Quality Assurance Project Plan for 2022 National Lake Assessment (NLA) Fish Tissue Study Sample Preparation

Revision 1

September 21, 2023

Prepared for:

United States Environmental Protection Agency
Office of Water
Office of Science and Technology (OST)
Standards and Health Protection Division

Prepared with support from:

Tetra Tech, Inc.
under
OST Engineering and Analysis Division
Contract No. 68HERC20D0016

Quality Assurance Project Plan for 2022 National Lakes Assessment (NLA) Fish Tissue Study Sample Preparation

A. PROJECT MANAGEMENT

The U.S. Environmental Protection Agency's (EPA's) Office of Science and Technology (OST) within the Office of Water (OW) prepared this Quality Assurance Project Plan (QAPP) with support from Tetra Tech under EPA Contract No. 68HERC20D0016. It presents objectives, procedures, performance requirements, and acceptance criteria for the preparation of fish fillet tissue samples from whole fish composite samples collected by field crews during the 2022 sampling season of the National Lakes Assessment (NLA). It does not address fish sample collection because that information is included in separate documents (USEPA 2022a and USEPA 2022b) prepared by the Office of Wetlands, Oceans, and Watersheds (OWOW).

This QAPP was prepared in accordance with the most recent version of EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans* (USEPA 2001), that was reissued in 2006. It is a dynamic document that is subject to change as project activities progress. Changes to procedures in this QAPP must be reviewed by the OST Project Manager and the OST Standards and Health Protection Division (SHPD) Quality Assurance Coordinator to determine whether the changes will impact the technical and quality objectives of the project. If so, the QAPP is revised accordingly, circulated for approval, and forwarded to all project participants listed in the QAPP distribution list (Section A3). Key project personnel and their roles and responsibilities are discussed in the QAPP section to follow (Section A4), and information on project background and description is provided in Sections A5 and A6, respectively.

A1. Approvals

JOHN HEALEY Digitally signed by JOHN HEALEY Date: 2023.09.19 11:23:35 -04'00'

John Healey, OST Project Manager, EPA — Date

EDMOND DUNNE Digitally signed by EDMOND DUNNE Date: 2023.09.21 06:22:44 -04'00'

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HARRY KRAMER Digitally signed by HARRY KRAMER Date: 2023.09.21 08:52:20 -04'00'

Bill Kramer, SHPD QA Coordinator, EPA — Date

Beaman, Joe Digitally signed by Beaman, Joe Date: 2023.09.21 10:33:36 -04'00'

Joe Beaman, OST QA Officer, EPA — Date

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Blaine Snyder, Tetra Tech Project Leader — Date

Susan Lanberg Digitally signed by Susan Lanberg Date: 2023.09.19 11:18:34 -04'00'

Susan Lanberg, Tetra Tech QA Officer — Date

A2. Table of Contents

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LIST OF ACRONYMS AND ABBREVIATIONS

C	Celsius
DI	Deionized
DQO	Data quality objectives
EPA	Environmental Protection Agency
FTIS	Fish fillet tissue contaminants indicator
g	Gram
GDIT	General Dynamics Information Technology
HDPE	High density polyethylene
ID	Identification
IM	Information Management
IR	Infra-red
MDL	Method detection limit
mL	Milliliter
NARS	National Aquatic Resource Survey
NLA	National Lakes Assessment
NRSA	National Rivers and Streams Assessment
ORD	Office of Research and Development
OST	Office of Science and Technology
OW	Office of Water
OWOW	Office of Wetlands, Oceans, and Watersheds
PCB	Polychlorinated biphenyl
PFAS	Per- and polyfluoroalkyl substances
PTFE	Polytetrafluoroethylene
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RSD	Relative standard deviation
SD	Standard deviation
SHPD	Standards and Health Protection Division
TBD	To be determined

A3. Distribution List

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A4. Project/Task Organization

This current study of contaminants in fish is referred to as the 2022 National Lakes Assessment (NLA) Fish Tissue Study. The EPA project team for the 2022 NLA Fish Tissue Study consists of managers, scientists, and QA personnel in OST and statisticians in the Pacific Ecological Systems Division within the Center for Public Health and Environmental Assessment (Corvallis, Oregon) in the Office of Research and Development (ORD). The EPA project team receives scientific, technical, and logistical support from contractors at Tetra Tech and at General Dynamics Information Technology (GDIT). Tetra Tech provides primarily fisheries support (e.g., fish sampling and fish sample preparation) and GDIT provides analytical support for the project team.

Members of the project team responsible for fish fillet sample preparation include the OST Project Manager, the OST Fish Sample Preparation and Analysis Technical Leader, the OST QA Officer, the SHPD QA Coordinator, the Tetra Tech Project Leader, the Tetra Tech QA Officer, and Tetra Tech staff providing scientific, technical, and logistical support for this activity. The project team organization provides the framework for conducting fish sample preparation to meet study objectives. The organizational structure and function also facilitate project performance and adherence to quality control (QC) procedures and quality assurance (QA) requirements. The project organizational chart is presented in Figure 1. It identifies individuals serving in key roles and the relationships and lines of communication among these project team members. Responsibilities for key members of the project team are described below.

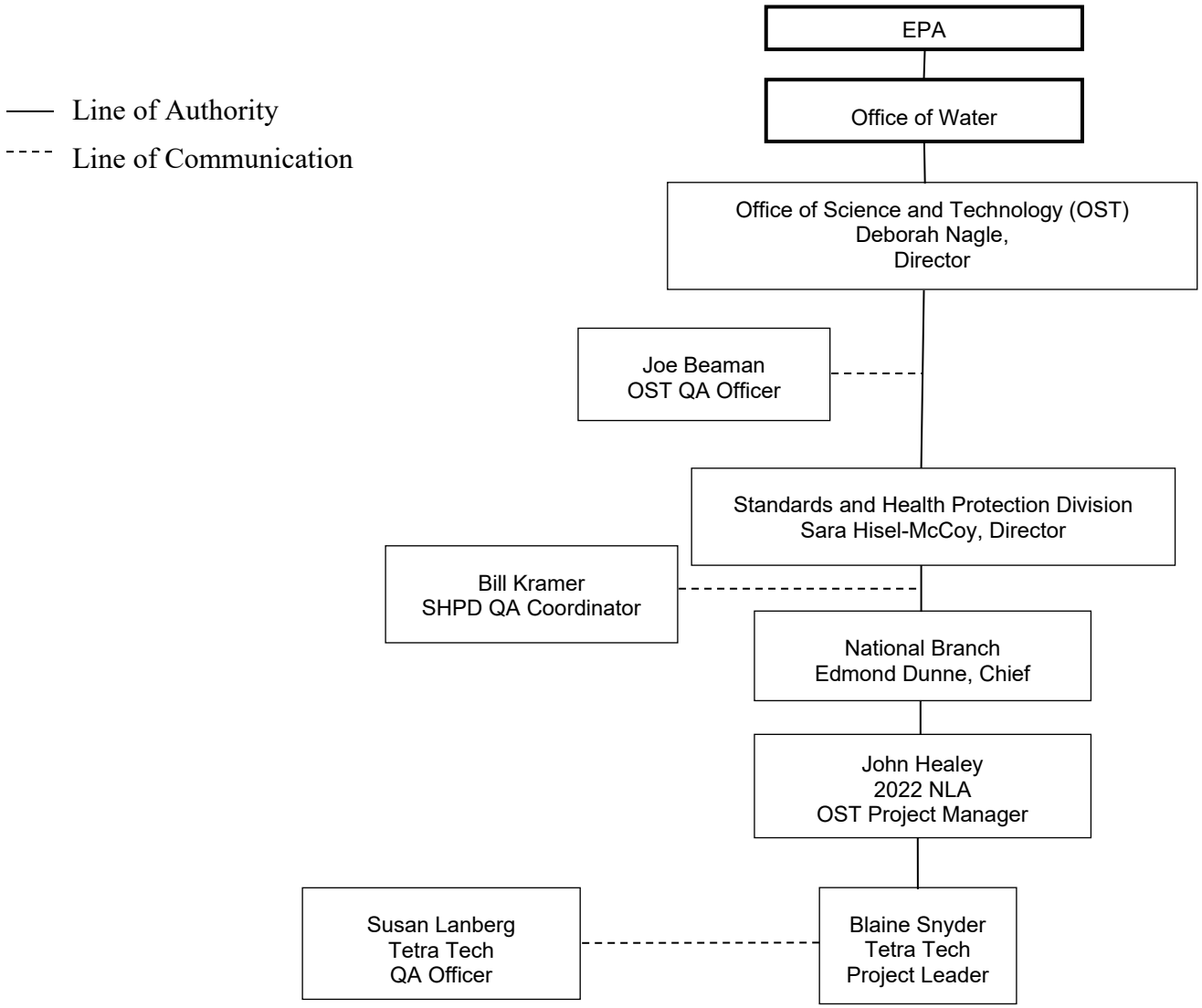

Figure 1. 2022 NLA Fish Tissue Study project team organization for sample preparation

John Healey of OST is the **OST Project Manager** who is providing overall direction for planning and implementation of the 2022 NLA Fish Tissue Study, focusing on sample collection. This role involves the following responsibilities related to the 2022 NLA:

- developing technical information for whole fish sample collection for fillet analysis that includes preparation of the fish sampling protocols and coordination with the NLA Project Leader in OWOW to integrate field sampling technical information for the 2022 NLA whole fish sampling into NLA documents and training materials
- providing technical support to conduct training on the 2022 NLA fish fillet tissue contaminants indicator field sampling requirements in coordination with the NLA Project Leader in OWOW
- developing the fish sample preparation procedures and requirements in coordination with the OST Fish Sample Preparation and Analysis Technical Leader
- facilitating communication among 2022 NLA Fish Tissue Study project team members and coordinating with all of these individuals to ensure technical quality and adherence to QA/QC requirements
- developing and managing work assignments and task orders under OST or other EPA contracts to provide technical support for the 2022 NLA, providing oversight of contractor activities, and reviewing and approving study deliverables for each work assignment and task order (Contractor support is being provided for 2022 NLA Fish Tissue Study sample collection and associated activities.)
- scheduling and leading meetings and conference calls with 2022 NLA project team members for planning study activities, reporting progress on study tasks, and discussing and resolving technical issues related to the study
- working with QA staff to identify corrective actions necessary to ensure that study quality objectives are met for the 2022 NLA Fish Tissue Study sample collection and analysis
- managing the development of and/or reviewing and approving all major work products associated with the 2022 NLA and various other fish tissue studies, including products prepared by OWOW
- leading the Fish Tissue Study Team for reporting results of EPA fish tissue studies
- developing and managing a task order to obtain Tetra Tech support for fish study data analysis and reporting, for providing 2022 NLA fish sampling training, for preparing fish study briefings and presentations, and for providing general technical support
- presenting 2022 NLA and other fish tissue study briefings for EPA managers and delivering fish tissue study presentations in various forums (e.g., scientific conferences, government meetings, and webinars)

Joe Beaman is the **OW Quality Assurance Manager** and **OST Quality Assurance Officer** who, in this role, is responsible for reviewing and approving all QAPPs that involve scientific work being conducted by OST. Bill Kramer is the **Standards and Health Protection Division (SHPD) QA Coordinator** who is responsible for reviewing and recommending approval of all

QAPPs that include scientific work being conducted by SHPD within OST. The OST QA Officer and SHPD QA Coordinator are also responsible for the following QA/QC activities:

- reviewing and approving this QAPP
- reviewing and evaluating the QA/QC requirements and data for all the 2022 NLA Fish Tissue Study activities and procedures
- conducting external performance and system audits of the procedures applied for all 2022 NLA Fish Tissue Study activities
- participating in Agency QA reviews of the study

Blaine Snyder is the **Tetra Tech Project Leader** who is responsible for managing all aspects of the technical and logistical support being provided by Tetra Tech staff for the 2022 NLA Fish Tissue Study. His specific responsibilities include the following:

- providing direct technical and logistical support for the following 2022 NLA Fish Tissue Study activities or providing leadership and oversight for Tetra Tech staff supporting these activities:
  - developing procedures for fish sampling and fish sample preparation
  - preparing 2022 NLA Fish Tissue Study training materials and project information to incorporate into NLA documents developed by OWOW
  - preparing documents specific to the 2022 NLA Fish Tissue Study (including this QAPP)
  - providing fish sampling and fish sample preparation training
  - planning and implementing 2022 NLA logistics
  - supporting collection of fish samples at lakes designated for 2022 NLA whole fish sampling
  - obtaining and performing QC reviews of NLA field sampling data related to the Fish Tissue Study
  - assigning batches for fish sample preparation and drafting fish sample preparation instructions for whole fish sample processing into fillet samples
  - managing implementation of the fish sample preparation procedures, including obtaining laboratory services for analysis of mercury QC samples generated during fish sample preparation and lipid samples for all 2022 NLA Fish Tissue Study samples
  - preparing weekly fish sample processing reports and evaluating the reports for adherence to the technical and quality requirements in the fish sample preparation procedures
  - packing and shipping fish fillet tissue and any related samples (e.g., rinsate samples) to analytical laboratories designated for mercury, PCB, PFAS, and lipid analyses
  - preparing project information and graphics for development of project fact sheets, briefings, presentations, and other EPA meeting and outreach materials

  - providing technical support for planning and reviewing statistical analysis of 2022 NLA Fish Tissue Study fillet data and reporting the final results

- monitoring the performance of Tetra Tech staff participating in this study to ensure that they are following all QA procedures described in this QAPP that are related to Tetra Tech tasks being performed to support this study
- ensuring completion of high-quality deliverables within established budgets and time schedules
- participating in meetings and conference calls with project team members for planning study activities, reporting progress on study tasks, and discussing and resolving technical issues related to the study

Susan Lanberg is the **Tetra Tech QA Officer** whose primary responsibilities include the following:

- assisting Tetra Tech's Project Leader with the review of this QAPP
- approving this QAPP
- providing oversight for the implementation of QA procedures related to Tetra Tech tasks that are described in this QAPP
- reporting deviations from this QAPP to the Tetra Tech Project Leader and assisting in implementing corrective actions to resolve these deviations

A5. Problem Definition/Background

Obtaining statistically representative occurrence data on multiple contaminants in fish tissue is a priority area of interest for EPA. Since 2008, OST has collaborated with the Office of Wetlands, Oceans, and Watersheds (OWOW) within the Office of Water (OW), and with the Office of Research and Development (ORD) to conduct a series of national-scale assessments of chemical contaminants as part of EPA's National Aquatic Resource Surveys (NARS). This current study of contaminants in lakes fish is referred to as the 2022 NLA Fish Tissue Study. It is the first study of fish contamination conducted by OST under the NLA. OST conducted a previous study of contamination in lake fish called the National Lake Fish Tissue Study (NLFTS), which also analyzed fish fillet tissue for mercury, PCBs, and other contaminants; however, the 2022 NLA Fish Tissue Study will be the first national study to analyze fish fillet tissue from inland lakes for PFAS.

Overall, the 2022 NLA is a probability-based survey designed to assess the condition of our Nation's lakes across the lower 48 states. Building on EPA's experience from the 2007 NLA, the 2012 NLA, and the 2017 NLA, it includes collection and analysis of physical, chemical, and biological indicator data that will allow a statistically valid characterization of the condition of the Nation's lakes, ponds, and reservoirs. Fish collection will take place at 636 lakes designated as fish fillet tissue contaminants indicator (FTIS) sites (which are equivalent to 2022 NLA Fish Tissue Study sampling sites). OWOW within OW is responsible for managing the planning and implementation of the NLA.

A6. Project/Task Description

OST began planning and mobilizing for the 2022 NLA Fish Tissue Study (also referred to as the fish fillet tissue contaminants indicator) in 2020. There are 636 NLA lakes designated for whole fish sampling, abbreviated as FTIS for data reporting in the NARS IM database. Mobilizing activities for the 2022 NLA Fish Tissue Study have included updating fish sampling and handling protocols for the 2022 NLA Field Operations Manual (USEPA 2022b) and National Lakes Assessment 2022 Quality Assurance Project Plan (USEPA 2022a), along with assembling and shipping whole fish sampling kits to the NLA central supply distribution center in Traverse City, Michigan. OWOW has conducted 13 training workshops for the 2022 NLA, including a Train-the-Trainer workshop held in early March and 12 Regional training workshops that began in early April and will continue through mid-June 2022.

