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2020 Probabilistic Monitoring Work Plan for the West Fork and Lower White River Basin

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Work Plan Organization

This work plan is an extension of the existing Indiana Department of Environmental Management (IDEM) Office of Water Quality (OWQ), Watershed Assessment and Planning Branch (WAPB), March 2017 Quality Assurance Project Plan (QAPP) for Indiana Surface Water Programs (Surface Water QAPP) (IDEM 2017a). Per the United States Environmental Protection Agency (U.S. EPA) Guidance on Systematic Planning using the Data Quality Objectives (DQO) Process (U.S. EPA 2006) and the U.S. EPA Guidance for Quality Assurance Project Plans (U.S. EPA 2002), this work plan establishes criteria and specifications pertaining to a specific water quality monitoring project that are usually described in the following four QAPP groups and associated elements.

Group A. Project Management

- Project Objective
- Project Organization and Schedule
- Project Description
- Data Quality Objectives
- Training and Staffing Requirements

Group B. Data Generation and Acquisition

- Sampling Sites and Sampling Design
- Sampling Methods and Sample Handling
- Analytical Methods
- Quality Control and Custody Requirements
- Field Parameter Measurement and Instrument Testing and Calibration

Group C. Assessment and Oversight

- Data Quality Assessments Levels (DQAs)

Group D. Data Validation and Usability

- Quality Assurance, Data Qualifiers, and Flags
- Data Usability
- Information, Data, and Reports
- Laboratory and Estimated Costs

Table of Contents

List of Figures

List of Tables

List of Attachments

List of Appendices

List of Acronyms

AIMS	Assessment Information Management System
ALUS	Aquatic Life Use Support
ASTM	American Society for Testing and Materials
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
IAC	Indiana Administrative Code
IBI	Index of Biotic Integrity
MHAB	Multihabitat
NHD	National Hydrography Database
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
QHEI	Qualitative Habitat Evaluation Index
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	Reaches of waterbodies with similar features assigned unique identifiers to which all assessment information for that 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 1 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 of shoreline habitat in a stream or river is sampled with a standard 500 micrometer mesh width D-frame dip net 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 that is flooded in wet seasons and typically remains waterlogged at all times.
One (1) minute kick sample	A component of the IDEM multihabitat macroinvertebrate sampling method in which approximately 1 m^2 of riffle or run substrate habitat in a stream or river is sampled with a standard 500 μm mesh width D-frame dip net for approximately 1 minute.
Ocular reticle	A thin piece of glass marked with a linear or areal scale that is inserted into a microscope ocular, superimposing the scale onto the image viewed through the microscope.

Perennial Stream	A stream that has 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.
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.
Seston	Organisms and nonliving matter swimming or floating in a water body.
Target	A sampling point which falls on a perennial stream within the basin of interest and the boundaries of Indiana.
Wetland	Land areas that are wet for at least part of the year, are poorly drained, and are characterized by hydrophytic vegetation, hydric soils, and wetland hydrology.

A. Project Management

A.1. Project Objective

The main objective of the probabilistic monitoring project is to provide a comprehensive, unbiased assessment of the ability of rivers and streams in the West Fork and lower White River basin to support aquatic life and recreational uses. A secondary objective is diatom identification and enumeration, with the goal of developing algal metrics as an assessment tool to support nutrient criteria. Sampling begins in May and continues through October 2020, conditions permitting, with collected samples analyzed for chemical, physical, and biological parameters. Laboratory processing and data analysis will continue through spring of 2021. Data collected during probabilistic monitoring is used for the following purposes:

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

A.2. Project Organization and Schedule

Table 1. 2020 Probabilistic Monitoring Tasks, Schedule, and Evaluation

Activity	Date(s)	Number of Sites	Frequency of Sampling Related Activity	Parameter to be Sampled	How Evaluated
Site selection	Dec 2019	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, and 4th + stream order sites
Site reconnaissance	Jan 20 – Mar 25 2020	All 100 sites	At least one visit but may require several to obtain final approval		Land owner approval, stream access, and safety characteristics for the first 75 “Target” sites; “Nontarget” designations for remaining 25 sites.
Bacteriological sampling	Sep 28 – Oct 30 2020	First 40 target sites	Five times at equally-spaced intervals over a 30 calendar-day period	*Escherichia coli (E. coli)*	Geometric mean (action level is ≥125 colony forming units (CFU)/100mL or ≥125 most probable number (MPN)/100 mL); sampled during recreational season (Apr – Oct)
Biological sampling	Jun – mid Nov 2020	First 38 target sites and four targeted mainstem White River sites	Fish community (Jun 1 – Oct 15) Macroinvertebrate community (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. 2020 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	May – Sept or Oct 2020	First 45 target sites and four targeted mainstem White River sites	Once each in May, Jun or July, and Sept or Oct with a minimum 30 days between sampling events	Total phosphorous nitrogen, nitrate + nitrite dissolved oxygen (D,O,) pH Algal conditions Dissolved metals (See Table 9) 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); >12 mg/L (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
	Jun – Sept 2020	Subset of 18 target sites	Once each in Jun, Aug, and Sept 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	Sept – Oct 2020	First 45 target sites and four targeted White River mainstem sites	Once with the 3rd water chemistry sample in Sept or Oct	Algal diatoms Algal biomass	Diatom identification and enumeration Chlorophyll *a*
D.O. continuous monitoring	Jul – Aug 2020	Subset of 18 target sites	Once in Jul with 2 week deployment at 14 sites	D. O. Temperature	Minimum, maximum, and average change in D.O. for the 2 week period. Minimum, maximum, and average change in temperature for the 2 week period.

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

A.3. Background and Project Description

The Probabilistic Monitoring Program, created in 1996, operates in the WAPB of IDEM. Other organizations assisting with data preparation, collection, and analysis include private laboratories under contract with the State of Indiana (e.g., Pace Analytical, Pace Laboratory Inc. accreditation documents Appendix 1), 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 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 of all Indiana streams' ability 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 Section B Data Generation and Acquisition for random site selection details, (QAPP Element B1, IDEM 2017a). For target sites, the following categories of data are investigated and utilized for assessment purposes: bacteriological contamination, indicated by *E. coli* counts; water chemistry; algal samples (seston and periphyton); fish and macroinvertebrate communities; and habitat evaluations. At a subset of 18 target sites, Onset Hobo® U26-001 D.O. data loggers record diel D.O. and temperature swings.

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

A.4. Data Quality Objectives (DQO)

The 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. The DQO process is recommended for all significant data collection efforts of a project. The process is a seven-step systematic planning process used to clarify study objectives, define the types of data needed to achieve the objectives, and establish decision criteria for evaluating data quality. The DQO process for the Probabilistic Monitoring Program is identified in the following seven steps.

1. State the Problem

Assessments: Indiana is required to assess all waters of the state to determine their designated use attainment status. “Surface waters of the state are designated for full-body contact recreation” and “will be capable of supporting” a “well-balanced, warm water aquatic community” [327 IAC 2-1-3]. This project gathers bacteriological; biological (algal, fish, and macroinvertebrate communities); chemical; and habitat data for the purpose of assessing the designated use attainment status of streams in the West Fork and Lower White River Basin.

Nutrient Criteria: The U.S. EPA mandated that states 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). An extension was given to several states, including Indiana, submitting plans which describe data needs, analyses, and protocols for developing nutrient water quality criteria. Since 2001, IDEM and the Unites States Geological Survey (USGS) have collaborated on several projects which provide the technical background for developing nutrient criteria for rivers and streams in Indiana. The U.S. EPA has recommended a multiple-lines-of-evidence approach for developing nutrient criteria and approved the implementation of a program that includes the identification and enumeration of diatoms. In order to develop numeric nutrient criteria for rivers and streams in Indiana, IDEM and the USGS have statistically analyzed water chemistry, fish, macroinvertebrate, and chlorophyll data from 2005–2009 (Caskey et al. 2013). Taxonomic analysis of periphyton samples and diel D.O. add another line of evidence in the development of nutrient criteria.

2. Identify the Goals of the Study

An objective is to produce a statistically valid estimation of the percent of stream miles supporting or nonsupporting for aquatic life use and recreational use in the West Fork and Lower White River basin. To produce this 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) which has not yet been drafted but is based upon Indiana’s 2018 CALM (IDEM 2018a) and the water quality criteria shown in Table 2 [327 IAC 2-1-6].

In addition to the chemical and bacteriological criteria listed in Table 2, evaluate data for several nutrient parameters against the benchmarks listed below (IDEM 2020). Assuming a minimum of three sampling events, if two or more of the conditions below are met on the same date, classify the waterbody 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
- D.O: one or more measurements <4.0 mg/L, or measurements that are consistently at/close to the standard, in the range of 4.0-5.0 mg/L, or >12.0 mg/L

- 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. Further explanation of this observance is documented in B.4. Quality Control and Custody Requirements in 3. Algal Community Data.

a. Biological Criteria:
Indiana narrative biological criteria [327 IAC 2-1-3] states that “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 that: (A) is diverse in species composition; (B) contains several different trophic levels; and (C) is not composed mainly of pollution tolerant species” [327 IAC 2-1-9]. An interpretation or translation of narrative biological criteria into numeric criteria would be as 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 2020).

