OWQ- WATERSHED ASSESSMENT & PLANNING BRANCH
IDEM/OWQ/WAPB/WM
VIRTUAL FILE CABINET INDEX FORM

Program: Water Monitoring

Document Type: Report

***Document Date:** 4/10/2021

***Security:** Public

***Project Name:** 2021 Corvallis

***Project Type:** Watershed

***Report Type:** Work Plan

HUC Code: No Selection

Site #:

Route Name:

Document Control # B-048-OWQ-WAP-PRB-21-W-RO

Analysis Set #

County:

Cross Reference ID:

Comments: 2021 Probabilistic Monitoring WP for the Patoka River Basin Prepared By: Paul D. McMurray, Jr.; Probabilistic Monitoring Section

Redaction Reference ID:

2021 Probabilistic Monitoring WP for the Patoka River Basin

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April 10, 2021

B-048-OWQ-WAP-PRB-21-W-R0

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Date 01 June 2021

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Work Plan Organization

This sampling and analysis work plan is an extension of the existing Indiana Department of Environmental Management (IDEM) Watershed Assessment and Planning Branch (WAPB) March 2017 Quality Assurance Project Plan (QAPP) for Indiana Surface Water Programs (Surface Water QAPP) (IDEM 2017a) and October 2020 QAPP for Biological Community and Habitat Measurements (IDEM 2020a); and serves as a link to the existing QAPP as well as an independent QAPP of the project. Per the United States Environmental Protection Agency (U.S. EPA) guidance for QAPPs (U.S. EPA 2006) and the U.S. EPA 2002 Guidance for Quality Assurance Project Plans (U.S. EPA 2002), the work plan establishes criteria and specifications, pertaining to a specific water quality monitoring project, usually described in the following four groups containing elements similar to a QAPP per Guidance for Quality Assurance project Plans (U.S. EPA 2002).

Group A. Project Management

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

Group B. Data Generation and Acquisition

- Sampling Sites and Sampling Design
- Sampling Methods and Sample Handling
- Analytical Methods
- Quality Control (QC) and Custody Requirements
- Field Parameter Measurements and Instrument Testing and Calibration

Group C. Assessment and Oversight

- Assessments and Response Levels
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List of Acronyms

AIMS	Assessment Information Management System
ALUS	Aquatic Life Use Support
ASTM	American Society for Testing and Materials
AU	Assessment Unit
CAC	Chronic Aquatic Criterion
CALM	Consolidated Assessment Listing Methodology
CFU	Colony Forming Unit
DQA	Data Quality Assessment
DQO	Data Quality Objective
E. coli	*Escherichia coli*
GPS	Global Positioning System
HUC	Hydrologic Unit Code
IDOH	Indiana Department of Health (formerly ISDH)
IAC	Indiana Administrative Code
IBI	Index of Biotic Integrity
MHAB	Multihabitat
NHD	National Hydrography Database
PDE	Percent Difference in Enumeration
PSE	Percent Sorting Efficiency
PTD	Percent Taxonomic Difference
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
QHEI	Qualitative Habitat Evaluation Index
RPD	Relative Percent Difference
SM	Standard Method
SOP	Standard Operating Procedure
SU	Standard Units
TMDL	Total Maximum Daily Load
U.S. EPA	United States Environmental Protection Agency
USGS	Unites States Geological Survey

Definitions

Assessment unit	Segments of waterbodies with similar features, assigned unique identifiers to which all assessment information for a specific reach is associated, and which allow for mapping with geographic information systems.
Backwater	A part of the river not reached by the current, where the water is stagnant.
Elutriate	To purify, separate, or remove lighter or finer particles by washing, decanting, and settling.
Fifteen (15) minute pick	A component of the IDEM multihabitat macroinvertebrate sampling method, used to maximize taxonomic diversity while in the field, in which the one-minute kick sample and fifty-meter sweep sample collected at a site are first combined and elutriated. Macroinvertebrates are then manually removed from the resulting sample for 15 minutes.
Fifty (50) meter sweep	A component of the IDEM multihabitat macroinvertebrate sampling method in which approximately 50 meters (m) of shoreline habitat in a stream or river is sampled with a standard 500 micrometer (µm) mesh width D-frame dipnet by taking 20–25 individual “jab” or “sweep” samples, which are then composited.
Impoundment	A body of water confined within an enclosure, such as a reservoir.
Lotic	A waterbody, such as a stream or river, in which the water is flowing.
Macroinvertebrate	Aquatic animals which lack a backbone, are visible without a microscope, and spend some period of their lives in or around water.
Marsh	An area of low-lying land flooded in wet seasons and typically remains waterlogged.
One (1) minute kick sample	A component of the IDEM multihabitat macroinvertebrate sampling method in which approximately 1 square meter (m^2) of riffle or run substrate habitat in a stream or river is

	sampled with a standard 500 µm mesh width D-frame dipnet for approximately 1 minute.
Ocular reticle	A thin piece of glass marked with a linear or areal scale inserted into a microscope ocular, superimposing the scale onto the image viewed through the microscope.
Perennial stream	A stream with continuous flow in the stream bed all year during years of normal rainfall. Water must be present in at least 50% of the stream reach during the time of fish community sampling.
Periphyton	Algae attached to an aquatic substrate.
Sampling Reach	A segment of a stream used for fish community sampling equal in length to 15 times the average wetted width of the stream, with a minimum length of 50 meters and a maximum length 500 meters. For macroinvertebrate community sampling, the stream reach is 50 meters of all available habitat.
Target	A sampling point which falls on a perennial stream within the basin of interest and the boundaries of Indiana.
Wetland	Land areas which are wet for at least part of the year, are poorly drained, characterized by hydrophytic vegetation, hydric soils, and wetland hydrology.

A. Project Management

A.1. Project Objective

The probabilistic monitoring project's main objective is to provide a comprehensive, unbiased assessment of the Patoka River basin's rivers and streams ability to support aquatic life and recreational uses. A secondary objective of the project is diatom identification and enumeration, with the goal of developing algal metrics as an assessment tool to support nutrient criteria. Sampling for the project begins in April and continues through November 2021, conditions permitting, with sample collection and analysis for chemical, physical, and biological parameters. Laboratory processing and data analysis for the project continues through spring of 2022. Data collected during probabilistic monitoring is used for the following purposes:

- Provide water quality and biological data for assessment of aquatic life and recreational uses as integral components of the IDEM biennial Integrated Water Monitoring and Assessment Report (Integrated Report). Thus satisfying U.S. EPA Clean Water Act (CWA) sections 305(b) and 303(d) reporting requirements (33 U.S.C. §1251 et seq. 1972).
- Provide a statistically valid estimation of the percent of stream miles supporting or nonsupporting for aquatic life and recreational uses in the basin of interest.
- Provide water quality and biological data which may support municipal, industrial, agricultural, and recreational decision-making processes, including the Total Maximum Daily Load (TMDL) process and National Pollutant Discharge Elimination System (NPDES) permit waste load allocations modeling.
- Compile water quality and biological data for trend analyses and future pollution abatement activities.
- Aid in the development of nutrient criteria as well as refined chemical and narrative biological water quality criteria.

A.2. Project or Task Organization and Schedule

Table 1. 2021 Probabilistic Monitoring Tasks, Schedule, and Evaluation

Activity	Dates	Number of Sites	Frequency of Sampling Related Activity	Parameter to be Sampled	How Evaluated
Site selection	Dec 2020	100 per basin of interest			Randomly ordered list generated by the National Health Environmental Effects Research Laboratory (NHEERL), Western Ecology Division, Corvallis, OR. Sites are stratified in statistically equal numbers of 1st, 2nd, 3rd, 4th, and higher order stream sites
Site reconnaissance	Jan 4 – Feb 4, 2021	All 100 sites	At least one visit but may require several to obtain final approval		Landowner approval, stream access, and safety characteristics for the first 75 target sites. Nontarget designations for the remaining 25 sites.
Bacteriological sampling	Apr 12 – Jun 17, 2021	First 40 target sites	Five times at equally spaced intervals over a 30 calendar-day period	*Escherichia coli (E. coli)*	Geometric mean of samples collected during recreational season (April – October). Action level is ≥125 colony forming units (CFU)/100mL or ≥125 most probable number (MPN)/100 mL).
Biological sampling	Jun – mid-Nov 2021	First 38 target sites	Fish community, once per sample (Jun 1 – Oct 15) Macroinvertebrate community, once per sample (Jul 15 – Nov 15) Qualitative Habitat Evaluation Index (QHEI), once per sample	Fish community Macroinvertebrate community Habitat quality	Fish Index of Biotic Integrity (IBI) Macroinvertebrate IBI (mIBI) QHEI evaluated separately for fish and macroinvertebrate communities

Table 1. 2021 Probabilistic Monitoring Tasks, Schedule, and Evaluation (cont)

Activity	Date(s)	Number of Sites	Frequency of Sampling Related Activity	Parameter to be Sampled	How Evaluated
Water chemistry	April – Sep or Oct 2021	First 45 target sites	Once each in April, Jun-July, and Sept-Oct with a minimum 30 days between sampling events	Total phosphorous Nitrogen (nitrate+nitrite) Dissolved oxygen pH Algal conditions Dissolved metals (Table 8) Dissolved arsenic (III) Nitrogen ammonia Chloride Free cyanide* Sulfate Total dissolved solids	>0.3 mg/L (for nutrients) >10.0 mg/L (for nutrients) <4.0 mg/L (warm water aquatic life) <6.0 mg/L (cold water aquatic life) dissolved oxygen >125% saturation (nutrients) >9.0 Standard Units (SU) (for nutrients) <6 or >9 SU (warm water aquatic life) Excessive (for nutrients, based on observation) Chronic Aquatic Criterion (CAC) based on hardness 190 µg/L CAC based on pH and temperature CAC based on hardness and sulfate CAC 5.2 µg/L Based on hardness and chloride 750 mg/L
	May – Oct 2021	Subset of 18 target sites	Once each in May, Aug, and Oct with a minimum of 30 days between sampling events	Dissolved orthophosphate	There are no criteria for this parameter in the Indiana Administrative Code (IAC). The Indiana Great Lakes Water Quality Agreement (GLWQA) Domestic Action Plan (DAP) for the Western Lake Erie Basin (WLEB) provides a springtime flow weighted mean concentration (FWMC) target of 0.05 mg/L for the Maumee River in Indiana.
Algal samples	Sep – Oct 2021	First 45 target sites	Once, with the 3rd water chemistry sample in Sept or Oct	Algal diatoms	Diatom identification and enumeration
Dissolved oxygen continuous monitoring	Aug 2021	Subset of 18 target sites	Once in Aug with two-week deployment at 18 sites	Dissolved oxygen Temperature	Minimum, maximum, and average change in dissolved oxygen for the two-week period Minimum, maximum, and average change in temperature for the two-week period

*Analyzed only where the total value exceeds the free Cn criterion of 5.2 ug/L.

A.3 Background and Project Description

Created in 1996, IDEM WAPB operates the Probabilistic Monitoring Program. Other organizations assisting with data preparation, collection, and analysis include private laboratories under contract with the state of Indiana (e.g., Pace Laboratory Inc. Appendix 1 accreditation documents), the Department of Biological and Environmental Sciences at Georgia College and State University, the U.S. EPA National Health Environmental Effects Research Laboratory (NHEERL), U.S. EPA Region 5, and the Indiana Department of Natural Resources. Landowners and property managers throughout the state also participate in the Probabilistic Monitoring Program by assisting staff with access to remote stream locations for sample collection.

The Probabilistic Monitoring Program provides a comprehensive, unbiased assessment the ability of all Indiana streams to support aquatic life and recreational uses by sampling randomly generated sites in major Indiana river basins. Major river basins are sampled using a nine-year rotating basin approach to assess and characterize overall water quality and biological integrity. B. Measurement and Data Acquisition details random site selection. For target sites, investigate the following data categories and utilize for assessment purposes: bacteriological contamination indicated by *E. coli* counts; water chemistry; algal samples (periphyton); fish and macroinvertebrate assemblages; and habitat evaluations. At a subset of 18 target sites, Onset Hobo® U26-001 D.O. data loggers record diel dissolved oxygen and temperature swings.

The U.S. EPA recommends the use of multiple bioindicators (e.g., fish, diatom, and macroinvertebrate communities) (U.S. EPA 2004), which facilitate the "weight-of-evidence" approach (U.S. EPA 2016) for interpretation of biomonitoring results. The approach involves interpreting data from multiple sources to arrive at conclusions about an environmental system or stressors such as nutrients. Multiple lines of evidence, utilizing more than one bioindicator, are valuable in correlating critical levels of nutrients available to stream biota. Diatom identification and enumeration aid in establishing algal metrics as part of Indiana's development of nutrient criteria for lotic surface waters.

A.4. Data Quality Objectives

The data quality objectives (DQO) process (U.S. EPA 2006) is a planning tool for data collection activities. It provides a basis for balancing control of data uncertainty against available resources. All significant data collection project efforts require the DQO process. The process is a seven-step systematic planning process used to clarify study objectives, define the types and amount of data needed to achieve the objectives, and establish decision criteria for evaluating data quality. The following seven steps document the Probabilistic Monitoring Program DQO process.

1. State the Problem

Assessments: Indiana requires assessment of 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]. The project gathers bacteriological, biological (diatom, fish, and macroinvertebrate communities), chemical, and habitat data to assess the designated use attainment status of streams in the Patoka River basin.

Nutrient Criteria: The U.S. EPA mandates states to either adopt U.S. EPA’s nutrient criteria or develop criteria specific to waters within each state by the year 2004 (U.S. EPA 2000a, 2000b, 2000c). Several states, including Indiana, obtained plan submission date extensions to describe data needs, analyses, and protocols for developing nutrient water quality criteria. Since 2001, IDEM and the United States Geological Survey (USGS) have collaborated on several projects providing the technical background for developing nutrient criteria for rivers and streams in Indiana. U.S. EPA recommends a multiple-lines-of-evidence approach for developing nutrient criteria and approves implementation of a program which includes the identification and enumeration of diatoms. To develop numeric nutrient criteria for rivers and streams in Indiana, IDEM and the USGS statistically analyzed water chemistry, fish, macroinvertebrate, and chlorophyll data from 2005–2009 (Caskey et al. 2013). Taxonomic analysis of diatom samples and diel dissolved oxygen, during the project, add another line of evidence in the development of nutrient criteria.

2. Identify the Goals of the Study

A project objective is producing a statistically valid estimation of the percent of stream miles supporting or nonsupporting for aquatic life use and recreational use in the Patoka River basin. To produce the evaluation, sample each target site for concentrations of physical, chemical, and biological parameters. Evaluate sites as supporting or nonsupporting following the decision-making processes described in Indiana’s 2020 Consolidated Assessment Listing Methodology (CALM). Water quality criteria are shown in Table 2 [327 IAC 2-1-6] and the Indiana 2020 CALM (IDEM 2020b).

In addition to the chemical and bacteriological criteria listed in Table 2, evaluate data for several nutrient parameters against the benchmarks listed below (IDEM 2020b). Assuming a minimum of three sampling events, if two or more of the conditions below are met on the same date, the waterbody is classified as nonsupporting due to excessive nutrients.

- Total phosphorus: One or more measurements >0.3 mg/L
- Nitrogen, (nitrate+nitrite): One or more measurements >10.0 mg/L
- Dissolved oxygen: One or more measurements <4.0 mg/L, or measurements consistently at or close to the standard, in the range of 4.0-5.0 mg/L, or dissolved oxygen percent saturation >125%

- pH: One or more measurements >9.0 SU or measurements consistently at or close to the standard, in the range of 8.7–9.0 SU
- Algal Conditions: Visually observed as excessive by trained staff using best professional judgment. B.4. Quality Control and Custody Requirements 3. Algal Community Data provides further explanation of the excessive observation.

Biological Criteria

Indiana narrative biological criteria [327 IAC 2-1-3] states “all waters, except as described in subdivision (5),” (i.e., limited use waters) “will be capable of supporting” a “well-balanced, warm water aquatic community”. The water quality standard definition of a “well-balanced aquatic community” is “an aquatic community which: (A) is diverse in species composition; (B) contains several different trophic levels; and (C) is not mainly composed of pollution tolerant species” [327 IAC 2-1-9]. An interpretation or translation of narrative biological criteria into numeric criteria follows: A stream segment is nonsupporting for aquatic life use when the monitored fish or macroinvertebrate community receives an IBI score of less than 36 (on a scale of 0–60 for fish and 12–60 for macroinvertebrate communities), which is considered “Poor” or “Very Poor” (IDEM 2020b).

Develop nutrient criteria and algal numeric criteria through the collection of benthic diatoms and chemical data from each site, along with field parameters and physical site descriptions. Once collected, preserve and transport samples to the IDEM Shadeland facility laboratory. Georgia College and State University, Department of Biological and Environmental Sciences (Milledgeville, Georgia) identifies and enumerates diatoms as part of development of algal metrics.

Following assessment of each site sampled in the Patoka River Basin, calculate the percent of stream miles attaining and not attaining recreational use and aquatic life use designations. First, develop a spreadsheet which lists the following site information:

- All initially drawn sites
- Site status (i.e., access denied; site sampled for biology, chemistry, or both; an overdraw site not needed)
- Site assessment status (impaired, not impaired, NA for denials and unused overdraw sites)
- A weight (based on stream order and stream miles within the basin)

Then analyze the data with a software package (*spsurvey*) using the R statistics environment (IDEM 2020c). Instructions for downloading and using the software are available at: http://archive.epa.gov/nheerl/arm/web/html/software.html. The analysis end-product is an estimate of the number of stream miles which are impaired (or not) along with confidence intervals for the particular basin. Report calculated mileages to U.S. EPA in the 2024 update of Integrated Report. List sites not attaining recreational use criteria or the aquatic life use support (ALUS) designation in the CWA section 303(d) List of Impaired Waters for Indiana (Consolidated List). For sites not attaining the ALUS designation, consider possible additional sampling to determine the extent, causes, and likely sources of the ALUS nonattainment area as a Targeted Monitoring Program watershed characterization project.

Use site-specific data to classify associated assessment units (AU) into one of five major categories in the state's Consolidated List (IDEM 2020b) included in IDEM's 2024 Integrated Report.

Table 2. Water Quality Criteria [327 IAC 2-1-6]

Parameter	Level	Criterion
Dissolved metals (Cd, Cr III, Cr VI, Cu, Pb, Ni, Zn)	Calculated based on hardness	CAC
Dissolved arsenic III	190 µg/L	CAC
Ammonia nitrogen	Calculated based on pH and temperature	CAC
Chloride	Calculated based on hardness and sulfate	CAC
Free cyanide	5.2 µg/L (analyzed only if total cyanide result exceeds the CAC for free cyanide)	CAC
Dissolved oxygen	At least 5.0 mg/L (warm water aquatic life) At least 6.0 mg/L (cold water fish*)	Not less than 4.0 mg/L at any time. Not less than 6.0 mg/L at any time and not less than 7.0 mg/L in areas where spawning occurs during the spawning season and in areas used during salmonids imprinting time.
pH	6.0 – 9.0 SU	Must remain between 6.0 and 9.0 SU except for daily fluctuations exceeding 9.0 due to photosynthetic activity
Nitrogen, (nitrate+nitrite)	10 mg/L	HHC at point of drinking water intake
Sulfate	Calculated based on hardness and chloride	In all waters outside the mixing zone
E. coli (April–October recreational season)	125 CFU/100mL or 125 MPN/100 mL 235 CFU/100 mL or 235 MPN/100 mL	5 sample geometric mean based on at least 5 samples equally spaced over a 30-day period Not to exceed in any one sample in a 30-day period except in cases with collection of 10 or more samples, where 10% of the samples may exceed the criterion
Dissolved solids	750 mg/L	Not to exceed at point of drinking water intake

CAC = Chronic Aquatic Criterion, SU = Standard Units, HHC = Human Health Criteria, MPN = Most Probable Number, CFU = Colony Forming Unit

*Waters protected for cold water fish include waters designated by the Indiana Department of Natural Resources for put-and-take trout fishing, as well as salmonid waters listed in 327 IAC 2-1.5-5.