2022 NLA whole fish sample collection and fillet sample preparation for the 2022 NLA Fish Tissue Study involves the following key components:

- Collecting whole fish samples at 636 randomly selected lakes (Appendix A)[1] during 2022.

- Obtaining one fish composite sample from each lake site designated for whole fish sampling, which ideally consists of five similarly sized adult fish of the same species that are commonly consumed by humans.

- Shipping NLA whole fish samples to freezers at Microbac Laboratories in Baltimore, MD for interim storage.

- Transferring the whole fish samples to the Tetra Tech facility in Owings Mills, MD for fish sample preparation.

- Preparing fillet tissue samples for chemical analysis by scaling and filleting each fish in the composite sample, homogenizing the fillets from all the fish in the sample, and dividing the fillet tissue into aliquots for various chemical analyses and for long-term storage of archived fish fillet tissue samples in a freezer.

- Shipping fillet tissue samples to laboratories contracted to analyze these samples for mercury, PFAS, and PCBs.

This QAPP focuses on fish sample preparation activities for the 2022 NLA Fish Tissue Study samples, which include the last three study components listed above. Specific fish sample preparation procedures and requirements are described in Appendix B.

[1] The list of lakes designated for whole fish sample collection is undergoing revisions based on ongoing site evaluation information being provided by states and tribes.

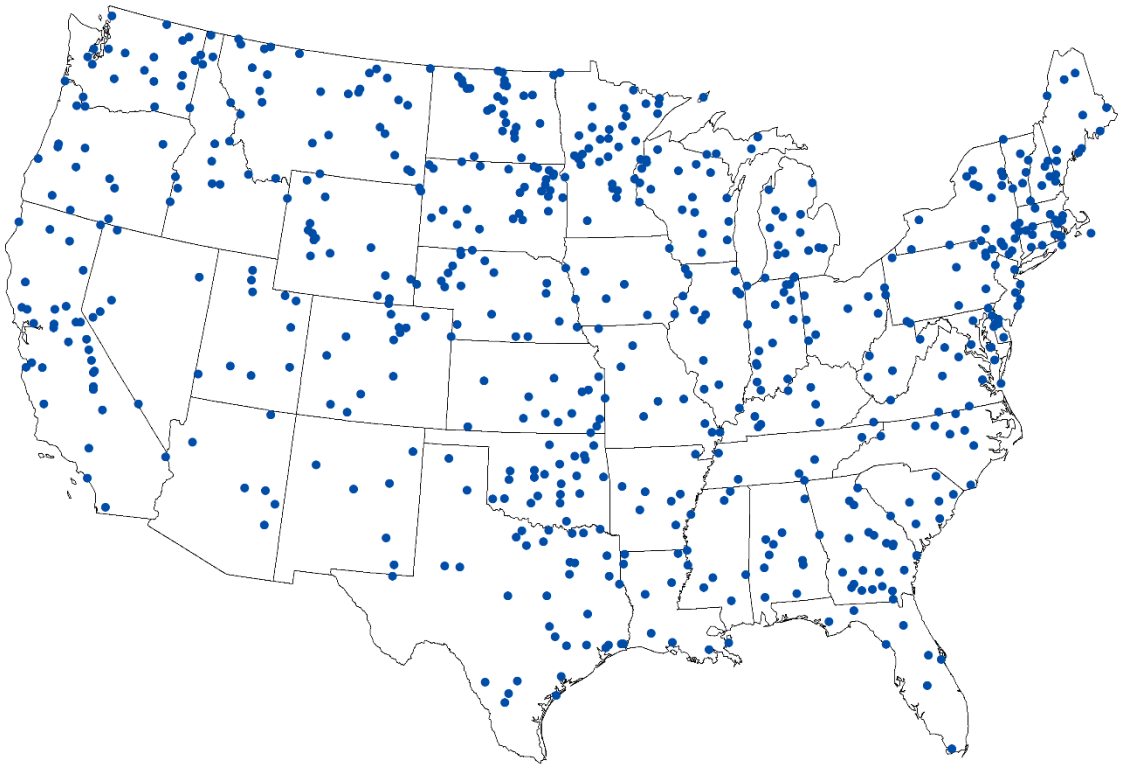

Figure 2. 2022 NLA Fish Tissue Study sampling locations (636 sites)

A7. Quality Objectives and Criteria

Data of known and documented quality are essential to the success of any sampling program. Data quality objectives (DQOs) are qualitative and quantitative statements that clarify the intended use of the data, define the type of data needed to support the decision, identify the conditions under which the data should be collected, and specify tolerable limits on the probability of making a decision error due to uncertainty in the data. DQOs are developed by data users to specify the data quality needed to support specific decisions. Sources of error or uncertainty include the following:

- Sampling error: The difference between sample values and *in situ* true values from unknown biases due to collection methods and sampling design.

- Measurement error: The difference between sample values and in situ true values associated with the measurement process.

- Natural variation: Natural spatial heterogeneity and temporal variability in population abundance and distribution.

- Error sources or biases associated with compositing, sample handling, storage, and preservation.

This QAPP addresses activities associated with NLA Fish Tissue Study fillet sample preparation, so the relevant quality objectives are related to issues involving fillet tissue sample preparation and handling in the laboratory. Table 1 lists the types of fillet tissue sample preparation data needed for the 2022 NLA Fish Tissue Study. Methods and procedures described in this document are intended to reduce the magnitude of the sources of uncertainty and their frequency of occurrence by applying the following approaches:

- Use of standardized fish sample preparation procedures (Appendix B)
- Use of trained scientists to perform the fish sample preparation activities

Table 1. Types of Laboratory Data to Be Collected in Association with Fish Fillet Sample Preparation for the 2022 NLA Fish Tissue Study

Data Type	Measurement Endpoint(s) or Units
Fish weight	Grams (g)
Unhomogenized fillet weight	Grams (g)
Homogenized fillet weight	Grams (g)
Tissue homogenate recovery	Percent (%)
Tissue aliquot weight	Grams (g)
Tissue archive weight	Grams (g)

Measurement performance criteria are quantitative statistics that are used to interpret the degree of acceptability or utility of the data to the user. These criteria, also known as data quality indicators, include the following:

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability

Precision

Precision is a measure of internal method consistency. It is demonstrated by the degree of agreement between individual measurements (or values) of the same property of a sample measured under similar conditions. The only analytical testing that is within the scope of this QAPP is the analysis of fish preparation rinsate and solvent blank samples for mercury (to ensure that the preparation laboratory environment and equipment are not an extraneous source of mercury) and lipid analysis to test the homogeneity of the prepared fish fillet tissue samples and to provide lipid results for the full complement of fish composite samples in each fish sample preparation batch (usually 20 fish samples per batch).

The sample preparation laboratory will prepare two sets of rinsate samples (each consisting of one deionized [DI] water equipment rinsate sample and one DI water blank sample) for mercury

and PFAS analysis, one set of rinsate samples (consisting of one hexane equipment rinsate sample and one hexane blank sample) for PCB analysis, and one homogenized fillet sample for triplicate lipid determinations per fish sample preparation batch, as described in Steps 25 through 29 of Appendix B. The batch-specific homogeneity and paired rinsate and solvent blank results are reviewed by EPA against the QC specifications detailed in Section B5.1 (for homogenates), and Section B5.2 (for mercury rinsates). The QC requirements for PCB and PFAS analysis of rinsate and solvent blank samples will be specified in the 2022 NLA Fish Tissue Study sample analysis QAPP, which will be developed at a later date.

Accuracy

Accuracy is defined as the degree of agreement between an observed value and an accepted reference or true value. Accuracy is a combination of random error (precision) and systematic error (bias) introduced during sampling and analytical operations. Bias is the systematic distortion of a measurement process that causes errors in one direction, so that the expected sample measurement is always greater or lesser to the same degree than the sample's true value. Proper sample handling procedures will be followed to minimize sample contamination during fish sample preparation (Section B4.1) and QC analyses (Sections B4.2 through B4.4).

Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter, a process condition, an environmental condition, or variations at a sampling point. The representativeness goal for the 2022 NLA Fish Tissue Study was addressed during the study design phase and will be satisfied by using experienced field biologists to ensure that the samples collected are actually of the type (species) specified for this study and are from the randomly selected sites specifically identified in the statistical (i.e., probabilistic) study design. Representativeness in the fish sample preparation phase centers on the fish fillet composite samples or fillet tissue aliquots and how accurately they represent the fillet mass for analysis of mercury, PCBs, or PFAS in the fish. Batch-specific rinsate and homogeneity sample analyses (Sections B5.1 through B5.3) are included as QC steps in the fish preparation process to ensure that the fish fillet homogenates are free from any laboratory sources of contamination and are thoroughly mixed, so they are therefore a representative sample of the fillet tissue.

Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. To optimize completeness, every effort is made to avoid sample and/or data loss. Accidents during sample transport or lab activities that cause the loss of the original samples will result in irreparable loss of data, which will reduce the ability to perform analyses, integrate results, and prepare reports. Whole fish samples are packed in unbreakable (plastic) shipping containers (i.e., insulated ice chests) to avoid damage during shipment of the samples to the sample repository (i.e. Microbac Laboratories in Baltimore, MD) or during transport of the samples to the fish sample preparation laboratory in Owings Mills, MD. Fillet homogenates are also packed in unbreakable shipping containers for shipment to each analytical laboratory.

Percent completeness (%C) for measurement parameters can be defined as follows:

$$\%C = \frac{v}{T} \times 100$$

Where v = the number of measurements judged valid and
T = the total number of measurements.

Completeness for the 2022 NLA Fish Tissue Study sample preparation effort is the number of samples processed relative to the number of samples that are collected and identified as valid samples for analysis. The completeness goal for the sample preparation phase of this study is 100% because processing all valid samples is critical for maintaining the integrity of the statistical design for the study. In some cases, whole fish samples may contain small fish and/or less than five individual specimens, and therefore may not provide sufficient tissue for analysis of the full list of target chemicals. In those cases, the OST Project Manager and the OST Fish Sample Preparation and Analysis Technical Leader must be notified before sample preparation activities begin, and EPA's priority order for preparing fillet aliquots for analysis must be followed (i.e., highest to lowest priority order is mercury, PFAS, and PCBs). The completeness goals for individual fillet aliquots listed in the bullets below reflect these priorities for analyzing the target chemicals. It should be noted that the total number of sampling locations may change over the course of the NLA based on location conditions (e.g., accessibility of target locations) and the availability of target species (e.g., natural biological abundance or distribution). Any changes must be approved by the OST Project Manager, and approved changes must be considered when assessing completeness. The completeness goal is achieved when the following requirements are met:

- Fillet samples are collected from each fish identified by the OST Project Manager as a valid specimen for inclusion in the composite sample, and those fillets are homogenized to prepare fish tissue aliquots for mercury, PFAS, PCBs, and lipid analyses (completeness goal is 100% for mercury, 100% for PFAS, 90% for PCB congeners, and 80% for single lipids).

- All homogenized fillet aliquots are shipped with no errors in documentation or sample handling procedures, which facilitates timely delivery of every shipment of samples and arrival of the samples at the analytical laboratory in good condition.

Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is dependent on the proper design of the sampling program and on adherence to accepted sampling techniques, procedures, and quality assurance guidelines. For fish sample preparation, comparability of data is accomplished by standardizing the sample preparation methods and the laboratory training as follows:

- All homogenized fillet samples are prepared by sample preparation laboratory personnel according to the procedures contained in this QAPP (Appendix B).

- All laboratory personnel involved with fish sample preparation will have adequate training and appropriate fillet tissue sample preparation experience (Section A8).

A8. Special Training/Certification

All laboratory staff involved in the preparation of fish fillet tissue samples must be proficient in the associated tasks, as required by the 2022 NLA Fish Tissue Study Fillet Sample Preparation, Homogenization, and Distribution Procedures (Appendix B). Specialized training is being provided for laboratory technicians who will be preparing homogenized fillet tissue samples from the whole fish samples collected for the 2022 NLA Fish Tissue Study. This training will be conducted at the Tetra Tech Biological Research Facility in Owings Mills, MD for all laboratory staff involved with fillet tissue sample preparation to accomplish the following objectives:

- Present homogenized fillet tissue sample preparation and distribution procedures as described in Appendix B,

- Demonstrate filleting and homogenizing techniques with practice fish provided by the Tetra Tech laboratory, and

- Provide hands-on opportunities for Tetra Tech laboratory staff to develop proficiency with filleting and homogenizing fish fillet samples, including equipment cleaning procedures and collection of equipment rinsate and solvent blank samples.

A9. Documents and Records

Thorough documentation of all 2022 NLA Fish Tissue Study sample preparation activities is necessary for proper sample processing in the laboratory and, ultimately, for the interpretation of study results. The Tetra Tech Biological Research Facility in Owings Mills, MD is serving as the fish sample preparation laboratory, and Tetra Tech is responsible for producing and maintaining the following documents and records:

- The Tetra Tech laboratory must prepare and submit a weekly progress report to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager (based on fish processing information recorded on each 2022 NLA Fish Sample Preparation Laboratory Bench Sheet in Appendix C) to document the status of fish sample preparation activities and provide information specified in the procedures described in Appendix B.

- The Tetra Tech laboratory must report the results for the paired rinsate and solvent blank sample analyses for mercury (PCB and PFAS rinsates and solvent blanks will be analyzed by the laboratories selected for analysis of 2022 NLA Fish Tissue Study fillet samples for PCBs and PFAS) and for the triplicate lipid results associated with each fish sample preparation batch (generally 20 fish samples per batch) to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. The Tetra

Tech laboratory is also responsible for reporting the full set of lipid analysis results to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. This includes the single lipid analysis results for 19 of the 20 fish samples in a typical batch and the average triplicate lipid results for one fish sample in the batch.

- The Tetra Tech laboratory must provide shipping information (e.g., tracking number, airbills, and shipping forms) to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager for aqueous QC samples and fillet tissue samples sent to designated analytical laboratories.

All documents and records prepared for the 2022 NLA Fish Tissue Study fillet sample preparation will be maintained by Tetra Tech for the duration of the study and retained for a period of five years following completion of the study (unless otherwise directed by EPA).

B. DATA GENERATION AND ACQUISITION

B1. Sampling Process Design (Experimental Design)

The target population for the 2022 NLA Fish Tissue Study, also referred to as the fish fillet tissue contaminants indicator, consists of all lakes and reservoirs (collectively referred to as "lakes") in the lower 48 states that have a surface area $\geq$1 hectare and that contain 1,000 square meters of open, unvegetated space and a permanent population of predator fish species. The design for selecting the whole fish sampling sites for this human health fish tissue study incorporated objectives to generate the following:

- Statistically representative data on the concentrations of mercury, PCBs, and PFAS in lake fish commonly consumed by humans.

- The first national-scale information on the potential for PFAS to bioaccumulate in fish fillet tissue from fish samples collected in lakes across the lower 48 states.

- Data to answer questions concerning the occurrence of PFAS in the fillets of lake fish and the potential for human exposure through fish consumption.

Fish fillet tissue data from the 2022 NLA Fish Tissue Study (i.e., fish fillet tissue contaminants indicator) will also provide EPA with the opportunity to evaluate changes in the levels of lake contamination over time by comparing 2022 predator fish fillet tissue results to the predator fish fillet tissue data generated during the 2000-2003 National Lake Fish Tissue Study (NLFTS).

The details of the sampling process design, sampling methods, and sample handling and custody procedures are described in EPA's *National Lakes Assessment 2022 Field Operations Manual* prepared by OWOW with fish sampling and handling input from OST (USEPA 2022b).

Sampling at the 2022 NLA Fish Tissue Study sites involves collection of whole fish samples for analysis of fillet tissue samples for mercury, PFAS, and PCBs. To meet the study objectives, one fish sample is collected from each site. Ideally, each fish sample is a routine fish composite

sample that consists of five fish of adequate size to provide a minimum of 60 grams of fillet tissue for chemical analysis. Fish are selected for each composite sample by applying the following criteria:

- All are of the same species.
- All satisfy legal requirements of harvestable size (or weight) for the sampled site, or at least be of consumable size (defined as 190 mm or greater in length for this study) if no legal harvest requirements are in effect.
- All are of similar size, so that the smallest fish specimen in a composite sample is no less than 75% of the total length of the largest specimen.
- All are collected at the same time, i.e., collected as close to the same time as possible, but no more than one week apart. (Note: Individual fish may have to be frozen until all fish to be included in the composite sample are available for delivery to the designated laboratory.)