Nutrient criteria and algal numeric criteria are being developed through the collection of benthic diatoms, chemical, and chlorophyll *a* data from each site, along with field parameters and physical site descriptions. Once collected, preserve and transport samples to the IDEM OWQ WAPB Shadeland laboratories (Shadeland laboratory). Georgia College and State University, Department of Biological and Environmental Sciences (Milledgeville, Georgia) will identify and enumerate diatoms as part of the development of algal metrics.

Following the assessment of each site sampled in the West Fork and Lower White River basin, calculate the percent of stream miles attaining and not attaining recreational use and aquatic life use designations. First a spreadsheet is developed which lists the following site information:

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

Analyze data using a software package (*spsurvey*) used with the R statistics environment (IDEM 2020a DRAFT). Instructions on how to download and use the software are available at: http://archive.epa.gov/nheerl/arm/web/html/software.html. The end product of this analysis is an estimate of the number of stream miles that are impaired (or not) along with confidence intervals for that particular basin. Report calculated mileages to U.S. EPA in the 2022 update of Integrated Report. List sites designated as not attaining recreational use criteria or the aquatic life use support (ALUS) in the CWA section 303(d) List of Impaired Waters for Indiana (Consolidated List). Sites, designated as ALUS nonsupporting, may be considered for possible additional sampling to determine the extent, causes, and likely sources of the ALUS nonattainment area in a Targeted Monitoring Program watershed characterization project.

Use site-specific data to classify associated assessment units into one of five major categories in the state’s Consolidated List (IDEM 2020b), which will be included in IDEM’s 2020 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
D.O.	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 shall not be less than 7.0 mg/L in areas where spawning occurs during the spawning season and in areas used for imprinting during the time salmonids are being imprinted.
pH	6.0 – 9.0 SU	Must remain between 6.0 and 9.0 SU except for daily fluctuations that exceed 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	Five sample geometric mean based on at least five samples equally spaced over a 30 day period Not to exceed in any one sample in a 30 day period except in cases where there are at least 10 samples, 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 those 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

Under the probabilistic design, field monitoring activities are required to collect physical, chemical, algal, bacteriological, biological, and habitat data. These data are required to address the necessary decisions previously described. Monitoring activities take place at target sites for which permission to access has been granted by the necessary landowners or property managers. 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. Collection procedures for field measurements, bacteriological, algal, chemical, biological, and habitat data are described in detail under B. Data Generation and Acquisition.

4. Define the Boundaries for the Study

For the purpose of this program, the West Fork and Lower White River basin (Figure 1) are geographically defined as within the borders of Indiana contained within the eight-digit Hydrologic Unit Codes 05120201, 05120202, and 05120203. This area includes:

- The upper White River subbasin (05120201) located in central Indiana drains approximately 2719 square miles. Using the 2011 National Land Cover Database for the Conterminous United States, predominant land uses are cropland (54%), urban (26%), forest (13%), and pasture (5%) (Homer et al. 2015).
- The lower White River subbasin (05120202) located in southwestern Indiana drains approximately 1658 square miles within Indiana borders. Predominant land uses are cropland (43%), forest (38%), pasture (8%), and urban (6%) (Homer et al. 2015).
- The Eel River subbasin (05120203) located in west central Indiana drains approximately 1206 square miles within Indiana borders. Predominant land uses are cropland (55%), forest (29%), pasture (8%), and urban (6%) (Homer et al. 2015).

The target sample population for the basin is defined as all perennial streams in the West Fork and Lower White River basin that lie within the geographic boundaries of Indiana. The sample frame is comprised of all rivers, streams, canals, and ditches as indexed through the NHD-Plus dataset (U.S. EPA and USGS 2005). Considered as excluded nontarget populations are marshes, wetlands, backwaters, impoundments, dry sites, and streams with no apparent channel (i.e., submerged, or run underground either through natural processes or by anthropogenic channel alterations). Table 3 gives the site status for 100 potential sampling sites for the West Fork of the White River basin. From these 100 potential sites, sample the first 45 target sites for physical, chemical, and algal parameters. Sample four additional mainstem White River sites (beyond the first 45 targeted sites) for the White River Mainstem Monitoring Project. Complete bacteriological sampling at the first 40 target sites. Sample biological communities and habitat information at the first 38 target sites (plus the four additional mainstem White River sites). Sample 18 target sites for diel D.O. 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 (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). Use R to calculate the percent of perennial stream miles in the basin that support or do not support aquatic life and recreational uses (IDEM 2020a DRAFT). Sites listed as "Other, Deadline 3/25/2020" in Table 3 were thought to be part of the target population. However, the landowner could not be contacted before the site reconnaissance deadline which occurred on March 25, 2020.

5. Develop the Analytical Approach

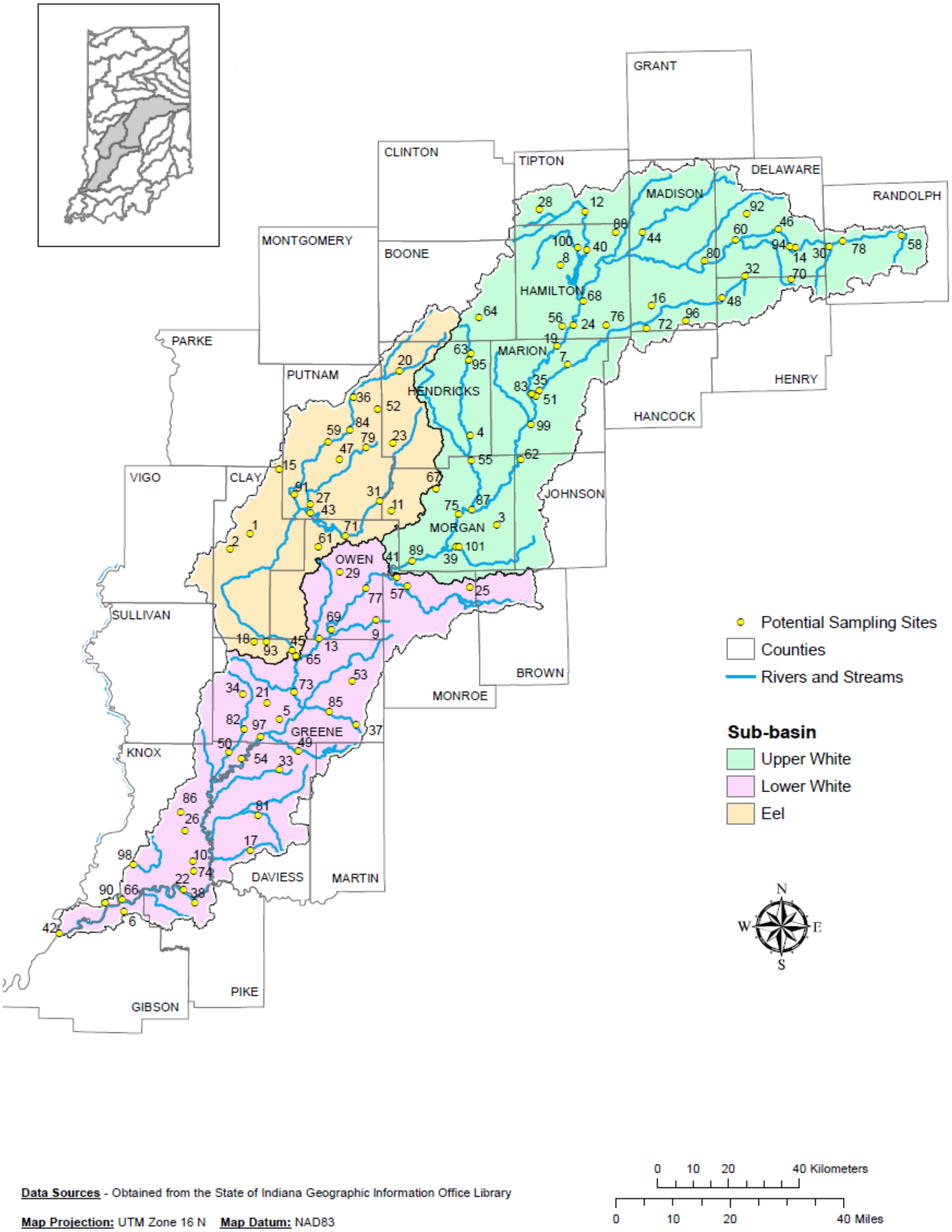
Collect samples for physical, chemical, bacteriological parameters, and algal and biological communities, if the flow is not dangerous for staff to enter the stream (e.g., water levels at or below median base flow); barring any hazardous weather conditions (e.g., thunderstorms or heavy rain in the vicinity); or unexpected physical barriers to accessing the site. The field crew chief makes the final determination as to whether or not a stream is safe to enter. Even if the weather conditions and stream flow are safe, sample collections for algal and biological communities may be postponed 1 to 4 weeks at a particular site due to scouring of the stream substrate or instream cover following a high water event resulting in nonrepresentative samples.

For assessment purposes in the Integrated Report, include independent evaluations of chemical, biological, and bacteriological criteria as outlined in Indiana's 2018 CALM (IDEM 2020b, pp. 18–21) in aquatic life use and recreational use support decisions. Evaluate fish communities at each site using the appropriate IBI (Dufour 2002; Simon 1992, DRAFT; Simon and Dufour, 1998, 2005). Also 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 scores are less than 36. Where biological or chemical criteria are nonsupporting for aquatic life use, the site may be considered for possible additional as a Targeted Monitoring Program watershed characterization sampling project to determine the extent, causes, and likely sources of the ALUS nonattainment area.