3. Identify Information Inputs

The probabilistic design requires field monitoring activities for collection of physical, chemical, algal, bacteriological, biological, and habitat data to address the necessary decisions previously described. Monitoring activities take place at target sites where the necessary landowners or property managers grant permission to access. Due to the statistical nature of the survey design, historical data is not used in the calculation of predicted stream mileages supporting or nonsupporting aquatic life or recreational uses. Section B. Measurement and Data Acquisition describes the collection procedures for field measurements, bacteriological, algal, chemical, biological, and habitat data in detail.

4. Define the Boundaries for the Study

For the study, the Patoka River basin (Figure 1) is geographically defined as within the borders of Indiana contained by the eight-digit Hydrologic Unit Code (HUC) 05120209. The area includes:

- The Patoka River subbasin (05120209), located in central Indiana, draining approximately 861 square miles. The 2011 National Land Cover Database for the Conterminous United States lists predominant land uses as forest (45%), cropland (30%), pasture (13%), and urban (6%) (Homer et al. 2015).

All perennial streams in the Patoka River basin lying within the geographic boundaries of Indiana define the basin's target sample population. All rivers, streams, canals, and ditches, as indexed through the National Hydrography Database-Plus (NHD-Plus) dataset (U.S. EPA and USGS 2005), comprise the sample frame. Marshes, wetlands, backwaters, impoundments, dry sites, and streams with no apparent channel (i.e., submerged, run underground either through natural processes or by anthropogenic channel alterations) are considered nontarget populations and excluded. Table 3 provides the site status for 100 potential Patoka River basin sampling sites. From the 100 potential sites, sample the first 45 target sites for physical, chemical, and algal parameters. Complete bacteriological sampling at the first 40 target sites. Sample biological communities and habitat information at the first 38 target sites. Sample eighteen target sites for diel dissolved oxygen and orthophosphate. For sites listed as "Target, Approved but not sampled" in Table 3, list the site as Not-needed, when using the *R* statistics environment software to calculate the percent of perennial stream miles in the basin which support or do not support aquatic life and recreational uses (IDEM 2020c). *R* software (R Core Team 2014) package *spsurvey* is available on the U.S. EPA Aquatic Resources Monitoring and Analysis webpage, http://archive.epa.gov/nheerl/arm/web/html/software.html or at https://cran.r-project.org/web/packages/spsurvey/spsurvey.pdf. Of the original 75 target sites in Table 3, redesignate sites as "Other, Deadline 2/4/2021" when during site reconnaissance the landowner could not be contacted prior to the February 4, 2021 deadline.

Collect physical, chemical, bacteriological parameters, and biological community samples when the stream flow is not dangerous for staff entry (e.g., water levels at or below median base flow); barring any hazardous weather conditions (e.g., thunderstorms or heavy rain in the vicinity); or barring unexpected physical barriers to site access. The field crew chief makes the final determination as to whether a stream is safe to enter. Even if the weather conditions and stream flow are safe, postpone biological communities' sample collections, at a particular site, for one to four weeks due to scouring of the stream substrate or in stream cover following a high-water event which can result in nonrepresentative samples.

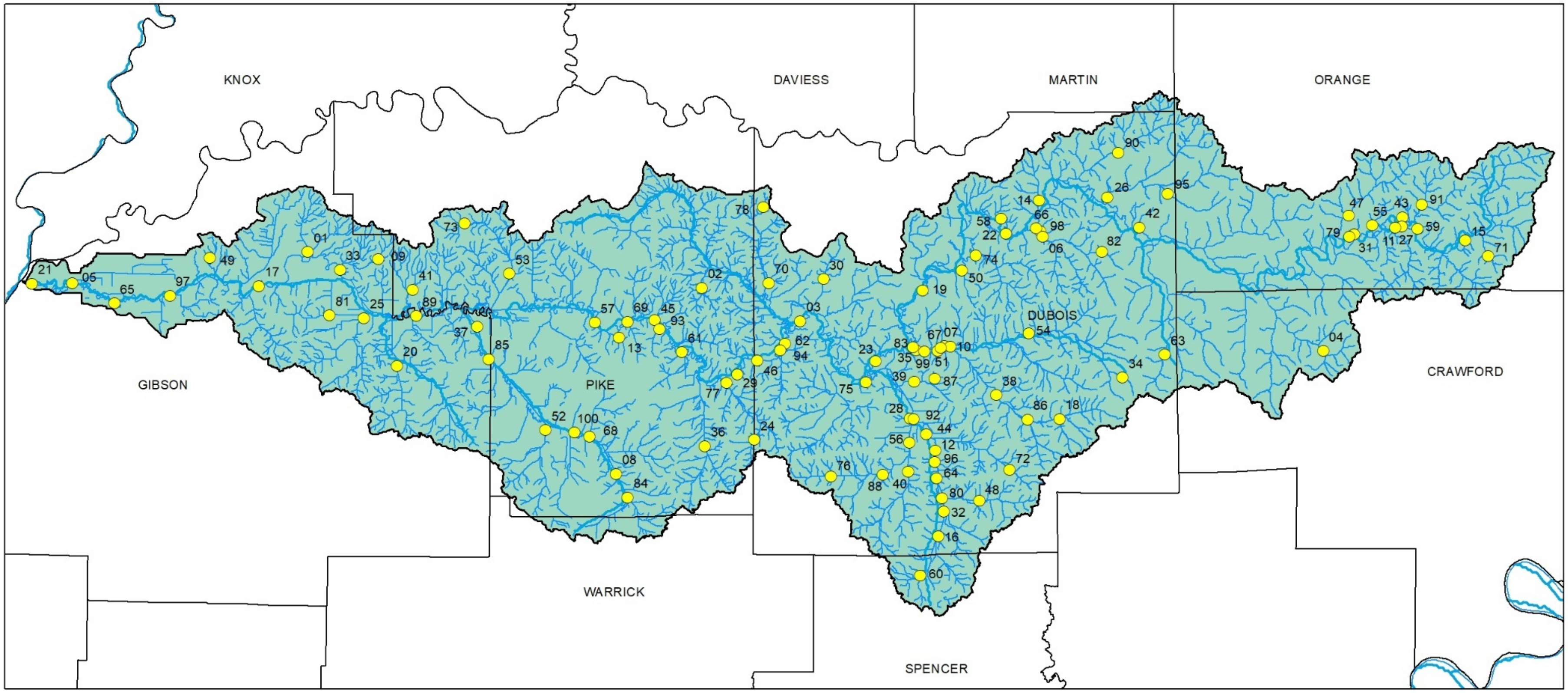
5. Develop the Analytical Approach

For Integrated Report assessment purposes, aquatic life use and recreational use support decisions include independent evaluations of chemical, biological, and bacteriological criteria outlined in Indiana's 2020 CALM (IDEM 2020b, pp 19–24). Evaluate the fish assemblage at each site using the appropriate IBI (Dufour 2002, Simon DRAFT; Simon and Dufour 2005). Evaluate macroinvertebrate multihabitat (MHAB) samples using a statewide mIBI developed for lowest practical taxonomic level identifications. Specifically, consider a site nonsupporting for aquatic life use when the IBI or the mIBI score is less than 36. Where biological or chemical criteria are nonsupporting for aquatic life use, consider additional sampling at the site to determine the extent, causes, and likely source of the ALUS nonattainment area as a Targeted Monitoring Program watershed characterization project.

Make statistical estimations of the percentage of perennial stream miles in the Patoka River basin which support or do not support aquatic life or recreational uses following use-attainment decisions for each site sampled. Calculate estimations using the *R* statistics environment software (R Core Team 2014) package *spsurvey* available on the U.S. EPA Aquatic Resources Monitoring and Analysis webpage, http://archive.epa.gov/nheerl/arm/web/html/software.html, or at https://cran.r-project.org/web/packages/spsurvey/spsurvey.pdf (IDEM 2020c). Publish the percent attainment and nonattainment for the target population (Patoka River Basin) in the 2024 Integrated Report.

Once determined, IDEM intends to develop and use algal metrics as part of nutrient criteria for Indiana's surface waters. Eventually, IDEM plans to use algal metrics with macroinvertebrate and fish metrics for ALUS decisions. Given known ecological tolerances for many diatom species, changes in diatom community composition could diagnose environmental stressors affecting ecological health (Stevenson 1998; Stevenson and Pan 1999). Thus, many regions develop and test periphyton IBI metrics (KYDEP 1993; Hill et al. 1997). Assessing a waterbody's biological integrity using the periphyton assemblage without any other information is possible. However, periphyton are most effective when used with habitat and macroinvertebrate assessments, particularly because of the close relationship between periphyton and these stream ecosystems’ elements (Barbour et al. 1999). For this reason, conduct algal sampling at the same sites where the Probabilistic Monitoring Program collects macroinvertebrates, fish, habitat, chemical, and physical data.

Figure 1. Potential Sampling Sites for the Patoka River Basin.



This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By: J Wood, Office of Water Quality
Date 12/03/2020

Spatial Data Sources:
State of Indiana Geographic Information Office Library

Map Projection & Datum: UTM Zone 16 N / NAD83

N W E S

0 2 4 8 Miles

IDEM

Legend
- Potential Sampling Sites
- Rivers and Streams
- Counties
- 05120209

Table 3. List of Potential Sites for the Patoka River Basin. Potential Diel Dissolved Oxygen sites are marked with *.

Site #	AIMS Site Name	Stream Name and Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)	Topo	Stream Order	Site Status
1	WPA-08-0024	Goose Creek	Gibson	38.42361261	-87.48641796	I-44	2	Other, Deadline 2/4/2021
2	WPA-05-0007	Bone Creek	Pike	38.39847551	-87.12084317	I-47	1	Other, Deadline 2/4/2021
3	WPA-04-0032	Patoka River @ CR 650 West	Dubois	38.37396576	-87.02972403	J-08	4	Target, Approved
4 *	WPA-01-0023	Sycamore Creek @ Alstott Road	Crawford	38.35142988	-86.54538685	J-12	1	Target, Approved
5	WPA-08-0025	Patoka River @ CR 350 North	Gibson	38.39965709	-87.70513279	I-42	4	Target, Approved
6 *	WPA-04-0033	Polson Creek @ SR 545	Dubois	38.43956859	-86.80709664	I-49	3	Target, Approved
7	WPA-02-0013	Straight River	Dubois	38.35595954	-86.89609087	J-09	3	Non-target, Access Denied
8 *	WPA-07-0020	South Fork Patoka River @ CR 400 East	Pike	38.2623913	-87.20010684	J-07	2	Target, Approved
9	WPA-08-0026	Tributary of Yellow Creek @ CR 775 East	Gibson	38.41896879	-87.42107041	I-44	1	Target, Approved
10	WPA-02-0014	Straight River	Dubois	38.35577676	-86.89053259	J-09	3	Non-target, Access Denied
11 *	WPA-01-0034	Patoka River @ CR 50 West	Orange	38.44866935	-86.4709154	I-52	3	Target, Approved
12	WPA-03-0019	Hunley Creek @ CR 660 South	Dubois	38.28005999	-86.9048589	J-09	3	Target, Approved
13	WPA-06-0017	Tributary of Patoka River	Pike	38.3620777	-87.19760035	J-07	1	Non-target, Backwater
14 *	WPA-04-0047	Leistner Creek @ JFS Milling	Dubois	38.46223459	-86.80805586	I-49	1	Target, Approved
15	WPA-01-0024	Patoka River @ CR 840 South	Orange	38.43181243	-86.41318879	I-52	2	Target, Approved
16 *	WPA-03-0020	Hunley Creek @ CR 1100 South	Dubois	38.21734041	-86.90169822	J-28	2	Target, Approved
17 *	WPA-08-0027	Patoka River @ Dunlap Drive	Gibson	38.3984982	-87.53148764	I-43	4	Target, Approved
18	WPA-02-0015	Flat Creek	Dubois	38.30275992	-86.78972798	J-10	2	Non-target, Access Denied
19	WPA-04-0034	Patoka River @ 15th Street	Dubois	38.39676206	-86.91634993	I-48	4	Target, Approved
20	WPA-08-0028	West Fork Keg Creek @ CR 125 South	Gibson	38.34095897	-87.4031051	J-05	2	Target, Approved
21	WPA-08-0029	Patoka River @ CR 270 North	Gibson	38.39914331	-87.74204336	I-42	4	Target, Approved
22	WPA-04-0035	Patoka River	Dubois	38.43796251	-86.83900959	I-49	4	Non-target, Access Denied
23 *	WPA-04-0036	Patoka River @ CR 250 South	Dubois	38.34246183	-86.96375375	J-09	4	Target, Approved
24	WPA-06-0018	Tributary of Rock Creek	Pike	38.28770511	-87.07191643	J-08	2	Non-target, Dry
25	WPA-08-0030	Lost Creek	Gibson	38.37565614	-87.43403232	I-44	2	Non-target, Backwater
26 *	WPA-04-0037	Dillon Creek @ CR 850 East	Dubois	38.46393757	-86.74438577	I-50	2	Target, Approved
27	WPA-01-0025	Patoka River @ CR 50 West	Orange	38.44191569	-86.47192378	I-52	3	Target, Approved
28	WPA-03-0021	Bruner Creek	Dubois	38.30324479	-86.9282106	J-09	3	Other, Deadline 2/4/2021
29	WPA-06-0019	Patoka River @ CR 550 South	Pike	38.33584187	-87.08835999	J-08	4	Target, Approved
30 *	WPA-04-0048	Altar Creek @ Alder Creek Drive	Dubois	38.40462119	-87.00825438	I-47	2	Target, Approved
31	WPA-01-0026	Patoka River	Orange	38.43631582	-86.51609289	I-51	3	Non-target, Backwater
32 *	WPA-03-0022	Hunley Creek @ CR 1000 South	Dubois	38.23531966	-86.89687614	J-28	2	Target, Approved
33	WPA-08-0031	Patoka River	Gibson	38.41065211	-87.45629704	I-44	4	Non-target, Backwater
34	WPA-02-0024	Tributary of Hall Creek	Dubois	38.33268321	-86.73139377	J-11	1	Non-target, Access Denied
35	WPA-02-0016	Straight River	Dubois	38.35289688	-86.92238062	J-09	3	Other, Deadline 2/4/2021
36	WPA-06-0020	Cup Creek @ CR 800 East	Pike	38.28367756	-87.11834606	J-08	2	Target, Approved
37	WPA-07-0025	South Fork Patoka River @ CR 75 North	Gibson	38.36956073	-87.3290238	J-06	2	Target, Approved
38	WPA-02-0017	Flat Creek	Dubois	38.32024807	-86.84789372	J-10	2	Non-target, Access Denied
39	WPA-03-0023	Tributary of Hunley Creek @ CR 130 South	Dubois	38.33008283	-86.92427693	J-09	1	Target, Approved
40	WPA-03-0024	Bruner Creek @ CR 100 West	Dubois	38.26434199	-86.92999972	J-09	2	Target, Approved
41	WPA-08-0036	Tributary of Big Creek	Pike	38.39632624	-87.38880317	I-44	1	Non-target, Marsh/Wetland
42 *	WPA-04-0038	Patoka River @ Cuzco Road	Dubois	38.44192187	-86.71488085	I-50	4	Target, Approved
43	WPA-01-0027	Patoka River @ CR 150 West	Orange	38.44128284	-86.47783936	I-52	3	Target, Approved
44	WPA-03-0034	Hunley Creek @ CR 75 West	Dubois	38.29157003	-86.91269427	J-09	3	Target, Approved
45	WPA-06-0021	Patoka River @ CR 650 East	Pike	38.37439032	-87.16341498	J-07	4	Target, Approved
46	WPA-06-0022	Patoka River @ CR 475 South	Pike	38.3463062	-87.07359262	J-08	4	Target, Approved
47 *	WPA-01-0028	Youngs Creek @ CR 350 West	Orange	38.44978776	-86.5208976	I-51	1	Target, Approved
48 *	WPA-03-0035	Green Creek @ SR 162	Dubois	38.24313659	-86.86413121	J-29	2	Target, Approved
49 *	WPA-08-0032	Tributary of Patoka River @ CR 450 North	Gibson	38.41927847	-87.57705703	I-43	1	Target, Approved
50 *	WPA-04-0039	Patoka River @ CR 175 East	Dubois	38.41370402	-86.87666472	I-48	4	Target, Approved

Table 3 List of Potential Sites for the Patoka River Basin. Potential Diel Dissolved Oxygen sites are marked with *. (cont)