Accurate taxonomic identification is essential for preventing the mixing of closely related target species. Under no circumstances may specimens from different species be used in a fish composite sample.

Field crews are collecting fish samples for the 2022 NLA Fish Tissue Study between May and September during the 2022 field season unless additional time is required in October or later to complete fish sampling due to constraints imposed on field crews (for example, due to field sampling restrictions associated with the coronavirus pandemic).

B2. Sampling Methods

Sampling method procedures and requirements for collection of whole fish samples for the 2022 NLA Fish Tissue Study are detailed in EPA's *National Lakes Assessment 2022 Quality Assurance Project Plan* (USEPA 2022a) and *National Lakes Assessment 2022 Field Operations Manual* (USEPA 2022b). These sampling procedures and requirements, which apply to whole fish sample collection at the 636 lakes designated as 2022 NLA Fish Tissue Study sampling sites, are summarized below.

The sampling objective is for field crews to obtain one representative whole fish composite sample from each designated lake. Collecting fish composite samples is a cost-effective means of estimating average chemical concentrations in the tissue of target species, and compositing fish ensures adequate sample mass for analysis of multiple chemicals. The sampling procedures specify that each fish composite sample should consist of five similarly sized adult fish of the same species. OST developed a recommended fish species list that contains 12 primary target predator fish species and 10 secondary predator fish species (Table 2). Field crews use this list as the basis for selecting appropriate fish species for the 2022 NLA fish samples. In the event that a crew is unable to collect fish which are on either of the predator lists, then the onsite biologist can select an appropriate predator fish species. The method applied for fish collection is left to the discretion of the field crew, but the crews are encouraged to use hook and line or

electrofishing. Crews may also seine or use gill nets when this would be an efficient approach to sample the target fish species and when allowed by the sampling permit, but crews are not to use trawling to collect fish.

Table 2. Primary and Secondary NLA Target Species for Whole Fish Collection

Primary Predator Fish Species Scientific Name*	Primary Predator Fish Species Common Name
Micropterus salmoides	Largemouth Bass
Micropterus dolomieu	Smallmouth Bass
Pomoxis nigromaculatus	Black Crappie
Pomoxis annularis	White Crappie
Sander vitreus	Walleye
Perca flavescens	Yellow Perch
Morone chrysops	White Bass
Esox lucius	Northern Pike
Salvelinus namaycush	Lake Trout
Salmo trutta	Brown Trout

Secondary Predator Fish Species Scientific Name*[a]	Secondary Predator Fish Species Common Name
Lepomis macrochirus	Bluegill
Ambloplites rupestris	Rock Bass
Micropterus punctulatus	Spotted Bass
Sander canadenis	Sauger
Morone saxatilis	Striped Bass
Morone americana	White Perch
Esox niger	Chain Pickerel
Oncorhynchus clarkii	Cutthroat Trout
Coregonus clupeaformis	Lake Whitefish
Prosopium williamsoni	Mountain Whitefish

* Minimum acceptable length is 190 mm, TL

In preparing 2022 NLA Fish Tissue Study samples for shipping, field crews record sample number, species name, specimen length, sampling location, and sampling date and time on an electronic Whole Fish Sample Form in the 2022 NLA app. Each fish is wrapped in solvent-rinsed, oven-baked aluminum foil, with the dull side in using foil sheets provided by EPA. Individual foil-wrapped specimens are placed into a length of food-grade polyethylene tubing, each end of the tubing is sealed with a plastic cable tie, and a fish specimen label is affixed to the outside of the food-grade tubing with clear tape. All of the wrapped fish in the sample from each lake are placed in a large plastic bag and sealed with another cable tie, then placed immediately on dry ice for shipment to Microbac Laboratories in Baltimore, Maryland. Field crews are directed to pack fish samples on dry ice in sufficient quantities to keep samples frozen for up to 48 hours (i.e., 50 pounds), and to ship them via priority overnight delivery service (i.e., FedEx), so that they arrive at Microbac Laboratories in less than 24 hours from the time of sample collection. Alternatively, field crews may transport 2022 NLA Fish Tissue Study whole fish samples on wet or dry ice (depending on the distance) to an interim facility where the fish samples are frozen and stored for up to two weeks before overnight shipping to Microbac Laboratories on dry ice as described above.

B3. Sample Receipt and Inspection

This section describes the procedures that apply once the 2022 NLA fish fillet tissue contaminants indicator (FTIS) samples are shipped from the field to Microbac Laboratories. The whole fish samples are being collected by various organizations participating with EPA in this study, including state and tribal agencies and contractors. Although samples are shipped frozen on dry ice, they must be inspected promptly on receipt. As samples are received, a Microbac Laboratories representative will:

- Check that each cooler has arrived undamaged and verify that samples are still frozen and in good condition.
- Check the temperature of one of the samples in the cooler using a thermometer that reads to at least -20 degrees Celsius (ºC), or an infra-red (IR) temperature "gun" and report the reading to GDIT via email.
- Notify GDIT via email about receipt of samples on the day of delivery and report if each sample arrives frozen with dry ice remaining in the cooler.
- Store the coolers in the onsite freezer.

Microbac Laboratories will notify GDIT on the day of delivery about any problems encountered upon receipt of samples (e.g., no dry ice left in cooler, fish partly or completely thawed, etc.). GDIT subsequently reports sample receipt and inspection issues to the OST Project Manager and OST Fish Sample Preparation and Analysis Technical Leader, then coordinates with EPA to resolve the issues.

Generally, within two weeks of 2022 NLA whole fish sample deliveries, a GDIT staff member acting as a sample custodian will:

- Retrieve coolers containing 2022 NLA whole fish samples from the freezer at Microbac Laboratories.
- Remove whole fish samples from each cooler and record the Site ID and EPA Sample Number.
- Transfer the whole fish samples to trays in the freezer for interim storage and leave empty coolers outside the freezer for Tetra Tech staff to retrieve.
- Report any discrepancies GDIT finds in individual fish label information and receipt of fish samples from sampling sites to the OST Project Manager for resolution.

After completing whole fish sample check-in, GDIT stores the whole fish samples in the freezer at Microbac Laboratories where they are kept at temperatures less than or equal to -20°C until they are ready to transfer to the Tetra Tech laboratory in Owings Mills, MD for fish sample preparation. (The freezers are maintained by Microbac Laboratories under a separate agreement with GDIT and are continuously monitored by an automated temperature monitoring system.)

B4. Fish Sample Preparation and Analytical Methods

The laboratory at Tetra Tech's Biological Research Facility in Owings Mills, MD is the fish sample preparation laboratory (prep lab) for the 2022 NLA Fish Tissue Study samples. Tetra Tech is responsible for preparing fillet tissue samples from the whole fish samples, which involves removing scales from each valid fish in the whole fish sample, filleting valid fish in the whole fish samples, homogenizing the fillet tissue, preparing the required number of fish fillet tissue aliquots for analysis and archive, shipping the fillet tissue aliquots for each type of analysis to the designated analytical laboratories, and providing short-term storage for archived fillet tissue samples in a freezer at their facility. The specific procedures for 2022 NLA Fish Tissue Study sample preparation activities are described in Appendix B.

This section provides descriptions of 2022 NLA Fish Tissue Study fillet sample preparation methods (i.e., methods for preparing homogenized fillet tissue samples). It also describes

methods for analysis of lipids in ground fillet tissue samples for homogeneity testing and lipid content and for analysis of mercury, PCBs, and PFAS in equipment rinsate and solvent blank samples to test the adequacy of equipment cleaning. Lipid analysis of ground fillet tissue samples for homogeneity testing and mercury, PCB, and PFAS analysis of equipment rinsate and solvent blank samples for testing sufficient equipment cleaning are conducted as part of the QC procedures for fish sample preparation. Analytical method requirements for analysis of homogenized fillet samples for target chemicals (i.e., mercury, PFAS, and PCBs) will be described in the 2022 NLA Fish Tissue Study sample analysis QAPP, which will be developed at a later date.

B4.1 Fish Fillet Sample Preparation

Trained laboratory staff at Tetra Tech's Biological Research Facility in Owings Mills, MD are responsible for preparation of homogenized fillet tissue samples from 2022 NLA whole fish samples. Preparing the homogenized fillet tissue samples involves removing scales from each valid fish specimen in a sample, filleting the individual fish to be included in the tissue composite sample, homogenizing the fillet tissue from each whole fish sample, preparing the required number of fish fillet tissue aliquots for analysis and archive, shipping the fillet tissue aliquots for each type of analysis to the designated analytical laboratories, and storing archived fillet tissue samples on an interim basis in a freezer at their facility. Specific procedures for fillet tissue sample preparation activities are summarized below and fully described in Appendix B.

Homogenized Fillet Sample Preparation

The filleting process involves removing the fillet (with skin on and "belly flap" or ventral muscle attached) from both sides of each valid fish in the whole fish sample. The combined fillets from all valid fish in the whole fish sample are weighed to the nearest gram (wet weight) before they are homogenized together. An electric meat grinder is used to prepare each homogenized fillet sample. The entire set of fillets (with skin and belly flap) from both sides of every valid fish in the whole fish sample (i.e., ideally 5 fish per sample) are homogenized, and the entire homogenized volume is used to prepare the fillet tissue sample aliquots. Grinding of the fillet tissue is repeated until the tissue consists of a uniform color and finely ground texture. Homogeneity is confirmed by conducting triplicate analyses of the lipid content in one fish sample from each fish sample preparation batch (generally one in 20 fish samples). The collective weight of the homogenized fillet tissue from the whole fish sample is recorded to the nearest gram (wet weight) after processing. Tetra Tech lab technicians prepare fillet tissue sample aliquots for chemical analysis and archive according to specifications in Table 1 of Appendix B.

Fish Sample Preparation Batches

Each 2022 NLA fish sample preparation batch generally consists of 20 whole fish samples. The number of whole fish samples in the final fish sample preparation batch (or two) may be adjusted to include a few more than 20 or fewer than 20, depending on what fraction of 20 whole fish samples are left near the end of fish processing for assignment to a batch. Tetra Tech staff will develop fish sample preparation instructions that include all valid fish samples available for processing. Processing may not begin until the OST Fish Sample Preparation and Analysis

Technical Leader and the OST Project Manager review the draft instructions and the OST Fish Sample Preparation and Analysis Technical Leader approves the final instructions, and batch assignments with OST Project Manager concurrence.

B4.2 Lipid Analysis

Tetra Tech will procure the services of an analytical laboratory (ALS Environmental) to conduct one set of triplicate lipid analyses per fish sample preparation batch (see definition in Section B4.1) as described in Steps 28 and 29 of Appendix B. For each of the remaining samples in the batch (usually 19), the laboratory will analyze a single homogenized fillet tissue aliquot for lipid content.

Lipids are extracted from each fillet tissue sample using the EPA 3541/NOAA Method. This method is based on the procedure described in the Puget Sound Protocols (Bligh and Dyer 1959) and EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1 (USEPA 2000). This procedure is used to determine the lipid content in biological tissue. A homogenized fillet tissue sample aliquot is extracted with organic solvent, the extract is evaporated using moderate heat, and the lipid weight is determined.

Percent lipid content is calculated by dividing the lipid weight by the initial fillet tissue aliquot weight and multiplying that result by 100. The batch-specific lipid results for homogeneity evaluations are reviewed initially by Tetra Tech and independently by GDIT against the QC specifications detailed in Section B5.1.

B4.3 Mercury Rinsate Analysis

Tetra Tech laboratory technicians prepare one set of paired rinsate and solvent blank samples per fish sample preparation batch (see definition in Section B4.1) for mercury analysis as described in Steps 25 through 27 of Appendix B. This set of paired QC samples consists of one DI water equipment rinsate sample and one DI water blank sample. Tetra Tech will procure the services of an analytical laboratory (ALS Environmental) to conduct mercury analysis of these QC samples using EPA Method 245.1 (USEPA 1994). This method was developed to measure total mercury (organic and inorganic) in aqueous samples. The flameless atomic absorption procedure is a physical method based on the absorption of radiation at 253.7 nanometers by mercury vapor. Mercury is first reduced to its elemental state using a potassium permanganate digestion procedure. The samples/standards and a stannous chloride reagent are then pumped into the mercury analyzer and mixed. Argon gas is introduced into the solution stream. Absorbance (peak height) is measured as a function of mercury concentration. Results of the batch-specific mercury rinsate and solvent blank analyses are reviewed initially by Tetra Tech and independently by GDIT against the QC specifications detailed in Section B5.2.

B4.4 PCB and PFAS Rinsate Analysis

The PCB and PFAS paired rinsate and solvent blank samples will not be analyzed during the fish sample preparation process. Instead, they will be analyzed by the respective laboratories selected for PCB and PFAS analysis of the 2022 NLA fish fillet tissue samples. A description of the method used for analysis of the aqueous PCB and PFAS rinsate and solvent blank samples

will be provided in the 2022 NLA Fish Tissue Study sample analysis QAPP, which will be developed at a later date.

B5. Fish Sample Preparation Quality Control Requirements

The procedures associated with the 2022 NLA Fish Tissue Study fillet tissue sample preparation process include the following: preparation of homogenized fillet tissue samples, which includes triplicate lipid analyses of homogenized fillet tissue samples to test for homogeneity (Section B5.1) and analytical testing for mercury, PCBs, and PFAS in equipment rinsate and solvent blank samples (Sections B5.2, and B5.3, respectively) to test for adequate equipment cleaning. These QC procedures are performed for one whole fish sample in each fish sample preparation batch (usually one in a batch of 20 fish samples).

B5.1 Homogenized Fillet Samples

Lipid content analysis is used as a surrogate to confirm homogeneity of the homogenized fish fillet samples that are prepared in the Tetra Tech Biological Research Facility laboratory. A laboratory (ALS Environmental) under contract to Tetra Tech will conduct triplicate lipid analyses of ground fillet tissue aliquots from one whole fish sample in each fish sample preparation batch and use the lipid content of those 3 fillet tissue aliquots to confirm that the ground fillet tissue is homogeneous. Laboratory technicians prepare this triplicate lipid aliquot (30 to 35 g) of homogenized fillet tissue mass for lipid analysis following the specific procedures described in Appendix B for placing the aliquot in a container, labeling it, and storing it in a freezer (refer to Step 19 in Appendix B). All homogenized fillet tissue aliquots for lipid analysis are shipped on dry ice and under chain of custody to the designated analytical laboratory. The results of the homogeneity testing are delivered to Tetra Tech for their initial review and forwarded to the OST Fish Sample Preparation and Analysis Technical Leader and OST Project Manager for independent review by GDIT and EPA.

From the triplicate lipid results, GDIT calculates the mean lipid content (in percent), the standard deviation (SD), and the relative standard deviation (RSD) using the formulas below, or the corresponding functions in Excel, and reports the results to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager.

$$\text{mean } \%\,\text{lipids} = \frac{\sum_{i=1}^{3} (\%\,\text{lipids})_i}{3}$$

$$\text{SD} = \sqrt{\frac{\sum_{i=1}^{3} (\%\,\text{lipids}_i - \text{mean lipids})^2}{2}}$$

$$\text{RSD} = \frac{\text{SD}}{\text{mean}}$$

If the RSD of the triplicate lipid results is less than or equal to 15% for mean % lipid measurements that are greater than or equal to 2.5%, or if the RSD of the triplicate lipid results is less than or equal to 20% for mean % lipid measurements less than 2.5%, then EPA will notify

Tetra Tech that the homogenization effort is sufficient for all of the homogenized fillet tissue samples (usually 20) in each analysis batch (refer to Step 29 in Appendix B).

Tetra Tech laboratory staff may continue to process up to two additional fish sample preparation batches. However, the laboratory may not continue to process batches beyond that third fish sample preparation batch until receiving notification from the OST Fish Sample Preparation and Analysis Technical Leader (after OST Project Manager concurrence) that review of homogeneity test results from the initial batch is complete and the results are deemed satisfactory.