Make statistical estimations of the percentage of perennial stream miles in the West Fork and lower White River basin that support or do not support aquatic life and 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 2020a DRAFT). Publish the percent attainment and nonattainment for the target population (West Fork and lower White River basin) in a table within the 2022 Integrated Report.

Once determined, IDEM's intention is to use algal metrics as part of nutrient criteria being developed for Indiana's surface waters. Eventually, IDEM plans to use algal metrics with macroinvertebrate and fish metrics for ALUS decisions. Given that ecological tolerances for many diatom species are known, changes in diatom community composition can be used to diagnose the environmental stressors affecting ecological health (Stevenson 1998; Stevenson and Pan 1999). Thus, periphyton IBI metrics have been developed and tested in many regions (Kentucky Department of Environmental Protection 1993; Hill et al. 1997). The periphyton communities may be used to assess biological integrity of a waterbody without any other information. However, periphyton are most effective when used with habitat and macroinvertebrate assessments, due particularly to the close relationship between periphyton and these elements of stream ecosystems (Barbour et al. 1999). For this reason, conduct algal sampling at the same sites where macroinvertebrates, fish, habitat, chemical, and physical data are collected as part of the Probabilistic Monitoring Program.

Figure 1. Potential Sampling Sites for the West Fork and Lower White River Basin.



Data Sources - Obtained from the State of Indiana Geographic Information Office Library

Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Mapped By: Joanna Wood, Office of Water Quality **Date:** 02/05/2020

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

Table 3. List of Potential Sites for the West Fork and Lower White River Basin. Potential Diel Dissolved Oxygen sites are marked with [1]. White River Mainstem Monitoring Project sites are marked with [2].

Site #	AIMS Site Name	Stream Name and Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)	Topo	Stream Order	Site Status
1	WWE-06-0006	Prairie Creek	Clay	39.43617067	-87.11946447	G-05	1	Non-target, Access Denied
2	WWE-06-0007	Brush Creek	Clay	39.39600528	-87.18466395	G-04	1	Other, Deadline 2/24/2020
3	WWU-14-0006	South Prong Stotts Creek	Morgan	39.45451631	-86.30951169	G-11	2	Non-target, Access Denied
4	WWU-13-0008	White Lick Creek @ Hummel Park	Hendricks	39.68308646	-86.39500045	F-33	3	Target, Approved
5	WWL-05-0013	Timmons Ditch @ SR 57	Greene	38.96404133	-87.02253569	H-29	1	Target, Approved
6	WWL-10-0047	Tributary of Robb Creek @ SR 56	Gibson	38.47457923	-87.52564340	I-43	1	Target, Approved
7	WWU-09-0028	Fall Creek @ Fall Creek	Marion	39.86168536	-86.07178215	F-13	3	Target, Approved
8	WWU-06-0010	Hinkle Creek @ 225th Street	Hamilton	40.11457845	-86.09291521	E-36	3	Target, Approved
9	WWL-02-0006	Raccoon Creek	Owen	39.21428561	-86.70640670	G-55	1	Other, Deadline 2/24/2020
10	WWL-09-0002	Kessinger Ditch @ Burke Road	Knox	38.60321721	-87.30376839	I-25	3	Target, Approved
11	WWE-05-0010	Rhodes Creek	Morgan	39.49265040	-86.65474273	G-08	2	Other, Deadline 2/24/2020
12	WWU-06-0014	Cicero Creek @ CR 400 South	Tipton	40.25065069	-86.00815399	D-59	3	Target, Approved
13 [1,2]	WWL-02-0007	White River @ CR 990 North	Greene	39.16583673	-86.89300152	G-53	5	Target, Approved
14 [1,2]	WWU-01-0012	White River @ Windsor Road	Delaware	40.14878125	-85.31327823	E-19	4	Target, Approved
15	WWE-07-0011	Alma Creek	Clay	39.59953056	-87.02428194	F-51	1	Other, Deadline 2/24/2020
16 [1]	WWU-08-0012	Foster Branch @ CR 600 West	Madison	40.00821496	-85.79110267	E-38	1	Target, Approved
17	WWL-09-0003	Veale Creek @ CR 200 South	Daviess	38.62954606	-87.11627138	I-05	1	Target, Approved
18	WWE-08-0011	Howesville Ditch	Greene	39.15963040	-87.10603637	G-52	2	Other, Deadline 2/24/2020
19 [1,2]	WWU-10-0040	White River @ 86th Street	Marion	39.91005074	-86.10532505	E-59	5	Target, Approved
20	WWE-01-0006	East Fork Big Walnut Creek	Hendricks	39.84921753	-86.62793905	F-08	1	Other, Deadline 2/24/2020
21	WWL-05-0014	Fourmile Ditch	Greene	39.00530111	-87.06294030	H-06	2	Other, Deadline 2/24/2020
22 [1,2]	WWL-10-0048	White River @ River Road	Pike	38.52896441	-87.33520865	I-25	7	Target, Approved
23	WWE-05-0014	Tributary of Mill Creek	Hendricks	39.66464281	-86.64893952	F-31	1	Other, Deadline 2/24/2020
24 [1,2]	WWU-10-0037	White River @ River Road Park	Hamilton	39.96802202	-86.04920433	E-59	5	Target, Approved
25 [1]	WWL-01-0047	North Fork Honey Creek @ Low Gap Road	Monroe	39.29601664	-86.40078235	G-33	1	Target, Approved
26 [1]	WWL-09-0006	Roberson Ditch @ SR 550	Knox	38.68154809	-87.32943113	I-03	2	Target, Approved
27	WWE-03-0003	Deer Creek	Putnam	39.50912616	-86.92233910	F-52	3	Non-target, Access Denied
28	WWU-06-0011	Kigin Ditch	Tipton	40.25587998	-86.16044097	D-58	1	Non-target, Dry
29 [1]	WWL-02-0008	Rattlesnake Creek @ Rattlesnake Road	Owen	39.33676091	-86.82530413	G-30	1	Target, Approved
30	WWU-01-0016	Stoney Creek @ CR 130 South	Randolph	40.15028403	-85.20054655	E-20	3	Target, Approved
31	WWE-05-0011	Mill Creek @ CR 875 East	Putnam	39.51906031	-86.69345794	F-54	3	Target, Approved
32	WWU-02-0006	Bell Creek	Delaware	40.08148728	-85.48103111	E-41	2	Other, Deadline 2/24/2020
33	WWL-05-0017	Kane Ditch @ CR 800 East	Daviess	38.83521868	-87.02355406	H-52	1	Target, Approved
34	WWL-06-0122	Tributary of Beehunter Ditch @ Base Line Road	Greene	39.02817538	-87.14272601	H-05	1	Non-target, Access Denied
35	WWU-09-0029	Fall Creek	Marion	39.79684767	-86.16635260	F-12	3	Other, Unsafe
36	WWE-04-0009	Big Walnut Creek @ Big Walnut Nature Preserve	Putnam	39.78203695	-86.77849535	F-07	3	Target, Approved
37	WWL-03-0054	Plummer Creek @ Mineral-Koleen Road	Greene	38.95110089	-86.77240797	H-31	1	Target, Approved
38	WWL-10-0049	Prides Creek @ Spruce Street	Pike	38.49461710	-87.29888694	I-45	2	Target, Approved
39	WWU-16-0006	Indian Creek @ Burton Lane	Morgan	39.40039310	-86.44416074	G-10	2	Target, Approved
40 [1]	WWU-06-0012	Cicero Creek @ Beechwood Drive	Hamilton	40.15210525	-86.00392953	E-13	3	Target, Approved
41	WWL-01-0048	Beanblossom Creek @ Brighton Road	Monroe	39.32346808	-86.63789383	G-31	3	Target, Approved
42 [1,2]	WWL-10-0050	White River @ CR 400 N	Gibson	38.41697729	-87.73508944	I-42	7	Target, Approved
43	WWE-05-0012	Mill Creek @ Cagles Mill Dam	Putnam	39.48739810	-86.92139927	G-06	3	Target, Approved
44	WWU-04-0003	Pipe Creek	Madison	40.19474614	-85.81897944	E-15	2	Other, Deadline 2/24/2020
45	WWE-08-0012	Lemon Creek @ CR 200 West	Greene	39.13973979	-86.98136040	G-53	2	Target, Approved
46 [1,2]	WWU-01-0013	White River @ Bunch Boulevard	Delaware	40.19655500	-85.36724566	E-19	4	Target, Approved
47	WWE-03-0005	Owl Branch @ Airport Road	Putnam	39.62542224	-86.82456911	F-30	1	Target, Approved
48 [1]	WWU-08-0009	Fall Creek @ Mechanicsburg Road	Henry	40.02490676	-85.55739396	E-40	2	Target, Approved
49	WWL-05-0015	First Creek @ CR 1100 East	Daviess	38.88216985	-86.96142042	H-30	2	Target, Approved
50	WWL-06-0124	Black Creek @ SR 59	Knox	38.87991898	-87.18747512	H-28	3	Target, Approved

Table 3 (continued). List of Potential Sites for the West Fork and Lower White River Basin.

