73-7	200	2,2',3,3',4,5,6,6'-Octachlorobiphenyl	Congener
---_4CL_--_2M	40186-71-8	201	2,2',3,3',4,5',6,6'-Octachlorobiphenyl	Congener
---_4CL_--_2M	2136-99-4	202	2,2',3,3',5,5',6,6'-Octachlorobiphenyl	Congener
---_4CL_PP_2M	52663-76-0	203	2,2',3,4,4',5,5',6-Octachlorobiphenyl	Congener
---_4CL_PP_2M	74472-52-9	204	2,2',3,4,4',5,6,6'-Octachlorobiphenyl	Congener
---_4CL_PP_2M	74472-53-0	205	2,3,3',4,4',5,5',6-Octachlorobiphenyl	Congener
---_4CL_PP_2M	40186-72-9	206	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Congener
---_4CL_PP_2M	52663-79-3	207	2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	Congener
---_4CL_--_2M	52663-77-1	208	2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl	Congener
---_---_--_--	2051-24-3	209	Decachlorobiphenyl	Congener
	27323-18-8		Monochlorobiphenyl	Homolog
	25512-42-9		Dichlorobiphenyl	Homolog
	25323-68-6		Trichlorobiphenyl	Homolog
	26914-33-0		Tetrachlorobiphenyl	Homolog
	25429-29-2		Pentachlorobiphenyl	Homolog
	26601-64-9		Hexachlorobiphenyl	Homolog
	28655-71-2		Heptachlorobiphenyl	Homolog
	55722-26-4		Octachlorobiphenyl	Homolog
	53742-07-7		Nonachlorobiphenyl	Homolog
	1336-36-3		Polychlorinated biphenyl (PCB)	Category

1 BZ was named after Ballschmiter, K.; Zell, M. (1980). "Analysis of polychlorinated biphenyls (PCB) by glass capillary gas chromatography". *Fresenius' Zeitschrift für Analytische Chemie* 302: 20–31.

Table 7: Fish Tissue Chemistry Polychlorinated Dioxins and Furans.

TASK 3C
POLYCHLORINATED DIOXINS AND FURANS
TARGET PARAMETER LIST (TPL)

Method 1613 Rev. B (U.S. EPA 1994a)

PARAMETER	CAS NUMBER	BIOLOGICAL CRQL	UNITS*	SEDIMENT CRQL	UNITS**
2,3,7,8-TCDF	51207-31-9	1.0	ng/kg	1.0	ng/kg
2,3,7,8-TCDD (Dioxin)	1746-01-6	1.0	ng/kg	1.0	ng/kg
1,2,3,7,8-PeCDF	57117-41-6	2.5	ng/kg	2.5	ng/kg
2,3,4,7,8-PeCDF	57117-31-4	2.5	ng/kg	2.5	ng/kg
1,2,3,7,8-PeCDD	40321-76-4	2.5	ng/kg	2.5	ng/kg
1,2,3,4,7,8-HxCDF	70648-26-9	5.0	ng/kg	5.0	ng/kg
1,2,3,6,7,8-HxCDF	57117-44-9	5.0	ng/kg	5.0	ng/kg
2,3,4,6,7,8-HxCDF	60851-34-5	5.0	ng/kg	5.0	ng/kg
1,2,3,4,7,8-HxCDD	39227-28-6	5.0	ng/kg	5.0	ng/kg
1,2,3,6,7,8-HxCDD	57653-85-7	5.0	ng/kg	5.0	ng/kg
1,2,3,7,8,9-HxCDD	19408-74-3	5.0	ng/kg	5.0	ng/kg
1,2,3,7,8,9-HxCDF	72918-21-9	5.0	ng/kg	5.0	ng/kg
1,2,3,4,6,7,8-HpCDF	67562-39-4	5.0	ng/kg	5.0	ng/kg
1,2,3,4,6,7,8-HpCDD	35822-46-9	5.0	ng/kg	5.0	ng/kg
1,2,3,4,7,8,9-HpCDF	55673-89-7	5.0	ng/kg	5.0	ng/kg
OCDD	3268-87-9	5.0	ng/kg	5.0	ng/kg
OCDF	39001-02-0	5.0	ng/kg	5.0	ng/kg

CRQL Contract Required Quantitation Limit
* wet weight basis
** dry weight basis
TCDD = Tetrachlorodibenzo-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin
PeCDF = Pentachlorodibenzofuran
HxCDD = Hexachlorodibenzo-p-dioxin
HxCDF = Hexachlorodibenzofuran
HpCDD = Heptachlorodibenzo-p-dioxin
HpCDF = Heptachlorodibenzofuran
OCDD = Octachlorodibenzo-p-dioxin
OCDF = Octachlorodibenzofuran
ng/kg nanograms per kilogram

Table 8: Fish Tissue Chemistry Organochlorine Pesticides.