B5.2 Mercury Analysis of Rinsate Samples

The Tetra Tech laboratory prepares one set of DI water equipment rinsate and DI water blank samples during processing of each fish sample preparation batch and a subcontracted laboratory (ALS Environmental) analyzes each set of rinsate and blank samples for total mercury using EPA Method 245.1, which is a cold-vapor atomic absorption procedure applicable to water samples (Section B4.3). The pair of blank and rinsate samples are analyzed individually, not in batches of up to 20, in order to provide timely feedback of the cleanliness of the homogenization equipment.

EPA Method 245.1 requires daily instrument calibration and analysis of two quality control samples, an instrument blank and a laboratory control sample. The rinsates are prepared in reagent water, so there is little chance of a "matrix effect." Each laboratory control sample, which is also prepared in reagent water, provides sufficient information on the performance of the method and the laboratory. The QC sample requirements, including the acceptance criteria and corrective actions, are summarized in Table 3 below.

Table 3. QC Samples and Acceptance Criteria for Mercury Analysis of Rinsates

Quality Control Sample	Frequency	Acceptance Criteria
Instrument blank	With each rinsate sample	Result must be less than the MDL. Otherwise, redigest and reanalyze the rinsate sample.
Laboratory control sample	With each rinsate sample	80 - 120% recovery of mercury. Otherwise, correct instrumental problems, and redigest and reanalyze the rinsate sample.

The batch-specific rinsate results are reviewed initially by Tetra Tech and forwarded to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager for independent review by GDIT. The rinsate results are evaluated based on the mass of mercury detected and the assumption that all of the apparent contamination could be transferred to a nominal 410-g mass of homogenized tissue. If review of the results shows that the rinsate samples are below the acceptance limit for mercury, i.e., 0.2 µg/L for total mercury based on the method detection limit for an aqueous sample, then the equipment cleaning effort is sufficient for all samples in that fish sample preparation batch.

Rinsate results for mercury above the reporting limit mentioned above may cause a need for corrective actions by the Tetra Tech laboratory. These corrective actions may include revisions to the laboratory's equipment cleaning procedures, followed by a successful demonstration of the revised cleaning procedures through preparation and analysis of additional rinsate samples.

Tetra Tech laboratory staff may continue to process up to two additional fish sample preparation batches. However, laboratory staff may not continue to process batches beyond that third fish sample preparation batch until receiving notification from the OST Fish Sample Preparation and Analysis Technical Leader (with OST Project Manager concurrence) that review of rinsate test results from the initial fish sample preparation batch is complete and the results are deemed satisfactory.

B5.3 PCB and PFAS Analysis of Rinsate Samples

The QC requirements for PCB and PFAS analysis of rinsate samples will be specified in the 2022 NLA Fish Tissue Study sample analysis QAPP, which will be developed at a later date.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

There are no analytical instruments used in the preparation of the fillet tissue samples. However, the balances used to weigh the whole fish and the fillet tissue sample aliquots are inspected daily and the homogenization equipment (meat grinder) is inspected when it is reassembled after cleaning between samples.

All analytical instruments associated with fish sample preparation operations are inspected and maintained as described in the respective analytical methods and laboratory Standard Operating Procedures. This includes the instruments involved with the fish fillet homogeneity (lipid) testing; with analyses of aqueous rinsate and solvent blank samples for mercury, PCBs, and PFAS; and with analysis of single-lipid fillet tissue aliquots for percent lipids.

B7. Instrument/Equipment Calibration and Frequency

The balances used to weigh the whole fish and the fillet tissue during the various stages of homogenization and aliquot preparation are calibrated on a regular schedule and calibrations are verified at the beginning of each day on which the balances are used.

The mercury analysis method for the rinsate samples, Method 245.1 described in Section B5, specifies calibration with five calibration standards. This method requires initial calibration and periodic calibration verifications and specifies QC acceptance criteria for calibration.

B8. Inspection/Acceptance of Supplies and Consumables

Careful and thorough planning is necessary to ensure the efficient and effective completion of the fillet tissue sample preparation tasks. Fish preparation laboratory equipment and supplies are described in Appendix B. All fish sample packaging and shipping supplies are provided by Tetra Tech. It is the responsibility of the Tetra Tech laboratory technicians to procure, compile, and inspect the necessary fillet sample preparation equipment and supplies prior to commencement of fillet tissue sample preparation activities, and to inspect packaging and shipping supplies before fillet tissue samples are shipped to the respective analytical laboratories for analysis.

B9. Non-direct Measurements

Non-direct measurements are not required for this project.

B10. Data Management

Data management practices employed in this study are based on standard data management practices used for EPA's National Lake Fish Tissue Study and other OST fish contamination studies (e.g., the 2008-09 NRSA Fish Tissue Study, 2010 Great Lakes Human Health Fish Tissue Study, 2013-14 NRSA Fish Tissue Study, 2015 Great Lakes Human Health Fish Fillet Tissue Study, 2018-19 NRSA Fish Tissue Study, and 2020 Great Lakes Human Health Fish Fillet Tissue Study). The data management (i.e., sample tracking, data tracking, data inspection, data quality assessment, and database development) procedures have been regularly applied to other technical studies by Tetra Tech and GDIT.

Fish Sample Collection Data

Collection of whole fish samples for the 2022 NLA Fish Tissue Study is documented and tracked through the use of standardized FTIS fields in the 2022 NLA app, Whole Fish Sample Identification Labels, and 2022 NLA FTIS tracking spreadsheets. Specific fish sample collection data requirements are detailed in the Field Operations Manual (USEPA 2022b) prepared by OWOW with fish sampling, handling, and shipping information provided by OST. Whole fish samples are shipped to Microbac Laboratories (Baltimore, MD) by an overnight air delivery service that provides constant tracking of shipments (i.e., FedEx).

The Tetra Tech laboratory retains a copy of the 2022 NLA FTIS tracking spreadsheet sample information that is received electronically from the NARS IM group upon shipment of each 2022 NLA whole fish sample. Tetra Tech staff perform a data QC check on each sample tracking spreadsheet, compile each individual sample tracking spreadsheet into a combined current master sample tracking spreadsheet, and forward it to the OST Project Manager and the OST Fish Sample Preparation and Analysis Technical Leader, along with documentation reporting the field data QC review (consistent with field data QC documentation provided for previous EPA fish tissue studies). All electronic files related to fish sample collection that are produced and retained by Tetra Tech are maintained in a project file during the active phase of this project, and for a period of 5 years following completion of the project (unless otherwise directed by EPA).

Upon completion of fish sampling activities, Tetra Tech develops a Fish Sample Master Spreadsheet based on information recorded by all field sampling crews in the 2022 NLA app and provided by the NARS IM group in sample tracking spreadsheets. All data entries are checked for errors in transcription and computer input by qualified persons (minimum of two) who did not originally enter the data. If there is any indication that requirements for sample integrity or data quality have not been met, the Tetra Tech QA Officer is notified immediately (with an accompanying explanation of the problems encountered) for discussion and resolution of quality issues before delivery of the Fish Sample Master Spreadsheet to the OST Project Manager and the OST Fish Sample Preparation and Analysis Technical Leader.

Fish Sample Preparation Data

The Tetra Tech laboratory is required to maintain all records and documentation associated with the preparation of 2022 NLA whole fish samples (e.g., weekly reports containing fillet tissue sample preparation data and fillet tissue aliquot documentation), the analyses of fillet tissue samples for lipids for homogeneity testing and lipid content, and the analyses of rinsate samples for mercury. All required analytical laboratory reports and documentation, including raw data, must be sequentially paginated and clearly labeled with the laboratory name, and associated sample numbers. Any electronic media submitted must be similarly labeled. The sample preparation laboratory and analytical laboratories contracted for homogeneity testing and rinsate analysis will adhere to a comprehensive data management plan that is consistent with the principles set forth in Good Automated Laboratory Practices, EPA Office of Administration and Resources Management (USEPA 1995) or with commonly employed data management procedures approved by the National Environmental Laboratory Accreditation Conference (NELAC).

Data Retention

All computer files associated with the 2022 NLA whole fish samples are stored in a project subdirectory by Tetra Tech and are copied to network storage for archive for the 5 years subsequent to project completion (unless otherwise directed by the OST Project Manager).

C. ASSESSMENT AND OVERSIGHT

C1. Assessments and Response Actions

C1.1 Fish Sample Preparation

The Tetra Tech laboratory supporting fish sample preparation for this study and the analytical laboratories responsible for lipid testing and rinsate analysis each have a comprehensive QA program in place and operating at all times. In performing fish sample preparation and QC and lipid sample analyses for this study, each laboratory will adhere to the requirements of those respective QA programs. Copies of those plans are maintained on file at Tetra Tech.

If any technical problems are encountered during operations at the Tetra Tech laboratory, the Tetra Tech Project Leader will consult with the Tetra Tech Laboratory Manager, the OST Fish Sample Preparation and Analysis Technical Leader, and the OST Project Manager to identify corrective actions. The Tetra Tech Project Leader is responsible for ensuring that the corrective actions are successfully implemented. Section B5 of this QAPP identifies corrective actions for any lipid or mercury analysis results generated by the analytical laboratory (or laboratories) that do not meet the QC acceptance criteria. The Tetra Tech Project Leader is responsible for ensuring that each analytical laboratory implements the required corrective actions.

Analysis of the QC rinsate samples for PCBs and PFAS will be conducted by the respective laboratories selected for PCB and PFAS analysis of the 2022 NLA homogenized fillet tissue samples, respectively. PCB and PFAS analyses of both the QC rinsate samples (from the fish sample preparation process) and the fillet tissue samples will be included under a separate sample analysis QAPP that will be developed at a later date.

C1.2 Performance Audits

Performance audits are qualitative checks on different segments of project activities. For the 2022 NLA Fish Tissue Study, performance audit techniques include checks on post-collection review of field measurements and the use of triplicate lipid analyses of one homogenized sample in every fish sample preparation batch as a check on homogeneity. The Tetra Tech Project Leader is responsible for overseeing work as it is performed and for periodically conducting QC checks during fillet sample preparation for this project. Results of these checks are reported to the Tetra Tech Quality Assurance Officer, the OST Fish Sample Preparation and Analysis Technical Leader, and the OST Project Manager.

C1.3 System Audits

System audits are qualitative reviews of project activities to check that the overall quality program is functioning and that the appropriate QC measures identified in the QAPP are being implemented. If the results of the performance audits described in Section C1.2 indicate problems, the Tetra Tech QA Officer will conduct an internal system audit during the project and report the results to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. If QA/QC deficiencies are discovered, additional internal system audits are conducted until the Tetra Tech QA Officer, the OST Fish Sample Preparation and Analysis Technical Leader, and the OST Project Manager conclude that overall project quality requirements are being met.

C2. Surveillance

C2.1 Whole Fish Sample Shipment

When 2022 NLA Fish Tissue Study whole fish samples are shipped to Microbac Laboratories (Baltimore, MD), the NARS Information Management (IM) Group contacts the OST Project Manager, OST Fish Sample Preparation and Analysis Technical Leader, Tetra Tech Project Leader, and GDIT via email distribution of the sample tracking spreadsheet to notify them of the upcoming fish sample deliveries, and GDIT contacts the OST Project Manager and the OST Fish Sample Preparation and Analysis Technical Leader when the samples arrive. Within 24 hours of sample receipt, GDIT notifies the OST Project Manager and the OST Fish Sample Preparation and Analysis Technical Leader of sample condition. If problems with the shipment are noted, Tetra Tech and GDIT will work with the OST Project Manager to resolve any problems as quickly as possible to minimize data integrity problems.

C2.2 Fish Sample Preparation

The content of fish sample preparation batches and the process for forming the batches are described in Section B4.1. The Tetra Tech laboratory may not begin processing any 2022 NLA Fish Tissue Study whole fish samples until this QAPP is approved and the laboratory personnel responsible for fish sample preparation have been trained on the fish sample preparation procedures and requirements described in this QAPP.

The Tetra Tech Project Leader coordinates with the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager regarding fish tissue sample shipments to other laboratories (i.e., the analytical laboratories responsible for mercury analysis of fish sample preparation equipment rinsate and solvent blank QC samples and for lipid analysis of homogenized fillet tissue samples, including triplicate lipid analysis of one fish sample per fish sample preparation batch for homogeneity testing) once analysis contracts are in place. Tetra Tech communicates periodically with laboratory staff by telephone or email to monitor the progress of lipid and mercury analyses. If technical problems are encountered during fish sample preparation or during lipid and mercury analyses, the Tetra Tech Project Leader will identify a technical expert within Tetra Tech to assist in resolving the problem, and work with the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager to identify and implement a solution to the problem. The Tetra Tech laboratory is permitted to work two batches ahead of the delivery and review of batch-specific QC results that indicate if the homogenization and equipment cleaning procedures for each fish sample preparation batch are adequate.

If the fish sample preparation (Tetra Tech) or analytical (ALS Environmental) laboratories fail to deliver QC data on time, or if an analytical laboratory notifies Tetra Tech of anticipated reporting or sample processing delays, Tetra Tech notifies the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager of the situation. To the extent possible, Tetra Tech will adjust schedules and shift resources as necessary to minimize the impact of laboratory delays on EPA schedules. Tetra Tech will immediately notify the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager of any laboratory delays that are anticipated to impact EPA schedules.

C3. Reports to Management

Upon completion of weekly fish sampling and sample preparation activities, the Tetra Tech Project Leader provides the OST Project Manager and OST Fish Sample Preparation and Analysis Technical Leader with reports of fish sampling crew and Tetra Tech laboratory progress for the preceding week when these activities are occurring. These weekly progress reports include specific details about the fish sample collection and fillet sample preparation activities and note any concerns about sample quality and resolution of those concerns. Following completion of fish sampling and fillet sample preparation activities, Tetra Tech prepares a fish collection effort summary (which details all sampling participants, sampling locations, and specimens collected) and a sample preparation summary (which lists all samples processed and identifies all fillet tissue aliquots prepared) for review by the OST Project Manager and the OST Fish Sample Preparation and Analysis Technical Leader.

D. DATA VALIDATION AND USABILITY

D1. Data Review, Verification, and Validation

The processes for data review, verification, and validation provide an approach for standardized data quality assessment. These processes are also important for determining the usability and limitations of the whole fish sample collection and fillet tissue sample preparation data generated

for the 2022 NLA Fish Tissue Study. Processes for each step in the data quality assessment are described below.

D1.1 Data Review

Fish Sample Collection

Tetra Tech reviews data entries in the 2022 NLA Fish Tissue Study whole fish sample tracking spreadsheets and individual fish sample labels for completeness, correctness, and consistency among the fish sampling records. Any errors or omissions identified during this review are reported to the OST Project Manager and corrected by contacting the 2022 NLA Field Logistics Coordinator (Chris Turner of GLEC) or the field crew leader who initially made the data entries, if necessary. The Tetra Tech Project Leader is responsible for ensuring that all errors or omissions are addressed in the fish sampling records before the fish samples are transferred from Microbac Laboratories to the Tetra Tech Laboratory for fish sample preparation.

Analysis of Lipid and Fish Sample Preparation QC Samples

The Laboratory Managers at each analytical laboratory designated for analysis of lipid and fish sample preparation QC samples review all laboratory results and calculations prior to submission of a data package. Any errors identified during this peer review are returned to the lab analyst for correction. Following correction of the errors, each Laboratory Manager verifies that the final data package is complete and compliant with the contract, signs each data submission to certify that the package was reviewed and determined to be in compliance with the terms and conditions of the contract, and submits the data package to the Tetra Tech Project Leader.

D1.2 Data Verification

The basic goal of data verification is to ensure that project participants know what data were produced, if these data are complete, if the data are contractually compliant, and if the data meet the objectives of the study and the QA requirements described in this QAPP.

Fish Sample Collection

Tetra Tech staff independent of fish sampling crews verify fish sample collection data reviewed and submitted by each field crew leader. This involves verifying that all data entries in the sample tracking spreadsheets for 2022 NLA whole fish samples and whole fish sample labels are complete, correct, and consistent among the fish sampling records. The data verifier reports any discrepancies identified during this process to the Tetra Tech Project Leader. The Tetra Tech Project Leader is responsible for reconciling any discrepancies reported during data verification with the appropriate associated field personnel and for notifying the data verifier about the resolution of these discrepancies. The data verifier is responsible for documenting resolution of these data entry discrepancies.