Site #	AIMS Site Name	Stream Name and Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)	Topo	Stream Order	Site Status
51	WWU-09-0030	Fall Creek	Marion	39.78176923	-86.17715898	F-12	3	Other, Unsafe
52	WWE-04-0010	Clear Creek @ Victory Hill Court	Putnam	39.75198905	-86.69900663	F-08	1	Target, Approved
53	WWL-03-0055	Beech Creek @ Ray Road	Greene	39.05918598	-86.78483287	H-08	1	Target, Approved
54	WWL-05-0018	White River	Knox	38.86452094	-87.14723608	H-51	6	Non-target, Channel Missing
55 [1]	WWU-13-0009	McCracken Creek @ White Lick Road	Morgan	39.61927678	-86.39239267	F-56	2	Target, Approved
56	WWU-10-0038	Cool Creek @ Flowing Well Park	Hamilton	39.95825180	-86.08785891	E-59	2	Target, Approved
57	WWL-01-0049	Beanblossom Creek @ North Bottom Road	Monroe	39.30186105	-86.60430299	G-32	3	Target, Approved
58	WWU-01-0014	Peach Creek @ Winchester Street Department	Randolph	40.17465380	-84.95993069	E-22	2	Target, Approved
59	WWE-04-0011	Big Walnut Creek @ Greencastle Filtration Plant	Putnam	39.66924701	-86.86278354	F-30	3	Target, Approved
60	WWU-03-0006	White River @ Yorktown WWTP	Delaware	40.17349519	-85.51003062	E-17	4	Target, Approved
61	WWE-07-0012	Jordan Creek @ Lower Cliff Road	Owen	39.40260131	-86.89543747	G-06	1	Target, Approved
62	WWU-12-0036	Pleasant Run Creek	Johnson	39.62017400	-86.22903018	F-58	2	Other, Deadline 2/24/2020
63	WWU-13-0010	White Lick Creek @ Maloney Road	Hendricks	39.89106348	-86.39064359	E-56	2	Target, Approved
64	WWU-11-0026	Fishback Creek @ CR 575 East	Boone	39.98352460	-86.36266380	E-57	1	Target, Approved
65	WWE-08-0013	Eel River @ US 231	Greene	39.12439198	-86.97075720	G-53	5	Target, Approved
66 [1,2]	WWL-10-0051	White River @ 1st Street	Gibson	38.50439349	-87.53305243	I-23	7	Target, Approved
67	WWU-15-0004	Tributary of Lambs Creek @ Hurt Road	Morgan	39.54793311	-86.50774467	F-55	1	Target, Approved
68	WWU-07-0004	White River @ Noblesville Landfill	Hamilton	40.02340560	-86.01706562	E-36	4	Target, Approved
69	WWL-02-0009	White River @ Worthington Public Access	Owen	39.19102851	-86.85242940	G-54	5	Target, Approved
70	WWU-02-0007	Buck Creek	Henry	40.06886771	-85.32905657	E-42	1	Other, Deadline 2/24/2020
71	WWE-05-0013	Mill Creek @ Owen Park Road	Owen	39.42879834	-86.80781260	G-07	3	Target, Approved
72	WWU-08-0010	Lick Creek @ Lick Creek Drive	Madison	39.94995655	-85.80949086	E-61	2	Target, Approved
73	WWL-04-0005	Lattas Creek @ River Road	Greene	39.03422523	-86.97556884	H-07	3	Non-target, Impounded
74	WWL-09-0004	Kessinger Ditch @ Petersburg Road	Knox	38.57753855	-87.30133800	I-25	3	Target, Approved
75	WWU-15-0005	White River @ Three Rivers Public Fishing Area	Morgan	39.48405855	-86.43464294	G-10	5	Target, Approved
76	WWU-09-0031	Mud Creek @ Brook School Park	Hamilton	39.96065998	-85.94291371	E-60	1	Target, Approved
77	WWL-02-0010	White River @ McCormicks Creek State Park	Owen	39.29620186	-86.73915920	G-31	5	Target, Approved
78	WWU-01-0017	Cabin Creek	Randolph	40.16432692	-85.15572910	E-20	1	Target, Approved
79	WWE-03-0004	Deer Creek @ CR 50 South	Putnam	39.65406210	-86.73839662	F-31	1	Target, Approved
80	WWU-03-0007	White River @ Holiday KOA	Madison	40.12135319	-85.61353849	E-40	4	Target, Approved
81	WWL-07-0005	Antioch Creek @ CR 500 N	Daviess	38.72019440	-87.09249603	I-05	1	Target, Approved
82	WWL-06-0123	Black Creek	Greene	38.93882196	-87.13790671	H-28	3	Target, Approved
83	WWU-10-0039	White River @ Waterway Blvd	Marion	39.78627603	-86.19242035	F-12	5	Target, Approved
84	WWE-04-0012	Big Walnut Creek	Putnam	39.69987571	-86.79008083	F-30	3	Target, Approved
85	WWL-03-0056	Plummer Creek	Greene	38.98453908	-86.86078430	H-31	3	Target, Approved
86	WWL-09-0005	Indian Creek @ Royal Oak Church Road	Knox	38.72705899	-87.34320841	I-03	1	Target, Approved
87 [1,2]	WWU-15-0006	White River @ Blue Bluff Road	Morgan	39.49390576	-86.39260709	G-10	5	Target, Approved
88	WWU-05-0003	Bear Creek	Hamilton	40.19485423	-85.90711109	E-14	1	Target, Approved
89	WWU-17-0008	White River @ Burton Road	Morgan	39.36515594	-86.58811886	G-32	5	Target, Approved
90	WWL-10-0052	White River @ Decker Chapel Road	Knox	38.49630166	-87.58691527	I-43	7	Target, Approved
91	WWE-04-0013	Big Walnut Creek	Putnam	39.53429472	-86.97413821	F-52	4	Target, Approved
92	WWU-03-0008	Jakes Creek	Delaware	40.23891249	-85.47180604	E-18	1	Target, Approved
93	WWE-08-0014	Howesville Ditch @ CR 700 W	Greene	39.16043218	-87.06506893	G-52	2	Target, Approved
94	WWU-01-0015	White River @ Inlow Springs Road	Delaware	40.15291392	-85.33142075	E-19	4	Target, Approved
95	WWU-13-0011	White Lick Creek @ Connection Point Christian Church	Hendricks	39.87457130	-86.39791376	F-10	2	Target, Approved
96	WWU-08-0011	Lick Creek	Madison	39.96775252	-85.68021263	E-62	2	Target, Approved
97	WWL-05-0016	White River @ Semullberry Lane	Greene	38.91825474	-87.08475902	H-29	6	Target, Approved
98	WWL-10-0053	Upper River Deshee	Knox	38.59447362	-87.49676525	I-24	2	Target, Approved
99	WWU-12-0037	Lick Creek	Marion	39.70872765	-86.19478059	F-35	2	Target, Approved
100	WWU-06-0013	Little Cicero Creek @ 256th Street	Hamilton	40.15799251	-86.03307494	E-13	2	Target, Approved
102 [1,2]	WWL-05-0021	West Fork White River @ Riverdale Road	Daviess	38.82692921	-87.18619997	H-51	6	Target, Approved
166 [1,2]	WWL-08-0008	West Fork White River @ CR 400 W	Daviess	38.71948081	-87.25622050	I-03	6	Target, Approved

6. Specify Performance or Acceptance Criteria

Good quality data are essential for minimizing decision error. By identifying errors in the sampling design, measurement, and laboratory for physical, chemical, and biological parameters, more confidence can be placed in the percentage of perennial stream miles in the river basin that support or do not support aquatic life and recreational uses, and in algal metrics produced. In this project, making decisions protective of human health and the environment are desired. 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 below.

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 the confidence level is reached 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. These 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 (IDEM 2002;) and Standard Operating Procedures (SOP)s (IDEM 1992a, 1992b, 1992c, 2015a, 2018c, 2019a, 2019b, 2019c, 2020d).

The QA/QC process detects deficiencies in the data collection as set forth in the Surface Water QAPP (IDEM 2017a). The QAPP requires 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. Do not use any data which is "Rejected" due to analytical problems or errors for water quality assessment decisions. Any data flagged as "Estimated" may be used on a case by case basis and is noted in the QA/QC report. Criteria for acceptance or rejection of results as well as application of data quality flags is presented in the Surface Water QAPP (2017a, Table D3-1: Data Qualifiers and Flags, p. 184). Precision and accuracy goals with acceptance limits for applicable analytical methods are provided in the Surface Water QAPP (2017a Table A7-1): Precision and Accuracy Goals for Data Acceptability by Matrix (2017a pp. 61–63; and Table B2.1.1.8-2 Field Parameters, p. 117). Conduct further investigation in response to consistent "rejected" data to determine the source of error. Field techniques used during sample collection and preparation, and laboratory procedures are subject to evaluation by both the WAPB QA manager and project manager in troubleshooting error introduced throughout the entire data collection process. Implement corrective actions once the source of error is determined, Surface Water QAPP (IDEM 2017a).

If funding and resources are available, verify results showing nonsupport for aquatic life use through a targeted monitoring program prior to completion of the Integrated Report. Stream reaches showing nonsupport may also be verified through the TMDL development process.

7. Develop the Plan for Obtaining Data

The rotating basin, probability design is optimal for assessing 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 that are nonsupporting for aquatic life and recreational uses. The estimations are derived from total perennial stream miles in the basin of interest and the design requires minimal use of sampling and staff resources (B.1. Sampling Design and Site Locations).