Site #	AIMS Site Name	Stream Name and Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)	Topo	Stream Order	Site Status
51	WPA-02-0018	Straight River	Dubois	38.35250552	-86.9024468	J-09	3	Target, Approved
52	WPA-07-0021	Honey Creek @ CR 900 South	Pike	38.29440891	-87.2656103	J-06	1	Non-target, Access Denied
53	WPA-06-0023	Flat Creek @ CR 125 South	Pike	38.40735751	-87.29892169	I-45	2	Target, Approved
54	WPA-02-0019	Hall Creek	Dubois	38.36518127	-86.81760549	J-10	2	Other, Deadline 2/4/2021
55	WPA-01-0029	Tributary of Patoka River @ Apple Chapel Road	Orange	38.44309389	-86.4990003	I-52	1	Non-target, Physical Barrier
56	WPA-03-0025	Bruner Creek @ 1st Street	Dubois	38.28547194	-86.92877533	J-09	3	Target, Approved
57	WPA-06-0024	Patoka River @ SR 61	Pike	38.3731061	-87.22016554	J-07	4	Target, Approved
58	WPA-04-0040	Patoka River @ CR 325 East	Dubois	38.44865966	-86.84362627	I-49	4	Non-target, Physical Barrier
59	WPA-01-0030	Patoka River @ SR 37	Orange	38.44007928	-86.45694615	I-52	2	Target, Approved
60 *	WPA-03-0026	Hunley Creek @ CR 700 East	Spencer	38.18865935	-86.91878259	J-28	1	Target, Approved
61	WPA-06-0030	Tributary of Patoka River	Pike	38.35150042	-87.13924098	J-07	1	Non-target, Marsh/Wetland
62	WPA-06-0025	Patoka River @ CR 175 West	Dubois	38.35750745	-87.04438537	J-08	4	Target, Approved
63 *	WPA-01-0031	Lick Fork @ Harts Gravel Road	Dubois	38.3494252	-86.69225342	J-11	1	Target, Approved
64	WPA-03-0036	Hunley Creek @ CR 75 East	Dubois	38.25969943	-86.90322876	J-09	3	Target, Approved
65	WPA-08-0033	Patoka River @ CR 175 North	Gibson	38.38535263	-87.66555562	I-42	4	Target, Approved
66	WPA-04-0041	Polson Creek @ SR 545	Dubois	38.44169591	-86.81088914	I-49	3	Target, Approved
67	WPA-02-0020	Straight River	Dubois	38.35476806	-86.89942152	J-09	3	Non-target, Access Denied
68	WPA-07-0026	South Fork Patoka River @ CR 875 South	Pike	38.28988812	-87.22462938	J-07	2	Target, Approved
69	WPA-06-0026	Patoka River @ CR 350 South	Pike	38.3735415	-87.18943772	J-07	4	Target, Approved
70	WPA-05-0008	Little Flat Creek	Dubois	38.40204408	-87.05903222	I-47	1	Other, Deadline 2/4/2021
71	WPA-01-0035	Tributary of Patoka River @ CR 375 East	Orange	38.42006858	-86.39186818	I-52	1	Target, Approved
72	WPA-03-0027	Indian Creek @ South Club Road	Dubois	38.2657505	-86.83583936	J-10	1	Target, Approved
73	WPA-06-0027	Flat Creek @ CR 350 West	Pike	38.44469745	-87.34099653	I-45	1	Target, Approved
74	WPA-04-0042	Beaver Creek @ CR 175 East	Dubois	38.42341834	-86.86749493	I-49	2	Target, Approved
75	WPA-04-0049	Patoka River @ Old Huntingburg Road	Dubois	38.3294048	-86.96690255	J-09	4	Target, Approved
76	WPA-03-0028	Short Creek	Dubois	38.26103569	-87.00112296	J-08	1	Target, Approved
77	WPA-06-0028	Rock Creek	Pike	38.32928074	-87.0977178	J-08	2	Target, Approved
78	WPA-05-0009	Little Flat Creek	Dubois	38.45741454	-87.06390325	I-47	1	Target, Approved
79	WPA-01-0032	Patoka River	Orange	38.43482236	-86.52044609	I-51	3	Non-target, Backwater
80	WPA-03-0029	Hunley Creek	Dubois	38.24520074	-86.89862916	J-28	3	Target, Approved
81	WPA-08-0034	Morrow Lateral	Gibson	38.37749031	-87.46604295	I-44	1	Target, Approved
82	WPA-04-0043	Bailey Creek	Dubois	38.4246092	-86.75017826	I-49	1	Target, Approved
83	WPA-02-0021	Straight River	Dubois	38.35509929	-86.92538709	J-09	3	Target, Approved
84	WPA-07-0022	South Fork Patoka River	Pike	38.24544793	-87.18916623	J-26	2	Target, Approved
85	WPA-07-0023	South Fork Patoka River @ CR 525 South	Gibson	38.34604474	-87.3179753	J-06	2	Target, Approved
86	WPA-02-0022	Flat Creek	Dubois	38.30228409	-86.81933806	J-10	2	Target, Approved
87	WPA-03-0030	Tributary of Hunley Creek	Dubois	38.33211171	-86.90485154	J-09	1	Non-target, Dry
88	WPA-03-0031	Short Creek	Dubois	38.26242538	-86.95299981	J-09	2	Target, Approved
89	WPA-08-0035	Patoka River @ CR 500 West	Gibson	38.37726637	-87.3855417	I-44	4	Target, Approved
90	WPA-04-0044	Davis Creek	Dubois	38.49656238	-86.73474614	I-50	1	Target, Approved
91	WPA-01-0033	Underwood Hollow	Orange	38.45782648	-86.45290396	I-52	1	Target, Approved
92	WPA-03-0032	Hunley Creek	Dubois	38.30257916	-86.92442934	J-09	3	Target, Approved
93	WPA-06-0029	Hog Branch	Pike	38.36839887	-87.15986389	J-07	1	Target, Approved
94	WPA-06-0031	Patoka River @ CR 800 West	Dubois	38.35280045	-87.04798275	J-08	4	Target, Approved
95	WPA-04-0045	George Creek	Dubois	38.4663624	-86.68856288	I-50	1	Target, Approved
96	WPA-03-0033	Hunley Creek	Dubois	38.27154117	-86.90514563	J-09	3	Target, Approved
97	WPA-08-0037	Patoka River @ US 41	Gibson	38.39107572	-87.61387716	I-43	4	Target, Approved
98	WPA-04-0046	Polson Creek	Dubois	38.43539261	-86.8045307	I-49	3	Target, Approved
99	WPA-02-0023	Straight River	Dubois	38.35201717	-86.91476508	J-09	3	Target, Approved
100	WPA-07-0024	South Fork Patoka River	Pike	38.292697	-87.23875884	J-07	2	Target, Approved

6. Specify Performance or Acceptance Criteria

Good quality data are essential for minimizing decision error. Identifying errors in the sampling design, measurement, and laboratory for physical, chemical, and biological parameters allows for more confidence in the percentage of perennial stream miles in the river basin supporting or not supporting aquatic life and recreational uses, and in algal metrics produced. The project's intent is making decisions protective of human health and the environment. Therefore, the null hypothesis is: The reach is not supportive of Indiana's aquatic life and recreational uses. The resulting Type 1 and Type 2 decision errors are listed in Table 4.

Table 4. Decision Error Associated with Probabilistic Monitoring.

	Actual Status of Sampled Stream Reaches of the Studied Watershed	
WAPB Work Plan Findings	**Stream reach IS supportive of aquatic life and recreational use**	**Stream reach IS NOT supportive of aquatic life and recreational use**
Stream reach IS supportive of aquatic life and recreational use	Stream reach is correctly identified as supporting aquatic life and recreational use	**Decision Error (Type 1)**
Stream reach IS NOT supportive of aquatic life and recreational use	**Decision Error (Type 2)**	Stream reach is correctly identified as NOT supporting aquatic life and recreational use

The probabilistic sampling design provides estimations of the proportion of streams in the basin attaining designated uses with a 95% confidence level. Sampling a minimum of 38 probabilistic sites in the basin assures reaching the confidence level for overall stream mileage estimations (B.1. Sampling Design and Site Locations).

Site specific aquatic life use and recreational use assessments include program specific controls to identify the introduction of errors. The controls include water chemistry and bacteriological blanks and duplicates; biological site revisits or duplicates; and laboratory controls through verification of species identifications as described in field procedure manuals and standard operating procedures (SOPs) (IDEM 1992a, 1992b, 1992c, 2015a, 2018c, 2019a, 2019b, 2019c, 2020a, 2020d, 2020f).

The quality assurance (QA) and quality control (QC) process detects deficiencies in the data collection as set forth in the QAPPs (IDEM 2017a, 2020a). The QAPPs require all contract laboratories to adhere to rigorous standards during sample analyses and to provide good quality usable data. Chemists within the WAPB provide a QA review of the laboratory analytical results. Any data rejected due to analytical problems or errors is not used for water quality assessment decisions. Any data flagged as Estimated may be used on a case-by-case basis and noted in the QA and QC report. Criteria for acceptance or rejection of results as well as application of data quality flags is presented in the Surface Water QAPP, Table D3-1: Data Qualifiers and Flags (IDEM 2017a p 184) and Biological and Habitat QAPP (IDEM 2020a pp 32–36). The Surface QAPP Table A7-1: Precision and Accuracy Goals for Data Acceptability by Matrix; and Table B2.1.1.8-2 Field Parameters (IDEM 2017a, pp 61–63 and p 117) provide precision and accuracy goals with acceptance limits for applicable analytical methods. Conduct further investigation in response to consistent “rejected” data to determine the source of error. Field techniques used during sample collection and preparation, along with laboratory procedures are subject to evaluation by both the WAPB QA manager and project manager through troubleshooting error introduced throughout the entire data collection process. Implement corrective actions once the source of error is determined per the QAPPs (IDEM 2017a, IDEM 2020a).

If funding and resources are available, subsequently verify results showing nonsupport for aquatic life use through a Targeted Monitoring Program watershed characterization prior to completion of the Integrated Report. Also, possibly verify stream reaches showing nonsupport through the TMDL development process.

7. Develop the Plan for Obtaining Data

The rotating basin, probability design optimizes assessment of the recreational use and ALUS status of river and stream resources in Indiana. The design facilitates statistically valid estimations of the total percent of perennial stream miles within the basin of interest which are nonsupporting for aquatic life and recreational uses. Derive estimations from total perennial stream miles in the basin of interest using the design which requires minimal use of sampling and staff resources (B.1. Sampling Design and Site Locations).

Habitat and macroinvertebrate community structure impact periphyton assemblages. Thus, develop algal metrics and subsequent nutrient criteria by collecting algal samples from the same fish and macroinvertebrate communities, and habitat sites sampled using the rotating basin, probability design.

A.5 Training and Staffing Requirements

Table 5. Project Roles, Experience, and Training

Role	Required Training or Experience	Responsibilities	Training References
Project manager	-Bachelor of Science degree in biology or other closely related area plus four years of experience in aquatic ecosystems (A master’s degree with two years aquatic ecosystems experience may substitute.)	-Establish project in the Assessment Information Management System (AIMS) II database. -Oversee development of the project work plan. -Oversee entry and QC of field data.	-U.S. EPA 2006 -IDEM 2017a, 2020a, 2020b, 2020c -AIMS II Database User Guide

Role	Required Training or Experience	Responsibilities	Training References
	-Database experience -Experience in project management and QA and QC procedures	-Query data from AIMS II to determine results not meeting Water Quality Criteria. -Calculate predicted percentage of perennial stream miles nonsupporting for aquatic life uses and recreational uses in the river basin of interest.	
Field crew chief – Biological community sampling	-Bachelor of Science degree in biology or other closely related area -At least one year of experience in sampling methodology and taxonomy of aquatic communities in the region -An annual review of the Principles and Techniques of Electrofishing. -An annual review of relevant safety procedures. -An annual review of relevant field operations SOPs.	-Complete field data sheets. -Ensure taxonomic accuracy. -Ensure sampling efficiency and representation. -Track voucher specimens. -Ensure overall operation of the field crew when remote from central office. -Ensure adherence to safety and field SOP procedures by crew members. -Ensure weekly calibration of multiprobe analyzers are prior to field sampling activities. -Ensure field sampling equipment is functioning properly and loaded into field vehicles prior to field sampling activities.	-IDEM 1992a, 1992b, 1992c, 2010a, 2010b, 2015b, 2018c, 2019b, 2019c, 2019d, 2020a, 2020d, 2020f -Barbour et al. 1999 -Dufour 2002 -Klemm et al. 1990 -Plafkin et al. 1989 -Simon DRAFT -Simon and Dufour 2005 -YSI 2017, 2020
Field crew members – Biological community sampling	-Completion of hands-on training for sampling methodology prior to participation in field sampling activities -A review of the Principles and Techniques of Electrofishing. -A review of relevant safety procedures. -A review of relevant SOPs for field operations.	-Follow all safety and SOP procedures while engaged in field sampling activities. -Follow direction of field crew chief while engaged in field sampling activities.	-IDEM 1992a, 1992b, 1992c, 2010a, 2010b, 2015b, 2018d, 2019b, 2019c, 2019d, 2020a, 2020d, 2020f -Barbour et al. 1999 -Klemm et al. 1990 -Plafkin et al. 1989 -YSI 2017, 2020

Role	Required Training or Experience	Responsibilities	Training References
Field crew chief – Water chemistry, algal, or bacteriological sampling	-Bachelor of Science degree in biology or other closely related area -At least one year of experience in sampling methodology -An annual review of relevant safety procedures. -An annual review of relevant SOPs for field operations.	-Complete field data sheets. -Ensure sampling efficiency and representation. -Ensure overall operation of the field crew when remote from central office. -Ensure crew members adhere to safety and field SOP procedures. -Ensure multiprobe analyzers are calibrated weekly prior to field sampling activities. -Ensure field sampling equipment is functioning properly and loaded into field vehicles prior to field sampling activities.	-IDEM 1997, 2010a, 2010b, 2015b, 2018b, 2019a, 2020a, 2020d, 2020f -YSI 2017, 2020
Field crew members – Water chemistry, algal, or bacteriological sampling	-Completion of hands-on training for sampling methodology prior to participation in field sampling activities -A review of relevant safety procedures. -A review of relevant SOP documents for field operations.	-Follow all safety and SOP procedures while engaged in field sampling activities. -Follow direction of field crew chief while engaged in field sampling activities.	-IDEM 1997, 2010a, 2010b, 2015b, 2018b, 2019a, 2020a, 2020d, 2020f -YSI 2017, 2020
Laboratory supervisor – Biological community sample processing	-Bachelor of Science degree in biology or other closely related area -At least one year of experience in taxonomy of aquatic communities in the region -An annual review of relevant safety procedures. -An annual review of relevant SOPs for laboratory operations.	-Identify fish and macroinvertebrate specimens collected during field sampling. -Complete laboratory data sheets. -Verify taxonomic accuracy of processed samples. - Track voucher specimens. -Ensure laboratory staff adhere to safety and SOP procedures. -Check data for completeness. -Perform all necessary calculations on the data. -Ensure data are entered into the AIMS II Database.	-IDEM 1992c, 2004, 2010a, 2010b, 2012e, 2020a -AIMS II Database User Guide

Role	Required Training or Experience	Responsibilities	Training References
		-Ensure required QA and QC are performed on the data. -Query data from AIMS II to determine results not meeting Water Quality Criteria.	
Laboratory staff – Biological community sample processing	-Completion of hands-on training for laboratory sample processing methodology prior to participation in laboratory sample processing activities. -An annual review of relevant safety procedures. -An annual review of relevant SOPs for laboratory operations.	-Adhere to safety and SOP procedures. -Follow laboratory supervisor direction while processing samples. -Identify fish and macroinvertebrate specimens collected during field sampling. -Complete laboratory data sheets. Perform necessary calculations on data. Enter field sheets.	-IDEM 1992c, 2004, 2010a, 2010b, 2018d, 2020a -AIMS II Database User Guide
Laboratory supervisor – Water chemistry, algal or bacteriological sample processing	-Bachelor of Science degree in biology or other closely related area -An annual review of relevant safety procedures. -An annual review of relevant SOPs for field operations.	-Complete laboratory data sheets. -Ensure laboratory staff adhere to safety and SOP procedures. -Check data for completeness. -Perform all necessary calculations on the data. -Ensure data are entered into the AIMS Data Base. -Ensure required QA and QC are performed on the data. -Query data from AIMS II to determine results not meeting Water Quality Criteria.	-IDEM 2010a, 2010b, 2015a, 2020a -AIMS II Database User Guide
Quality assurance officer	-Bachelor of Science in chemistry or a related field of study -Familiarity with QA and QC practices and methodologies -Familiarity with the QAPPs and data qualification methodologies	-Ensure adherence to QA and QC requirements of QAPPs. -Evaluate data collected by sampling crews for adherence to project work plan. -Review field sampling crews' data collected for completeness and accuracy.	-U.S. EPA 2006 -IDEM 2017c, 2018e, 2020a -AIMS II Database User Guide

Role	Required Training or Experience	Responsibilities	Training References
		-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 database. -Ensure field sampling methodology audits are completed according to WAPB procedures.	

B. Measurement and Data Acquisition

B.1. Sampling Design and Site Locations

The U.S. EPA, NHEERL, Western Ecology Division, in Corvallis, Oregon generates sites by using Environmental Monitoring Assessment Program selection methods. The Environmental Monitoring Assessment Program design uses a statistically valid number of randomly selected sites to assess and characterize the overall water quality and biotic integrity of the study basin. To statistically estimate the percent of the basin attaining designated uses with a 95% confidence level, sample a minimum of 38 probabilistic sites in the basin of interest. The minimum required number of sites is determined by analyzing IDEM fish community IBI metric scores from 317 sites sampled between 1996–2000 with the following formula:

$$n = \frac{s^2}{(p)^2(\bar{x})^2}$$

Where:
$\boldsymbol{n}$ is the number of sites required
$\boldsymbol{s}$ is the sample standard deviation (10.98922)
$\bar{\boldsymbol{x}}$ is the sample mean (35.52366)
$\boldsymbol{p}$ is the p-value (set at 0.05 for a 95% confidence level)
(Elliott 1983).

Thereby, determining a sample size of 38 is sufficient to arrive at the "true" average IBI score for a basin 95% of the time. Also, the sample size is sufficient to provide 80% estimations for eight of the more frequently used individual metrics used to calculate the fish community IBI.

Stratified site selection ensures effort is equally distributed between stream orders for equal representation of the various stream sizes within the basin. IDEM's site selection process incorporates a stratified random probability design in order to select an approximately equal number of 1st, 2nd, 3rd, 4th, and higher order streams in the basin. Utilizing the stratification method ensures a greater number of sampling sites on lesser order streams are not chosen based on proportion of stream miles. Requesting an over draw of sampling sites compensates for denial of access, dry stream conditions, and sites presenting extremely difficult or unsafe access.

Conduct site reconnaissance activities in-house and through physical site visits (IDEM 2018a). In-house activities include preparation and review of site maps and aerial photographs; initial evaluation for target or nontarget site status; potential access routes; and initial property owner searches. Physical site visits include property owner consultations; verification of site status (target or nontarget); confirmation and documentation of access routes; and determination of equipment needed to properly sample the site. Determine precise coordinates for each approved target site using an agency approved handheld Global Positioning System (GPS) unit which can verify horizontal precision within five meters or less (IDEM 2015b). Visit all 100 potential sites at least once during site reconnaissance to determine target or nontarget (marsh, dry, backwater, etc.,) status. However, determine landowner permission and site access for only the first 75 potential target sites with the remaining 25 sites noted only as nontarget. After visiting each site once and when at least 45 sites are approved in the basin of interest, site reconnaissance activities may require minimal field work. Although eight weeks is the maximum time allotted for site reconnaissance field work (A. Project Management for site reconnaissance activities, QAPP element A.4.), most work is completed within a six-week period dependent upon weather, drive time to sites, and other unforeseeable constraints. Perform the remaining work, if possible, in the office with phone calls to seek landowner permission. If permission to visit a site is granted before the 12-week deadline, determine access routes, equipment, and more accurate GPS coordinates possibly requiring a daytrip or overnight. Upon reaching the deadline, enter sites not accessible through bridge right-of-way, yet appear to be a target site from the nearest bridge, into the database with the Reconnaissance Decision as No, Other. In the Comments field enter the following text “Unable to contact landowner by deadline" along with the date and initials of the person entering the data and document on the IDEM Site Reconnaissance Form (Attachment 1).

Table 3 lists the potential sampling sites generated by U.S. EPA Corvallis for the Patoka River basin. Take target sampling sites in sequential order in Table 3 until 45 sites are sampled for algal community and water chemistry, 40 sites for bacteriological sampling, and 38 sites for biological sampling programs. If a site is considered nontarget (dry, backwater, marsh, wetland, etc.,) or unavailable to sample for some other reason (physical barrier, landowner denial, etc.,), take the next target site on the list. Figure 1 depicts potential sampling sites generated by U.S. EPA Corvallis for this project and the approximate locations.

B.2. Sampling Methods and Sample Handling

1. Bacteriological Sampling

Conduct bacteriological sampling with one or two teams consisting of two staff (IDEM 2019a). The work effort requires an average of one hour per site per week. Process samples in the IDEM Fixed or Mobile *E. coli* Laboratory (van) equipped with all materials and equipment necessary for Standard Method (SM) 9223B Colilert® *E. coli* Test Method near the sampling sites. Collect five samples from each site (40 sites total) at equally spaced intervals over a thirty calendar-day period. Staff collect the samples in a 120 mL presterilized wide mouth container from the center of flow, if the stream is wadeable, or from the shoreline using a pole sampler, if the stream is not wadeable. Field staff determine wadeability based on available personal protective equipment (PPE), turbidity, and other factors. However, streams waist deep or shallower are generally considered wadeable. For all samples, consistently label, and cool and hold at a temperature less than 10ºC during transport. Collect all *E. coli* samples on a schedule in which any sampling crew can deliver to the IDEM Fixed or Mobile *E. coli* Laboratory for analyses within the bacteriological six hour holding time.