Analysis of Lipid and Fish Sample Preparation QC Samples

The Tetra Tech Laboratory Manager conducts initial reviews of the fish sample preparation QC sample analysis results for each 2022 NLA Fish Tissue Study sample preparation batch and for the single lipid analysis results associated with each fish sample to verify the completeness and accuracy of these data and their compliance with QC acceptance criteria in Section B5 of this QAPP. Verification of these analytical results involves review of data for percent lipid measurements (including the triplicate lipid analysis results for the homogeneity testing of one fish sample per fish sample preparation batch, along with lipid analysis results for the remaining fish samples) and review of sample processing equipment rinsate and corresponding solvent blank QC sample data. The Tetra Tech Project Leader verifies the summary level results for these QC samples and remaining lipid samples, determines if they meet the project objectives in this QAPP, and reports the verification findings to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. The GDIT analytical chemist supporting the 2022 NLA Fish Tissue Study conducts an independent review of analytical results for lipids and for fish sample preparation QC samples and reports the verification findings to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. The OST Project Manager and OST Fish Sample Preparation and Analysis Technical Leader work with the Tetra Tech Project Leader and the GDIT analytical chemist to resolve any differences in their respective verification findings.

D1.3 Data Validation

Data validation is the process of evaluating the quality of the results relative to their intended use. This process is applied to fish sample collection and fish sample preparation as described below.

Fish Sample Collection

Evaluating the quality of fish sample collection results involves comparing these results to the fish sampling requirements described in the 2022 NLA Field Operations Manual (USEPA 2022b) prepared by OWOW. These requirements include collecting fish samples from specific waterbodies and obtaining particular fish species and numbers of fish to meet study objectives.

Fish Sample Preparation

The data validation process for fillet tissue sample preparation is more limited than the process applied during validation of analytical data from analysis of fillet tissue samples for the study-specific target chemicals. It focuses on evaluating the clarity and accuracy of required information in the fish sample preparation weekly progress reports (e.g., percentage of total fillet mass compared to the total body mass, tissue mass requirements for specified tissue aliquots, etc.).

D2. Verification and Validation Methods

Fish Sample Collection Data

The initial step in the process for data verification involves Tetra Tech staff independent of fish sampling operations conducting reviews of all data related to fish sample collection as a means of identifying any discrepancies among sampling data and related information entered in the sample tracking spreadsheets for 2022 NLA Fish Tissue Study whole fish samples and whole fish sample labels. Results from each review are documented in a series of data verification forms and compiled in a data review file that is submitted to the OST Project Manager after the end of the final field sampling season. The fish sample collection data QC file includes the study-specific collective 2022 NLA Fish Tissue Study sample tracking spreadsheet for whole fish samples, as well as detailed results of the QC review of the fish sampling data and sample description information that are recorded on standard forms (e.g., the Data Review Form and the Sample Description Review Form). Any discrepancies among the fish sampling records for the 2022 NLA Fish Tissue Study and resolution of these discrepancies are reported to the OST Project Manager.

Lipid Data and Fish Sample Preparation QC Sample Data

The first stage in the data verification process involves the Tetra Tech Laboratory Manager performing a completeness check in which all elements in each analytical laboratory submission are evaluated to verify that results for all specified samples are provided, that data are reported in the correct format, and that all relevant information, such as preparation and analysis logs, are included in the data package. Corrective action procedures will be initiated if deficiencies are noted. The Tetra Tech Lab Manager will transmit the analytical laboratory submission to the OST Fish Sample Preparation and Analysis Technical Leader, the OST Project Manager, and the GDIT data review chemist for independent review.

The second stage of the data verification process focuses on an instrument performance check in which the GDIT data review chemist verifies that calibrations, calibration verifications, standards, and calibration blanks, as they apply to either lipid analysis or analysis of fish sample preparation QC samples, were analyzed at the appropriate frequency and met method or study performance specifications. If errors are noted at this stage, GDIT will identify corrective action procedures for Tetra Tech to initiate with the analytical laboratory immediately.

Stage three of the data verification process focuses on a laboratory performance check in which the GDIT data review chemist verifies that the laboratory correctly performed the required analytical procedures and was able to demonstrate a high level of precision and accuracy. This stage includes evaluation of QC elements, such as laboratory control samples and blanks, as they apply to either analysis of lipid samples or fish sample preparation QC samples. GDIT will provide corrective action procedures for Tetra Tech to initiate with the analytical laboratory to resolve any deficiencies identified.

D3. Reconciliation with User Requirements

Fish Sample Collection Data

As soon as possible following completion of fish sampling operations during the 2022 NLA field season, the Tetra Tech Project Leader assesses fish sample collection data for completeness, precision, and representativeness by comparing these data with the criteria

discussed for each of these measures in Section A7 of this QAPP. This represents the final determination of whether the fish samples collected for the 2022 NLA Fish Tissue Study are of the correct type, quantity, and quality to support their intended use for this study. The Tetra Tech Project Leader will report any problems encountered in meeting the performance criteria (or uncertainties and limitations in the use of the data) to the OST Project Manager, and work with the OST Project Manager to reconcile the problems, if possible.

Lipid Data and Fish Sample Preparation QC Sample Data

The QC results for lipids from the homogeneity testing and for the mercury rinsate analysis from homogenization of fillet tissue samples for each fish sample preparation batch are assessed by the GDIT data review chemist against the QC acceptance criteria in Section B5 of this QAPP. Although the Tetra Tech laboratory will be permitted to work two fish sample preparation batches ahead of the delivery of the batch-specific QC results, the Tetra Tech Project Leader will track laboratory performance, notify the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager of any issues, initiate corrective actions, and track progress by the fish sample preparation laboratory.

References

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Appendix A

Target List of 2022 NLA Fish Tissue Study Sampling Locations

2022 NLA Fish Tissue Study Target Sampling Locations (636)[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
4	AL	NLA22_AL-10001	Covington	Unnamed Lake	31.24821	-86.45315	NLA22_17RVT2FT
4	AL	NLA22_AL-10002	DeKalb	Unnamed Lake	34.38640	-85.67056	NLA22_17RVT2FT
4	AL	NLA22_AL-10003	Marengo	Marengo Lake	32.21074	-87.75033	NLA22_17BaseFT
4	AL	NLA22_AL-10004	Baldwin	Dunn Lake	31.21649	-87.82055	NLA22_17BaseFT
4	AL	NLA22_AL-10005	Montgomery	W R Turnipseed Lake	32.18871	-86.04742	NLA22_17BaseFT
4	AL	NLA22_AL-10008	Perry	Watershed Structure Number Twelve	32.63631	-87.48769	NLA22_22BaseFT
4	AL	NLA22_AL-10009	Bibb	Kornegay Lake	32.97790	-87.25674	NLA22_22BaseFT
4	AL	NLA22_AL-10010	Montgomery	Belser Lake	32.34362	-86.06102	NLA22_22BaseFT
4	AL	NLA22_AL-10011	Shelby	Riverchase Lake	33.34404	-86.82478	NLA22_22BaseFT
4	AL	NLA22_AL-10012	Tuscaloosa	Mimosa Lake	33.15635	-87.56812	NLA22_22BaseFT
6	AR	NLA22_AR-10001	Phillips	DeSoto Lake	34.17390	-90.81417	NLA22_17RVT2FT
6	AR	NLA22_AR-10002	Logan	Fletcher Lake	35.21048	-93.87560	NLA22_17RVT2FT
6	AR	NLA22_AR-10003	Perry	South Fouche Site Seven Reservoir	35.01247	-92.82550	NLA22_17BaseFT
6	AR	NLA22_AR-10004	Monroe	Unnamed Lake	34.88872	-91.24761	NLA22_17BaseFT
6	AR	NLA22_AR-10006	Greene	Unnamed Lake	36.17826	-90.45791	NLA22_22BaseFT
6	AR	NLA22_AR-10007	Desha	Walnut Lake	33.85307	-91.51053	NLA22_22BaseFT
6	AR	NLA22_AR-10008	Prairie	Unnamed Lake	34.66058	-91.66310	NLA22_22BaseFT
6	AR	NLA22_AR-10009	Garland	Unnamed Lake	34.40384	-93.09574	NLA22_22BaseFT
9	AZ	NLA22_AZ-10001	Navajo	Unnamed Lake	36.84980	-110.21950	NLA22_17RVT2FT
9	AZ	NLA22_AZ-10002	Graham	Bonita Tank	33.17258	-109.76150	NLA22_17RVT2FT
9	AZ	NLA22_AZ-10003	Navajo	Unnamed Lake	34.31337	-109.94530	NLA22_17BaseFT
9	AZ	NLA22_AZ-10005	Mohave	Mud Tank	35.51125	-113.55344	NLA22_22BaseFT
9	AZ	NLA22_AZ-10006	Coconino	Willow Springs Lake	34.30857	-110.87558	NLA22_22BaseFT
9	AZ	NLA22_AZ-10007	Apache	Basin Lake	33.91776	-109.43459	NLA22_22BaseFT
9	CA	NLA22_CA-10001	San Bernardino	Unnamed Lake	34.85684	-114.62300	NLA22_17RVT2FT
9	CA	NLA22_CA-10002	Monterey	Unnamed Lake	36.68960	-121.80650	NLA22_17RVT2FT
9	CA	NLA22_CA-10003	Fresno	Papoose Lake	37.47135	-118.93320	NLA22_17BaseFT
9	CA	NLA22_CA-10004	Orange	Bonita Reservoir	33.61125	-117.85720	NLA22_17BaseFT
9	CA	NLA22_CA-10005	Tulare	Unnamed Lake	36.53765	-118.52490	NLA22_17BaseFT
9	CA	NLA22_CA-10006	Fresno	Unnamed Lake	37.09401	-118.71030	NLA22_17BaseFT
9	CA	NLA22_CA-10007	Lassen	Hartson Lake Levee	40.30286	-120.37640	NLA22_17BaseFT
9	CA	NLA22_CA-10008	Modoc	Lake Annie	41.90946	-120.10670	NLA22_17BaseFT
9	CA	NLA22_CA-10009	San Luis Obispo	Unnamed Lake	35.67160	-120.57120	NLA22_17BaseFT
9	CA	NLA22_CA-10010	Sonoma	Donovan 1422 Lake	38.56822	-122.76590	NLA22_17BaseFT
9	CA	NLA22_CA-10011	Solano	Grizzly Island Unnamed Lake	38.16683	-122.00850	NLA22_17BaseFT
9	CA	NLA22_CA-10012	Trinity	Deadfall Lakes	41.31673	-122.50270	NLA22_17BaseFT
9	CA	NLA22_CA-10013	Mono	Alger Lakes	37.79168	-119.17360	NLA22_17BaseFT
9	CA	NLA22_CA-10014	Alpine	Lower Sunset Lake	38.61141	-119.87510	NLA22_17BaseFT
9	CA	NLA22_CA-10015	San Joaquin	Unnamed Lake	38.20816	-121.05130	NLA22_17BaseFT
9	CA	NLA22_CA-10016	San Diego	Loveland Reservoir	32.78670	-116.78180	NLA22_17BaseFT
9	CA	NLA22_CA-10025	Humboldt	Freshwater Lagoon	41.26803	-124.09326	NLA22_22BaseFT
9	CA	NLA22_CA-10026	Lake	Lake Pillsbury	39.41592	-122.93803	NLA22_22BaseFT
9	CA	NLA22_CA-10027	Inyo	Little Lake	35.94668	-117.90253	NLA22_22BaseFT
9	CA	NLA22_CA-10028	Tuolumne	Big Humbug Creek Lake	37.88188	-120.19394	NLA22_22BaseFT
9	CA	NLA22_CA-10029	Napa	Bell Canyon Reservoir	38.55836	-122.48570	NLA22_22BaseFT
9	CA	NLA22_CA-10030	Placer	Oxbow Reservoir	39.00194	-120.74064	NLA22_22BaseFT

2022 NLA Fish Tissue Study Target Sampling Locations (636)[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
9	CA	NLA22_CA-10031	Merced	Unnamed Lake	36.82643	-121.06004	NLA22_22BaseFT
9	CA	NLA22_CA-10032	Fresno	Unnamed Lake	37.14520	-118.68010	NLA22_22BaseFT
9	CA	NLA22_CA-10033	Placer	Antelope Creek Lake	38.80385	-121.22605	NLA22_22BaseFT
9	CA	NLA22_CA-10034	Amador	Long Lake	38.57519	-120.08100	NLA22_22BaseFT
9	CA	NLA22_CA-10035	San Benito	Anzar Lake	36.88941	-121.60198	NLA22_22BaseFT
9	CA	NLA22_CA-10036	Mono	Glacier Lake	38.11576	-119.40284	NLA22_22BaseFT
9	CA	NLA22_CA-10037	Sacramento	Unnamed Lake	38.33236	-121.06648	NLA22_22BaseFT
9	CA	NLA22_CA-10038	Shasta	Horr Pond	41.11614	-121.40130	NLA22_22BaseFT
9	CA	NLA22_CA-10039	Tulare	Unnamed Lake	36.63681	-118.55861	NLA22_22BaseFT
9	CA	NLA22_CA-10040	Los Angeles	Unnamed Lake	34.59193	-118.09292	NLA22_22BaseFT
8	CO	NLA22_CO-10001	Yuma	Unnamed Lake	40.08740	-102.05870	NLA22_17RVT2FT
8	CO	NLA22_CO-10002	Weld	Bebee Draw Pond	40.25343	-104.63590	NLA22_17RVT2FT
8	CO	NLA22_CO-10003	Adams	Upper Derby Lake	39.83055	-104.84290	NLA22_17BaseFT
8	CO	NLA22_CO-10004	Garfield	Riland Creek Lake No. 2	39.77247	-107.16220	NLA22_17BaseFT
8	CO	NLA22_CO-10005	Logan	Unnamed Lake	40.68702	-103.38050	NLA22_17BaseFT
8	CO	NLA22_CO-10006	Larimer	Rocky Ridge Lake Reservoir Number 1	40.67240	-105.08550	NLA22_17BaseFT
8	CO	NLA22_CO-10007	Weld	Unnamed Lake	40.26063	-104.28670	NLA22_17BaseFT
8	CO	NLA22_CO-10011	La Plata	Unnamed Lake	37.47004	-107.52019	NLA22_22BaseFT
8	CO	NLA22_CO-10012	Mesa	Cottonwood Lake Number 1	39.07303	-107.97500	NLA22_22BaseFT
8	CO	NLA22_CO-10013	Weld	Banner Lakes	40.07659	-104.56291	NLA22_22BaseFT
8	CO	NLA22_CO-10014	El Paso	Nixon Power Plant Pond	38.62437	-104.69787	NLA22_22BaseFT
8	CO	NLA22_CO-10015	Archuleta	Lake Ann	37.27364	-106.68755	NLA22_22BaseFT
8	CO	NLA22_CO-10016	Saguache	Crow Drainage and Seepage Pond	37.92140	-106.14625	NLA22_22BaseFT
1	CT	NLA22_CT-10001	Litchfield	Deep Lake	41.95109	-73.46631	NLA22_17RVT2FT
1	CT	NLA22_CT-10002	Hartford	Unnamed Lake	41.72973	-72.84363	NLA22_17RVT2FT
1	CT	NLA22_CT-10003	Middlesex	Chapmans Pond	41.30714	-72.49567	NLA22_17BaseFT
1	CT	NLA22_CT-10005	New Haven	Parkers Pond	41.34105	-73.05978	NLA22_22BaseFT
1	CT	NLA22_CT-10006	Litchfield	Crystal Lake	41.92229	-73.10148	NLA22_22BaseFT
1	CT	NLA22_CT-10007	Hartford	Whites Pond	41.99542	-72.72681	NLA22_22BaseFT
3	DE	NLA22_DE-10001	Kent	Unnamed Lake	39.04532	-75.71528	NLA22_17RVT2FT
3	DE	NLA22_DE-10002	Kent	Wier Gut	39.26203	-75.43339	NLA22_17RVT2FT
3	DE	NLA22_DE-10003	Kent	Unnamed Lake	39.12592	-75.63714	NLA22_17BaseFT
3	DE	NLA22_DE-10005	New Castle	Noxontown Lake	39.42265	-75.68728	NLA22_22BaseFT
3	DE	NLA22_DE-10006	Kent	Unnamed Lake	39.11172	-75.46860	NLA22_22BaseFT
3	DE	NLA22_DE-10007	Sussex	Unnamed Lake	38.63576	-75.36494	NLA22_22BaseFT
4	FL	NLA22_FL-10001	Alachua	Bonnet Lake	29.72533	-82.12170	NLA22_17RVT2FT
4	FL	NLA22_FL-10002	Gulf	Dead Lakes	30.17746	-85.20963	NLA22_17RVT2FT
4	FL	NLA22_FL-10003	Highlands	Lake Anoka	27.58052	-81.51214	NLA22_17BaseFT
4	FL	NLA22_FL-10004	Brevard	Unnamed Lake	28.37866	-80.76733	NLA22_17BaseFT
4	FL	NLA22_FL-10007	Monroe	Unnamed Lake	25.30269	-80.92666	NLA22_22BaseFT
4	FL	NLA22_FL-10008	Orange	Lake Mira	28.59763	-81.27203	NLA22_22BaseFT
4	FL	NLA22_FL-10009	Levy	Unnamed Lake	29.17842	-82.95504	NLA22_22BaseFT
4	FL	NLA22_FL-10010	Leon	Unnamed Lake	30.45947	-84.11412	NLA22_22BaseFT
4	GA	NLA22_GA-10001	Wayne	Little Harper Lake	31.57157	-81.73026	NLA22_17RVT2FT
4	GA	NLA22_GA-10002	Colquitt	Unnamed Lake	31.09580	-83.65396	NLA22_17RVT2FT
4	GA	NLA22_GA-10003	Washington	Unnamed Lake	33.01464	-83.02665	NLA22_17BaseFT