Periphyton communities are impacted by habitat and macroinvertebrate community structure. Thus, to develop algal metrics and subsequent nutrient criteria, collect algal samples from the same sites generated using the rotating basin, probability design from which fish and macroinvertebrate communities, and habitat data are collected.

A.5. Training and Staffing Requirements

Table 5. Project Roles, Experience, and Training

Role	Required Training/Experience	Responsibilities	Training References
Project manager	-Bachelor of Science Degree in biology or other closely related area plus 4 years of experience in aquatic ecosystems (master's degree with 2 years aquatic ecosystems experience may substitute) -Database experience -Experience in project management and QA/QC procedures	-Establish project in the Assessment Information Management System (AIMS) II database -Oversee development of project work plan -Oversee entry and QC of field data -Query data from AIMS II to determine results not meeting water quality criteria -Calculate predicted percentage of perennial stream miles nonsupporting for aquatic	-AIMS II database User Guide -IDEM 2020a DRAFT, 2020b -U.S. EPA 2006

Role	Required Training/Experience	Responsibilities	Training References
		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 1 year of experience in sampling methodology and taxonomy of aquatic communities in the region -Annually review the Principles and Techniques of Electrofishing -Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	-Complete field data sheets -Identify taxonomy accurately -Ensure sampling efficiency and representativeness - Track voucher specimen -Operate the field crew when remote from the 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	-Barbour et al. 1999 -Dufour 2002 -IDEM 1992a, 1992b, 1992c, 2002, 2010a, 2010b, 2015b, 2018d, 2019b, 2019c, 2019d, 2020b, 2020c, 2020d -Klemm et al. 1990 -Plafkin et al. 1989 -Simon 1997, DRAFT -Simon and Dufour, 1998, 2005 -YSI 2018, 2019
Field crew members – biological community sampling	-Complete hands-on training for sampling methodology prior to participation in field sampling activities -Review the Principles and Techniques of Electrofishing -Review relevant safety procedures -Review 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	-Barbour et al. 1999 -IDEM 1992a, 1992b, 1992c, 2002, 2010a, 2010b, 2015b, 2018d, 2019b, 2019c, 2019d, 2020b, 2020c, 2020d -Klemm et al. 1990 -Plafkin et al. 1989 -YSI 2018, 2019
Field crew chief – water chemistry, algal, or bacteriological sampling	-Bachelor of Science degree in biology or other closely related area -At least 1 year of experience in sampling methodology -Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	-Complete field data sheets -Sampling efficiency and representativeness -Operate the field crew when remote from the central office -Ensure crew members adhere to safety and field SOP procedures -Ensure multiprobe analyzers are calibrated	-IDEM 1997, 2002, 2010a, 2010b, 2015b, 2018c, 2019a, 2020b, 2020c, 2020d -YSI 2018, 2019

Role	Required Training/Experience	Responsibilities	Training References
		weekly prior to field sampling activities -Ensure field sampling equipment is functioning properly and loaded into field vehicles prior to field sampling activities	
Field crew members – water chemistry, algal, or bacteriological sampling	-Complete hands-on training for sampling methodology prior to participation in field sampling activities -Review relevant safety procedures -Review 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, 2002, 2010a, 2010b, 2015b, 2018c, 2019a, 2020b, 2020c, 2020d -YSI 2018, 2019
Laboratory supervisor – biological community sample processing	-Bachelor of Science degree in biology or other closely related area -At least 1 year of experience in taxonomy of aquatic communities in the region -Annually review relevant safety procedures -Annually review relevant SOP documents 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 -Ensure required QA/QC are performed on the data -Query data from AIMS II to determine results not meeting water quality criteria	-IDEM 1992c, 2004, 2010a, 2010b, 2012e -AIMS II Database User Guide
Laboratory staff – biological community sample processing	-Complete hands-on training for laboratory sample processing methodology prior to participation in laboratory sample processing activities -Annually review relevant safety procedures	-Adhere to safety and SOP procedures -Follow laboratory supervisor directions while processing samples -Identify fish and macroinvertebrate specimens collected during field sampling -Complete laboratory data sheets	-IDEM 1992c, 2004, 2010a, 2010b, 2018e -AIMS II Database User Guide

Role	Required Training/Experience	Responsibilities	Training References
	-Annually review relevant SOP documents for laboratory operations	Perform necessary calculations on data Enter field sheets	
Laboratory supervisor – water chemistry, algal or bacteriological sample processing	-Bachelor of Science degree in biology or other closely related area -Annually review relevant safety procedures -Annually review relevant SOP documents 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 database -Ensure required QA/QC are performed on the data -Query data from AIMS II to determine results not meeting water quality criteria	-IDEM 2010a, 2010b, 2015a -AIMS II Database User Guide
Quality assurance officer	-Bachelor of Science in chemistry or a related field of study -Familiarity with QA/QC practices and methodologies -Familiarity with the Surface Water QAPP and data qualification methodologies	-Adhere to QA/QC requirements of the Surface Water QAPP -Evaluate data collected by sampling crews for adherence to project work plan -Review data collected by field sampling crews for completeness and accuracy -Perform a data quality analysis of data generated by the project -Assign data quality levels based on the data quality analysis -Import data into the AIMS database -Ensure field sampling methodology audits are completed according to WAPB procedures	-IDEM 2017c, 2018e -U.S. EPA 2006 -AIMS II Database User Guide

B. Data Generation and Acquisition

B.1. Sampling Design and Site Locations

A list of sites is generated by the U.S. EPA, NHEERL, Western Ecology Division, in Corvallis, Oregon 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 basin of study. 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. This minimum required number of sites was determined by analyzing fish community IBI metric scores from 317 sites sampled from 1996–2000 with the following formula:

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

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

A sample size of 38 was thereby determined to be sufficient to arrive at the "true" average IBI score for a basin 95% of the time. An n=38 sample size was also found to be sufficient to provide “true” estimations for eight of the more frequently used individual metrics used in the calculation of the fish community IBI 80% of the time.

Site selection is stratified to ensure 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 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and higher order streams in the basin. Utilizing the stratification method ensures that a greater number of sampling sites on lesser order streams are not chosen based on proportion of stream miles. An over draw of sampling sites is requested to compensate 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 2018b). In-house activities include preparation and review of site maps and aerial photographs; initial evaluation of 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 of 5 meters or less (IDEM 2015b). All 100 potential sites are to be visited at least once during site reconnaissance to determine target or nontarget status (marsh, dry, backwater, etc.). However, only determine landowner permission and site access for the first 75 potential sites with the remaining 25 sites noted only as “Target” or “NonTarget”. After each site has been visited once, and at least 45 sites have been approved in the basin of interest, field work for site reconnaissance activities should be minimal. Site reconnaissance field work is allotted a maximum time of 8 weeks (Section A. Project Management for site reconnaissance activities, QAPP Element A.4.). Most work can be completed in a six-week period, dependent upon weather, drive time to sites, and other unforeseeable constraints. The remaining work, if possible, can be done in the office with phone calls to seek landowner permission. If permission to visit a site is granted before the 12 week deadline, a daytrip or overnight may be needed to determine access routes, equipment, and more accurate GPS coordinates. Once the deadline is reached, enter sites inaccessible through bridge right-of-way, yet appeared to be “target” from the nearest bridge, into the database with the Reconnaissance Decision as “No, Other”. In the Comments field enter “Unable to contact landowner by deadline" along with the date and initials of the person entering the data. Also, write the decision on the IDEM Site Reconnaissance Form (Attachment 1).

Table 3 lists the 100 potential West Fork and Lower White River basin sampling sites generated by U.S. EPA Corvallis. Sample target sites in sequential order as shown 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 or some other reason (physical barrier, landowner denial, etc.), take the next target site on the list. Figure 1 depicts potential sampling sites and approximate locations generated by U.S. EPA Corvallis.

B.2. Sampling Methods and Sample Handling

1. Bacteriological Sampling

Conduct bacteriological sampling using one or two teams consisting of two staff (IDEM 2019a). The work effort requires an average of 1 hour per site per week. Process samples in the Shadeland fixed *E. coli* laboratory (fixed *E. coli* lab) or mobile *E. coli* laboratory (mobile *E. coli* lab). The mobile *E. coli* lab is equipped with all materials and equipment necessary to perform the 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. Wadeability is subject to field staff determinations based on available Personal Protective Equipment (PPE), turbidity, and other factors. However, streams waist deep or shallower are generally considered wadeable. Consistently label, cool, and hold at a temperature less than 10ºC during transport all samples. Collect all *E. coli* samples on a schedule such that any sampling crew can deliver them to the fixed *E. coli* lab or mobile *E. coli* lab for analyses within the bacteriological holding time of 6 hours.

The mobile *E. coli* lab facilitates *E. coli* testing by eliminating the necessity of transporting samples to distant contract laboratories within a six-hour holding time. The mobile *E. coli* lab provides work space containing storage for samples, supplies for Colilert® Quanti-tray testing, and all equipment required 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, record water chemistry field measurements, and record physical site descriptions on the IDEM Stream Sampling Field Data Sheet (Attachment 2). All water chemistry sampling will adhere to the Water Chemistry Field Sampling

Procedures (IDEM 2020d, DRAFT). Only collect dissolved orthophosphate at the 18 sites at which a HOBO data logger is deployed. Collect orthophosphate 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 upon accessibility.