TASK 5
ORGANOCHLORINE PESTICIDES
TARGET PARAMETER LIST (TPL)

Method 8081B (U.S. EPA 2007c)

PARAMETER	CAS NUMBER	BIOTA CRQL	UNITS*	SEDIMENT CRQL	UNIT**
Aldrin	309-00-2	2.5	µg/kg	2.5	µg/kg
BHC, alpha-	319-84-6	2.5	µg/kg	2.5	µg/kg
BHC, beta-	319-85-7	2.5	µg/kg	2.5	µg/kg
BHC, delta-	319-86-8	2.5	µg/kg	2.5	µg/kg
BHC, gamma-	58-89-9	2.5	µg/kg	2.5	µg/kg
Chlordane, gamma(trans)	5103-74-2	2.5	µg/kg	2.5	µg/kg
Chlordane, alpha(cis)	5103-71-9	2.5	µg/kg	2.5	µg/kg
DDD, o,p'-	53-19-0	2.5	µg/kg	2.5	µg/kg
DDD, p,p'-	72-54-8	5.0	µg/kg	5.0	µg/kg
DDE, o,p'-	3424-82-6	2.5	µg/kg	2.5	µg/kg
DDE, p,p'-	72-55-9	5.0	µg/kg	5.0	µg/kg
DDT, o,p'-	789-02-6	2.5	µg/kg	2.5	µg/kg
DDT, p,p'-	50-29-3	5.0	µg/kg	5.0	µg/kg
Dieldrin	60-57-1	5.0	µg/kg	5.0	µg/kg
Endosulfan I	959-98-8	2.5	µg/kg	2.5	µg/kg
Endosulfan II	33213-65-9	5.0	µg/kg	5.0	µg/kg
Endosulfan sulfate	1031-07-8	5.0	µg/kg	5.0	µg/kg
Endrin	72-20-8	5.0	µg/kg	5.0	µg/kg
Endrin aldehyde	7421-93-4	5.0	µg/kg	5.0	µg/kg
Endrin ketone	53494-70-5	5.0	µg/kg	5.0	µg/kg
Heptachlor	76-44-8	2.5	µg/kg	2.5	µg/kg
Heptachlor epoxide	1024-57-3	2.5	µg/kg	2.5	µg/kg
Hexachlorobenzene	118-74-1	2.5	µg/kg	2.5	µg/kg
Methoxychlor	72-43-5	25.0	µg/kg	25.0	µg/kg
Mirex	2385-85-5	5.0	µg/kg	5.0	µg/kg
cis- Nonachlor	5103-73-1	5.0	µg/kg	5.0	µg/kg
trans- Nonachlor	39765-80-5	5.0	µg/kg	5.0	µg/kg
Oxychlordane	27304-13-8	5.0	µg/kg	5.0	µg/kg
Pentachloroanisole	1825-21-4	2.5	µg/kg	2.5	µg/kg
Toxaphene	8001-35-2	75.0	µg/kg	75.0	µg/kg

CRQL Contract Required Quantitation Limit
* wet weight basis
** dry weight basis
µg/kg micrograms per kilogram

Table 9: Fish Tissue Chemistry Cd, Pb, Hg, and Se.

TASK 6
INORGANICS
TARGET PARAMETER LIST (TPL)

Method 6020A (U.S. EPA 2007a)

PARAMETER	CAS NUMBER	BIOLOGICAL CRQL	UNITS*	SEDIMENT CRQL	UNITS**
Cadmium	7440-43-9	10.0	µg/kg	200.0	µg/kg
Lead	7439-92-1	70.0	µg/kg	500.0	µg/kg
Mercury	7439-97-6	20.0	µg/kg	20.0	µg/kg
Selenium	7782-49-2	100	µg/kg	500	µg/kg

CRQL Contract Required Quantitation Limit
* wet weight basis
** dry weight basis
µg/kg micrograms per kilogram

Table 10: Fish Tissue Chemistry Metals Long List.