Use the IDEM *E. coli* Mobile Laboratory to facilitate *E. coli* testing by eliminating the necessity of transporting samples to distant contract laboratories within the six-hour holding time. The *E. coli* Mobile Laboratory provides workspace containing storage for samples, supplies for Colilert® Quanti-tray testing, and all equipment needed for collecting, preparing, incubating, and analyzing results. Obtain all supplies from IDEXX Laboratories, Inc., Westbrook, Maine.

2. Water Chemistry Sampling

During three discrete sampling events, one team of two staff collect grab water chemistry samples, and record water chemistry field measurements and physical site descriptions on the IDEM Stream Sampling Field Data Sheet (Attachment 2). All water chemistry sampling adheres to the Water Chemistry Field Sampling Procedures (IDEM 2020f). Only collect dissolved orthophosphate at the 18 sites at which a HOBO data logger is deployed. Collect samples on a separate sampling trip from the water chemistry sampling due to the shorter (96 hr) holding times for this analyte. Water chemistry sampling usually takes 30 minutes to complete for each site, depending on accessibility.

3. Algal Sampling

In addition to standard water chemistry sampling, one team of two staff collect attached periphyton samples at all sites during the third round of water chemistry sampling in September or October (Table 1) for the purposes of diatom community enumeration and identification.

Sampling for an average site, including all the above parameters, requires approximately 1.5 hours of effort. Use the Algal Biomass Lab Datasheet (Attachment 3) and Probabilistic Monitoring Section Physical Description of Stream Site Form (Attachment 4) to record information regarding substrates sampled for periphyton and physical parameters of the stream sampling area. IDEM 2018b describes methods used in algal community sampling.

4. Laboratory Procedures for Diatom Identification and Enumeration
IDEM 2015a describes methods used in diatom identification and enumeration.

5. Fish Community Sampling
Perform fish community sampling using various standardized electrofishing methodologies depending on stream size and site accessibility. Perform fish assemblage assessments in a sampling reach of 15 times the average wetted width, with a minimum reach of 50 meters and a maximum reach of 500 meters (IDEM 2018c). Attempt to sample all habitat types available (i.e., pools, shallows; and IDEM 2019b, pp 10–11 for more potential habitat types) within the sample reach ensuring adequate representation of the fish community present at the time of the sampling event. Electrofishing equipment that may be used in wadeable streams includes:

- Midwest Lake Electrofishing Systems (MLES) Infinity XStream
- Smith-Root LR-24 or LR-20B Series backpack electrofishers
- MLES Infinity Control Box with MLES junction box and rat-tail cathode cable, assembled in a canoe (if parts of the stream are not wadeable, the system may require the use of a dropper boom array outfitted in a canoe or possibly a 12 or 14 foot Loweline boat);

Electrofishing equipment that may be used in non-wadeable streams includes

- Smith-Root Type VI-A electrofisher assembled in a 16 foot Loweline or Blazer boat
- MLES Infinity Control Box assembled in a 16 foot Loweline or Blazer boat (IDEM 1992a, 1992b, 1992c, 2018b).

Avoid sample collections during high flow or turbid conditions due to 1) low collection rates resulting in nonrepresentative samples and 2) safety considerations for the sampling team. Avoid sample collection during late autumn due the cooling water temperatures, which may affect the responsiveness of some species to the generated electric field. The lack of responsiveness can result in nonrepresentative samples of the stream's fish assemblage (IDEM 2018c).

Collect fish using dipnets with fiberglass handles and netting of 1/8-inch bag mesh. Sort fish collected in the sampling reach by species into baskets or buckets. Do not retain young-of-the-year fish less than 20 millimeters (mm) total length in the community sample (IDEM 2018c).

For each field taxonomist (generally the crew leader), retain a complete set of fish vouchers for any different species encountered during the summer sampling season. Vouchers may consist of either preserved specimens or digital images. Prior to processing fish specimens and completion of the fish community datasheet, possibly preserve one to two individuals per new species encountered in 3.7% formaldehyde solution to serve as representative fish vouchers. Individual fish voucher specimens must be positively identified and small enough to fit in a 2000 mL jar for preservation. If, however, the specimens are too large to preserve, take a photo of key characteristics (e.g., fin shape, size, body coloration) for later examination (IDEM 2018b, p 8; IDEM 2018c). Also, prior to sampling, 10% of the sites are randomly selected for revisiting. Preserve or photograph a few representative individuals of all species found at the revisit site to serve as vouchers (IDEM 2020a). Review taxonomic characteristics for possible species encountered in the basin of interest prior to field work. Also preserve fish specimens, if positive identification in the field is not achieved (i.e., co-occurring like the Striped and Common Shiners or difficult to identify when immature); individuals appearing to be hybrids or having unusual anomalies; and dead specimens taxonomically valuable for undescribed taxa (e.g., Red Shiner or Jade Darter); life history studies; or research projects (IDEM 2018c).

Record the following data for nonpreserved fish on the IDEM Fish Collection Data Sheet (Attachment 5): number of individuals; minimum and maximum total length (mm); mass weight in grams (g); and number of individuals with deformities, eroded fins, lesions, tumors, and other anomalies (DELTs). Once the data are recorded, release specimens within the sampling reach from which they were collected. Record data for preserved fish specimens following taxonomic identification in the laboratory (IDEM 2018c).

6. Macroinvertebrate Sampling

Collect aquatic benthic macroinvertebrate samples using a modification of the U.S. EPA Rapid Bioassessment Protocol MHAB approach using a D-frame dip net (Plafkin et al. 1989; Barbour et al. 1999; Klemm et al. 1990; IDEM 2019c). The IDEM MHAB approach (IDEM 2019c) is composed of a 1-minute kick sample within a riffle or run (collect dislodged macroinvertebrates with a dipnet by disturbing one square meter of stream bottom substrate in a riffle or run habitat); and a 50 meter sweep sample of additional in stream habitats (collect dislodged macroinvertebrates within the dipnet by disturbing habitats such as emergent vegetation, root wads, coarse particulate organic matter, depositional zones, logs, and sticks). Define the 50-meter length of riparian sampling corridor at each site using a tape measure or rangefinder. If the stream is too deep to wade, use a boat to sample the 50-meter zone along the shoreline with the best available habitat. Combine the 1-minute kick sample, if collected, and 50-meter sweep sample in a bucket of water. Elutriate the sample through a U.S. standard number 35 (500 µm) sieve a minimum of five times ensuring removal of all rocks, gravel, sand, and large pieces of organic debris from the sample. Then transfer the remaining sample from the sieve to a white plastic tray. The collector, while still onsite, conducts a 15-minute pick of macroinvertebrates at a single organism rate with an effort to pick for maximum organism diversity and relative abundance through turning and examination of the entire sample in the tray. Preserve the resulting picked sample in 80% isopropyl alcohol. Return the sample to the laboratory for identification at the lowest practical taxonomic level, usually genus or species level, if possible. Evaluate the sample using the MHAB macroinvertebrate IBI. Before leaving the site, complete an IDEM OWQ Macroinvertebrate Header Form (Attachment 6) for the sample (IDEM 2019d).

7. Habitat Assessments

Immediately complete habitat assessments following macroinvertebrate and fish community sample collections at each site using a slightly modified version of the Ohio Environmental Protection Agency (OHEPA) Procedures for Completing the QHEI, 2006 edition (Rankin 1995; OHEPA 2006). Complete a separate QHEI (Attachment 7) for the two sample types, since the sampling reach length may differ (i.e., 50 meters for macroinvertebrates and between 50 and 500 meters for fish). IDEM 2019b describes the method used in completing the QHEI.

8. Field Parameter Measurements

Measure dissolved oxygen, pH, water temperature, specific conductance, and dissolved oxygen percent saturation with a data sonde during each sampling event, regardless of the sample type collected. Perform measurement procedures and operation of the data sonde in accordance with the manufacturers' manuals (IDEM 2020d). Measure turbidity with a Hach turbidity kit and document the meter number in the comments under the field parameter measurements (IDEM 2020f). If a Hach turbidity kit is not available, record the data sonde measurement for turbidity and note in the comments. Record all field parameter measurements and weather codes on the IDEM Stream Sampling Field Data Sheet (Attachment 2) with other sampling observations. Take upstream and downstream digital photos of the site during each sampling event (IDEM 2018b).

9. Dissolved Oxygen Continuous Data Logger Measurements

During the low-flow portion of the sampling season, generally from the end of August to mid-September, deploy an Onset Hobo® U26-001 D.O. data logger in a representative location within each of the 18 preselected target sites. The data logger records D.O. measurements at 10-minute intervals for no less than 14 consecutive days (IDEM 2017b). Attach a programmed and calibrated data logger to a 16"x4"x8" cinder block, post, or other securing device dependent on the particular conditions observed at the stream sampling site. Place the data logger in a calm glide portion of the stream segment with a water depth of between 0.3 and 1.0 meters. Do not place the data logger directly below a riffle, a turbulent run, or in a deep pool. Place the data logger near the cross-sectional center of the channel, if possible. Determine the GPS coordinates of each data loggers' exact placement using an agency approved handheld GPS unit, which can verify horizontal precision of 5 meters or less (IDEM 2015b). Take at least one photograph or digital image of the placement point in relation to the stream reach documenting the location and stream flow conditions, to the extent possible. Record *In-situ* water quality measurements at the time of each data logger deployment. Upon retrieval of the D.O. data logger, off-load all data to a Hobo U-DTW-1 Waterproof Shuttle. Once data are off-loaded, return the data logger to the WAPB calibration room at the Western Select Property IDEM OWQ laboratory and prepare, program, and calibrate for redeployment at another location. Also record *In-situ* water quality measurements during the retrieval of each D.O. data logger.

B.3. Analytical Methods

Table 6 lists the *E. coli* bacteriological and field parameters and respective test method with IDEM quantification limits. Table 7 shows bacteriological and water chemistry sample container, preservative, and holding time requirements. Ice all samples to 4 Degrees Celsius °C. Table 8 lists numerous parameters (priority metals, anions or physical, and nutrients or organic) with their respective test methods, IDEM reporting limits, and contract laboratory reporting limits. The IDEM OWQ Chain of Custody Form (Attachment 8) and the 2021 Corvallis Water Sample Analysis Request Forms (Attachments 9 and 10) accompany each sample set through the analytical process.

Collect diatoms in the field using protocols described in IDEM 2018b.

B.4. Quality Control and Custody Requirements

Follow QA protocols of the Surface Water QAPP B.5. (IDEM 2017a, p 170) and of the Biological and Habitat QAPP B.5. (IDEM 2020a, p 27).

1. Bacteriological Data

Analyze bacteriological samples using the SM 9223B Enzyme Substrate Coliform Test Method. Table 6 contains quantification limits. Collect samples using 120 mL presterilized wide mouth containers and adhere to the six-hour holding time (Table 7). Analytical results from the IDEM Fixed or Mobile *E. coli* Laboratory include QC check sample results to determine precision, accuracy, and completeness for each batch of samples. Archive raw data by analytical batch for easy retrieval and review. Follow chain of custody procedures, including time of collection, time of setup, time of reading the results, and time and method of disposal (IDEM 2019a). Thoroughly document any method deviations in the field notes.

Test all QA and QC samples according to the following guidelines:

Field Duplicate:	Collect at a frequency of 1 per batch or at least 1 for every 20 samples collected (≥ 5%).
Field Blank:	Collect at a frequency of 1 per batch or at least 1 for every 20 samples collected (≥ 5%).
Laboratory Blank:	Test sterile laboratory water blanks at a frequency of 1 per day.
Positive Control:	Test each lot of media with *E. coli* bacterial cultures for positive performance (SM 9020 B.8 and B.9).
Negative Controls:	Test each lot of media with bacterial cultures other than *E. coli* or a noncoliform for negative performance (SM 9020 B.8 and B.9).

For each batch of samples, QA documentation consists of a chain of custody form; a QA and QC summary sheet; and results spreadsheets. Submit the documentation to the Technical and Logistical Services Section for QA review and assignment of an appropriate Data Quality Assessment (DQA) Level.

2. Water Chemistry Data

Use sample bottles and preservatives certified for purity. Sample collection procedures, including the container and preservative used for each parameter and holding times adhere to U.S. EPA requirements for water chemistry testing (Table 8). Collect field duplicates, and matrix spike and matrix spike duplicates (MS and MSD) at the rate of one per sample analysis set or one per every 20 samples, whichever is greater. Additionally, take field blank samples using American Society for Testing and Materials (ASTM) D1193-91 Type I water at a rate of one set per sampling crew for each week of sampling activity. Pace Analytical Services, Inc. (Indianapolis, Indiana) processes all samples collected for water chemistry analysis by following the specifications set forth in Request for Proposals 16-074 (IDEM 2016), except orthophosphate which Indiana Department of Health (IDOH), Indianapolis, Indiana analyzes.

Table 6. Bacteriological and Field Parameters showing method and IDEM quantification limit.

Parameters	Method	IDEM Quantification Limit
E. coli (Enzyme Substrate Coliform Test)	SM [1] 9223B	1 MPN [2]/100 mL
Dissolved oxygen (data sonde optical)	ASTM D888-09	0.05 mg/L
Dissolved oxygen % saturation (data sonde optical)	ASTM D888-09	0.05 %
Dissolved oxygen (membrane probe)	SM4500-OG [3]	0.05 mg/L
pH (data sonde)	U.S. EPA 150.2	0.10 SU
pH (field pH meter)	SM 4500H-B [3]	0.10 SU
Specific conductance (data sonde)	SM 2510B	1.00 µmhos/cm
Temperature (data sonde)	SM 2550B(2)	0.1 Degrees Celsius (°C)
Temperature (field meter)	SM 2550B(2) [3]	0.1 Degrees Celsius (°C)
Turbidity (data sonde)	SM 2130B	0.02 NTU [4]
Turbidity (Hach™ turbidity kit)	U.S. EPA 180.1	0.05 NTU [4]

[1] SM = Standard Method
[2] 1 MPN (Most Probable Number) = 1 CFU (Colony Forming Unit)
[3] Method used for Field Calibration Check
[4] NTU = Nephelometric Turbidity Unit

Table 7. Bacteriological and Water Chemistry Sample Container, Preservative, and Holding Time Requirements[1]

Parameter	Container	Preservative	Holding Time
[1,2] Alkalinity as $CaCO_3$*	1 L, HDPE, narrow mouth	None	14 days
[3] Ammonia-N**	1 L, glass, amber Boston round	H_2SO_4 < pH 2	28 days
Chloride*	1 L, HDPE, narrow mouth	None	28 days
Chemical oxygen demand**	1 L, glass, amber Boston round	H_2SO_4 < pH 2	28 days
Cyanide (all forms)	1 L, HDPE, narrow mouth	NaOH > pH 12	14 days
E. coli	120 mL, presterilized, wide mouth	$Na_2S_2O_3$	6 hours
Hardness (as $CaCO_3$*) calculated	1 L, HDPE, narrow mouth	HNO_3 < pH 2	6 months
Metals (total and dissolved)	1 L, HDPE, narrow mouth	HNO_3 < pH 2	6 months
Nitrogen, (nitrate+nitrite)**	1 L, glass, amber Boston round	H_2SO_4 < pH 2	28 days
Total phosphorus**	1 L, glass, amber Boston round	H_2SO_4 < pH 2	28 days
Orthophosphate, dissolved**	500 mL, brown HDPE, narrow mouth	Unpreserved (frozen), dry ice	6 days
[5] Solids (all forms)*	1 L, HDPE, narrow mouth	None	7 days
Sulfate*	1 L, HDPE, narrow mouth	None	28 days
Total Kjeldahl Nitrogen**	1 L, glass, amber Boston round	H_2SO_4 < pH 2	28 days
Total organic carbon**	1 L, glass, amber Boston round	H_2SO_4 < pH 2	28 days

[1] All samples iced to 4°C
[2] General chemistry includes all parameters noted with an *
[3] Nutrients include all parameters noted with a **
[4] HDPE – High Density Polyethylene
[5] Separate 1 Liter sample is required for Total Suspended Solids

Table 8. Water Chemistry Parameters with Test Method and IDEM and Laboratory Reporting Limits.

Priority Metals					
Parameter	Total	Dissolved	Test Method	IDEM-requested Reporting Limit (µg/L)	Pace Laboratory Reporting Limit (µg/L)
Aluminum	☒	☒	U.S. EPA 200.8	10	10
Antimony	☒	☒	U.S. EPA 200.8	1	1
Arsenic	☒	☒	U.S. EPA 200.8	2	1
Calcium	☒	☐	U.S. EPA 200.7	20	1,000
Cadmium	☒	☒	U.S. EPA 200.8	1	0.2
Chromium	☒	☒	U.S. EPA 200.8	3	2
Copper	☒	☒	U.S. EPA 200.8	2	1
Lead	☒	☒	U.S. EPA 200.8	2	1
Magnesium	☒	☐	U.S. EPA 200.7	95	1,000
Nickel	☒	☒	U.S. EPA 200.8	1.5	0.5
Selenium	☒	☒	U.S. EPA 200.8	4	1
Silver	☒	☒	U.S. EPA 200.8	0.3	0.5
Zinc	☒	☒	U.S. EPA 200.8	5	3

Nutrients/Organic (IDOH)			
Parameter	ISDH Test Method	IDEM-requested Reporting Limit (mg/L)	ISDH Laboratory Reporting Limit (mg/L)
Orthophosphate, Dissolved	U.S. EPA 365.1	0.006	0.002

SM: Standard Methods for the Examination of Water and Wastewater
U.S. EPA: United States Environmental Protection Agency

Anions/Physical			
Parameter	Pace Test Method	IDEM-requested Reporting Limit (mg/L)	Pace Laboratory Reporting Limit (mg/L)
Alkalinity (as $CaCO_3$)	SM 2320B	10	2
Total Solids	SM 2540B	1	10
Total Suspended Solids	SM 2540D	1	2.5
Dissolved Solids	SM 2540C	10	10
Sulfate	U.S. EPA 300.0	0.05	0.25
Chloride	U.S. EPA 300.0	1	0.25
Hardness (as $CaCO_3$) by calculation	SM 2340B	0.4	1

Nutrients/Organic (Pace)			
Parameter	Pace Test Method	IDEM-requested Reporting Limit (mg/L)	Pace Laboratory Reporting Limit (mg/L)
Total Kjeldahl Nitrogen (TKN)	U.S. EPA 351.2	0.1	0.5
Ammonia-N	U.S. EPA 350.1	0.01	0.1
Nitrogen, Nitrate + Nitrite	U.S. EPA 353.2	0.05	0.1
Total Phosphorus	U.S. EPA 365.1	0.01	0.05
Total Organic Carbon (TOC)	SM 5310C	1	1
Cyanide-Total	U.S. EPA 335.4	0.01	0.005
Cyanide-Weak Acid Dissociable	SM 4500CN-I	0.01	0.005
Chemical Oxygen Demand (COD)	U.S. EPA 410.4	3	10

3. Algal Community Data

If an algal bloom is observed on the water's surface or in the water column, staff record the excessive algal conditions. Staff are not calibrated on this rating (i.e., the decision as to the severity of the bloom is based on best professional judgement), but an algal mat on the surface of the water or a bloom giving the water the appearance of green paint justify a decision of excessive algal conditions.

To decrease the potential for cross contamination and bias of the algal samples, clean all equipment contacting the sample with detergent and rinse with ASTM D1193-91 Type III water after completion of sampling at a given site. Complete all sample labels accurately and thoroughly, including AIMS II sample numbers, date, stream name, and sampling location. Complete Chain of Custody forms in the field to document the collection and transfer of samples to the laboratory. Upon arrival to the laboratory, the laboratory manager checks in samples. For the diatom samples, another Chain of Custody form documents when the sample is removed from storage, processed, and made into a permanent mount.