3. Algal Sampling

In addition to standard water chemistry sampling, one team of two staff collect chlorophyll *a* from the seston community at sites with a drainage area greater than 1000 square miles and periphyton community at all sites during the third round of water chemistry in September and October (Table 1). Sampling, including all of the above parameters, for an average site requires approximately 2.5 hours of effort. Record information regarding substrates sampled for periphyton and physical parameters of the stream sampling area on the Algal Biomass Lab Datasheet (Attachment 3) and Probabilistic Monitoring Section Physical Description of Stream Site Form (Attachment 4). IDEM 2018c 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 dependent upon stream size and site accessibility. Perform fish community 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 2018d). Attempt to sample all habitat types available (i.e., pools, shallows; IDEM 2019b, pp. 10–11, contains more potential habitat types) within the sample reach to ensure adequate representation of the fish community present at the time of the sampling event. The possible list of electrofishers to be utilized include: the Smith-Root LR-24 or LR-20B Series backpack electrofishers; the Smith-Root 1.5kVa electrofishing system; or Midwest Lake Electrofishing Systems (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 foot Loweline boat; or, for nonwadeable sites, the Smith-Root Type VI-A electrofisher or MLES Infinity Control Box assembled in a 16 foot Loweline 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 to cooling water temperature, which may affect the responsiveness of some species to the generated electric field. This lack of responsiveness can result in nonrepresentative fish community samples of the stream (IDEM 2018d).

Collect fish using dip nets 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 2018d).

For each field taxonomist (generally the crew leader), a complete set of fish vouchers are retained 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, preserve one to two individuals per new species encountered in 3.7% formaldehyde solution to serve as representative fish vouchers if the fish specimens can be positively identified and the individuals for preservation are small enough to fit in a 2000 mL jar. 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 2018c, p. 8; IDEM 2018d). Also, prior to sampling, 10% of the sites are randomly selected for revisiting and preserve or photograph a few representative individuals of all species found at the site to serve as vouchers. Review taxonomic characteristics for possible species encountered in the basin of interest prior to field work. Fish specimens should also be preserved if they cannot be positively identified in the field (i.e., those that co-occur like the Striped and Common Shiners or are difficult to identify when immature); individuals that appear to be hybrids or have unusual anomalies; and dead specimens that are taxonomically valuable for undescribed taxa (e.g., Red Shiner or Jade Darter), life history studies, or research projects (IDEM 2018d).

For nonpreserved fish, record the following data 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 have been recorded, release specimens within the sampling reach from which they were collected. Following preserved fish specimens' laboratory taxonomic identification, record data (IDEM 2018d).

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 and a 50 meter "sweep" sample of additional instream habitats. At each site, define the 50 meter length of riparian corridor sampled 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 that has the best available habitat. Combine the 1-minute "kick", if collected and 50 meter "sweep" samples in a bucket of water. Elutriate the sample through a U.S. standard number 35 (500 μm) sieve a minimum of five times to remove 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, if possible at genus or species level. Evaluate 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

Complete habitat assessments immediately 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 (Rankin 1995; OHEPA 2006). Complete a separate QHEI (Attachment 7) for these 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

During each sampling event regardless of the sample type collected, measure D.O., pH, water temperature, specific conductance, and D.O. percent saturation with a data sonde. Perform measurement procedures and operation of the data sonde according to the manufacturers' manuals (IDEM 2020c and IDEM 2020d, DRAFT). Measure turbidity with a Hach turbidity kit, and write the meter number in the comments under the field parameter measurements (IDEM 2002). 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) along with other sampling observations. Also, take a digital photo upstream and downstream of the site during each sampling event (IDEM 2018c).

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 the 18 preselected Target sample sites' stream segment. The 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 upon the particular conditions observed at the stream sampling site. Place the 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. If possible, place the logger near the center of the channel's cross section. Determine GPS coordinates at the exact point of placement for each data logger 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 logger's placement point in relation to the stream reach. The photograph documents location and stream flow conditions to the extent possible. Record *in-situ* water quality measurements at the time of each data logger deployment. Upon D.O. data logger retrieval, 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 Shadeland laboratory. The lab prepares (programs and calibrates) the logger 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 with their respective test method and IDEM quantification limits. Table 7 lists the algal parameters with test method and IDEM quantification limits. Table 8 shows bacteriological and water chemistry sample container, preservative, and holding time requirements (all samples iced to 4 °C). Table 9 lists numerous parameters (priority metals, anions/physical, and nutrients/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 2019 Corvallis Water Sample Analysis Request Form (Attachments 9 and 10) accompanies each sample set through the analytical process.

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

B.4. Quality Control and Custody Requirements

Follow QA protocols in the Surface Water QAPP (IDEM 2017a, B.5. pp. 170).

1. Bacteriological Data

Analyze bacteriological samples using the SM 9223B Enzyme Substrate Coliform Test Method (see Table 6 for quantification limits). Collect samples using 120 mL presterilized wide mouth containers and adhere to the six hour holding time (Table 8). Analytical results from the fixed *E. coli* lab or mobile *E. coli* lab include QC check sample results from which precision, accuracy, and completeness can be determined 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/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	Sterile laboratory water blanks, test 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).

QA documentation for each batch of samples consists of a chain of custody form, a QA/QC summary sheet, and spreadsheets of results. This documentation is submitted to the Technical and Logistical Services Section for QA review and the assignment of an appropriate data quality assessment (DQA) Level.

2. Water Chemistry Data

Use sample bottles and preservatives certified for purity. Adhere to U.S. EPA requirements for water chemistry testing (Table 8) for sample collection procedures, the container and preservative used for each parameter, and holding times. Collect field duplicates and matrix spike and matrix spike duplicates (MS/MSD) at the rate of one per sample analysis set or 1 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) analyzes all water chemistry samples collected and processed following the specifications set forth in Request for Proposals 16-074 (IDEM 2016). The Indiana State Department of Health (ISDH, Indianapolis, Indiana) analyzes orthophosphate samples.

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
D.O. (data sonde optical)	ASTM D888-09	0.05 mg/L
D.O. % Saturation (data sonde optical)	ASTM D888-09	0.05 %
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(s)

Table 7. Algal Parameters showing method and IDEM quantification limit.

Algal Parameter	Method	IDEM Quantification Limit
Seston (Uncorrected; Non-Acidification Method) Chlorophyll *a* – Suspended	Modified U.S. EPA 445.0	0.3 µg/L Chl-a
Periphyton (Uncorrected; Non-Acidification Method) Chlorophyll *a* – Attached	Modified U.S. EPA 445.0	0.3 µg/L Chl-a

Table 8. Bacteriological and Water Chemistry Sample Container, Preservative, and Holding Time Requirements1

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 & 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	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 9. 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 (ISDH)

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	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

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

To decrease the potential for cross contamination and bias of the algal samples, clean all sample contacting equipment. After completion of sampling at a given site, use detergent and rinse with ASTM D1193-91 Type III water. Accurately and thoroughly complete all sample labels, include 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 to be processed and made into a permanent mount.

Table 7 contains chlorophyll *a* analysis methods. Since 2019, the new Shadeland Algal Laboratory processes all samples collected for chlorophyll *a*. Measure the total chlorophyll *a* using a modified U.S. EPA Method 445.0. The method fluorometrically determines the "uncorrected" total chlorophyll *a* value via a set of very narrow bandpass excitation and emission filters. No pheophytin *a* concentration is determined in the modified method, and this method is not impacted by other chlorophyll *a* degradation products which may be prevalent in inland waters. The method quantification limit of 0.3 µg/L chlorophyll *a* was determined using U.S. EPA Method 445.0 Section 9.0 Quality Control during laboratory set up prior to the 2019 sampling season.

Run blank filters for periphyton and seston chlorophyll *a*. Process all chlorophyll *a* filters in triplicate for QC purposes (three filters are processed from the same sample per analysis method). A separate laboratory (TBD) 10 % analyzes 1- of replicate field samples.

Document QC of the diatom sampling, enumeration, and identification project using QC checks of both field and laboratory data. Diatom Identification and Enumeration (IDEM 2015a p. 22) describes QA/QC protocols. The Department of Biological and Environmental Sciences of Georgia College and State University (Milledgeville, Georgia) verifies at least 10 % of diatom samples following the specifications set forth in IDEM 2015a.

4. Fish Community Data

Perform fish community sampling revisits at a rate of 10 % of the total fish community sites sampled, approximately 4, in the basin (IDEM 2018d). Allow at least 2 weeks of recovery between the initial and revisit sampling events. Either a partial or complete change in field team members (IDEM 2018d) perform the fish community revisit sampling and habitat assessment. Use the resulting IBI and QHEI total score between the initial visit and the revisit to evaluate precision. The IDEM OWQ Chain of Custody Form is used to track samples from the field to the laboratory (Attachment 8). Fish taxonomic identifications made by IDEM staff in the laboratory may be verified by regionally recognized non-IDEM freshwater fish taxonomists (e.g., Brant Fisher, Nongame Aquatic Biologist, Indiana Department of Natural Resources). All raw data are: 1) checked for completeness; 2) utilized to calculate derived data (i.e., total weight of all specimens of a taxon), which is entered into the AIMS II database; and 3) checked again for data entry errors.