TASK 6B
INORGANICS
TARGET PARAMETER LIST (TPL)

Method 6020A (U.S. EPA 2007a)

PARAMETER	CAS NUMBER	BIOLOGICAL CRQL	UNITS*	SEDIMENT CRQL	UNITS**
Aluminum	7429-90-5	5,000	µg/kg	1,500	µg/kg
Antimony	7440-36-0	2,000	µg/kg	1,000	µg/kg
Arsenic	7440-38-2	1,000	µg/kg	2,000	µg/kg
Barium	7440-39-3	5,000	µg/kg	1,500	µg/kg
Beryllium	7440-41-7	500	µg/kg	1,500	µg/kg
Cadmium	7440-43-9	10.0	µg/kg	200	µg/kg
Calcium	7440-70-2	500,000	µg/kg	5,000	µg/kg
Chromium	7440-47-3	100	µg/kg	800	µg/kg
Cobalt	7440-48-4	5,000	µg/kg	200	µg/kg
Copper	7440-50-8	100	µg/kg	500	µg/kg
Iron	7439-89-6	5,000	µg/kg	5,000	µg/kg
Lead	7439-92-1	70.0	µg/kg	500	µg/kg
Magnesium	7439-95-4	500,000	µg/kg	3,000	µg/kg
Manganese	7439-96-5	1,500	µg/kg	200	µg/kg
Mercury	7439-97-6	20.0	µg/kg	20.0	µg/kg
Nickel	7440-02-0	1,000	µg/kg	250	µg/kg
Potassium	7440-09-7	500,000	µg/kg	60,000	µg/kg
Selenium	7782-49-2	100	µg/kg	500	µg/kg
Silver	7440-22-4	500	µg/kg	200	µg/kg
Sodium	7440-23-5	10,000	µg/kg	6,000	µg/kg
Thallium	7440-28-0	1,000	µg/kg	500	µg/kg
Vanadium	7440-62-2	2,000	µg/kg	1,000	µg/kg
Zinc	7440-66-6	2,000	µg/kg	500	µg/kg

CRQL Contract Required Quantitation Limit
* wet weight basis
** dry weight basis
µg/kg micrograms per kilogram

Table 2: Fish Tissue Chemistry Total Mercury and Methylmercury.

TASK 6F
Total Mercury
Methyl Mercury

Method 1631 (U.S. EPA 2002, U.S. EPA 2001)
Method 1630 (U.S. EPA 2001b, U.S. EPA 1998b)

PARAMETER	CAS NUMBER	BIOLOGICAL CRQL	UNITS*	SEDIMENT CRQL	UNITS**
Mercury	7439-97-6	1.0	µg/kg	1.0	µg/kg
Methyl Mercury	22967-92-6	1.0	µg/kg	1.0	µg/kg

CRQL Contract Required Quantitation Limit
NA Not Applicable.
* wet weight basis
** dry weight basis
µg/kg micrograms per kilogram

Table 3: Fish Tissue Chemistry Acid Extractable Polynuclear Aromatic Hydrocarbon Compounds.

TASK 10
POLYNUCLEAR AROMATIC HYDROCARBONS
TARGET PARAMETER LIST (TPL)

Method GCMS-SIM HP-5973
Method 8270D (U.S. EPA 2007d)
Method 8310 (U.S. EPA 1986)

PARAMETER	CAS NUMBER	BIOLOGICAL CRQL	UNITS*	SEDIMENT CRQL	UNITS**
Naphthalene	91-2-03	100	µg/kg	33.0	µg/kg
1-Methyl Naphthalene	90-12-0	100	µg/kg	16.0	µg/kg
2-Methyl Naphthalene	91-57-6	100	µg/kg	16.0	µg/kg
Acenaphthylene	208-96-8	125	µg/kg	67.0	µg/kg
Acenaphthene	83-32-9	50.0	µg/kg	33.0	µg/kg
Fluorene	86-73-7	10.0	µg/kg	3.3	µg/kg
Phenanthrene	85-01-8	5.0	µg/kg	3.3	µg/kg
Anthracene	120-12-7	7.5	µg/kg	3.3	µg/kg
Chrysene	218-01-9	5.0	µg/kg	3.3	µg/kg
Fluoranthene	206-44-0	7.5	µg/kg	5.0	µg/kg
Pyrene	129-00-0	2.0	µg/kg	3.3	µg/kg
Benzo (a) anthracene	56-55-3	5.0	µg/kg	3.3	µg/kg
Benzo (b) fluoranthene	205-99-2	5.0	µg/kg	3.3	µg/kg
Benzo (k) fluoranthene	207-08-9	5.0	µg/kg	3.3	µg/kg
Benzo (a) pyrene	50-32-8	10.0	µg/kg	3.3	µg/kg
Dibenzo (a,h) anthracene	53-70-3	15.0	µg/kg	6.7	µg/kg
Benzo (g,h,i) perylene	191-24-2	12.5	µg/kg	6.7	µg/kg
Indeno (1,2,3-c,d) Pyrene	193-39-5	7.5	µg/kg	6.7	µg/kg