QC checks of both field and laboratory data document QC of the diatom sampling, enumeration, and identification project. IDEM 2015a p 22 describes QA and QC protocols used in Diatom Identification and Enumeration. The Department of Biological and Environmental Sciences of Georgia College and State University (Milledgeville, Georgia) analyze or verify at least ten percent of diatom samples, possibly up to 100 percent, following the specifications set forth in IDEM 2015a (IDEM 2020a).

4. Fish Community Data

Perform fish community sampling revisits at a rate of 10 percent of the total fish community sites sampled, approximately 4 in the basin (IDEM 2018c). Perform revisit sampling with at least 2 weeks of recovery between the initial and revisit sampling events. Perform fish community revisit sampling and habitat assessment with either a partial or complete change in field team members (IDEM 2018c). Evaluate precision using the resulting IBI and QHEI total score between the initial visit and the revisit (IDEM 2020a). Use the IDEM OWQ Chain of Custody Form to track samples from the field to the laboratory (Attachment 8). IDEM laboratory staff make fish taxonomic identifications and a regionally recognized non-IDEM freshwater fish taxonomists (e.g., Brant Fisher, Nongame Aquatic Biologist, Indiana Department of Natural Resources) may verify identifications. For all raw data: 1) Check for completeness; 2) Utilize to calculate derived data (i.e., total weight of all specimens of a taxon), and input to the AIMS II database; and 3) Check again for data entry errors.

5. Macroinvertebrate Community Data

Collect duplicate macroinvertebrate field samples at sites randomly selected prior to the beginning of the field season and which occur at a rate of 10 percent of the total macroinvertebrate community sites sampled, approximately 4 in the basin. Immediately after the initial sample collection, the same staff performing the original sampling collection performs macroinvertebrate community duplicate sampling and a corresponding habitat assessment. The precision evaluation is based on a 10% duplicate of samples collected (IDEM 2020a). Equally divide duplicate sites in the basin among the macroinvertebrate staff. Each staff collects at least one duplicate sample. Use the IDEM OWQ Chain of Custody Form to track samples from the field to the laboratory (Attachment 8). The IDEM macroinvertebrate laboratory supervisor maintains laboratory identifications, and QA and QC of taxonomic work. An outside taxonomist verifies 10% of the initial samples collected with duplicate samples. (IDEM 2019c).

B.5. Field Parameter Measurements, Instrument Testing and Calibration

Immediately calibrate the data sonde prior to each week's sampling (IDEM 2020d). Conduct the dissolved oxygen component of the calibration procedure using the air calibration method. Record, maintain, store, and archive calibration results and drift values in the calibration laboratories at the Shadeland facility. The drift value is the difference between two successive calibrations. Field parameter calibrations conform to the procedures described in the instrument users' manuals (IDEM 2020d, IDEM 2020f). Field check the unit for accuracy once during the week by comparison with a YSI D.O. meter (IDEM 2020d), Hach turbidity, and Oakton pH and temperature meters (IDEM 2020f). Record weekly field calibrations in the field calibrations portion of Attachment 2 and input to the AIMS II database. Also use the YSI D.O. meter in the field at sites where dissolved oxygen concentration is 4.0 mg/L or less.

The Onset Hobo® U26-001 D.O. data loggers utilize optical D.O. measurement technology specified in ASTM D888-12 (ASTM 2012). Calibration and maintenance of these units follows the manufacturers procedures listed in the HOBO® Dissolved Oxygen Logger (U26-001) Manual (IDEM 2017b).

1. Field Analysis Data

Collect *In-situ* water chemistry field data using calibrated or standardized equipment. Perform calculations either in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges are set for each analysis. Perform QC checks on information for field or laboratory results to estimate project precision, accuracy, and completeness described in the Surface Water QAPP Section C1.1 (IDEM 2017a p 176).

2. Algal Community Data

IDEM 2018b describes the equipment required for the collection of periphyton. None of the equipment requires calibration. Field tested equipment ensures capability for appropriately removing periphyton from different types of substrate (rocks, sticks, sand, or silt) (IDEM 2018b).

IDEM 2015a describes the equipment required for the preparation of permanent diatom mounts. Other than micropipettes, none of the laboratory equipment requires calibration. Check and recalibrate the micropipette as necessary according to manufacturer's specifications (IDEM 2015a).

Use a Nikon differential interference contrast (DIC) microscope, and Nikon Elements D camera and imaging system for identification and enumeration of diatoms. Branch staff calibrate the ocular reticle in the microscope. Calibrate the ocular reticle at each magnification with a stage micrometer. Check the calibration again if the microscope is moved to a new location.

C. Assessment and Oversight

Conduct field and laboratory performance and system audits to ensure good quality data. Field and laboratory performance checks include precision measurements by relative percent difference (RPD) of field and laboratory duplicates (IDEM 2017a, pp 56, 61–63); accuracy measurements by percent of recovery of MS and MSD samples analyzed in the laboratory (IDEM 2017a, pp 58, 61–63); and completeness measurements by the percent of planned samples collected, analyzed, reported, and usable for the project (IDEM 2017a, p 58).

Biological and habitat measurements, field performance measurements include:

- Completeness (IDEM 2020a, pp 10-11, 14, 17)
- Examination of fish IBI score differences and the RPD for number of fish species at the revisit sites (IDEM 2020a, pp 9-10)
- RPD for number of taxa for macroinvertebrate duplicate samples (IDEM 2020a, p 13)
- RPD for number of taxa for diatom duplicate samples (IDEM 2020a, p 17)
- RPD between the two total QHEI scores (IDEM 2020a, p 18)

Lab performance measurements include:

- Percent taxonomic difference (PTD) for fish (IDEM 2020a, p 12)
- PTD for macroinvertebrates (IDEM 2020a, pp 15-16)
- PTD for diatoms (IDEM 2020a, p 18)
- Percent difference in enumeration (PDE) and percent sorting efficiency (PSE) for macroinvertebrates (IDEM 2020a, pp 14-16)

IDEM WAPB staff conduct field audits biannually to ensure sampling activities adhere to approved SOPs. WAPB QA staff systematically conduct audits of all WAPB staff engaged in field sampling activities. QA staff trained in the associated sampling SOPs and in the processes related to conducting an audit evaluate WAPB field staff involved with sample collection and preparation. QA staff produce an evaluation report documenting each audit for review by the field staff audited, as well as WAPB management. Corrective actions, resulting from the audit process, are communicated to, and implemented by field staff (IDEM 2017a, pp 176–177; IDEM 2020a, p 31).

Contract laboratories are required to have NELAC audits at the beginning of a laboratory contract and at least once a year during the contract. In addition, IDEM QA staff annually review performance studies conducted by the contract laboratories. The audit includes any or all the operational QC elements of the laboratory's QA system. All applicable elements of this QAPP and the laboratory contract requirements are addressed including, but not limited to, sample handling, sample analysis, record keeping, preventative maintenance, proficiency testing, staff requirements, training, and workload. (IDEM 2017a, pp 177-178).

For macroinvertebrate verifications by an external lab, the lab's taxonomists are required to maintain Society for Freshwater Science taxonomic certifications. Genus level taxonomic certifications are required for (1) Eastern General Arthropods; (2) Eastern Ephemeroptera, Plecoptera, and Trichoptera; (3) Chironomidae; and (4) Oligochaeta.

C.1. Data Quality Assessment Levels

The samples and various types of data collected by this program are intended to meet the QA criteria and rated DQA Level 3, as described in the Surface Water QAPP (IDEM 2017a, pp 182–183) and the Biological and Habitat QAPP (IDEM 2020a, pp 34-35).

D. Data Validation and Usability

Quality assurance reports to management, and data validation and usability are also important components of the QAPP ensuring good quality data for the project.

- Submit a QA audit report to the QA manager and project manager for review of the project should problems arise, and require investigation and correction.
- Data reduction – Conversion from raw analytical data to final results in the proper reporting units.
- Validation – Qualify based on the performance of field and laboratory QC measures incorporated into the sampling and analysis procedures.
- Report – Describe, to completely document, the calibration, analysis, QC measures, and calculations.

The steps allow users to assess the data and ensure the project DQOs are met.

D.1. Quality Assurance – Data Qualifiers and Flags

Find the various data qualifiers and flags used for QA and validation of the data in the Surface Water QAPP (IDEM 2017a pp 184–185) and the Biological and Habitat QAPP (IDEM 2020a pp 33-34).

D.2. Data Usability

Qualify collected environmental data usability per each lab or field result obtained and classify into one or more of the four categories: Acceptable Data, Enforcement Capable Results, Estimated Data, and Rejected Data as described in the Surface Water QAPP (IDEM 2017a p 184) and in the Biological and Habitat QAPP (IDEM 2020a pp 35-36).

D.3. Information, Data, and Reports

Record data collected in 2021 in the AIMS II database and present in three compilation summaries. The first summary is a general compilation of the 2021 Patoka River basin field and water chemistry data prepared for use in the 2024 Integrated Report. The second summary is in database report format containing biological results and habitat evaluations, produced for inclusion in the Integrated Report as well as individual site folders. All site folders are maintained at the WAPB facility. The third summary includes diatom species taxa names and enumerations on laboratory bench sheets. Using U.S. EPA's *spsurvey* package written in the R programing language (R Core Team 2014), determine the percent of perennial stream miles in the basin supporting, or not supporting aquatic life and recreational uses using the attainment decisions for each site sampled (IDEM 2020c). All data and reports are made available to public and private entities which may find the data useful for municipal, industrial, agricultural, and recreational decision-making processes (TMDL, NPDES permit modeling, watershed restoration projects, water quality criteria refinement, etc.,).

D.4. Laboratory and Estimated Cost

Laboratory analysis and data reporting for this project complies with the Surface Water QAPP; TMDL Program (IDEM 2017a), Request for Proposals 16-074 (IDEM 2016), and the IDEM Quality Management Plan (IDEM 2018d). Pace Analytical Services in Indianapolis, Indiana performs water chemistry parameters analytical tests outlined in Table 8. Appendix 1 contains Pace Analytical Services' accreditation. IDOH analyzes orthophosphate. IDEXX Laboratories, Inc., Westbrook, Maine supplies bacteriological sampling. IDEM staff collect algal samples. IDEM staff perform periphyton laboratory processing and diatom slide mounting. The Department of Biological and Environmental Sciences, Georgia College and State University performs diatom identification and enumeration (IDEM 2020a). IDEM staff collect and analyze all fish and macroinvertebrate samples. Rhithron Associates, Inc verifies 10% of macroinvertebrate samples (IDEM 2020a). Table 9 outlines the anticipated budget for laboratory cost.

Table 9. Total Estimated Laboratory Cost for the Project.

Analysis	Number of Samples Collected	Laboratory	Estimated Cost
Water chemistry	3 times @ 45 sites + 15 duplicates + 15 field blanks (1 per sample week) = 165 samples	Pace Analytical Services 7726 Moller Road. Indianapolis, Indiana 46268	$71,500
Orthophosphate	3 times @ 18 sites + 3 duplicates + 3 field blanks (1 per sample week) = 60 samples	IDOH, Environmental Laboratory Division 550 West 16th Street Indianapolis, IN 46202	$0
Bacteriological (*E. coli*)	5 times @ 40 sites + 10 blanks + 10 duplicates + 30 equipment blanks = 250 samples	IDEM Fixed or Mobile *E. coli* laboratory supplies: IDEXX Laboratories, Inc. One IDEXX Drive Westbrook, Maine 04092	$1,127
Diatom identification and enumeration	1 time @ 45 sites + 5 duplicates (1 per sample week) = 50 samples 5 samples (10%) sent out for verification	Department of Biological and Environmental Sciences Georgia College and State University 320 S. Wayne St. Milledgeville, Georgia 31061	$6,250
Macroinvertebrate identification	1 time @ 38 sites + 4 duplicates = 42 samples 4 samples (10%) sent out for verification	Rhithron Associates, Inc. 33 Fort Missoula Road Missoula, Montana 59804	$920
		Total	$79,797

Table 10. Personnel Safety and Reference Manuals

Role	Required Training or Experience	Training References	Training Notes
All staff participating in field activities	-Basic First Aid and Cardiopulmonary Resuscitation (CPR)	-A minimum of 4 hours of in-service training provided by WAPB (IDEM 2010a)	-Staff lacking 4 hours of in-service training or appropriate certification are accompanied by WAPB staff, meeting health and safety training requirements, in the field at all times.
	-Personal Protective Equipment (PPE) Policy -Personal Flotation Devices (PFD)	-IDEM 2008 -February 29, 2000 WAPB internal memorandum regarding use of approved PFDs	-When working on boundary waters as defined by Indiana Code (IC) 14-8-2-27 or between sunset and sunrise on any waters of the state, all staff in the watercraft must wear a high intensity whistle and Safety of Life at Sea (SOLAS) certified strobe light.

References

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Attachment 1. IDEM Site Reconnaissance Form

IDEM

Site Reconnaissance Form

EPA Site Identifier	Rank
Recon #:	
Trip #:	

Site Number: ______ Stream: ______ County: ______

Location Description: ______

Reconnaissance Data Collected

Recon Date | Crew Members

Avg. Width (m) | Avg. Depth (m) | Max. Depth (m) | Nearest Town

Water Present? ☐ | Site Wadeable? ☐ | Riffle/Run Present? ☐ | Road/Public Access Possible? ☐

Site Impacted by Livestock? ☐ | Collect Sediment? ☐ | Gauge Present? ☐

Landowner/Contact Information

First Name | Last Name

Street A ddress

City | State | Zip

Telephone | E-Mail Address

Pamphlet Distributed? ☐ | Please Call In Advance? ☐ | Results Requested? ☐

Rating, Results, Comments, and Planning

Site Rating By Category (1=easy, 10=difficult)

- Access Route
- Safety Factor
- Sampling Effort

Reconnaissance Decision

- Pre-Recon
- Recon In process
- Approved Site
- No, Landowner denied access
- No, Dry
- No, Stream channel missing
- No, Physical barriers
- No, Impounded stream
- No, Marsh/Wetland
- No, Bridge gone or not accessible
- No, Unsafe due to traffic or location
- No, Site impacted by backwater
- No, Other

Equipment Selected

Circle Equipment Needed

- Backpack
- Boat
- Totebarge
- Longline
- Scanoe
- Seine
- Weighted Handline
- Waders
- Gill Net

Comments

Sketch of Stream & Access Route – Indicate Flow, Direction, Obstacles, & Land Use (Use Back of Page, if Necessary)

Attachment 2. IDEM Stream Sampling Field Data Sheet

IDEM Stream Sampling Field Data Sheet

Analysis Set #	EPA Site ID	Rank

Sample #	Site #	Sample Medium	Sample Type	Duplicate Sample #

Stream Name:		River Mile:		County:	
Site Description:					

Survey Crew Chief	Sample Collectors				Sample Collected		Hydrolab #	Water Depth/Gage Ht (ft)	Water Flow (cf/sec)	Flow Estimated?	Algae?	Aquatic Life?
	1	2	3	4	Date	Time						
										☐	☐	☐

Sample Taken?	Aliquots	Water Flow Type	Water Appearance	Canopy Closed %
◇ Yes ◇ No; Frozen	◇ 1 ◇ 2 ◇ 3 ◇ 4	◇ Riffle ◇ Dry ◇ Stagnant	◇ Clear ◇ Green ◇ Sheen	◇ 0-20% ◇ 60-80%
◇ No; Stream Dry ◇ No; Other	◇ 6 ◇ 8 ◇ 12 ◇ 24	◇ Pool ◇ Run ◇ Flood	◇ Murky ◇ Black ◇ Other	◇ 20-40% ◇ 80-100%
◇ No; Owner refused Access	◇ 48 ◇ 72 ◇ AS-Flow	◇ Glide ◇ Eddy ◇ Other	◇ Brown ◇ Gray (Septic/Sewage)	◇ 40-60%

Special Notes:	

Field Data:

Date (m/d/yy)	24-hr Time (hh:mm)	D.O. (mg/l)	pH	Water Temp (°C)	Spec Cond (µohms/cm)	Turbidity (NTU)	% Sat.	Chlorine (mg/l)	Chloride (mg/l)	Chlorophyll (mg/l)	Weather Codes SC	WD	WS	AT
Comments														
Comments														
Comments														
Comments														
Comments														
Comments														

Measurement Flags		
	<	< Min. Meter Measurement
	>	> Max. Meter Measurement
	E	Estimated (See Comments)
	R	Rejected (See Comments)

Weather Code Definitions

SC Sky Conditions		WD Wind Direction	WS Wind Strength	AT Air Temp
1 Clear	8 Rain	00 North (0 degrees)	0 Calm	1 < 32
2 Scattered	9 Snow	09 East (90 degrees)	1 Light	2 33-45
3 Partly	10 Sleet	18 South (180 degrees)	2 Mod./Light	3 46-60
4 Cloudy		27 West (270 degrees)	3 Moderate	4 61-75
5 Mist			4 Mod./Strong	5 76-85
6 Fog			5 Strong	6 > 86
7 Shower			6 Gale	

Field Calibrations:

Date (m/d/yy)	Time (hh: mm)	Calibrator Initials	Calibrations Type	Meter #	Value	Units

Calibration Type	
	pH
	DO
	Turbidity

Preservatives/Bottle Lots:

Group: Preservative	Preservative Lot #	Bottle Type	Bottle Lot #

Groups: Preservatives

GC	General Chemistry: Ice
Nx	Nutrients: H2SO4
Metals	Metals: HNO3
CN	Cyanide: NaOH
O&G	Oil & Grease: H2SO4
Toxics	Toxics: Ice
Ecoli	Bacteriology: Ice
VOA	Volatile Organics: HCl & Thiosulfate
Pest	Pesticides: Ice
Phen	Phenols: H2SO4
Sed	Sediment: Ice
Gly	Glyphosate: Thiosulfate
Hg	Mercury(1631): HCl
Cr6	ChromiumVI(1636): NaOH
MeHg	Methyl Mercury(1630): HCl

Bottle Types

2000P	2000mL Plastic, Narrow Mouth
1000P	1000mL Plastic, Narrow Mouth
500P	500mL Plastic, Narrow Mouth
250P	250mL Plastic, Narrow Mouth
1000G	1000mL Glass, Narrow Mouth
500G	500mL Glass, Wide Mouth
250G	250mL Glass, Wide Mouth
125G	125mL Glass, Wide Mouth
40GV	40mL Glass Vial
120PB	120ml Plastic (Bacteria Only)
1000PF	1000mL Plastic, Corning Filter
500PF	500mL Plastic, Corning Filter
60P	60mL Plastic
250T	250mL Teflon
500T	500mL Teflon
125T	125mL Teflon

Data Entered By: ________________ QC1: ________________
QC2: ________________

Attachment 3. IDEM Algal Biomass Lab Data Sheet

IDEM

Algal Biomass Lab Datasheet

Sample #	Site	Stream

Supporting Site Information

Traditional Forestry % Closed Canopy: ☐ <=10m ☐ >10m (Measure center only if width <=10m, record to nearest whole percent)

	North	East	South	West	Average x 1.04 =
Left Bank					
Center					
Right Bank					
Total %CC (Average from above, or Center only = %CC)				100 - %CC	

Phytoplankton Information

Sampling Method: ☐ Grab Sample (Dip) ☐ Multiple Verticles Number of Verticles:

Chlorphyll A	Blank	Filter 1	Filter 2	Filter 3	Filter 4
Sample Time					
Sample Volume (mL)					

Periphyton Information

Periphyton Habitat: ☐ Epilithic (Area-Scape) ☐ Epidendric (Cylinder Scrape) ☐ Epipsammic (Petri Dish)

Diatom Sample Collected: ☐ Yes ☐ No | Diatom Volume: mL | Formalin Volume: mL | Slurry Volume mL

Chlorphyll A	Blank	Filter 1	Filter 2	Filter 3	Filter 4
Sample Time					
Sample Volume (mL)					

Periphyton Area Calculation

Cylinder Scrape

Snag #	Length (cm)(L)	Circumference U₁			U	Area (L * U)
		U_1	U_2	U_3		
1						
2						
3						
4						
5						
					Total Area (cm^2)	

Area Scrape (Using SG-92)

Rock#	1	2	3	4	5
Area (cm^2)	7.38	7.38	7.38	7.38	7.38
Total (cm^2)			36.9		

Petri Dish

Number of Discrete Samples (n):	
Total Area of One Sampler (a):	19.01 cm^2
Total Sample Area (n * a):	

Stream Discharge / Rainfall Information

Nearest USGS Gage Site: ☐ Upstream ☐ Downstream ☐ No USGS Gage Near

River miles from site:	Discharge CFS at sampling: CFS
Gage location:	Discharge days since 50% flow exceeded: days

Rainfall data source: ☐ NOAA ☐ CoCoRaHS ☐ Indiana State Climate Office ☐ USGS gage rain gauge ☐ Other:

Total precipitation at sampling: in. on date:	Cumulative rain 7 days previous to sampling: in. Inches since last rainfall previous to sampling: in. Days since last rainfall previous to sampling: days
Rain station location, county:	

Identifier	Date	Reviewer 1	Date	Reviewer 2	Date	Notes:
		☐ Review 1 Completed		☐ Review 2 Completed		

Attachment 4. IDEM Physical Description of Stream Site Form (front)

Revised 4/20/12

Probabilistic Monitoring Section Physical Description of Stream Site

Stream :______________________ AIMS #______________Program #:________

Date: _________ Time: _________ Crew Chief:_______________Crew________

General Stream Description:

____

____

____

____

____

Characteristics at the site and immediately upstream (check All that apply).