5. Macroinvertebrate Community Data

Duplicate macroinvertebrate field sampling sites are randomly selected prior to the beginning of the field season and occur at a rate of 10 % of the total macroinvertebrate community sites sampled, approximately four in the basin. The same team member performing the original sample performs the macroinvertebrate community duplicate sample and corresponding habitat assessment. Conduct duplicate sampling immediately after collecting the initial sample, resulting in a precision evaluation based on 10% of samples collected. Divide sites in the basin equally among the macroinvertebrate staff. Each staff is responsible for collecting at least one duplicate sample. The IDEM OWQ Chain of Custody Form is used to track samples from the field to the laboratory (Attachment 8). Laboratory identifications and QA/QC of taxonomic work is maintained by the IDEM macroinvertebrate laboratory supervisor. An outside taxonomist (IDEM 2019c) verifies 10% of the initial samples taken at sites where duplicate samples were collected.

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

Calibrate the data sonde immediately prior to each week's sampling (IDEM 2020c). Conduct the D.O. component of the calibration procedure using the air calibration method. Record, maintain, store, and archive the calibration results and drift values in record logs in the Shadeland calibration laboratories, which are uploaded to Virtual File Cabinet after five years (IDEM 2020c). The drift value is the difference between two successive calibrations. Field parameter calibrations will conform to the procedures described in the instrument users manuals (IDEM 2020c, IDEM 2020d DRAFT). Field check the unit for accuracy once during the week by comparison with a YSI D.O. meter (IDEM 2020c), a Hach turbidity meter, and an Oakton pH and temperature meter (IDEM 2002). Record weekly field calibrations in the field calibrations portion of Attachment 2 and enter into the AIMS II database. Also use the YSI D.O. meter at field sites where the D.O. concentration is 4.0 mg/L or less.

Onset Hobo® U26-001 D.O. data loggers utilize optical D.O. measurement technology specified in ASTM D888-12 (ASTM 2012). Calibrate and maintain HOBO units following the manufacturer's 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 in the field or later at the office. Each analysis' detection limits and ranges are set. QC checks are performed on information for field or laboratory results to estimate precision, accuracy, and completeness, as described in the Surface Water QAPP (IDEM 2017a Section C1.1 on page 176).

2. Algal Community Data

IDEM 2018c describes the equipment required for the collection of periphyton. None of this equipment requires calibration. Equipment has been field tested to ensure its capability of appropriately removing periphyton from different types of substrate (rocks, sticks, sand, or silt) (IDEM 2018c).

Use a Turner Designs Trilogy Laboratory Fluorometer with the Chlorophyll α Non-Acidification Bandpass Filter Module to determine chlorophyll *a* concentrations. Calibrate this instrument according to manufacturer and method specifications at the beginning of the sampling season and as needed. Perform continued calibration verification checks during each analysis.

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

Use a Nikon differential interference contrast (DIC) microscope and identify and enumerate diatoms using a Nikon Elements D camera and imaging system. 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. The field and laboratory performance checks include precision measurements using relative percent difference (RPD) of field and laboratory duplicate (IDEM 2017a, pp. 56, 61–63); accuracy measurements using percent of recovery of MS/MSD samples analyzed in the laboratory (IDEM 2017a, pp. 58, 61–63); and completeness measurements using the of percent of planned samples actually collected, analyzed, reported, and usable for the project (IDEM 2017a, p. 58).

The IDEM WAPB staff conduct field audits biannually ensuring sample activities adhere to approved SOPs. Audits are systematically conducted by WAPB QA staff to include all WAPB personnel that engage 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 and WAPB management. As a result of the audit process (IDEM 2017a, p. 176–177), communicate corrective actions to field staff, who implement the action.

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).

D. Data Validation and Usability

Quality assurance reports to management, data validation, and usability are also important components of a QAPP which ensures good quality data. Should problems arise and need to be investigated and corrected, submit a QA audit report to the QA manager and project manager for review. Data are reduced (converted from raw analytical data into final results in proper reporting units), validated (qualified based on the performance of field and laboratory QC measures incorporated into the sampling and analysis procedures), and reported (described so as to completely document the calibration, analysis, QC measures, and calculations). These steps allow users to assess the data ensuring data quality objectives are met.

D.1. Quality Assurance, Data Qualifiers, and Flags

The various data qualifiers and flags used for QA and validation of the data are found in the Surface Water QAPP (IDEM 2017a pp. 184–185).

D.2. Data Usability

Usability of the environmental data collected are qualified per each lab or field result obtained and classified into one or more of the four categories. Surface Water QAPP (IDEM 2017a p. 184) describes the categories: Acceptable Data, Enforcement Capable Results, Estimated Data, and Rejected Data.

D.3. Information, Data, and Reports

Record data, collected in 2020, in the AIMS II database and present in three compilation summaries. The first summary is a general compilation of the 2020 West Fork and Lower White River basin field and water chemistry data prepared for use in the 2022 Integrated Report. The second summary is in database report format and contains biological results and habitat evaluations produced for inclusion in the Integrated Report and in individual site folders. All site folders are maintained at the Shadeland laboratories. The third summary includes diatom species taxa names and enumerations on laboratory bench sheets. After making use attainment decisions for each site sampled (IDEM 2020a DRAFT), determine the percent of perennial stream miles in the basin supporting or not supporting aquatic life and recreational uses, using U.S. EPA’s *spsurvey* package written in the “R” programing language (R Core Team 2014). Make all data and reports 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 will comply with the Surface Water QAPP (IDEM 2017a), Request for Proposals 16-074 (IDEM 2016), and the IDEM 2018 Quality Management Plan (IDEM 2018e). Pace Analytical Services in Indianapolis, Indiana performs analytical tests on the water chemistry parameters outlined in Table 9. Accreditation related to Pace Indy is included as Appendix 1. ISDH analyzes orthophosphate. IDEXX Laboratories, Inc., Westbrook, Maine supplies the bacteriological sampling materials. IDEM staff collect algal samples. Shadeland laboratory staff analyze chlorophyll *a*. IDEM staff perform diatom identification and enumeration and the Department of Biological and Environmental Sciences, Georgia College and State University analyzes 10% of the samples. IDEM staff collect and analyze all fish and macroinvertebrate samples. Rhithron Associates, Inc. verifies 10% of macroinvertebrate samples. Table 10 outlines the anticipated budget for laboratory cost.

Table 10. Total Estimated Laboratory Cost for the Project.

Analysis	Number of Samples Collected	Laboratory	Estimated Cost
Water chemistry	3 times @ 45 sites + 12 duplicates + 12 field blanks (1 per sample week) = 159 samples	Pace Analytical Services 7726 Moller Road. Indianapolis, Indiana 46268	$69,000
Orthophosphate	3 times @ 14 sites + 3 duplicates + 3 field blanks (1 per sample week) = 48 samples	ISDH, Environmental Laboratory Division 550 West 16th Street Indianapolis, IN 46202	$0
Bacteriological (*E. coli)*	5 times @ 40 sites + 10 blanks + 10 duplicates = 220 samples	Shadeland fixed lab or mobile *E.coli* lab supplies IDEXX Laboratories, Inc. One IDEXX Drive Westbrook, Maine 04092	$1,100
Algal biomass	1 time @ 45 sites + 5 duplicates (1 per sample week) = 50 samples	Shadeland Algal Laboratory 2525 Shadeland Avenue, Indianapolis, IN 46204	$7,024
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	$1500
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	$880
		Total	$79,504

Table 11. Personnel Safety and Reference Manuals

Role	Required Training/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 will be accompanied in the field at all times by WAPB staff that meet Health and Safety Training requirements
	-Personal Protective Equipment (PPE) Policy	-IDEM 2008	-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 personnel in the watercraft must wear a high intensity whistle and Safety of Life at Sea (SOLAS) certified strobe light.
	-Personal Flotation Devices (PFD)	-February 29, 2000 WAPB internal memorandum regarding use of approved PFDs	

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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

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

Recon Date ______ Crew Members ______

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 Address ______

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 U_1	U_2	U_3	U	Area (L * U)
1						
2						
3						
4						
5						
					Total Area (cm²)	

Area Scrape (Using SG-92)

Rock#	1	2	3	4	5
Area (cm²)	7.38	7.38	7.38	7.38	7.38
Total (cm²)	36.9				

Petri Dish

Number of Discrete Samples (n):	
Total Area of One Sampler (a):	19.01 cm²
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.

Rain station location, county: | Inches since last rainfall previous to sampling: in.

Days since last rainfall previous to sampling: days

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)	Inner Riparian Zone (L R)	L.Width(m)	R.Width(m)
☐ ☐ Agricultural Row crop	☐ ☐ Agricultural Rowcrop	____	____
☐ ☐ Agricultural Pasture	☐ ☐ Agricultural Pasture	____	____
☐ ☐ Devoid of Vegetation	☐ ☐ Devoid of Vegetation	____	____
☐ ☐ Fallow	☐ ☐ Fallow	____	____
☐ ☐ Forested	☐ ☐ Forest	____	____
☐ ☐ Residential	☐ ☐ Residential	____	____
☐ ☐ Commercial/Industrial	☐ ☐ Commercial/Industrial	____	____
☐ ☐ Weeds and Scrub	☐ ☐ Treeline	____	____
☐ ☐ Other __________	☐ ☐ Weeds and Scrub		
	☐ ☐ Other ________	____	____

Flow above site	Flow at site	Substrate (if visable)
☐ Riffle	☐ Riffle	☐ Cobble
☐ Pool	☐ Pool	☐ Boulder
☐ Eddy	☐ Eddy	☐ Sand
☐ Run	☐ Run	☐ Muck
☐ Glide	☐ Glide	☐ Silt
☐ Other ________	☐ Other ________	☐ Gravel
____________	____________	☐ Bedrock
____________	____________	☐ Other ________

Characteristics at site and immediately upstream (check ONE).