2022 NLA Fish Tissue Study Target Sampling Locations (636)[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
4	GA	NLA22_GA-10004	Jackson	Unnamed Lake	34.14049	-83.68819	NLA22_17BaseFT
4	GA	NLA22_GA-10005	Mitchell	Rigsby Lake	31.24367	-84.08097	NLA22_17BaseFT
4	GA	NLA22_GA-10006	Atkinson	Unnamed Lake	31.13605	-82.76491	NLA22_17BaseFT
4	GA	NLA22_GA-10007	Candler	Unnamed Lake	32.49819	-82.03391	NLA22_17BaseFT
4	GA	NLA22_GA-10008	Stephens	Whispering Pines Lake	34.53704	-83.24839	NLA22_17BaseFT
4	GA	NLA22_GA-10009	Turner	Unnamed Lake	31.75569	-83.49964	NLA22_17BaseFT
4	GA	NLA22_GA-10010	Coffee	Unnamed Lake	31.63541	-82.81585	NLA22_17BaseFT
4	GA	NLA22_GA-10011	Candler	Unnamed Lake	32.43722	-82.07362	NLA22_17BaseFT
4	GA	NLA22_GA-10017	Chatham	Ambuc Park Lake	31.99943	-81.09664	NLA22_22BaseFT
4	GA	NLA22_GA-10018	Washington	Smith Pond	32.88182	-82.81713	NLA22_22BaseFT
4	GA	NLA22_GA-10019	Berrien	Batterbee Lake	31.08497	-83.19876	NLA22_22BaseFT
4	GA	NLA22_GA-10020	Terrell	Unnamed Lake	31.79064	-84.39505	NLA22_22BaseFT
4	GA	NLA22_GA-10021	Richmond	Unnamed Lake	33.44645	-81.96571	NLA22_22BaseFT
4	GA	NLA22_GA-10022	Emanuel	Unnamed Lake	32.56349	-82.32992	NLA22_22BaseFT
4	GA	NLA22_GA-10023	Ware	Unnamed Lake	30.65153	-82.37757	NLA22_22BaseFT
4	GA	NLA22_GA-10024	Worth	Unnamed Lake	31.34413	-83.96499	NLA22_22BaseFT
4	GA	NLA22_GA-10025	Monroe	McCook Lake	32.89196	-83.93114	NLA22_22BaseFT
4	GA	NLA22_GA-10026	Jackson	Bear Creek Reservoir	33.98931	-83.52458	NLA22_22BaseFT
4	GA	NLA22_GA-10027	Charlton	Unnamed Lake	30.93647	-82.35752	NLA22_22BaseFT
4	GA	NLA22_GA-10028	Troup	Reeds Lake	33.13508	-85.20361	NLA22_22BaseFT
7	IA	NLA22_IA-10001	Adair	Unnamed Lake	41.46639	-94.44048	NLA22_17RVT2FT
7	IA	NLA22_IA-10002	Story	Unnamed Lake	41.92535	-93.51853	NLA22_17RVT2FT
7	IA	NLA22_IA-10003	Des Moines	Unnamed Lake	40.87067	-91.07063	NLA22_17BaseFT
7	IA	NLA22_IA-10005	Jackson	Densmore Lake	42.16265	-90.28240	NLA22_22BaseFT
7	IA	NLA22_IA-10006	Davis	Pits Pond	40.89187	-92.41664	NLA22_22BaseFT
7	IA	NLA22_IA-10007	Ida	Grell Pond	42.37359	-95.49917	NLA22_22BaseFT
10	ID	NLA22_ID-10001	Lemhi	Unnamed Lake	44.60377	-113.26200	NLA22_17RVT2FT
10	ID	NLA22_ID-10002	Idaho	Line Lake	45.57256	-114.57490	NLA22_17RVT2FT
10	ID	NLA22_ID-10003	Boundary	Joe Lake	48.88855	-116.77560	NLA22_17BaseFT
10	ID	NLA22_ID-10004	Custer	Cove Lake	44.10115	-114.60850	NLA22_17BaseFT
10	ID	NLA22_ID-10005	Kootenai	Twin Lakes	47.88285	-116.87560	NLA22_17BaseFT
10	ID	NLA22_ID-10006	Idaho	Fish Lake	45.38776	-115.32050	NLA22_17BaseFT
10	ID	NLA22_ID-10009	Nez Perce	Lewiston Pond	46.37470	-117.03901	NLA22_22BaseFT
10	ID	NLA22_ID-10010	Owyhee	Succor Creek Reservoir	43.19169	-116.95932	NLA22_22BaseFT
10	ID	NLA22_ID-10011	Boise	Baron Lakes	44.08124	-115.03278	NLA22_22BaseFT
10	ID	NLA22_ID-10012	Canyon	Unnamed Lake	43.69576	-116.73120	NLA22_22BaseFT
10	ID	NLA22_ID-10013	Bonner	Beaver Lake	48.20351	-116.40947	NLA22_22BaseFT
10	ID	NLA22_ID-10014	Valley	Papoose Lakes	44.79496	-115.27758	NLA22_22BaseFT
5	IL	NLA22_IL-10001	Gallatin	Pounds Lake	37.61538	-88.27512	NLA22_17RVT2FT
5	IL	NLA22_IL-10002	Rock Island	Kickapoo Slu Unnamed Lake	41.46518	-90.61995	NLA22_17RVT2FT
5	IL	NLA22_IL-10003	Peoria	Lake Lancelot	40.63115	-89.74544	NLA22_17BaseFT
5	IL	NLA22_IL-10004	St. Clair	Peabody-River King Unnamed Lake	38.33230	-89.85636	NLA22_17BaseFT
5	IL	NLA22_IL-10005	Will	Monee Reservoir	41.39280	-87.76008	NLA22_17BaseFT
5	IL	NLA22_IL-10006	Knox	Green Oaks Lake	40.97766	-90.09147	NLA22_17BaseFT
5	IL	NLA22_IL-10009	Will	Unnamed Lake	41.49623	-87.92387	NLA22_22BaseFT
5	IL	NLA22_IL-10010	Woodford	Upper Peoria Lake	40.80198	-89.55004	NLA22_22BaseFT