Outer Riparian Zone

L R

☐ ☐ Agricultural Row crop

☐ ☐ Agricultural Pasture

☐ ☐ Devoid of Vegetation

☐ ☐ Fallow

☐ ☐ Forested

☐ ☐ Residential

☐ ☐ Commercial/Industrial

☐ ☐ Weeds and Scrub

☐ ☐ Other ________________

Inner Riparian Zone (L R)	L.Width(m)	R.Width(m)
☐ ☐ Agricultural Rowcrop	_____	_____
☐ ☐ Agricultural Pasture	_____	_____
☐ ☐ Devoid of Vegetation	_____	_____
☐ ☐ Fallow	_____	_____
☐ ☐ Forest	_____	_____
☐ ☐ Residential	_____	_____
☐ ☐ Commercial/Industrial	_____	_____
☐ ☐ Treeline	_____	_____
☐ ☐ Weeds and Scrub		
☐ ☐ Other ___________	_____	_____

Flow above site

☐ Riffle

☐ Pool

☐ Eddy

☐ Run

☐ Glide

☐ Other _____________

____

____

Flow at site

☐ Riffle

☐ Pool

☐ Eddy

☐ Run

☐ Glide

☐ Other _____________

____

____

Substrate (if visable)

☐ Cobble

☐ Boulder

☐ Sand

☐ Muck

☐ Silt

☐ Gravel

☐ Bedrock

☐ Other ______________

Characteristics at site and immediately upstream (check ONE).

Water Description

☐ Clear

☐ Grey (Septic)

☐ Murky

☐ Black

☐ Brown

☐ Green

☐ Other ____________

Sinuosity of Channel

☐ High

☐ Moderate

☐ Low

☐ Channelized

Discharge Pipe Present

☐ No

☐ Yes

If yes, Effluent Flowing?

☐ No

☐ Yes

Description of Effluent _____

____

Continued on back

Attachment 4. IDEM Physical Description of Stream Site Form (back)

Revised 4/20/12

Stream Bank

Functional Slope:
L R
☐ ☐ 0-30°
☐ ☐ 31-50°
☐ ☐ 51-70°
☐ ☐ 71-90°

Bank Erosion:
L R
☐ ☐ Low
☐ ☐ Moderate
☐ ☐ High

Percent Canopy Closed: _______

Stream Stage 1-5 (Low-High): _______

Velocity of Stream 1-5 (Slow-Fast): _______

Visible Stream Degradation? ☐ Yes ☐ No

Description:____

Aquatic Life Observed? ☐ Yes ☐ No

Description: ____

Algae Observed? ☐ Yes ☐ No

Description: ____

Rooted Macrophytes Observed? ☐ Yes ☐ No

Description: ____

Additional Comments:

____
____
____
____

Follow Up Date:________Time:________Crew Chief:__________Crew:__________

____
____
____
____

Follow Up Date:________Time:________Crew Chief:__________Crew:__________

____
____
____
____

Photography Date:________ Time:________ Number(s):________; ________;________

Notes (include items relevant for determining scale – items of known measurement, etc.)

____
____
____

Attachment 5. IDEM Fish Collection Data Sheet (front)

IDEM
OWQ-WATERSHED ASSESSMENT AND PLANNING BRANCH

Event ID______________ Voucher jars_______ Unknown jars________ Equipment________________ Page _____ of ______
Voltage_______ Time fished (sec)________ Distance fished (m)_________ Max. depth (m)_________ Avg. depth (m)________
Avg. width (m)______ Bridge in reach_____ Is reach representative_____ If no, why_____________________________________
Elapsed time at site (hh:mm)____:____ Comments____

____

____

Museum data: Initials__________ ID date__________ Jar count__________ Fish Total__________

Coding for Anomalies: D – deformities E – eroded fins L – lesions T – tumor M – multiple DELT anomalies O – other (A – anchor worm C – leeches W – swirled scales Y – popeye S – emaciated F – fungus P – parasites) H – heavy L – light (these codes may be combined with above codes)

TOTAL # OF FISH				WEIGHT (s) (mass g)				(length mm)	ANOMALIES					
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												

KRW: Rev/09.26.18 Calculation:________ QC1 + Entry________ QC 1 ________ QC 2________

Attachment 5. IDEM Fish Collection Data Sheet (back)

Event ID_______________ Page _____ of ______

								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												

KRW: Rev/09.26.18

Attachment 6. IDEM OWQ Macroinvertebrate Header Form

Office of Water Quality: Macroinvertebrate Header

L-Site	Stream Name	Location	County	Surveyor

Sample Date	Sample #	Macro#	# Containers

Macro Sample Type:
☐ Black Light ☐ Kick
☐ CPOM ☐ MHAB
☐ Hester-Dendy ☐ Qualitative

☐ Normal ___________
☐ Duplicate ___________
☐ Replicate ___________

☐ **Habitat Complete** ☐ **Sample Quality Rejected**

Riparian Zone/Instream Features

Macro Sub Sample (Field or Lab): _______________

Macro Reach Sampled (m): _______________

Watershed Erosion:
☐ Heavy
☐ Moderate
☐ None

Watershed NPS Pollution:
☐ No Evidence
☐ Obvious Sources
☐ Some Potential Sources

Stream Depth Riffle (m):	Stream Depth Run (m):	Stream Depth Pool (m):

Distances Riffle-Riffle (m):	Distances Bend-Bend (m):

Stream Width (m):	High Water Mark (m):

Stream Type:
☐ Cold
☐ Warm

Turbidity (Est):
☐ Clear ☐ Slightly Turbid
☐ Opaque ☐ Turbid

☐ **Channelization** ☐ **Dam Present**

Predominant Surrounding Land Use: ☐ Forest ☐ Field/Pasture ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial
Other ____________________

Sediment

Sediment Odors: ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None Other ____________

Sediment Deposits: ☐ Sludge ☐ Sawdust ☐ Paper Fiber ☐ Sand ☐ Relic Shells Other ____________

Sediment Oils: ☐ Absent ☐ Moderate ☐ Profuse ☐ Slight

☐ Are the undersides of stones, which are not deeply embedded, black?

Substrate Components

(Note: Select from 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, or 100% for each inorganic/ organic substrate component)

Inorganic Substrate Components (% Diameter)						
Bedrock	Boulder (>10 in)	Cobble (2.5-10 in)	Gravel (0.1-2.5 in)	Sand (gritty)	Silt	Clay (slick)

Organic Substrate Components (% Type)			
Detritus (sticks, wood)	Detritus (CPOM)	Muck/Mud (black, fine FPOM)	Marl(gray w/ shell fragments)

Water Quality

Water Odors: ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ None Other ____________

Water Surface Oils: ☐ Slick ☐ Sheen ☐ Glob ☐ Flocks ☐ None

IDEM 03/8/18

Attachment 7. IDEM OWQ Biological Qualitative Habitat Evaluation Index (front)

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

IDEM

Sample #	bioSample #	Stream Name	Location

Surveyor	Sample Date	County	Macro Sample Type	☐ Habitat Complete	QHEI Score:

1] *SUBSTRATE* Check ONLY Two predominant substrate TYPE BOXES and check every type present

BEST TYPES (PREDOMINANT / PRESENT P/G R/R)

☐☐ BLDR/SLABS [10] ☐☐
☐☐ BOULDER [9] ☐☐
☐☐ COBBLE [8] ☐☐
☐☐ GRAVEL [7] ☐☐
☐☐ SAND [6] ☐☐
☐☐ BEDROCK [5] ☐☐

OTHER TYPES (PREDOMINANT / PRESENT P/G R/R)

☐☐ HARDPAN [4] ☐☐
☐☐ DETRITUS [3] ☐☐
☐☐ MUCK [2] ☐☐
☐☐ SILT [2] ☐☐
☐☐ ARTIFICIAL [0] ☐☐

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

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

Check ONE (Or 2 & average)

ORIGIN

☐ LIMESTONE [1]
☐ TILLS [1]
☐ WETLANDS [0]
☐ HARDPAN [0]
☐ SANDSTONE [0]
☐ RIP/RAP [0]
☐ LACUSTRINE [0]
☐ SHALE [-1]
☐ COAL FINES [-2]

QUALITY

SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate ☐ Maximum 20

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3: **0**–Absent; **1**–Very small amounts or if more common of marginal quality; **2**–Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**–Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)

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

AMOUNT Check ONE (Or 2 & average)

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

Cover ☐ Maximum 20

Comments

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

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☐ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☐ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]

STABILITY: ☐ HIGH [3] ☐ MODERATE [2] ☐ LOW [1]

Channel ☐ Maximum 20

Comments

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

River right looking downstream

EROSION (L R)

☐☐ NONE/LITTLE [3]
☐☐ MODERATE [2]
☐☐ HEAVY/SEVERE [1]

RIPARIAN WIDTH (L R)

☐☐ WIDE > 50m [4]
☐☐ MODERATE 10-50m [3]
☐☐ NARROW 5-10m [2]
☐☐ VERY NARROW [1]
☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R)

☐☐ FOREST, SWAMP [3]
☐☐ SHRUB OR OLD FIELD [2]
☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
☐☐ FENCED PASTURE [1]
☐☐ OPEN PASTURE, ROWCROP [0]

(L R)

☐☐ CONSERVATION TILLAGE [1]
☐☐ URBAN OR INDUSTRIAL [0]
☐☐ MINING /CONSTRUCTION [0]

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

Riparian ☐ Maximum 10

Comments

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

MAXIMUM DEPTH Check ONE (ONLY!)

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

CHANNEL WIDTH Check ONE (Or 2 & average)

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

CURRENT VELOCITY Check ALL that apply

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

Indicate for reach – pools and riffles.

Recreation Potential (Check one and comment on back)

☐ Primary Contact
☐ Secondary Contact

Pool/Current ☐ Maximum 12

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

Check ONE (Or 2 & average) ☐ NO RIFFLE [metric = 0]

RIFFLE DEPTH

☐ BEST AREAS > 10cm [2]
☐ BEST AREAS 5 - 10cm [1]
☐ BEST AREAS < 5 cm [metric = 0]

RUN DEPTH

☐ MAXIMUM > 50cm [2]
☐ MAXIMUM < 50cm [1]

RIFFLE/RUN SUBSTRATE

☐ STABLE (e.g., Cobble, Boulder) [2]
☐ MOD. STABLE (e.g., Large Gravel) [1]
☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS

☐ NONE [2]
☐ LOW [1]
☐ MODERATE [0]
☐ EXTENSIVE [-1]

Riffle/Run ☐ Maximum 8

Comments

6] *GRADIENT* (ft/mi) ☐ VERY LOW - LOW [2 – 4] ☐ MODERATE [6 - 10] ☐ HIGH - VERY HIGH [10 - 6]

DRAINAGE AREA (mi²)

%POOL: ☐ **%GLIDE:** ☐ **%RUN:** ☐ **%RIFFLE:** ☐

Gradient ☐ Maximum 10

Entered ____________ QC1 ____________ QC2 ____________ IDEM 02/28/2018

Attachment 7 (cont.). IDEM OWQ Biological QHEI (back)

IDEM

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

COMMENT ____________________

A-CANOPY
- ☐ >85%-Open
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%-Closed

B-AESTHETICS
- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSOs/SSOs/Outfalls

C-RECREATION

Area Pool: ☐ > 100 ft^2 Depth ☐ > 3 ft

D-MAINTENANCE
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag : ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H_2O ☐ Tile ☐ H_2O Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition
- ☐ Agriculture ☐ Livestock

Looking upstream (> 10m, 3 readings; ≤ 10m, 1 reading in middle) ; Round to the nearest whole percent

	Right	Middle	Left	Total Average
% open	___ %	___ %	___ %	___ %

Stream Drawing:

IDEM 02/28/2018

Attachment 8. IDEM OWQ Chain of Custody Form

IDEM

Indiana Department of Environmental Management

OWQ Chain of Custody Form

Project:
OWQ Sample Set or Trip #:

I Certify that the sample(s) listed below was/were collected by me, or in my presence. Date:______________________

Signature:____ Section:______________________

Sample Media (☐ Water, ☐ Algae,☐ Fish, ☐ Macro, ☐ Cyanobacteria/Microcystin, ☐ Sediment)

Lab Assigned Number / Event ID	IDEM Control Number	Sample Type	ID	1000 ml P.N.M.	1000 ml G.N.M.	40 ml Vial	120 ml P (Bact)	2000 ml Nalgene	250 ml Nalgene	125 ml Glass	Date and Time Collected		One check per bottle present
											Date	Time	

P = Plastic	G = Glass	N.M. = Narrow Mouth	Bact = Bacteriological Only	Should samples be iced?	Y	N
M = MS/MSD	B = Blank	D = Duplicate	R = Revisit			

Carriers

I certify that I have received the above sample(s).

Signature	Date	Time	Seals Intact		Comments
Relinquished By:			Y	N	
Received By:					
Relinquished By:			Y	N	
Received By:					
Relinquished By:			Y	N	
Received By:					
IDEM Storage Room #					

Lab Custodian

I certify that I have received the above sample(s), which has/have been recorded in the official record book. The same sample(s) will be in the custody of competent laboratory personnel at all times, or locked in a secured area.

Signature:______________________________ Date:____________ Time:____________

Lab:______________________________ Address:______________________________

Revision Date: 4/27/2016

Attachment 9. 2021 Corvallis Water Sample Analysis Request Form (Pace Analytical)

IDEM

Indiana Department of Environmental Management
Office of Water Quality
Watershed Planning and Assessment Branch
www.idem.IN.gov

Water Sample Analysis Request

Project Name: 2021 Probabilistic Monitoring **Composite** ☐ **Grab** ☒

OWQ Sample Set	21WQW	IDEM Sample Nos.	
Crew Chief	Todd Davis	Lab Sample Nos.	
Collection Date	Apr. – Oct. 2021	Lab Delivery Date	

Anions and Physical Parameters

Parameter	Test Method	Total	Dissolved
Alkalinity (as $CaCO_3$)	310.2	☒ **	☐
Total Solids	SM2540B	☒ **	
Suspended Solids	SM2540D	☒ **	
Dissolved Solids	SM2540C		☒ **
Sulfate (as SO_4)	300.0	☐ **	☒ **
Chloride (as Cl)	300.0	☐ **	☒**
Hardness (Calculated)	SM-2340B	☒ **	☐**
Fluoride (as F)	SM4500-F-C	☐ **	☐**

Priority Pollutant Metals Water Parameters

Parameter	Test Method	Total	Dissolved
Antimony (as Sb)	200.8	☒	☒
Arsenic (as As)	200.8	☒	☒
Beryllium (as Be)	200.8	☐	☐
Cadmium (as Cd)	200.8	☒	☒
Chromium (as Cr)	200.8	☒	☒
Copper (as Cu)	200.8	☒	☒
Lead (as Pb)	200.8	☒	☒
Mercury, Low Level	1631, Rev E.	☐	☐
Nickel (as Ni)	200.8	☒	☒
Selenium (as Se)	200.8	☒	☒
Silver (as Ag)	200.8	☒	☒
Thallium (as Tl)	200.8	☐	☐
Zinc (as Zn)	200.8	☒	☒

Cations and Secondary Metals Parameters

Parameter	Test Method	Total	Dissolved
Aluminum (as Al)	**200.7**	☒	☒
Barium (as Ba)	200.8	☐	☐
Boron (as B)	200.8	☐	☐
Calcium (as Ca)	**200.7**	☒ ***	☐
Cobalt (as Co)	200.8	☐	☐
Iron (as Fe)	200.7	☐	☐
Magnesium (as Mg)	**200.7**	☒ ***	☐
Manganese (as Mn)	200.8	☐	☐
Sodium (as Na)	200.7	☐	☐
Silica, Total Reactive (as SiO_2)	200.7	☐	☐
Strontium (as Sr)	200.8	☐	☐

Send reports (Fed. Ex. or UPS) to:
Tim Bowren - IDEM
Bldg. 20, STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219

Deliver reports to:
Tim Bowren - IDEM
Bldg. 20, STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219

Organic Water Parameters

Parameter	Test Method	Total
Priority Pollutants: Oranochlorine Pesticides and PCBs	608	☐
Priority Pollutants: VOCs - Purgeable Organics	624	☐
Priority Pollutants: Base/Neutral Extractables	625	☐
Priority Pollutants: Acid Extractables	625	☐
Phenolics, 4AAP	420.4	☐
Oil and Grease, Total	1664A	☐

Nutrient & Organic Water Chemistry Parameters

Parameter	Test Method	Total	Dissolved
Ammonia Nitrogen	SM4500NH3-G	☒	☐
$CBOD_5$	SM5210B	☐	
Total Kjeldahl Nitrogen (TKN)	SM4500N(Org)	☒	☐
Nitrogen, Nitrate + Nitrite as N	353.2	☒	☐
Total Phosphorus	365.1	☒	☐
TOC	SM 5310C	☒	☐
COD	410.4	☒	☐
Cyanide (Total)	335.4	☐	☐
Cyanide (Free)	SM4500CN-I	☐ *	☐
Cyanide (Amenable)	SM4500CN-G	☐ *	☐
Sulfide, Total	376.2	☐	☐

RFP 16-74 Contract Number:	018620 (Pace-Indy) PO # 0020000887-9 (Pace-Indy)

30 day reporting time required.