CRQL Contract Required Quantitation Limit
NA Not Applicable.
* wet weight basis
** dry weight basis
µg/kg micrograms per kilogram

Table 4: Fish Tissue Chemistry Polybrominated Diphyenyl Ethers.

TASK 11
POLYBROMINATED DIPHENYL ETHERS (PBDE)
TARGET PARAMETER LIST

Method 1614 HRGC/HRMS (U.S. EPA 2007e)

Congener	IUPAC #	MDL ug/kg (ww)	CRQL ug/kg (ww)
2-MonoBDE	1	0.5	1.5
3-MonoBDE	2	0.48	1.5
4-MonoBDE	3	0.48	1.5
2,4-DiBDE	7	0.03	0.1
2,4'-DiBDE	8	0.03	0.1
2,6-DiBDE	10	0.03	0.1
3,3'-DiBDE	11	0.00	0.1
3,4-DiBDE	12	0.03	0.1
3,4'-DiBDE	13	0.03	0.1
4,4'-DiBDE	15	0.03	0.1
2,2',4-TriBDE	17	0.03	0.1
2,3',4-TriBDE	25	0.03	0.1
2,4,4'-TriBDE	28	0.03	0.1
2,4,6-TriBDE	30	0.03	0.1
2,4',6-TriBDE	32	0.03	0.1
2',3,4-TriBDE	33	0.00	0.1
3,3',4-TriBDE	35	0.03	0.1
3,4,4'-TriBDE	37	0.03	0.1
2,2',4,4'-TetraBDE	47	0.02	0.1
2,2',4,5'-TetraBDE	49	0.02	0.1
2,3',4,4'-TetraBDE	66	0.03	0.1
2,3',4',6-TetraBDE	71	0.02	0.1
2,4,4',6-TetraBDE	75	0.02	0.1
3,3',4,4'-TetraBDE	77	0.02	0.1
2,2',3,4,4'-PentaBDE	85	0.03	0.1
2,2',4,4',5-PentaBDE	99	0.03	0.1
2,2',4,4',6-PentaBDE	100	0.02	0.1
2,3,3',4,4'-PentaBDE	105	0.02	0.1
2,3,4,5,6-PentaBDE	116	0.02	0.1
2,3',4,4',6-PentaBDE	119	0.02	0.1
3,3',4,4',5-PentaBDE	126	0.02	0.1
2,2',3,4,4',5'-HexaBDE	138	0.08	0.2
2,2',3,4,4',6'-HexaBDE	140	0.06	0.2
2,2',4,4',5,5'-HexaBDE	153	0.07	0.2
2,2',4,4',5,6'-HexaBDE	154	0.05	0.2
2,2',4,4',6,6'-HexaBDE	155	0.06	0.2
2,3,4,4',5,6-HexaBDE	166	0.00	0.2
2,2',3,4,4',5,6-HeptaBDE	181	0.07	0.2
2,2',3,4,4',5',6-HeptaBDE	183	0.05	0.2
2,3,3',4,4',5,6-HeptaBDE	190	0.10	0.3
2,2',3,3',4,4',5,5',6-	206	0.14	0.5
2,2',3,3',4,4',5,6,6'-	207	0.14	0.5
2,2',3,3',4,5,5',6,6'-	208	0.14	0.5
2,2',3,3',4,4',5,5',6,6'-	209	1.10	3.5

IUPAC=International Union of Pure and Applied Chemistry
MDL=method detection limit
DL=detection limit.