Water Description	Sinuosity of Channel	Discharge Pipe Present
☐ Clear	☐ High	☐ No
☐ Grey (Septic)	☐ Moderate	☐ Yes
☐ Murky	☐ Low	If yes, Effluent Flowing?
☐ Black	☐ Channelized	☐ No
☐ Brown		☐ Yes
☐ Green		Description of Effluent ______
☐ Other ________		____________

Continued on back

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

Revised 4/20/12

Stream Bank

Functional Slope: L R	Bank Erosion: L R	
☐ ☐ 0-30°	☐ ☐ Low	Percent Canopy Closed: _______
☐ ☐ 31-50°	☐ ☐ Moderate	Stream Stage 1-5 (Low-High): _______
☐ ☐ 51-70°	☐ ☐ High	Velocity of Stream 1-5 (Slow-Fast): _______
☐ ☐ 71-90°		

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

☐ Habitat Complete ☐ Sample Quality Rejected

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

☐ Normal ___________
☐ Duplicate ___________
☐ Replicate ___________

Riparian Zone/Instream Features

Watershed Erosion:
☐ Heavy
☐ Moderate
☐ None

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

Macro Sub Sample (Field or Lab): _______________

Macro Reach Sampled (m): ____________________

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

Check ONE (Or 2 & average)

BEST TYPES PREDOMINANT	PRESENT P/G R/R	OTHER TYPES PREDOMINANT	PRESENT P/G R/R	ORIGIN	QUALITY
☐☐ BLDR/SLABS [10]	☐☐	☐☐ HARDPAN [4]	☐☐	☐ LIMESTONE [1]	SILT ☐ HEAVY [-2]
☐☐ BOULDER [9]	☐☐	☐☐ DETRITUS [3]	☐☐	☐ TILLS [1]	SILT ☐ MODERATE [-1]
☐☐ COBBLE [8]	☐☐	☐☐ MUCK [2]	☐☐	☐ WETLANDS [0]	SILT ☐ NORMAL [0]
☐☐ GRAVEL [7]	☐☐	☐☐ SILT [2]	☐☐	☐ HARDPAN [0]	SILT ☐ FREE [1]
☐☐ SAND [6]	☐☐	☐☐ ARTIFICIAL [0]	☐☐	☐ SANDSTONE [0]	EMBEDDEDNESS ☐ EXTENSIVE [-2]
☐☐ BEDROCK [5]	☐☐	(Score natural substrates; ignore sludge from point-sources)		☐ RIP/RAP [0]	EMBEDDEDNESS ☐ MODERATE [-1]
				☐ LACUSTRINE [0]	EMBEDDEDNESS ☐ NORMAL [0]
				☐ SHALE [-1]	EMBEDDEDNESS ☐ NONE [1]
				☐ COAL FINES [-2]	

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

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	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [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

L R EROSION	L R RIPARIAN WIDTH	L R FLOOD PLAIN QUALITY	L R
☐☐ NONE/LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY/SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING /CONSTRUCTION [0]
	☐☐ VERY NARROW [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Riparian Maximum 10

Comments

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

MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	
☐ > 1m [6]	☐ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☐ SLOW [1]
☐ 0.7 - < 1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4 - < 0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2 - < 0.4m [1]		☐ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0] [metric = 0]		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	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5 - 10cm [1]	☐ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☐ BEST AREAS < 5 cm [metric = 0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Riffle/Run Maximum 8

Comments

6] *GRADIENT* (ft/mi) ☐ VERY LOW - LOW [2 – 4]
☐ MODERATE [6 - 10]
DRAINAGE AREA (mi²) ☐ HIGH - VERY HIGH [10 - 6]

%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	Depth
Pool:	☐ > 100 ft²	☐ > 3 ft

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

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

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

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. 2020 Corvallis Water Sample Analysis Request Form (Pace Analytical)

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

Water Sample Analysis Request

Project Name: 2020 Probabilistic Monitoring **Composite** ☐ **Grab** ☒

OWQ Sample Set	20WQW	IDEM Sample Nos.	
Crew Chief	Todd Davis	Lab Sample Nos.	
Collection Date	Jun. 25, 2019	Lab Delivery Date	

Anions and Physical Parameters			
Parameter	Test Method	Total	Dissolved
Alkalinity	310.2	☒ **	☐
Total Solids	SM2540B	☒ **	
Suspended Solids	SM2540D	☒ **	
Dissolved Solids	SM2540C		☒ **
Sulfate	300.0	☐ **	☒ **
Chloride	300.0	☐ **	☒
Hardness (Calculated)	SM-2340B	☒ **	☐
Fluoride	SM4500-F-C	☐ **	☐

Priority Pollutant Metals Water Parameters			
Parameter	Test Method	Total	Dissolved
Antimony	200.8	☒	☒
Arsenic	200.8	☒	☒
Beryllium	200.8	☐	☐
Cadmium	200.8	☒	☒
Chromium	200.7	☒	☒
Copper	200.8	☒	☒
Lead	200.8	☒	☒
Mercury, Low Level	1631, Rev E.	☐	☐
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	☒ ***	☐
Cobalt	200.8	☐	☐
Iron	200.7	☐	☐
Magnesium	**200.7**, 200.8	☒ ***	☐
Manganese	200.8	☐	☐
Sodium	200.7	☐	☐
Silica, Total Reactive	200.7	☐	☐
Strontium	200.8	☐	☐

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	☒	☐
CBOD5	SM5210B	☐	
Total Kjeldahl Nitrogen (TKN)	SM4500N(Org)	☒	☐
Nitrate + Nitrite	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 # 0020000887-4 (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 as Total Hardness components*

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

Testing Laboratory: Pace Analytical Services, Inc.
Attn: Sue Brotherton
7726 Moller Road
Indianapolis, IN 46268

Phone: 317-228-3136

Attachment 10. 2020 Corvallis Water Sample Analysis Request Form (ISDH)

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

Water Sample Analysis Request

Project Name: 2020 Corvallis **Composite** ☐ **Grab** ☒

OWQ Sample Set	20WQW	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	☐	☐

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*

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
STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219
DJordan@idem.in.gov

Testing Laboratory:
Indiana State Department of Health (ISDH)
Environmental Laboratory Division
550 W. 16th Street
Indianapolis, IN 46202
Phone: 317-921-5815 (Ray Beebe) (Rev. 01/2020)

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: 5/1/2020 Expiration Date: 4/30/2021

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: 5/1/2020 Accreditation End: 4/30/2021

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 1 of 25

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

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

Method ASTM D516-07	
Sulfate	KS
Method ASTM D516-11	
Sulfate	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
Molybdenum	KS

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 2 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
Cyanide	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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 3 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
Aroclor-1232 (PCB-1232)	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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 4 of 25

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

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

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
Naphthalene	KS
Tetrachloroethylene (Perchloroethylene)	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)*

	Primary AB
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
Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl 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 25

Pace Analytical Services, Inc - Indianapolis IN

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
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 2540 B-2011	
Residue-total	KS
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

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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 7 of 25

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

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

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-2000	
Sulfide	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

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.)

EPA Number: *IN00043* **Scope of Accreditation for Certification Number:** **E-10177** Page 8 of 25

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

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
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

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.)

Analyte	Primary AB
Program/Matrix: *RCRA (Non Potable Water)*	
Manganese	KS
Molybdenum	KS
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 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
Endrin	KS
Endrin aldehyde	KS
Endrin ketone	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 10 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
Chloramben	KS
Dalapon	KS
DCPA di acid degradate	KS
Dicamba	KS
Dichloroprop (Dichlorprop)	KS

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

EPA Number: *IN00043* **Scope of Accreditation for Certification Number:** **E-10177** Page 11 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
Acrolein (Propenal)	KS
Acrylonitrile	KS
Allyl chloride (3-Chloropropene)	KS
Benzene	KS
Bromobenzene	KS

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 12 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
Bromochloromethane	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon disulfide	KS
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

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

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

	Primary AB
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-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-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

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

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
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

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 15 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
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

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 16 of 25

Pace Analytical Services, Inc - Indianapolis IN

	Primary AB
Program/Matrix: ***RCRA (Non Potable Water)***	
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
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
Methane	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.)

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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

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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 19 of 25

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

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
Silvex (2,4,5-TP)	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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 20 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

Method EPA 8260C

	Primary AB
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
Carbon tetrachloride	KS
Chlorobenzene	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
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	
1,2,4,5-Tetrachlorobenzene	KS
1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 22 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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-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
4-Nitroquinoline 1-oxide	KS
5-Nitro-o-toluidine	KS
7,12-Dimethylbenz(a) anthracene	KS
a-a-Dimethylphenethylamine	KS

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

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 23 of 25

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

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

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
Isophorone	KS
Isosafrole	KS
Kepone	KS
Methapyrilene	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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 24 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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
Fluorene	KS
Indeno(1,2,3-cd) pyrene	KS
Naphthalene	KS
Phenanthrene	KS
Pyrene	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.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 25 of 25

Pace Analytical Services, Inc - Indianapolis IN

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

	Primary AB
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

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