Notes:
** **= DO NOT RUN PARAMETER IF SAMPLE IDENTIFIED AS A BLANK ON THE CHAIN OF CUSTODY**
* **= RUN ONLY IF TOTAL CYANIDE IS DETECTED**
*** = *Report Calcium, Magnesium components of Total Hardness (Calculated)*

Testing Laboratory: Pace Analytical Services, Inc.
Attn: Olivia Deck
Phone: 317-228-3102 7726 Moller Road
Indianapolis, IN 46268

Attachment 10. 2021 Corvallis Water Sample Analysis Request Form (IDOH)

Indiana Department of Environmental Management
Office of Water Quality
Watershed Planning and Assessment Branch
www.idem.IN.gov

Water Sample Analysis Request

Project Name: 2021 Corvallis **Composite** ☐ **Grab** ☒

OWQ Sample Set	21WQW	IDEM Sample Nos.	
Crew Chief		Lab Sample Nos.	
Collection Date		Lab Delivery Date	

Anions and Physical Parameters

Parameter	Test Method	Total	Dissolved
Alkalinity (as $CaCO_3$)	EPA 310.2	☐ **	☐
Total Solids	SM 2540B	☐ **	
Suspended Solids	SM 2540D	☐ **	
Dissolved Solids	SM 2540C		☐ **
Sulfate	EPA 375.2	☐ **	☐ **
Chloride	SM 4500Cl-E	☐ **	☐
Hardness (as $CaCO_3$)	EPA 130.1	☐ **	☐
Fluoride	380-75WE	☐ **	☐
Silica (Reactive)	SM 4500-SiD	☐ **	☐

Priority Pollutant Metals Water Parameters

Parameter	Test Method	Total	Dissolved
Antimony	200.8	☐	☐
Arsenic	200.8	☐	☐
Beryllium	200.8	☐	☐
Cadmium	200.8	☐	☐
Chromium (Hex)	SM 3500Cr-D	☐	☐
Chromium (Total)	200.8	☐	☐
Copper	200.8	☐	☐
Lead	200.8	☐	☐
Mercury,	EPA 245.1	☐	☐
Nickel	200.8	☐	☐
Selenium	200.8	☐	☐
Silver	200.8	☐	☐
Thallium	200.8	☐	☐
Zinc	200.7	☐	☐

Cations and Secondary Metals Parameters

Parameter	Test Method	Total	Dissolved
Aluminum	200.7, 200.8	☐	☐
Barium	200.8	☐	☐
Boron	200.8	☐	☐
Calcium	200.7, 200.8	☐ ***	☐
Calcium (as $CaCO_3$)	SM 3500Ca-D	☐	☐
Cobalt	200.8	☐	☐
Iron	200.7	☐	☐
Magnesium	200.7, 200.8	☐ ***	☐
Manganese	200.8	☐	☐
Potassium	SM 3500-K D	☐	☐
Sodium	200.7	☐	☐
Strontium	200.7	☐	☐

Send reports (Fed. Ex. or UPS) to:
David Jordan - IDEM
Mail Code 65-40-2 (Shadeland)
100 N. Senate Ave.
Indianapolis, IN 46204-2251

Deliver reports to:
David Jordan - IDEM
Bldg. 20 STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219
DJordan@idem.in.gov

Organic Water Parameters

Parameter	Test Method	Total
Priority Pollutants: Oranochlorine Pesticides and PCBs	EPA 608	☐
Polynuclear Aromatic Hydrocarbons	EPA 610	☐
Priority Pollutants: VOCs - Purgeable Organics	EPA 624	☐
Priority Pollutants: Base/Neutral Extractables	EPA 625	☐
Priority Pollutants: Acid Extractables	EPA 625	☐
Phenolics, 4AAP	EPA 420.4	☐
Oil and Grease, Total	EPA 1664A	☐
Semi-volatile Organics & Pesticides	EPA 525.2	☐

Nutrient & Organic Water Chemistry Parameters

Parameter	Test Method	Total	Dissolved
Ammonia Nitrogen	EPA 350.1	☐	☐
$CBOD_5$	SM 5210B	☐	
$CBOD_U$	SM 5210B	☐	
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	☐	☐
Nitrate + Nitrite	EPA 353.1	☐	☐
Total Phosphorus	EPA 365.1	☐	☐
Phosphorus, DRP	EPA 365.1	☐	☒
TOC	SM 5310B	☐	☐
COD (Low Level)	SM 5220D	☐	☐
Cyanide (Total)	EPA 335.4	☐	☐
Cyanide (Free)	SM 4500CN-I	☐ *	☐
Cyanide (Amenable)	SM 4500CN-G	☐ *	☐

Bacteriological Water Parameters

Parameter	Test Method	Total	Dissolved
E. coli *(Colilert Method)*	SM9223B	☐	

30 day reporting time required.

Notes:
**** = DO NOT RUN PARAMETER IF SAMPLE IDENTIFIED AS A BLANK ON THE CHAIN OF CUSTODY**
*** = RUN ONLY IF TOTAL CYANIDE IS DETECTED**
**** = Report Calcium, Magnesium as Total Hardness components if Hardness is calculated*

Testing Laboratory:
Indiana Department of Health (IDOH aka ISDH)
Environmental Laboratory Division
550 W. 16th Street
Indianapolis, IN 46202
Phone: 317-921-5815 (Ray Beebe) (Rev. 02/2021)

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents

State of Kansas

Department of Health and Environment

CERTIFICATE

This is to certify that Certification No.: E-10177

Pace Analytical Services, Inc - Indianapolis IN

7726 Moller Road

Indianapolis, IN 46268-4163

has been accredited in accordance with K.S.A. 65-1,109a under the standards adopted in K.A.R. 28-15-36 for performing environmental analyses for the parameters listed on the most current scope of accreditation. Continuous accreditation depends on successful, ongoing participation in the program. Clients are urged to verify with this agency the laboratory's certification status for particular methods and analytes.

Effective Date: 5/1/2021

Expiration Date: 4/30/2022

Director
Office of Laboratory Services

Certification Section Chief
Office of Laboratory Services

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Division of Environment
Kansas Health and Environmental Laboratories
Environmental Laboratory Improvement Program
6810 SE Dwight Street
Topeka, KS 66620-0001

Kansas Department of Health and Environment

Phone: 785-296-3811
Fax: 785-559-5207
KDHE.ELIPO@KS.GOV
www.kdheks.gov/envlab

Lee A. Norman, M.D., Secretary

Laura Kelly, Governor

The Kansas Department of Health and Environment encourages all clients and data users to verify the most current scope of accreditation for certification number E-10177

The analytes tested and the corresponding matrix and method which a laboratory is authorized to perform at any given time will be those indicated in the most recently issued scope of accreditation. The most recent scope of accreditation supersedes all previously issued scopes of accreditation. It is the certified laboratory's responsibility to review this document for any discrepancies. This scope of accreditation will be recalled in the event that your laboratory's certification is revoked.

Accreditation Start: 5/1/2021 Accreditation End: 4/30/2022

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177**

Pace Analytical Services, Inc - Indianapolis IN **Primary AB**

Program/Matrix: ***CWA (Non Potable Water)***

	Primary AB
Method ASTM D516-11	
Sulfate	KS
Method EPA 120.1	
Conductivity	KS
Method EPA 1631E	
Mercury	KS
Method EPA 1664A	
Oil & Grease	KS
Method EPA 180.1	
Turbidity	KS
Method EPA 200.7	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Calcium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Iron	KS
Lead	KS
Magnesium	KS
Manganese	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
Molybdenum	KS
Nickel	KS
Potassium	KS
Selenium	KS
Silver	KS
Sodium	KS
Strontium	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS
Method EPA 200.8	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Lead	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Selenium	KS
Silver	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS
Method EPA 245.1	
Mercury	KS
Method EPA 300.0	
Bromide	KS
Chloride	KS
Fluoride	KS
Nitrate	KS
Nitrate-nitrite	KS
Nitrite	KS
Sulfate	KS
Method EPA 335.4	
Amenable cyanide	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***CWA (Non Potable Water)***

Cyanide	KS
Method EPA 350.1	
Ammonia as N	KS
Method EPA 351.2	
Total Kjeldahl Nitrogen (TKN)	KS
Method EPA 351.2 minus EPA 350.1	
Organic nitrogen	KS
Method EPA 353.2	
Nitrate	KS
Nitrate-nitrite	KS
Nitrite	KS
Method EPA 365.1	
Phosphorus	KS
Method EPA 410.4	
Chemical oxygen demand	KS
Method EPA 420.4	
Total phenolics	KS
Method EPA 6010B	
Arsenic	KS
Cadmium	KS
Copper	KS
Lead	KS
Molybdenum	KS
Nickel	KS
Selenium	KS
Strontium	KS
Total chromium	KS
Zinc	KS
Method EPA 6020	
Arsenic	KS
Cadmium	KS
Copper	KS
Lead	KS
Nickel	KS
Selenium	KS
Total chromium	KS
Zinc	KS
Method EPA 608.3 GC-ECD	
4,4'-DDD	KS
4,4'-DDE	KS
4,4'-DDT	KS
Aldrin	KS
alpha-BHC (alpha-Hexachlorocyclohexane)	KS
Aroclor-1016 (PCB-1016)	KS
Aroclor-1221 (PCB-1221)	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***CWA (Non Potable Water)***

	Primary AB
Aroclor-1232 (PCB-1232)	KS
Aroclor-1242 (PCB-1242)	KS
Aroclor-1248 (PCB-1248)	KS
Aroclor-1254 (PCB-1254)	KS
Aroclor-1260 (PCB-1260)	KS
beta-BHC (beta-Hexachlorocyclohexane)	KS
Chlordane (tech.)(N.O.S.)	KS
delta-BHC	KS
Dieldrin	KS
Endosulfan I	KS
Endosulfan II	KS
Endosulfan sulfate	KS
Endrin	KS
Endrin aldehyde	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS
Heptachlor	KS
Heptachlor epoxide	KS
Methoxychlor	KS
Toxaphene (Chlorinated camphene)	KS

Method EPA 624.1

1,1,1-Trichloroethane	KS
1,1,2,2-Tetrachloroethane	KS
1,1,2-Trichloroethane	KS
1,1-Dichloroethane	KS
1,1-Dichloroethylene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Dichloroethane (Ethylene dichloride)	KS
1,2-Dichloropropane	KS
1,3-Dichlorobenzene	KS
1,4-Dichlorobenzene	KS
2-Chloroethyl vinyl ether	KS
Acrolein (Propenal)	KS
Acrylonitrile	KS
Benzene	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon tetrachloride	KS
Chlorobenzene	KS
Chlorodibromomethane	KS
Chloroethane (Ethyl chloride)	KS
Chloroform	KS
cis-1,3-Dichloropropene	KS
Ethylbenzene	KS
Methyl bromide (Bromomethane)	KS
Methyl chloride (Chloromethane)	KS
Methylene chloride (Dichloromethane)	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Pace Analytical Services, Inc - Indianapolis IN **Primary AB**

Program/Matrix: ***CWA (Non Potable Water)***

Naphthalene	KS
Tetrachloroethylene (Perchloroethylene)	KS
Toluene	KS
trans-1,2-Dichloroethylene	KS
trans-1,3-Dichloropropylene	KS
Trichloroethene (Trichloroethylene)	KS
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	KS
Vinyl chloride	KS
Xylene (total)	KS

Method EPA 625.1

1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,3-Dichlorobenzene	KS
1,4-Dichlorobenzene	KS
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	KS
2,4,6-Trichlorophenol	KS
2,4-Dichlorophenol	KS
2,4-Dimethylphenol	KS
2,4-Dinitrophenol	KS
2,4-Dinitrotoluene (2,4-DNT)	KS
2,6-Dinitrotoluene (2,6-DNT)	KS
2-Chloronaphthalene	KS
2-Chlorophenol	KS
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	KS
2-Nitrophenol	KS
3,3'-Dichlorobenzidine	KS
4-Bromophenyl phenyl ether	KS
4-Chloro-3-methylphenol	KS
4-Chlorophenyl phenylether	KS
4-Nitrophenol	KS
Acenaphthene	KS
Acenaphthylene	KS
Anthracene	KS
Benzidine	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
bis(2-Chloroethoxy)methane	KS
bis(2-Chloroethyl) ether	KS
Butyl benzyl phthalate	KS
Chrysene	KS
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	KS
Dibenz(a,h) anthracene	KS
Diethyl phthalate	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 6 of 26

Pace Analytical Services, Inc - Indianapolis IN **Primary AB**

Program/Matrix: ***CWA (Non Potable Water)***

Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl phthalate	KS
Fluoranthene	KS
Fluorene	KS
Hexachlorobenzene	KS
Hexachlorobutadiene	KS
Hexachloroethane	KS
Indeno(1,2,3-cd) pyrene	KS
Isophorone	KS
Naphthalene	KS
Nitrobenzene	KS
n-Nitrosodimethylamine	KS
n-Nitrosodi-n-propylamine	KS
n-Nitrosodiphenylamine	KS
Pentachlorophenol	KS
Phenanthrene	KS
Phenol	KS
Pyrene	KS
Method EPA 7470A	
Mercury	KS
Method EPA 7471A	
Mercury	KS
Method EPA 8015D	
Propylene glycol	KS
Method EPA 8260C	
1,1,2-Trichloro-1,2,2-trifluoroethane	KS
1,3,5-Trichlorobenzene	KS
Method EPA 8270C	
1-Methylnaphthalene	KS
Carbazole	KS
Method OIA 1677-09	
Available Cyanide	KS
Free cyanide	KS
Method SM 2310 B-2011	
Acidity, as CaCO3	KS
Method SM 2320 B-2011	
Alkalinity as CaCO3	KS
Method SM 2340 B-2011	
Hardness	KS
Method SM 2510 B-2011	
Conductivity	KS
Method SM 2540 B-2011	
Residue-total	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***CWA (Non Potable Water)***

Method / Analyte	Primary AB
Method SM 2540 C-2011	
Residue-filterable (TDS)	KS
Method SM 2540 D-2011	
Residue-nonfilterable (TSS)	KS
Method SM 2540 F-2011	
Residue-settleable	KS
Method SM 3500-Cr B-2011	
Chromium VI	KS
Method SM 4500-Cl G-2011	
Total residual chlorine	KS
Method SM 4500-Cl¯ E-2011	
Chloride	KS
Method SM 4500-CN¯ C-2011	
Cyanide	KS
Method SM 4500-CN¯ E-2011	
Cyanide	KS
Method SM 4500-CN¯ G-2011	
Amenable cyanide	KS
Method SM 4500-F¯ C-2011	
Fluoride	KS
Method SM 4500-H+ B-2011	
pH	KS
Method SM 4500-NH3 G-2011	
Ammonia as N	KS
Method SM 4500-P E-2011	
Orthophosphate as P	KS
Method SM 4500-S2¯ D-2011	
Sulfide	KS
Method SM 5210 B-2011	
Biochemical oxygen demand	KS
Carbonaceous BOD, CBOD	KS
Method SM 5310 C-2011	
Total organic carbon	KS
Method SM 5540 C-2011	
Surfactants - MBAS	KS
Method TKN-NH3-CAL	
Organic nitrogen	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

Method EPA 1010A	
Ignitability	KS
Method EPA 1311	
Toxicity Characteristic Leaching Procedure (TCLP)	KS
Method EPA 1312	
Synthetic Precipitation Leaching Procedure (SPLP)	KS
Method EPA 6010B	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Calcium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Iron	KS
Lead	KS
Lithium	KS
Magnesium	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Potassium	KS
Selenium	KS
Silicon	KS
Silver	KS
Sodium	KS
Strontium	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS
Method EPA 6020	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Cadmium	KS
Chromium	KS
Cobalt	KS
Copper	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

	Primary AB
Program/Matrix: ***RCRA (Non Potable Water)***	
Lead	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Selenium	KS
Silver	KS
Thallium	KS
Thorium	KS
Uranium	KS
Vanadium	KS
Zinc	KS
Method EPA 7196A	
Chromium VI	KS
Method EPA 7470A	
Mercury	KS
Method EPA 7471A	
Mercury	KS
Method EPA 8011	
1,2-Dibromo-3-chloropropane (DBCP)	KS
1,2-Dibromoethane (EDB, Ethylene dibromide)	KS
Method EPA 8015D	
Diesel range organics (DRO)	KS
Ethanol	KS
Ethylene glycol	KS
Gasoline range organics (GRO)	KS
Isobutyl alcohol (2-Methyl-1-propanol)	KS
Isopropyl alcohol (2-Propanol, Isopropanol)	KS
Methanol	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Propanol (1-Propanol)	KS
Propylene glycol	KS
Method EPA 8081B	
4,4'-DDD	KS
4,4'-DDE	KS
4,4'-DDT	KS
Aldrin	KS
alpha-BHC (alpha-Hexachlorocyclohexane)	KS
alpha-Chlordane, cis-Chlordane	KS
beta-BHC (beta-Hexachlorocyclohexane)	KS
Chlordane (tech.)(N.O.S.)	KS
delta-BHC	KS
Dieldrin	KS
Endosulfan I	KS
Endosulfan II	KS
Endosulfan sulfate	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

	Primary AB
Program/Matrix: ***RCRA (Non Potable Water)***	
Endrin	KS
Endrin aldehyde	KS
Endrin ketone	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS
gamma-Chlordane	KS
Heptachlor	KS
Heptachlor epoxide	KS
Methoxychlor	KS
Toxaphene (Chlorinated camphene)	KS
Method EPA 8082A	
Aroclor-1016 (PCB-1016)	KS
Aroclor-1221 (PCB-1221)	KS
Aroclor-1232 (PCB-1232)	KS
Aroclor-1242 (PCB-1242)	KS
Aroclor-1248 (PCB-1248)	KS
Aroclor-1254 (PCB-1254)	KS
Aroclor-1260 (PCB-1260)	KS
Method EPA 8141B	
Atrazine	KS
Azinphos-methyl (Guthion)	KS
Chlorpyrifos	KS
Chlorpyrifos-methyl	KS
Demeton-o	KS
Demeton-s	KS
Diazinon	KS
Dichlorovos (DDVP, Dichlorvos)	KS
Dimethoate	KS
Disulfoton	KS
Famphur	KS
Malathion	KS
Merphos	KS
Methyl parathion (Parathion, methyl)	KS
Naled	KS
Parathion, ethyl	KS
Phorate	KS
Ronnel	KS
Simazine	KS
Terbufos	KS
Tetrachlorvinphos (Stirophos, Gardona) E-isomer	KS
Method EPA 8151A	
2,4,5-T	KS
2,4-D	KS
2,4-DB	KS
3,5-Dichlorobenzoic acid	KS
Acifluorfen	KS
Bentazon	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

Dalapon	KS
DCPA di acid degradate	KS
Dicamba	KS
Dichloroprop (Dichlorprop)	KS
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	KS
MCPA	KS
MCPP	KS
Pentachlorophenol	KS
Picloram	KS
Silvex (2,4,5-TP)	KS