Table 14. Fish Tissue Chemistry Perfluorinated Alkyl Acids

TASK 12
TARGET PARAMETER LIST (TPL)

Method: WI ESS ORG 1480 (WI ESS 2010) [1]
Axys Method MLA-043 Rev 08 Ver 06 [2]

PARAMETER	CAS Number	BIOLOGICAL CRQL	UNITS**
Perfluoro-1-octanesulfonate (C8, PFOS)*	1763-23-1	0.50	µg/kg ww
Perfluoro-1-butanesulfonate (C4, PFBS)*	375-73-5	0.50	µg/kg ww
Perfluoro-1-hexanesulfonate (C6, PFHxS)*	355-46-4	0.50	µg/kg ww
Perfluoro-1-heptanesulfonate (C7,pFHpS)[3]	375-92-8	0.50	µg/kg ww
Perfluoro-1-decanesulfonate (C10, PFDS)[3]	335-77-3	0.50	µg/kg ww
Perfluoro-n-octanoic acid (C8, PFOA)*	335-67-1	0.50	µg/kg ww
Perfluoro-n-butanoic acid(C4 PFBA)	375-22-4	0.50	µg/kg ww
Perfluoro-n-pentanoic acid (C5, PFPeA)	2706-90-3	0.50	µg/kg ww
Perfluoro-n-hexanoic acid (C6, PFHxA)*	307-24-4	0.50	µg/kg ww
Perfluoro-n-heptanoic acid (C7, PFHpA)	375-85-9	0.50	µg/kg ww
Perfluoro-n-nonanoic acid (C9, PFNA)*	375-95-1	0.50	µg/kg ww
Perfluoro-n-decanoic acid (C10, PFDA)*	335-76-2	0.50	µg/kg ww
Perfluoro-n-undodecanoic acid (C11, PFUnA)	2058-94-8	0.50	µg/kg ww
Perfluoro-n-dodecanoic acid (C12, PFDoA)	307-55-1	0.50	µg/kg ww
Perfluoro-n-tridecanoic acid (C13, PFTrDA)[3]	72629-94-8	0.50	µg/kg ww
Perfluoro-n-tetradecanoic acid (C14, PFTeDA)[3]	376-06-7	0.50	µg/kg ww
Perfluoro-1-octanesulfonamide (PFOSA)	754-91-6	0.50	µg/kg ww

* Commonly found in the environment
** All results reported as µg/kg wet weight
1 Pace Analytical – Wisconsin Method WI ESS ORG 1480, "Analysis of Perfluorinated Compounds in Fish Tissue by HPLC-MS/MS, Matrix: Tissue", Nov. 2010.
2 AXYS Analytical Services Ltd. Test method, adapted from EPA method 537.
3 This parameter not available from AXYS Analytical Services.

Table 15. Method Holding Times and Conditions

Method	Hold Time	Conditions	Source
ASTM D2974-87	One year	<-10°C	Uses same value as EPA 1630/1631E. (U.S. EPA 2002)
EPA 1630 (U.S. EPA 2001b)	One year	<-15°C	Method (appendix)
EPA 1631E (U.S. EPA 2002)	One year	<-15°C	Method (appendix)
EPA 1668A	One year	Dark, <-10°C	Method
EPA 6020	6 months	N/A	SW-846, Ch. 3, Table 3-2
EPA 6020 (Cr+6)	30 days (extraction); 7 days (analysis)	≤6°C	SW-846, Ch. 3, Table 3-2
EPA 6020 (Hg)	28 days	≤6°C	SW-846, Ch. 3, Table 3-2
EPA 8081A	40 days after extraction	Dark; ≤4°C	Method
EPA 8082A (U.S. EPA 2007)	40 days after extraction	Dark; ≤4°C	Method
EPA 8270C	40 days after extraction	≤-4°C	SW-846, Ch. 4, Table 4-1

Pace Lipid	One year	<-10°C	Uses same value as EPA 1630/1631E. (U.S. EPA 2001b/U.S. EPA 2002)
EPA 537 Modified	One year	<-20°C	AXYS Method MLA-043 REV 08 Ver06, Appendix A
EPA 1614 (U.S. EPA 2007e)	One year	<-10°C	Method