2022 NLA Fish Tissue Study Target Sampling Locations (636)[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
5	IL	NLA22_IL-10011	Macoupin	Timbered Lake	39.29383	-89.81042	NLA22_22BaseFT
5	IL	NLA22_IL-10012	Washington	Unnamed Lake	38.45397	-89.15317	NLA22_22BaseFT
5	IL	NLA22_IL-10013	Lake	West Meadow Lake	42.17020	-87.91875	NLA22_22BaseFT
5	IL	NLA22_IL-10014	Jo Daviess	Spratts Lake	42.35543	-90.42688	NLA22_22BaseFT
5	IN	NLA22_IN-10001	Allen	Cook Lougheed Wildlife Pond	41.02069	-85.29615	NLA22_17RVT2FT
5	IN	NLA22_IN-10002	Miami	Unnamed Lake	40.92302	-86.07928	NLA22_17RVT2FT
5	IN	NLA22_IN-10003	Clark	Money Hollow Pond	38.43623	-85.86209	NLA22_17BaseFT
5	IN	NLA22_IN-10004	Sullivan	MauMee Lake	39.05293	-87.27957	NLA22_17BaseFT
5	IN	NLA22_IN-10005	Blackford	Chapel Lake	40.38023	-85.27225	NLA22_17BaseFT
5	IN	NLA22_IN-10006	LaGrange	Pond Lil	41.54465	-85.42743	NLA22_17BaseFT
5	IN	NLA22_IN-10007	Warrick	Owen Unnamed Mine Pond	38.14829	-87.17787	NLA22_17BaseFT
5	IN	NLA22_IN-10008	Warren	Jordan Creek Lake	40.36411	-87.51680	NLA22_17BaseFT
5	IN	NLA22_IN-10013	Lake	Lake Michigan	41.63819	-87.39998	NLA22_22BaseFT
5	IN	NLA22_IN-10014	Steuben	Lone Hickory Lake	41.73956	-85.01997	NLA22_22BaseFT
5	IN	NLA22_IN-10015	Pike	Unnamed Lake	38.42608	-87.32262	NLA22_22BaseFT
5	IN	NLA22_IN-10016	Hendricks	Crystal Bay Pond	39.67847	-86.39153	NLA22_22BaseFT
5	IN	NLA22_IN-10017	Noble	Smalley Lake	41.31160	-85.57877	NLA22_22BaseFT
5	IN	NLA22_IN-10018	LaGrange	Unnamed Lake	41.54890	-85.24555	NLA22_22BaseFT
5	IN	NLA22_IN-10019	Sullivan	More Lake	38.97994	-87.24489	NLA22_22BaseFT
5	IN	NLA22_IN-10020	Clay	Unnamed Lake	39.45077	-87.08941	NLA22_22BaseFT
7	KS	NLA22_KS-10001	Seward	Unnamed Lake	37.12815	-101.02500	NLA22_17RVT2FT
7	KS	NLA22_KS-10002	Franklin	Unnamed Lake	38.44580	-95.36794	NLA22_17RVT2FT
7	KS	NLA22_KS-10003	Sedgwick	Fishin' Lake	37.65573	-97.39951	NLA22_17BaseFT
7	KS	NLA22_KS-10004	Rice	Sterling Lake	38.20350	-98.20245	NLA22_17BaseFT
7	KS	NLA22_KS-10005	Cowley	Unnamed Lake	37.36651	-96.78801	NLA22_17BaseFT
7	KS	NLA22_KS-10006	Coffey	Sand Creek Pond	38.38463	-95.67273	NLA22_17BaseFT
7	KS	NLA22_KS-10007	Greenwood	Unnamed Lake	37.66700	-96.16676	NLA22_17BaseFT
7	KS	NLA22_KS-10011	Cherokee	Deer Creek Lake	37.22608	-94.99618	NLA22_22BaseFT
7	KS	NLA22_KS-10012	Labette	Unnamed Lake	37.01717	-95.26623	NLA22_22BaseFT
7	KS	NLA22_KS-10013	Lane	Unnamed Lake	38.67362	-100.36311	NLA22_22BaseFT
7	KS	NLA22_KS-10014	Kingman	Unnamed Lake	37.47586	-98.42391	NLA22_22BaseFT
7	KS	NLA22_KS-10015	Crawford	Unnamed Lake	37.46732	-94.83631	NLA22_22BaseFT
7	KS	NLA22_KS-10016	Johnson	New Olathe Lake	38.87607	-94.87323	NLA22_22BaseFT
7	KS	NLA22_KS-10017	Dickinson	Unnamed Carry Creek Lake	38.83591	-97.01293	NLA22_22BaseFT
4	KY	NLA22_KY-10001	Jefferson	Kosmos Cement Pond	38.04097	-85.88920	NLA22_17RVT2FT
4	KY	NLA22_KY-10002	Lincoln	Stanford Reservoir	37.48693	-84.67911	NLA22_17RVT2FT
4	KY	NLA22_KY-10003	Hopkins	Unnamed Lake	37.29977	-87.57088	NLA22_17BaseFT
4	KY	NLA22_KY-10005	Woodford	Rowes Run Pond	38.06590	-84.80619	NLA22_22BaseFT
4	KY	NLA22_KY-10006	Pulaski	Unnamed Lake	36.86492	-84.57831	NLA22_22BaseFT
4	KY	NLA22_KY-10007	Christian	Lake Morris	36.92895	-87.45560	NLA22_22BaseFT
4	KY	NLA22_KY-10008	Christian	Dam Number 6 Pond	37.01110	-87.32108	NLA22_22BaseFT
6	LA	NLA22_LA-10001	Caddo	Unnamed Lake	32.93598	-93.82210	NLA22_17RVT2FT
6	LA	NLA22_LA-10002	Natchitoches	Unnamed Lake	31.56099	-92.97875	NLA22_17RVT2FT
6	LA	NLA22_LA-10003	Lafourche	Unnamed Lake	29.59054	-90.36429	NLA22_17BaseFT
6	LA	NLA22_LA-10004	St. Bernard	Bayou Pisana	29.77620	-89.51460	NLA22_17BaseFT
6	LA	NLA22_LA-10007	West Carroll	Unnamed Lake	32.89590	-91.46462	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
6	LA	NLA22_LA-10008	Caddo	Northwood Lake	32.60497	-93.87630	NLA22_22BaseFT
6	LA	NLA22_LA-10009	Iberia	De Vance Pond	29.89747	-91.89555	NLA22_22BaseFT
6	LA	NLA22_LA-10010	Jefferson Davis	Unnamed Lake	30.22668	-92.77057	NLA22_22BaseFT
6	LA	NLA22_LA-10011	Catahoula	Sunk Lake	31.91781	-91.81415	NLA22_22BaseFT
1	MA	NLA22_MA-10001	Nantucket	Unnamed Lake	41.28917	-69.99508	NLA22_17RVT2FT
1	MA	NLA22_MA-10002	Norfolk	Dry Pond	42.10683	-71.13425	NLA22_17RVT2FT
1	RI	NLA22_MA-10003	Providence	Pratt Pond	42.01950	-71.54769	NLA22_17BaseFT
1	MA	NLA22_MA-10005	Berkshire	Housatonic River Oxbow	42.21780	-73.34401	NLA22_22BaseFT
1	MA	NLA22_MA-10006	Franklin	Unnamed Lake	42.56419	-72.38868	NLA22_22BaseFT
1	MA	NLA22_MA-10007	Bristol	Chartley Pond	41.94622	-71.23929	NLA22_22BaseFT
1	MA	NLA22_MA-10008	Worcester	Flint Pond	42.24136	-71.72584	NLA22_22BaseFT
3	MD	NLA22_MD-10001	Cecil	Unnamed Lake	39.69407	-75.79279	NLA22_17RVT2FT
3	MD	NLA22_MD-10002	Baltimore	Lake Roland	39.39093	-76.64478	NLA22_17RVT2FT
3	MD	NLA22_MD-10003	Dorchester	Bullock Pond	38.40128	-76.07816	NLA22_17BaseFT
3	MD	NLA22_MD-10005	Somerset	Unnamed Lake	37.96085	-76.00659	NLA22_22BaseFT
3	MD	NLA22_MD-10006	Dorchester	Goose Pond	38.39888	-76.04801	NLA22_22BaseFT
3	MD	NLA22_MD-10007	Charles	Hampshire Lake	38.62289	-76.95824	NLA22_22BaseFT
1	ME	NLA22_ME-10001	Washington	Baileyville Sewage Disposal Pond	45.13076	-67.40111	NLA22_17RVT2FT
1	ME	NLA22_ME-10002	Lincoln	Little Pond	43.97281	-69.49572	NLA22_17RVT2FT
1	ME	NLA22_ME-10003	Penobscot	Unnamed Lake	45.11771	-68.73956	NLA22_17BaseFT
1	ME	NLA22_ME-10004	Piscataquis	North Echo Lake	46.43398	-69.14687	NLA22_17BaseFT
1	ME	NLA22_ME-10005	York	Unnamed Lake	43.47445	-70.92767	NLA22_17BaseFT
1	ME	NLA22_ME-10006	Lincoln	Havener Pond	44.06857	-69.28787	NLA22_17BaseFT
1	ME	NLA22_ME-10009	Hancock	Jones Pond	44.45485	-68.08088	NLA22_22BaseFT
1	ME	NLA22_ME-10010	Oxford	Bird Pond	44.24424	-70.55330	NLA22_22BaseFT
1	ME	NLA22_ME-10011	Somerset	Roberts Pond	46.05930	-70.26933	NLA22_22BaseFT
1	ME	NLA22_ME-10012	Aroostook	Shields Lake	46.53262	-68.47856	NLA22_22BaseFT
1	ME	NLA22_ME-10013	Cumberland	Mariner Pond	43.89645	-70.69504	NLA22_22BaseFT
5	MI	NLA22_MI-10001	Keweenaw	Unnamed Lake	48.00015	-88.86112	NLA22_17RVT2FT
5	MI	NLA22_MI-10002	Gratiot	Unnamed Lake	43.20981	-84.41556	NLA22_17RVT2FT
5	MI	NLA22_MI-10003	Livingston	Unnamed Lake	42.58746	-84.10850	NLA22_17BaseFT
5	MI	NLA22_MI-10004	Mecosta	Unnamed Lake	43.79752	-85.21140	NLA22_17BaseFT
5	MI	NLA22_MI-10005	Iron	Horseshoe Lake	46.09770	-88.90776	NLA22_17BaseFT
5	MI	NLA22_MI-10006	Kent	Unnamed Lake	42.87447	-85.61069	NLA22_17BaseFT
5	MI	NLA22_MI-10007	Oakland	Unnamed Lake	42.64060	-83.57703	NLA22_17BaseFT
5	MI	NLA22_MI-10008	Osceola	Beaver Lake	44.02913	-85.54542	NLA22_17BaseFT
5	MI	NLA22_MI-10009	Schoolcraft	Lorraine Lake	46.14496	-86.48319	NLA22_17BaseFT
5	MI	NLA22_MI-10010	Barry	Newton Lake	42.58961	-85.29964	NLA22_17BaseFT
5	MI	NLA22_MI-10015	Berrien	Wagner Lake	41.84915	-86.44684	NLA22_22BaseFT
5	MI	NLA22_MI-10016	Alger	Deerfoot Lake	46.51802	-86.07541	NLA22_22BaseFT
5	MI	NLA22_MI-10017	Alcona	Lost Lake	44.79656	-83.45931	NLA22_22BaseFT
5	MI	NLA22_MI-10018	Grand Traverse	Unnamed Lake	44.74558	-85.78277	NLA22_22BaseFT
5	MI	NLA22_MI-10019	Allegan	Pickerel Lake	42.56553	-85.69547	NLA22_22BaseFT
5	MI	NLA22_MI-10020	Oakland	Pine Lake	42.58986	-83.34190	NLA22_22BaseFT
5	MI	NLA22_MI-10021	Newaygo	Second Lake	43.48059	-85.93478	NLA22_22BaseFT
5	MI	NLA22_MI-10022	Iron	Fortune Pond	46.09974	-88.38857	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
5	MI	NLA22_MI-10023	Branch	Huyck Lake	41.77818	-84.97801	NLA22_22BaseFT
5	MI	NLA22_MI-10024	Midland	Kawkawlin Creek Flooding	43.80632	-84.27323	NLA22_22BaseFT
5	MN	NLA22_MN-10001	Pine	Greigs Lake	46.05283	-92.47217	NLA22_17RVT2FT
5	MN	NLA22_MN-10002	Grant	Ashby Lake	46.10148	-95.81966	NLA22_17RVT2FT
5	MN	NLA22_MN-10003	Lake	Hush Lake	47.86655	-91.35346	NLA22_17BaseFT
5	MN	NLA22_MN-10004	Cass	Lake Lomish	47.07554	-94.13103	NLA22_17BaseFT
5	MN	NLA22_MN-10005	Wright	Somers Lake	45.26380	-94.02673	NLA22_17BaseFT
5	MN	NLA22_MN-10006	Todd	Beauty Lake	46.00960	-94.69823	NLA22_17BaseFT
5	MN	NLA22_MN-10007	Lake	Neglige Lake	48.04965	-91.30297	NLA22_17BaseFT
5	MN	NLA22_MN-10008	Beltrami	Unnamed Lake	47.83976	-95.05832	NLA22_17BaseFT
5	MN	NLA22_MN-10009	Cottonwood	Double Lake	44.05364	-95.37600	NLA22_17BaseFT
5	MN	NLA22_MN-10010	Cass	Unnamed Lake	46.75635	-94.63887	NLA22_17BaseFT
5	MN	NLA22_MN-10011	Itasca	Mississippi Lake	47.17212	-93.40033	NLA22_17BaseFT
5	MN	NLA22_MN-10012	Hubbard	Unnamed Lake	47.15998	-95.05449	NLA22_17BaseFT
5	MN	NLA22_MN-10013	Otter Tail	Upper Bullhead Lake	46.26641	-95.61862	NLA22_17BaseFT
5	MN	NLA22_MN-10014	Hennepin	Unnamed Lake	45.04195	-93.76155	NLA22_17BaseFT
5	MN	NLA22_MN-10015	St. Louis	Unnamed Lake	48.36183	-92.72804	NLA22_17BaseFT
5	MN	NLA22_MN-10016	Otter Tail	Iverson Lake	46.22321	-96.04381	NLA22_17BaseFT
5	MN	NLA22_MN-10017	Carlton	Jaskari Lake	46.67872	-92.70048	NLA22_17BaseFT
5	MN	NLA22_MN-10026	Kittson	Unnamed Lake	48.96596	-96.85510	NLA22_22BaseFT
5	MN	NLA22_MN-10027	Douglas	Unnamed Lake	45.91323	-95.69035	NLA22_22BaseFT
5	MN	NLA22_MN-10028	Becker	Unnamed Lake	46.87870	-95.79747	NLA22_22BaseFT
5	MN	NLA22_MN-10029	Chisago	North Center Lake	45.40963	-92.83550	NLA22_22BaseFT
5	MN	NLA22_MN-10030	St. Louis	Foss Lake	47.89288	-92.07205	NLA22_22BaseFT
5	MN	NLA22_MN-10031	Crow Wing	Hampton Lake	46.17622	-94.21392	NLA22_22BaseFT
5	MN	NLA22_MN-10032	Hubbard	Unnamed Lake	47.15083	-95.06487	NLA22_22BaseFT
5	MN	NLA22_MN-10033	Lake	Wilbur Lake	47.54885	-91.44395	NLA22_22BaseFT
5	MN	NLA22_MN-10034	Itasca	Unnamed Lake	47.50128	-93.18589	NLA22_22BaseFT
5	MN	NLA22_MN-10035	Otter Tail	Unnamed Lake	46.45817	-95.25268	NLA22_22BaseFT
5	MN	NLA22_MN-10036	Crow Wing	Unnamed Lake	46.77633	-94.17500	NLA22_22BaseFT
5	MN	NLA22_MN-10037	Wright	Unnamed Lake	45.11807	-94.02326	NLA22_22BaseFT
5	MN	NLA22_MN-10038	Itasca	Unnamed Lake	47.77088	-93.28092	NLA22_22BaseFT
5	MN	NLA22_MN-10039	Otter Tail	Sewell Lake	46.14359	-95.82284	NLA22_22BaseFT
5	MN	NLA22_MN-10040	Aitkin	Lake Four	46.49527	-93.63019	NLA22_22BaseFT
5	MN	NLA22_MN-10041	Carver	Unnamed Lake	44.80631	-93.82413	NLA22_22BaseFT
5	MN	NLA22_MN-10042	Big Stone	Unnamed Lake	45.49689	-96.53740	NLA22_22BaseFT
7	MO	NLA22_MO-10001	Bollinger	Masters Lake	37.18762	-89.93068	NLA22_17RVT2FT
7	MO	NLA22_MO-10002	Pulaski	Unnamed Lake	38.00504	-92.07754	NLA22_17RVT2FT
7	MO	NLA22_MO-10003	Nodaway	Unnamed Lake	40.47625	-94.85369	NLA22_17BaseFT
7	MO	NLA22_MO-10004	Bates	Unnamed Lake	38.15652	-94.58211	NLA22_17BaseFT
7	MO	NLA22_MO-10005	Scott	Sikeston Power Station Pond	36.87839	-89.61360	NLA22_17BaseFT
7	MO	NLA22_MO-10008	Mississippi	Henson Lake	36.85729	-89.24523	NLA22_22BaseFT
7	MO	NLA22_MO-10009	Laclede	Porto Farms Lake	37.51814	-92.78278	NLA22_22BaseFT
7	MO	NLA22_MO-10010	Washington	Diablo Lake	38.05071	-90.85549	NLA22_22BaseFT
7	MO	NLA22_MO-10011	Lafayette	Hicklin Lake	39.19283	-93.79138	NLA22_22BaseFT
7	MO	NLA22_MO-10012	Linn	Linneus Reservoir	39.88843	-93.19763	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
4	MS	NLA22_MS-10001	Tippah	BD Cox Pond	34.87096	-88.98125	NLA22_17RVT2FT
4	MS	NLA22_MS-10002	Clarke	Unnamed Lake	32.03380	-88.57709	NLA22_17RVT2FT
4	MS	NLA22_MS-10003	Warren	Purvis Lake	32.48160	-91.06594	NLA22_17BaseFT
4	MS	NLA22_MS-10004	Simpson	Unnamed Lake	32.01253	-90.01533	NLA22_17BaseFT
4	MS	NLA22_MS-10007	Lincoln	Burgess Lake	31.69412	-90.43625	NLA22_22BaseFT
4	MS	NLA22_MS-10008	Marshall	Unnamed Lake	34.57544	-89.29050	NLA22_22BaseFT
4	MS	NLA22_MS-10009	Issaquena	Unnamed Lake	32.97438	-91.07335	NLA22_22BaseFT
4	MS	NLA22_MS-10010	Forrest	Unnamed Lake	31.18912	-89.27800	NLA22_22BaseFT
8	MT	NLA22_MT-10001	Carbon	Triangle Lake	45.01284	-109.55190	NLA22_17RVT2FT
8	MT	NLA22_MT-10002	Rosebud	Unnamed Lake	46.60717	-106.35020	NLA22_17RVT2FT
8	MT	NLA22_MT-10003	Carter	Unnamed Lake	45.49482	-104.93780	NLA22_17BaseFT
8	MT	NLA22_MT-10004	Ravalli	Unnamed Lake	46.51488	-114.26860	NLA22_17BaseFT
8	MT	NLA22_MT-10005	Beaverhead	Red Rock Lakes	44.63601	-111.80490	NLA22_17BaseFT
8	MT	NLA22_MT-10006	Sheridan	Unnamed Lake	48.89743	-104.21200	NLA22_17BaseFT
8	MT	NLA22_MT-10007	Lincoln	Summerville Lake	48.79690	-115.00040	NLA22_17BaseFT
8	MT	NLA22_MT-10008	Powell	Unnamed Lake	47.04000	-113.23710	NLA22_17BaseFT
8	MT	NLA22_MT-10009	Dawson	Unnamed Lake	47.61756	-105.27980	NLA22_17BaseFT
8	MT	NLA22_MT-10010	Phillips	Unnamed Lake	47.97548	-108.01770	NLA22_17BaseFT
8	MT	NLA22_MT-10011	Flathead	Elk Ridge Lake	47.97640	-113.21900	NLA22_17BaseFT
8	MT	NLA22_MT-10012	Golden Valley	Unnamed Lake	46.31711	-109.37270	NLA22_17BaseFT