Method EPA 8260C

1,1,1,2-Tetrachloroethane	KS
1,1,1-Trichloroethane	KS
1,1,2,2-Tetrachloroethane	KS
1,1,2-Trichloro-1,2,2-trifluoroethane	KS
1,1,2-Trichloroethane	KS
1,1-Dichloroethane	KS
1,1-Dichloroethylene	KS
1,1-Dichloropropene	KS
1,2,3-Trichlorobenzene	KS
1,2,3-Trichloropropane	KS
1,2,4-Trichlorobenzene	KS
1,2,4-Trimethylbenzene	KS
1,2-Dibromo-3-chloropropane (DBCP)	KS
1,2-Dibromoethane (EDB, Ethylene dibromide)	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Dichloroethane (Ethylene dichloride)	KS
1,2-Dichloropropane	KS
1,3,5-Trichlorobenzene	KS
1,3,5-Trimethylbenzene	KS
1,3-Dichlorobenzene	KS
1,3-Dichloropropane	KS
1,4-Dichlorobenzene	KS
1,4-Dioxane (1,4- Diethyleneoxide)	KS
1-Methylnaphthalene	KS
2,2-Dichloropropane	KS
2-Butanone (Methyl ethyl ketone, MEK)	KS
2-Chloroethyl vinyl ether	KS
2-Chlorotoluene	KS
2-Hexanone	KS
2-Methylnaphthalene	KS
4-Chlorotoluene	KS
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	KS
4-Methyl-2-pentanone (MIBK)	KS
Acetone	KS
Acetonitrile	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Acrolein (Propenal)	KS
Acrylonitrile	KS
Allyl chloride (3-Chloropropene)	KS
Benzene	KS
Bromobenzene	KS
Bromochloromethane	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon disulfide	KS
Carbon tetrachloride	KS
Chlorobenzene	KS
Chlorodibromomethane	KS
Chloroethane (Ethyl chloride)	KS
Chloroform	KS
Chloroprene (2-Chloro-1,3-butadiene)	KS
cis-1,2-Dichloroethylene	KS
cis-1,3-Dichloropropene	KS
Cyclohexane	KS
Dibromomethane (Methylene bromide)	KS
Dichlorodifluoromethane (Freon-12)	KS
Diethyl ether	KS
Ethyl acetate	KS
Ethyl methacrylate	KS
Ethylbenzene	KS
Hexachlorobutadiene	KS
Iodomethane (Methyl iodide)	KS
Isobutyl alcohol (2-Methyl-1-propanol)	KS
Isopropylbenzene	KS
Methacrylonitrile	KS
Methyl acetate	KS
Methyl bromide (Bromomethane)	KS
Methyl chloride (Chloromethane)	KS
Methyl methacrylate	KS
Methyl tert-butyl ether (MTBE)	KS
Methylcyclohexane	KS
Methylene chloride (Dichloromethane)	KS
m-Xylene	KS
Naphthalene	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Butylbenzene	KS
n-Hexane	KS
n-Propylbenzene	KS
o-Xylene	KS
Propionitrile (Ethyl cyanide)	KS
p-Xylene	KS
sec-Butylbenzene	KS
Styrene	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

tert-Butyl alcohol	KS
tert-Butylbenzene	KS
Tetrachloroethylene (Perchloroethylene)	KS
Tetrahydrofuran (THF)	KS
Toluene	KS
trans-1,2-Dichloroethylene	KS
trans-1,3-Dichloropropylene	KS
trans-1,4-Dichloro-2-butene	KS
Trichloroethene (Trichloroethylene)	KS
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	KS
Vinyl acetate	KS
Vinyl chloride	KS
Xylene (total)	KS

Method EPA 8270C

1,2,4,5-Tetrachlorobenzene	KS
1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Diphenylhydrazine	KS
1,3,5-Trinitrobenzene (1,3,5-TNB)	KS
1,3-Dichlorobenzene	KS
1,3-Dinitrobenzene (1,3-DNB)	KS
1,4-Dichlorobenzene	KS
1,4-Naphthoquinone	KS
1,4-Phenylenediamine	KS
1-Methylnaphthalene	KS
1-Naphthylamine	KS
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	KS
2,3,4,6-Tetrachlorophenol	KS
2,4,5-Trichlorophenol	KS
2,4,6-Trichlorophenol	KS
2,4-Dichlorophenol	KS
2,4-Dimethylphenol	KS
2,4-Dinitrophenol	KS
2,4-Dinitrotoluene (2,4-DNT)	KS
2,6-Dichlorophenol	KS
2,6-Dinitrotoluene (2,6-DNT)	KS
2-Acetylaminofluorene	KS
2-Chloronaphthalene	KS
2-Chlorophenol	KS
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	KS
2-Methylaniline (o-Toluidine)	KS
2-Methylaniline (o-Toluidine)	KS
2-Methylnaphthalene	KS
2-Methylphenol (o-Cresol)	KS
2-Naphthylamine	KS
2-Nitroaniline	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
2-Nitrophenol	KS
2-Picoline (2-Methylpyridine)	KS
3,3'-Dichlorobenzidine	KS
3,3'-Dimethylbenzidine	KS
3-Methylcholanthrene	KS
3-Methylphenol (m-Cresol)	KS
3-Nitroaniline	KS
4-Aminobiphenyl	KS
4-Bromophenyl phenyl ether	KS
4-Chloro-3-methylphenol	KS
4-Chloroaniline	KS
4-Chlorophenyl phenylether	KS
4-Dimethyl aminoazobenzene	KS
4-Methylphenol (p-Cresol)	KS
4-Nitroaniline	KS
4-Nitrophenol	KS
4-Nitroquinoline 1-oxide	KS
5-Nitro-o-toluidine	KS
7,12-Dimethylbenz(a) anthracene	KS
a-a-Dimethylphenethylamine	KS
Acenaphthene	KS
Acenaphthylene	KS
Acetophenone	KS
Aniline	KS
Anthracene	KS
Aramite	KS
Atrazine	KS
Benzaldehyde	KS
Benzidine	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Benzoic acid	KS
Benzyl alcohol	KS
Biphenyl	KS
bis(2-Chloroethoxy)methane	KS
bis(2-Chloroethyl) ether	KS
Butyl benzyl phthalate	KS
Caprolactam	KS
Carbazole	KS
Chlorobenzilate	KS
Chrysene	KS
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	KS
Diallate	KS
Dibenz(a,h) anthracene	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

Dibenzofuran	KS
Diethyl phthalate	KS
Dimethoate	KS
Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl phthalate	KS
Diphenylamine	KS
Disulfoton	KS
Ethyl methanesulfonate	KS
Famphur	KS
Fluoranthene	KS
Fluorene	KS
Hexachlorobenzene	KS
Hexachlorobutadiene	KS
Hexachlorocyclopentadiene	KS
Hexachloroethane	KS
Hexachlorophene	KS
Hexachloropropene	KS
Indeno(1,2,3-cd) pyrene	KS
Isodrin	KS
Isophorone	KS
Isosafrole	KS
Kepone	KS
Methapyrilene	KS
Methyl methanesulfonate	KS
Methyl parathion (Parathion, methyl)	KS
Naphthalene	KS
Nitrobenzene	KS
n-Nitrosodiethylamine	KS
n-Nitrosodimethylamine	KS
n-Nitroso-di-n-butylamine	KS
n-Nitrosodi-n-propylamine	KS
n-Nitrosodiphenylamine	KS
n-Nitrosomethylethalamine	KS
n-Nitrosomorpholine	KS
n-Nitrosopiperidine	KS
n-Nitrosopyrrolidine	KS
o,o,o-Triethyl phosphorothioate	KS
Parathion, ethyl	KS
Pentachlorobenzene	KS
Pentachloronitrobenzene	KS
Pentachlorophenol	KS
Phenacetin	KS
Phenanthrene	KS
Phenol	KS
Phorate	KS
p-Phenylenediamine	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

Pronamide (Kerb)	KS
Pyrene	KS
Pyridine	KS
Safrole	KS
Sulfotep (Tetraethyl dithiopyrophosphate)	KS
Thionazin (Zinophos)	KS
Method EPA 8270C SIM	
1-Methylnaphthalene	KS
2-Methylnaphthalene	KS
Acenaphthene	KS
Acenaphthylene	KS
Anthracene	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Chrysene	KS
Dibenz(a,h) anthracene	KS
Fluoranthene	KS
Fluorene	KS
Indeno(1,2,3-cd) pyrene	KS
Naphthalene	KS
Phenanthrene	KS
Pyrene	KS
Method EPA 9012A	
Amenable cyanide	KS
Cyanide	KS
Method EPA 9038	
Sulfate	KS
Method EPA 9056A	
Bromide	KS
Chloride	KS
Fluoride	KS
Iodide	KS
Nitrate	KS
Nitrite	KS
Sulfate	KS
Method EPA 9066	
Total phenolics	KS
Method EPA 9095B	
Paint Filter Test	KS
Method EPA RSK-175 (GC/FID)	
Ethane	KS
Ethene	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

Methane	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 18 of 26

Pace Analytical Services, Inc - Indianapolis IN **Primary AB**

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

Method EPA 1010A

Ignitability	KS

Method EPA 1311

Toxicity Characteristic Leaching Procedure (TCLP)	KS

Method EPA 1312

Synthetic Precipitation Leaching Procedure (SPLP)	KS

Method EPA 6010B

Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Calcium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Iron	KS
Lead	KS
Magnesium	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Potassium	KS
Selenium	KS
Silver	KS
Sodium	KS
Strontium	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS

Method EPA 6020

Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Cadmium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Lead	KS
Manganese	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***	**Primary AB**
Nickel	KS
Selenium	KS
Silver	KS
Thallium	KS
Vanadium	KS
Zinc	KS
Method EPA 7196A	
Chromium VI	KS
Method EPA 7470A	
Mercury	KS
Method EPA 7471A	
Mercury	KS
Method EPA 8015D	
Diesel range organics (DRO)	KS
Ethanol	KS
Ethylene glycol	KS
Gasoline range organics (GRO)	KS
Isobutyl alcohol (2-Methyl-1-propanol)	KS
Isopropyl alcohol (2-Propanol, Isopropanol)	KS
Methanol	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Propanol (1-Propanol)	KS
Propylene glycol	KS
Method EPA 8081B	
4,4'-DDD	KS
4,4'-DDE	KS
4,4'-DDT	KS
Aldrin	KS
alpha-BHC (alpha-Hexachlorocyclohexane)	KS
alpha-Chlordane, cis-Chlordane	KS
beta-BHC (beta-Hexachlorocyclohexane)	KS
Chlordane (tech.)(N.O.S.)	KS
delta-BHC	KS
Dieldrin	KS
Endosulfan I	KS
Endosulfan II	KS
Endosulfan sulfate	KS
Endrin	KS
Endrin aldehyde	KS
Endrin ketone	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS
gamma-Chlordane	KS
Heptachlor	KS
Heptachlor epoxide	KS
Methoxychlor	KS
Toxaphene (Chlorinated camphene)	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

Method EPA 8082A

Aroclor-1016 (PCB-1016)	KS
Aroclor-1221 (PCB-1221)	KS
Aroclor-1232 (PCB-1232)	KS
Aroclor-1242 (PCB-1242)	KS
Aroclor-1248 (PCB-1248)	KS
Aroclor-1254 (PCB-1254)	KS
Aroclor-1260 (PCB-1260)	KS

Method EPA 8141B

Atrazine	KS
Azinphos-methyl (Guthion)	KS
Chlorpyrifos	KS
Chlorpyrifos-methyl	KS
Demeton-o	KS
Demeton-s	KS
Diazinon	KS
Dichlorovos (DDVP, Dichlorvos)	KS
Dimethoate	KS
Disulfoton	KS
Famphur	KS
Malathion	KS
Merphos	KS
Methyl parathion (Parathion, methyl)	KS
Naled	KS
Parathion, ethyl	KS
Phorate	KS
Ronnel	KS
Simazine	KS
Terbufos	KS
Tetrachlorvinphos (Stirophos, Gardona) E-isomer	KS

Method EPA 8151A

2,4,5-T	KS
2,4-D	KS
2,4-DB	KS
3,5-Dichlorobenzoic acid	KS
Acifluorfen	KS
Bentazon	KS
Dalapon	KS
DCPA di acid degradate	KS
Dicamba	KS
Dichloroprop (Dichlorprop)	KS
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	KS
MCPA	KS
MCPP	KS
Pentachlorophenol	KS
Picloram	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

Silvex (2,4,5-TP)	KS
Method EPA 8260C	
1,1,1,2-Tetrachloroethane	KS
1,1,1-Trichloroethane	KS
1,1,2,2-Tetrachloroethane	KS
1,1,2-Trichloro-1,2,2-trifluoroethane	KS
1,1,2-Trichloroethane	KS
1,1-Dichloroethane	KS
1,1-Dichloroethylene	KS
1,1-Dichloropropene	KS
1,2,3-Trichlorobenzene	KS
1,2,3-Trichloropropane	KS
1,2,4-Trichlorobenzene	KS
1,2,4-Trimethylbenzene	KS
1,2-Dibromo-3-chloropropane (DBCP)	KS
1,2-Dibromoethane (EDB, Ethylene dibromide)	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Dichloroethane (Ethylene dichloride)	KS
1,2-Dichloropropane	KS
1,3,5-Trichlorobenzene	KS
1,3,5-Trimethylbenzene	KS
1,3-Dichlorobenzene	KS
1,3-Dichloropropane	KS
1,4-Dichlorobenzene	KS
1,4-Dioxane (1,4- Diethyleneoxide)	KS
1-Methylnaphthalene	KS
2,2-Dichloropropane	KS
2-Butanone (Methyl ethyl ketone, MEK)	KS
2-Chloroethyl vinyl ether	KS
2-Chlorotoluene	KS
2-Hexanone	KS
2-Methylnaphthalene	KS
4-Chlorotoluene	KS
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	KS
4-Methyl-2-pentanone (MIBK)	KS
Acetone	KS
Acetonitrile	KS
Acrolein (Propenal)	KS
Acrylonitrile	KS
Allyl chloride (3-Chloropropene)	KS
Benzene	KS
Bromobenzene	KS
Bromochloromethane	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon disulfide	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

Carbon tetrachloride	KS
Chlorobenzene	KS
Chlorodibromomethane	KS
Chloroethane (Ethyl chloride)	KS
Chloroform	KS
cis-1,2-Dichloroethylene	KS
cis-1,3-Dichloropropene	KS
Dibromomethane (Methylene bromide)	KS
Dichlorodifluoromethane (Freon-12)	KS
Diethyl ether	KS
Ethyl acetate	KS
Ethyl methacrylate	KS
Ethylbenzene	KS
Hexachlorobutadiene	KS
Iodomethane (Methyl iodide)	KS
Isopropylbenzene	KS
Methacrylonitrile	KS
Methyl bromide (Bromomethane)	KS
Methyl chloride (Chloromethane)	KS
Methyl methacrylate	KS
Methyl tert-butyl ether (MTBE)	KS
Methylene chloride (Dichloromethane)	KS
m-Xylene	KS
Naphthalene	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Butylbenzene	KS
n-Hexane	KS
n-Propylbenzene	KS
o-Xylene	KS
Propionitrile (Ethyl cyanide)	KS
p-Xylene	KS
sec-Butylbenzene	KS
Styrene	KS
tert-Butyl alcohol	KS
tert-Butylbenzene	KS
Tetrachloroethylene (Perchloroethylene)	KS
Toluene	KS
trans-1,2-Dichloroethylene	KS
trans-1,3-Dichloropropylene	KS
trans-1,4-Dichloro-2-butene	KS
Trichloroethene (Trichloroethylene)	KS
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	KS
Vinyl acetate	KS
Vinyl chloride	KS
Xylene (total)	KS

Method EPA 8270C

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
1,2,4,5-Tetrachlorobenzene	KS
1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Diphenylhydrazine	KS
1,3-Dichlorobenzene	KS
1,3-Dinitrobenzene (1,3-DNB)	KS
1,4-Dichlorobenzene	KS
1,4-Naphthoquinone	KS
1,4-Phenylenediamine	KS
1-Methylnaphthalene	KS
1-Naphthylamine	KS
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	KS
2,3,4,6-Tetrachlorophenol	KS
2,4,5-Trichlorophenol	KS
2,4,6-Trichlorophenol	KS
2,4-Dichlorophenol	KS
2,4-Dimethylphenol	KS
2,4-Dinitrophenol	KS
2,4-Dinitrotoluene (2,4-DNT)	KS
2,6-Dichlorophenol	KS
2,6-Dinitrotoluene (2,6-DNT)	KS
2-Acetylaminofluorene	KS
2-Chloronaphthalene	KS
2-Chlorophenol	KS
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	KS
2-Methylaniline (o-Toluidine)	KS
2-Methylaniline (o-Toluidine)	KS
2-Methylnaphthalene	KS
2-Methylphenol (o-Cresol)	KS
2-Naphthylamine	KS
2-Nitroaniline	KS
2-Nitrophenol	KS
2-Picoline (2-Methylpyridine)	KS
3,3'-Dichlorobenzidine	KS
3,3'-Dimethylbenzidine	KS
3-Methylcholanthrene	KS
3-Methylphenol (m-Cresol)	KS
3-Nitroaniline	KS
4-Aminobiphenyl	KS
4-Bromophenyl phenyl ether	KS
4-Chloro-3-methylphenol	KS
4-Chloroaniline	KS
4-Chlorophenyl phenylether	KS
4-Dimethyl aminoazobenzene	KS
4-Methylphenol (p-Cresol)	KS
4-Nitroaniline	KS
4-Nitrophenol	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
4-Nitroquinoline 1-oxide	KS
5-Nitro-o-toluidine	KS
7,12-Dimethylbenz(a) anthracene	KS
a-a-Dimethylphenethylamine	KS
Acenaphthene	KS
Acenaphthylene	KS
Acetophenone	KS
Aniline	KS
Anthracene	KS
Aramite	KS
Benzidine	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Benzoic acid	KS
Benzyl alcohol	KS
bis(2-Chloroethoxy)methane	KS
bis(2-Chloroethyl) ether	KS
Butyl benzyl phthalate	KS
Carbazole	KS
Chlorobenzilate	KS
Chrysene	KS
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	KS
Diallate	KS
Dibenz(a,h) anthracene	KS
Dibenzofuran	KS
Diethyl phthalate	KS
Dimethoate	KS
Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl phthalate	KS
Diphenylamine	KS
Disulfoton	KS
Ethyl methanesulfonate	KS
Famphur	KS
Fluoranthene	KS
Fluorene	KS
Hexachlorobenzene	KS
Hexachlorobutadiene	KS
Hexachlorocyclopentadiene	KS
Hexachloroethane	KS
Hexachlorophene	KS
Hexachloropropene	KS
Indeno(1,2,3-cd) pyrene	KS
Isodrin	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Isophorone	KS
Isosafrole	KS
Kepone	KS
Methapyrilene	KS
Methyl methanesulfonate	KS
Methyl parathion (Parathion, methyl)	KS
Naphthalene	KS
Nitrobenzene	KS
n-Nitrosodiethylamine	KS
n-Nitrosodimethylamine	KS
n-Nitroso-di-n-butylamine	KS
n-Nitrosodi-n-propylamine	KS
n-Nitrosodiphenylamine	KS
n-Nitrosomethylethalamine	KS
n-Nitrosomorpholine	KS
n-Nitrosopiperidine	KS
n-Nitrosopyrrolidine	KS
o,o,o-Triethyl phosphorothioate	KS
Parathion, ethyl	KS
Pentachlorobenzene	KS
Pentachloronitrobenzene	KS
Pentachlorophenol	KS
Phenacetin	KS
Phenanthrene	KS
Phenol	KS
Phorate	KS
Pronamide (Kerb)	KS
Pyrene	KS
Pyridine	KS
Safrole	KS
Sulfotep (Tetraethyl dithiopyrophosphate)	KS
Thionazin (Zinophos)	KS
Method EPA 8270C SIM	
1-Methylnaphthalene	KS
2-Methylnaphthalene	KS
Acenaphthene	KS
Acenaphthylene	KS
Anthracene	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Chrysene	KS
Dibenz(a,h) anthracene	KS
Fluoranthene	KS

Appendix 1. Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Pace Analytical Services, Inc - Indianapolis IN

	Primary AB
Program/Matrix: ***RCRA (Solid & Hazardous Material)***	
Fluorene	KS
Indeno(1,2,3-cd) pyrene	KS
Naphthalene	KS
Phenanthrene	KS
Pyrene	KS
Method EPA 9012A	
Amenable cyanide	KS
Cyanide	KS
Method EPA 9045C	
pH	KS
Method EPA 9066	
Total phenolics	KS
Method EPA 9095B	
Paint Filter Test	KS

End of Scope of Accreditation