Table 16: Laboratory Charges by Analytical Task Group

Task #	Description	Bio 60 Day Reporting Time	Bio 30 Day Reporting Time	Sediment 60 Day Reporting Time	Sediment 30 Day Reporting Time
1	Percent Lipid	$80.00	$80.00	N/A	N/A
3	Total PCBs	$145.00	$145.00	N/A	N/A
3B	PCB Congeners	$650.00	$785.00	$650.00	$785.00
3C	Dioxins and Furans	$525.00	$665.00	$525.00	$665.00
5	Organochlorine Pesticides	$180.00	$180.00	$115.00	$140.00
3,5	Total PCB and Organochlorine Pesticides	$200.00	$210.00	N/A	N/A
1,3,5	Lipid, Solids, Total PCB and Organochlorine Pesticides	$205.00	$225.00	N/A	N/A
6	Metals Short List	$75.00	$100.00	$80.00	$80.00
6B	Metals Long List	$150.00	$195.00	$150.00	$150.00
6F	Total and Methyl-Mercury by Method 1631 Appendix	$190.00	$265.00	N/A	N/A
10	Polynuclear Aromatic Hydrocarbons	$125.00	$180.00	$95.00	$130.00
11	Polybrominated Diphenyl Ethers	$635.00	$900.00	$900.00	$900.00
12	Perfluorinated Alkyl Acids	$495.00	$545.00	N/A	N/A

ASSESSMENT/OVERSIGHT

Field and laboratory performance and system audits will be conducted to ensure good quality data. The field and laboratory performance includes precision measurements by relative percent difference (RPD) of field and laboratory duplicate (IDEM 2017a, pp 56-59) and accuracy measurements by percent of recovery of matrix spike and matrix spike duplicate (MS/MSD) samples analyzed in the laboratory (IDEM 2017a, pp 56-59), and completeness measurements by the percent of planned samples that are actually collected, analyzed, reported, and usable for the project (IDEM 2017a, p 58).

Field audits will be conducted to ensure that sampling activities adhere to WAPB SOPs. Audits are systematically conducted by WAPB Quality Assurance staff to include all WAPB personnel that engage in field sampling activities. WAPB field staff involved with fish tissue sample collection and preparation will be evaluated by QA staff trained in the associated sampling SOPs, and in the processes related to conducting an audit. QA staff will produce an evaluation report documenting each audit for review by those field staff in which the audit pertains, as well as WAPB management. Corrective actions will be communicated and implemented by field staff as a result of the audit process.

Data Quality Assessment Levels
The samples and various types of data collected by this program are intended to meet the quality assurance criteria and DQA Levels as described in the WAPB QAPP (IDEM 2017a, pp 182-183). All fish tissue contaminants analytical results for this project will adhere to DQA Level 4.

DATA VALIDATION AND USABILITY

Quality assurance reports to management, including data validation and usability, are also important components of the QAPP to ensure good quality data for this project. A quality assurance audit report will be submitted for this project should problems arise and need to be investigated and corrected (IDEM 2017a, pp 177-178). Data validation and usability will be achieved through data reduction (the process of converting raw analytical data into final results in proper reporting units), data validation (the process of qualifying analytical/ measurement data on the performance of field and laboratory quality control measures incorporated into the sampling and analysis procedures), and data reporting (the detailed description of the data deliverables used to completely document the calibration, analysis, quality control measures, and calculations).

Quality Assurance/Data Qualifiers and Flags
The various data qualifiers and flags that will be used for quality assurance and validation of the data are found on pages 184-185 of the WAPB QAPP (IDEM 2017a).

Data Usability
The environmental data collected and its usability are finally qualified and classified into one or more of the four Categories: Acceptable Data, Enforcement Capable Results, Estimated Data and Rejected Data as described on page 184 of the WAPB QAPP (IDEM 2017a).

Reports of analytical results will be produced by IDEM based on the data collected:
1) One report will be a general compilation of the 2018 Upper Wabash River Basin fish tissue contaminants results presented to the Indiana FCA Workgroup and to the 305(b)/303(d) Integrated Report Coordinator.
2) A second data assessment report will be produced using the 2018 data for the Indiana FCA workgroup to be used for decision-making purposes.
3) A third data assessment report will be produced for decision-making inclusion in the Integrated Report.
4) A fish collection report will be submitted to the IDNR DFW in January of 2019 as a condition of the Program Manager’s Scientific Purposes Collecting Permit issued by IDNR.
5) Other reports assessing various aspects of fish tissue contaminants data will be produced depending on time and indications by the data, as well as special requests. These may include further refinement of statewide mercury assessments for individual fish species contaminant models, an assessment of

brominated diphenyl ether compounds in fish, and a trend assessment of organochlorine pesticides in fish from across the state.

All data and reports will be made available to public and private entities who may find the data useful for municipal, industrial, agricultural, and recreational decision-making purposes (TMDL, NPDES permit modeling, Site Investigations, Natural Resources Damage Assessment, Watershed Restoration Projects, Water Quality Criteria refinement, health information, etc.).

Laboratory and Estimated Cost

Laboratory analysis and data reporting for this project will comply with the QAPP for Indiana Surface Water Quality Monitoring Program, Revision 4 (IDEM 2017a) and RFP 16-88 (IDEM 2016b). Analytical tests on the parameters outlined in Tables 4 through 14 will be performed by Pace Analytical, Inc. of Green Bay, WI under the professional services contract 19881 (IDOA 2017). Supplies for the fish tissue sampling, including aluminum foil and food grade zip lock bags for wrapping tissue samples and dry ice and coolers for shipping, will be provided by Pace Analytical, Inc. The anticipated budget for laboratory cost in 2018 is $122,000 (Table 16). The projected laboratory expenditures for 2018 are based on samples collected from 40 sites in the Upper Wabash River basin, and in the Indiana waters of southern Lake Michigan. The 60-day reporting time is the standard reporting time for the program for cost efficiency purposes. The 30-day reporting time is reserved for special studies that may arise, in which the results are time sensitive. The standardized tasks assigned to fish tissue samples include tasks 1, 3, 5, 6, and 6F. Task assignments are highly variable and are determined based on region, known contaminants of concern, budgetary constraints, and can be sample-, species-, or waterbody-specific. For the projected sampling sites in this work plan, samples from all sites will be analyzed for tasks 1, 3, 5, 6, and 6F with the following exceptions:

- Species from the southern portion of Lake Michigan will be analyzed for tasks 1, 3, 5, 6B, 6F, 10 and 12.
- Several samples from selected sites will be analyzed for tasks 1, 3, 5, 6, 6F, and 12.

Table 17: Provisional Laboratory Expenditures for 2018

Tasks	Cost Per Sample	# Samples	Lab Duplicates	MS/MSD	Total
1,3,5,6,6F	$470.00	140	7	16	$75,460.00
1,3,5,6B,6F,10,12	$1,165.00	12	1	2	$17,445.00
1,3,5,6,6F,12	$965.00	26	1	2	$27,955.00

Total: **$120,860.00**

Laboratory Competency and Certifications

The Green Bay lab of Pace Analytical, Inc. offers organic and inorganic analysis, as well as a broad range of specialty services, including low level mercury, U.S. EPA Contract Lab Program level packages and electronic deliverables. In addition to routine environmental matrices, the Green Bay laboratory has expertise in sediment work, biological tissue analysis and emergency response capability. The Green Bay laboratory holds a broad base of analytical certifications in numerous programs (e.g., National Environmental Laboratory Accreditation Program (NELAP)), and is certified in Wisconsin, Illinois and other states.

Dioxin and PCB congener analysis is performed at the Minneapolis Lab of Pace Analytical, Inc. Methyl mercury analysis using Method 1630 (U.S. EPA 2001b) is performed at the Duluth, MN Lab of Pace Analytical, Inc. There is no certification available for this method. All labs maintain multiple accreditations and are accredited to ISO 17025:2005 by the American Association for Laboratory Accreditation (AALA) and/or NELAP. Pace Analytical's certifications cover the following U.S. EPA test methods:

- Method 8082A (U.S. EPA 2007)
- Method 8081A/B
- Method 8270C
- Method 6020A (U.S. EPA 2007)
- Method 1631E (U.S. EPA 2002)

- Method 1613B (U.S. EPA 1994a)
- Method 1668A

Certification for the Green Bay lab issued by the Florida Department of Health (Certificate #E87948) expires June 30, 2018. The MN lab, A2LA Certificate Number 2926.01, was last audited August 10-14, 2015. NELAP Certification from Minnesota Department of Health for the Duluth lab (Certificate Number: 1321977) is effective until December 31, 2018. Perfluorinated alkyl acids analysis is performed at SGS AXYS Analytical Services, Ltd. Certification from Minnesota Department of Health for SGS AXYS analytical services lab (Certificate Number: 1348931) is effective until 12/31/2018.

Table 18*:* Personnel Safety and Reference Manuals

Role	Required Training/Experience	Training References	Training Notes
All staff participating in fish tissue sample collections	-Basic First Aid and Cardio-Pulmonary Resuscitation (CPR)	-A minimum of 4 hours of in-service training provided by WAPB (IDEM 2010b)	-Staff lacking 4 hours of in-service training or appropriate certification will be accompanied in the field at all times by WAPB staff that meet Health and Safety Training requirements
	-Personal Protective Equipment (PPE) Policy	-IDEM 2008	-Indiana Code 14-8-2-27 requires a high intensity whistle and Safety of Life at Sea (SOLAS) certified strobe light when working on co-jurisdictional waters or during hours of darkness
	-Memorandum "Use of Personal Flotation Devices (PFD) by Branch Personnel" dated February 29, 2000	-February 29, 2000 WAPB internal memorandum regarding use of approved PFDs	
	-IDEM Injury and Illness Resulting from Occupational Exposure Policy	-Hazard Communication Manual (IDEM 1992d)	
	-Compliance with the former Biological Studies Section (BSS) Standard Operating Procedures Manual: Section II		
	-Compliance with Indiana boating safety requirements	-State of Indiana Boating Safety Requirements (U.S. PS 2017) and the DNR approved online Boating Safety Course	-Staff lacking 2 years field experience will be accompanied in the field at all times by WAPB staff that meet the boating safety requirements

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Appendix 1. Field Record for Biological Tissue Contaminants Monitoring Program

Indiana Department of Environmental Management
Office of Water Quality - Watershed Assessment and Planning Branch

Field Record for Biological Tissue Contaminant Monitoring Program

Site ID #:_____ Sampling Date and Time:_____
Event ID:_____ (mm/dd/yyyy) (24hr clock)

SITE LOCATION
Waterbody Name/Number:_____
County_____ Fipscode_____ Lat./Long.:_____
Location:_____
Segment Number:_____ Ecoregion:_____ Hydrologic Unit:_____ IASNRI Code:_____
Waterbody Type: RIVER LAKE RESERVOIR WETLAND
Site Description:_____
_____
Collection Method:_____
Collector's Name(s):_____
Agency:_____ Phone:(____) _____

FISH (or other organism) COLLECTED

Composite Sample #:_____ Number of Individuals:_____ Lab ID _____
Species Name:_____
Sample Preparation:_____

Fish#	Length(mm)	Weight(gm)	Sex(M,F)	Fish#	Length(mm)	Weight(gm)	Sex(M,F)
001				007			
002				008			
003				009			
004				010			
005				011			
006				012			

(min length/max length)x 100 = _____% **Composite mean length** _____ **mm**
(min wt/max wt)x 100= _____% **Composite mean weight**_____ **gm**
Notes (e.g., DELT anomalies)_____
_____

Composite Sample #:_____ Number of Individuals:_____ Lab ID _____
Species Name:_____
Sample Preparation:_____

Fish#	Length(mm)	Weight(gm)	Sex(M,F)	Fish#	Length(mm)	Weight(gm)	Sex(M,F)
001				007			
002				008			
003				009			
004				010			
005				011			
006				012			

(min length/max length)x 100 = _____% **Composite mean length** _____ **mm**
(min wt/max wt)x 100= _____% **Composite mean weight**_____ **gm**
Notes (e.g., DELT anomalies)_____
_____

Fieldrec.doc (rev.date 19 Oct. 2011)

Appendix 2. Contract Laboratory Chain of Custody Form

Pace Analytical™
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

Page: of

REGULATORY AGENCY

☐ NPDES ☐ GROUNDWATER ☐ DRINKINGWATER

☐ UST ☐ RCRA ☐ OTHER _____

Site Location

STATE: _____

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW WT
WATER	WW P
WASTE WATER	SL
PRODUCT	OL
SOIL/SOLID	WP
OIL	AR
WIPE	OT
AIR	TS
OTHER	
TISSUE	

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test ↓ (Requested Analysis Filtered (Y/N))	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			

SAMPLER NAME AND SIGNATURE		Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER:					
SIGNATURE of SAMPLER:	DATE Signed (MM/DD/YY):				