8	MT	NLA22_MT-10013	Phillips	Unnamed Lake	47.76268	-108.62140	NLA22_17BaseFT
8	MT	NLA22_MT-10014	Valley	Unnamed Lake	48.44622	-106.55980	NLA22_17BaseFT
8	MT	NLA22_MT-10015	Glacier	Unnamed Lake	48.90706	-113.32580	NLA22_17BaseFT
8	MT	NLA22_MT-10023	Phillips	Frenchman Reservoir	48.70511	-107.22939	NLA22_22BaseFT
8	MT	NLA22_MT-10024	Glacier	Swiftcurrent Lake	48.79445	-113.66106	NLA22_22BaseFT
8	MT	NLA22_MT-10025	Phillips	Hewitt Lake	48.53832	-107.58881	NLA22_22BaseFT
8	MT	NLA22_MT-10026	Missoula	Doctor Lake	47.40364	-113.48145	NLA22_22BaseFT
8	MT	NLA22_MT-10027	Toole	Tomscheck Lake	48.84108	-111.64913	NLA22_22BaseFT
8	MT	NLA22_MT-10028	Carter	Unnamed Lake	45.42777	-104.76212	NLA22_22BaseFT
8	MT	NLA22_MT-10029	Phillips	Unnamed Lake	47.86165	-108.06333	NLA22_22BaseFT
8	MT	NLA22_MT-10030	Beaverhead	Unnamed Lake	44.63463	-111.82303	NLA22_22BaseFT
8	MT	NLA22_MT-10031	Flathead	Fennon Slough	48.10332	-114.12850	NLA22_22BaseFT
8	MT	NLA22_MT-10032	Custer	Unnamed Lake	45.91999	-105.70066	NLA22_22BaseFT
8	MT	NLA22_MT-10033	McCone	Unnamed Lake	47.76746	-105.80484	NLA22_22BaseFT
8	MT	NLA22_MT-10034	Sweet Grass	Beley Lakes	45.97489	-110.18186	NLA22_22BaseFT
8	MT	NLA22_MT-10035	Lincoln	Tooley Lake	48.95352	-115.20128	NLA22_22BaseFT
8	MT	NLA22_MT-10036	Rosebud	Round Butte Reservoir	46.80087	-106.65725	NLA22_22BaseFT
8	MT	NLA22_MT-10037	Mineral	Foley Lake	46.83499	-114.92425	NLA22_22BaseFT
8	MT	NLA22_MT-10038	Chouteau	Dammel Reservoir	47.70675	-110.14732	NLA22_22BaseFT
4	NC	NLA22_NC-10001	Avery	Wildcat Lake	36.14793	-81.88275	NLA22_17RVT2FT
4	NC	NLA22_NC-10002	Stokes	Fox Pond	36.29909	-80.21237	NLA22_17RVT2FT
4	NC	NLA22_NC-10003	Nash	Unnamed Lake	35.85621	-78.03021	NLA22_17BaseFT
4	NC	NLA22_NC-10004	Alamance	Unnamed Lake	36.18589	-79.35081	NLA22_17BaseFT
4	NC	NLA22_NC-10007	Warren	Unnamed Lake	36.46487	-78.30042	NLA22_22BaseFT
4	NC	NLA22_NC-10008	Brunswick	Clark Lake	34.03236	-78.21957	NLA22_22BaseFT
4	NC	NLA22_NC-10009	Lenoir	Walters Millpond	35.30355	-77.76077	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
4	NC	NLA22_NC-10010	Wake	Loch Haven Lake	35.83124	-78.72327	NLA22_22BaseFT
8	ND	NLA22_ND-10001	Pembina	Unnamed Lake	48.89866	-97.21368	NLA22_17RVT2FT
8	ND	NLA22_ND-10002	Kidder	Unnamed Lake	47.26394	-99.80461	NLA22_17RVT2FT
8	ND	NLA22_ND-10003	Stutsman	Unnamed Lake	47.13186	-99.23174	NLA22_17BaseFT
8	ND	NLA22_ND-10004	McLean	Unnamed Lake	47.63810	-100.85340	NLA22_17BaseFT
8	ND	NLA22_ND-10005	Rolette	Unnamed Lake	48.67467	-99.97743	NLA22_17BaseFT
8	ND	NLA22_ND-10006	Pierce	Sandy Lakes	47.98754	-99.98855	NLA22_17BaseFT
8	ND	NLA22_ND-10007	Stutsman	Unnamed Lake	46.76596	-99.29207	NLA22_17BaseFT
8	ND	NLA22_ND-10008	Ward	Unnamed Lake	48.35212	-101.89530	NLA22_17BaseFT
8	ND	NLA22_ND-10009	Burke	Unnamed Lake	48.60725	-102.38170	NLA22_17BaseFT
8	ND	NLA22_ND-10010	Ramsey	Unnamed Lake	48.21080	-98.39406	NLA22_17BaseFT
8	ND	NLA22_ND-10011	Dickey	Reinke Waterfowl Pond	46.11088	-98.89073	NLA22_17BaseFT
8	ND	NLA22_ND-10012	Mountrail	Unnamed Lake	48.33447	-102.05070	NLA22_17BaseFT
8	ND	NLA22_ND-10013	Bottineau	Unnamed Lake	48.97325	-100.37130	NLA22_17BaseFT
8	ND	NLA22_ND-10020	Pierce	Gilmore Lake	48.51396	-100.00218	NLA22_22BaseFT
8	ND	NLA22_ND-10021	Grant	Unnamed Lake	46.10015	-101.44526	NLA22_22BaseFT
8	ND	NLA22_ND-10022	Wells	Unnamed Lake	47.53587	-99.95606	NLA22_22BaseFT
8	ND	NLA22_ND-10023	Steele	Willow Lake	47.27271	-97.92621	NLA22_22BaseFT
8	ND	NLA22_ND-10024	Rolette	Berry Lake	48.93376	-100.11704	NLA22_22BaseFT
8	ND	NLA22_ND-10025	McLean	Unnamed Lake	47.71925	-100.62395	NLA22_22BaseFT
8	ND	NLA22_ND-10026	Ramsey	Unnamed Lake	48.18198	-98.86333	NLA22_22BaseFT
8	ND	NLA22_ND-10027	Stutsman	Unnamed Lake	46.93133	-99.32249	NLA22_22BaseFT
8	ND	NLA22_ND-10028	Burke	Unnamed Lake	48.70996	-102.60067	NLA22_22BaseFT
8	ND	NLA22_ND-10029	McHenry	Duckshire Lake	48.12172	-100.32450	NLA22_22BaseFT
8	ND	NLA22_ND-10030	Pierce	Unnamed Lake	48.48495	-99.83709	NLA22_22BaseFT
8	ND	NLA22_ND-10031	Kidder	Unnamed Lake	46.97926	-99.97285	NLA22_22BaseFT
8	ND	NLA22_ND-10032	Mountrail	Unnamed Lake	48.48370	-102.34263	NLA22_22BaseFT
7	IA	NLA22_NE-10001	Pottawattamie	Unnamed Lake	41.46472	-95.98270	NLA22_17RVT2FT
7	NE	NLA22_NE-10002	Morrill	Tercett Lake	41.90324	-102.73340	NLA22_17RVT2FT
7	NE	NLA22_NE-10003	Platte	Unnamed Lake	41.64920	-97.46338	NLA22_17BaseFT
7	NE	NLA22_NE-10004	Webster	Unnamed Lake	40.19761	-98.31906	NLA22_17BaseFT
7	NE	NLA22_NE-10005	Cherry	Rat Lake	42.94400	-101.85090	NLA22_17BaseFT
7	NE	NLA22_NE-10006	Grant	Rothwell Valley Pond	41.78254	-101.73330	NLA22_17BaseFT
7	NE	NLA22_NE-10007	Cherry	Bakers Lake	42.65573	-100.59630	NLA22_17BaseFT
7	NE	NLA22_NE-10008	Franklin	Unnamed Lake	40.18850	-98.90148	NLA22_17BaseFT
7	NE	NLA22_NE-10009	Sheridan	Unnamed Lake	42.18984	-102.42180	NLA22_17BaseFT
7	NE	NLA22_NE-10010	Chase	Unnamed Lake	40.49547	-101.79800	NLA22_17BaseFT
7	NE	NLA22_NE-10015	Otoe	Unnamed Lake	40.52835	-95.89892	NLA22_22BaseFT
7	NE:SD	NLA22_NE-10016	Cherry	Cody Lake	42.99306	-101.25515	NLA22_22BaseFT
7	NE	NLA22_NE-10017	Dawson	Unnamed Lake	40.89808	-100.13519	NLA22_22BaseFT
7	NE	NLA22_NE-10018	Madison	Unnamed Lake	41.98412	-97.41806	NLA22_22BaseFT
7	NE	NLA22_NE-10019	Cherry	Unnamed Lake	42.81278	-101.82092	NLA22_22BaseFT
7	NE	NLA22_NE-10020	Garden	Twin Lake	41.71661	-102.54054	NLA22_22BaseFT
7	NE	NLA22_NE-10021	Brown	Rat Lake	42.28000	-100.11907	NLA22_22BaseFT
7	NE	NLA22_NE-10022	Lancaster	Yankee Hill Lake	40.72519	-96.78433	NLA22_22BaseFT
7	NE	NLA22_NE-10023	Sheridan	Miller Lake	42.43342	-102.21267	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
7	NE	NLA22_NE-10024	Scotts Bluff	Unnamed Lake	41.73575	-103.95522	NLA22_22BaseFT
1	NH	NLA22_NH-10001	Carroll	Pequawket Pond	43.96937	-71.13569	NLA22_17RVT2FT
1	NH	NLA22_NH-10002	Merrimack	Unnamed Lake	43.23972	-71.76053	NLA22_17RVT2FT
1	NH	NLA22_NH-10003	Cheshire	Ash Swamp Lake	42.83783	-72.52464	NLA22_17BaseFT
1	NH	NLA22_NH-10005	Carroll	Bearcamp Pond	43.81588	-71.37039	NLA22_22BaseFT
1	NH	NLA22_NH-10006	Belknap	Meadow Dam Pond	43.45836	-71.24505	NLA22_22BaseFT
1	NH	NLA22_NH-10007	Strafford	Unnamed Lake	43.25171	-71.03483	NLA22_22BaseFT
2	NJ	NLA22_NJ-10001	Warren	Catfish Pond	41.03964	-74.99616	NLA22_17RVT2FT
2	NJ	NLA22_NJ-10002	Ocean	Unnamed Lake	39.73888	-74.18749	NLA22_17RVT2FT
2	NJ	NLA22_NJ-10003	Monmouth	Sunset Lake	40.22553	-74.00517	NLA22_17BaseFT
2	NJ	NLA22_NJ-10005	Ocean	Unnamed Lake	39.99744	-74.33554	NLA22_22BaseFT
2	NJ	NLA22_NJ-10006	Ocean	Unnamed Lake	39.55246	-74.36599	NLA22_22BaseFT
2	NJ	NLA22_NJ-10007	Hudson	Unnamed Lake	40.75414	-74.10356	NLA22_22BaseFT
6	NM	NLA22_NM-10001	Valencia	Unnamed Lake	34.74814	-106.01360	NLA22_17RVT2FT
6	NM	NLA22_NM-10002	Chaves	Zuber Hollow Reservoir	33.21249	-104.35860	NLA22_17RVT2FT
6	NM	NLA22_NM-10003	McKinley	Unnamed Lake	35.40173	-107.82330	NLA22_17BaseFT
6	NM	NLA22_NM-10005	Eddy	Nash Lake	32.33315	-103.91660	NLA22_22BaseFT
6	NM	NLA22_NM-10006	Union	Unnamed Lake	36.18013	-103.48570	NLA22_22BaseFT
6	NM	NLA22_NM-10007	Guadalupe	Unnamed Lake	35.05349	-104.41676	NLA22_22BaseFT
9	NV	NLA22_NV-10001	Humboldt	Echo Lake	41.87949	-119.24290	NLA22_17RVT2FT
9	NV	NLA22_NV-10002	Lyon	Unnamed Lake	38.87624	-119.35670	NLA22_17RVT2FT
9	NV	NLA22_NV-10003	Lyon	Unnamed Lake	39.11693	-119.08000	NLA22_17BaseFT
9	NV	NLA22_NV-10005	Nye	Horseshoe Reservoir	36.40765	-116.34202	NLA22_22BaseFT
9	NV	NLA22_NV-10006	Elko	Ralphs Warm Springs	40.95635	-114.73739	NLA22_22BaseFT
9	NV	NLA22_NV-10007	Churchill	Twin Lakes	39.57537	-118.68186	NLA22_22BaseFT
2	NY	NLA22_NY-10001	Genesee	Galloway Swamp Pond	43.02094	-78.30916	NLA22_17RVT2FT
2	NY	NLA22_NY-10002	Orange	Wilkins Pond	41.38004	-74.03007	NLA22_17RVT2FT
2	NY	NLA22_NY-10003	St. Lawrence	Long Pond	44.27153	-75.06178	NLA22_17BaseFT
2	NY	NLA22_NY-10004	Lewis	Unnamed Lake	43.80737	-75.15523	NLA22_17BaseFT
2	NY	NLA22_NY-10005	Ulster	Unnamed Lake	41.69110	-74.46433	NLA22_17BaseFT
2	NY	NLA22_NY-10006	Dutchess	Moffit Pond	41.74694	-73.73502	NLA22_17BaseFT
2	NY	NLA22_NY-10007	Essex	Rock Pond	43.85124	-73.59510	NLA22_17BaseFT
2	NY	NLA22_NY-10008	Fulton	County Line Lake	43.23406	-74.43414	NLA22_17BaseFT
2	NY	NLA22_NY-10009	Sullivan	Unnamed Lake	41.58713	-74.38424	NLA22_17BaseFT
2	NY	NLA22_NY-10010	Columbia	Melcher Pond	42.15924	-73.58872	NLA22_17BaseFT
2	NY	NLA22_NY-10016	Cattaraugus	Keyser Lake	42.10162	-78.95409	NLA22_22BaseFT
2	NY	NLA22_NY-10017	Warren	Upper Kellum Pond	43.55993	-73.77761	NLA22_22BaseFT
2	NY	NLA22_NY-10018	Sullivan	Davis Pond	41.57370	-74.98260	NLA22_22BaseFT
2	NY	NLA22_NY-10019	Delaware	Unnamed Lake	42.27785	-75.06931	NLA22_22BaseFT
2	NY	NLA22_NY-10020	Lewis	Crooked Pond	44.11567	-75.44370	NLA22_22BaseFT
2	NY	NLA22_NY-10021	Essex	Hammond Pond	44.00739	-73.62855	NLA22_22BaseFT
2	NY	NLA22_NY-10022	Ulster	Cape Pond	41.75099	-74.46746	NLA22_22BaseFT
2	NY	NLA22_NY-10023	Orange	Unnamed Lake	41.28816	-74.21149	NLA22_22BaseFT
2	NY	NLA22_NY-10024	Herkimer	Gray Lake	43.70266	-74.96271	NLA22_22BaseFT
2	NY	NLA22_NY-10025	Steuben	Unnamed Lake	42.00399	-77.01247	NLA22_22BaseFT
5	OH	NLA22_OH-10001	Darke	Wabash Conservancy District Structure Reservoir	40.31302	-84.63687	NLA22_17RVT2FT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
5	OH	NLA22_OH-10002	Montgomery	Unnamed Lake	39.78671	-84.27526	NLA22_17RVT2FT
5	OH	NLA22_OH-10003	Harrison	Consolidation Coal Company Pond 0110-	40.19428	-81.11995	NLA22_17BaseFT
5	OH	NLA22_OH-10004	Stark	Sippo Lake	40.80506	-81.45572	NLA22_17BaseFT
5	OH	NLA22_OH-10007	Mahoning	Burgess Lake	41.00363	-80.59803	NLA22_22BaseFT
5	OH	NLA22_OH-10008	Knox	Unnamed Lake	40.50757	-82.55143	NLA22_22BaseFT
5	OH	NLA22_OH-10009	Paulding	Paulding Upground Reservoir	41.12247	-84.58798	NLA22_22BaseFT
5	OH	NLA22_OH-10010	Preble	Unnamed Lake	39.61885	-84.65425	NLA22_22BaseFT
5	OH	NLA22_OH-10011	Columbiana	Caldwell Spring Lake	40.76430	-80.59751	NLA22_22BaseFT
6	OK	NLA22_OK-10001	Love	Oknoname 085003 Reservoir	33.74768	-97.16772	NLA22_17RVT2FT
6	OK	NLA22_OK-10002	Seminole	Unnamed Lake	34.95707	-96.67291	NLA22_17RVT2FT
6	OK	NLA22_OK-10003	Craig	Unnamed Lake	36.58641	-95.13408	NLA22_17BaseFT
6	OK	NLA22_OK-10004	Kingfisher	Uncle John Creek Site 12 Reservoir	35.75334	-97.86541	NLA22_17BaseFT
6	OK	NLA22_OK-10005	Seminole	Unnamed Lake	35.30597	-96.62588	NLA22_17BaseFT
6	OK	NLA22_OK-10006	Stephens	Unnamed Lake	34.64651	-98.00002	NLA22_17BaseFT
6	OK	NLA22_OK-10007	Rogers	Unnamed Lake	36.12308	-95.53258	NLA22_17BaseFT
6	OK	NLA22_OK-10008	Payne	Unnamed Lake	35.96813	-96.70164	NLA22_17BaseFT
6	OK	NLA22_OK-10009	Grady	Unnamed Lake	34.89731	-97.69107	NLA22_17BaseFT
6	OK	NLA22_OK-10010	Washita	Boggy Creek Watershed Site 25 Reservoir	35.41359	-99.00814	NLA22_17BaseFT
6	OK	NLA22_OK-10011	Sequoyah	Sallisaw Creek Site 36 Reservoir	35.52939	-94.69622	NLA22_17BaseFT
6	OK	NLA22_OK-10012	Custer	Unnamed Lake	35.71496	-98.96675	NLA22_17BaseFT
6	OK	NLA22_OK-10019	McCurtain	Red Lake	33.78855	-94.88728	NLA22_22BaseFT
6	OK	NLA22_OK-10020	Osage	Unnamed Lake	36.23489	-96.00728	NLA22_22BaseFT
6	OK	NLA22_OK-10021	Kay	Horseshoe Lake	36.61554	-97.19082	NLA22_22BaseFT
6	OK	NLA22_OK-10022	Pontotoc	Upper Clear Boggy Creek Site 32 Reservoir	34.66990	-96.67818	NLA22_22BaseFT
6	OK	NLA22_OK-10023	Pittsburg	Lake Talawanda Number Two	34.98518	-95.78925	NLA22_22BaseFT
6	OK	NLA22_OK-10024	Rogers	Petersons Lake	36.25544	-95.58686	NLA22_22BaseFT
6	OK	NLA22_OK-10025	Harmon	Tri County Turkey Creek Site 4 Reservoir	34.75801	-99.72474	NLA22_22BaseFT
6	OK	NLA22_OK-10026	Bryan	Unnamed Lake	34.05207	-96.38090	NLA22_22BaseFT
6	OK	NLA22_OK-10027	Okmulgee	Unnamed Lake	35.57960	-95.93679	NLA22_22BaseFT
6	OK	NLA22_OK-10028	Oklahoma	Lake Arcadia	35.62662	-97.39418	NLA22_22BaseFT
6	OK	NLA22_OK-10029	Jackson	Unnamed Lake	34.78041	-99.19076	NLA22_22BaseFT
6	OK	NLA22_OK-10030	Canadian	Unnamed Lake	35.51577	-97.85610	NLA22_22BaseFT
10	OR	NLA22_OR-10001	Coos	Unnamed Lake	43.45662	-124.08930	NLA22_17RVT2FT
10	OR	NLA22_OR-10002	Jackson	Unnamed Lake	42.43052	-122.86150	NLA22_17RVT2FT
10	OR	NLA22_OR-10003	Lane	Griffith Reservoir	44.02009	-123.29050	NLA22_17BaseFT
10	OR	NLA22_OR-10004	Multnomah	Unnamed Lake	45.55846	-122.50370	NLA22_17BaseFT
10	OR	NLA22_OR-10005	Lake	Unnamed Lake	43.20602	-119.90430	NLA22_17BaseFT
10	OR	NLA22_OR-10006	Klamath	Spring Lake	42.11722	-121.77900	NLA22_17BaseFT
10	OR	NLA22_OR-10007	Lane	Tenas Lakes	44.22932	-121.91610	NLA22_17BaseFT
10	OR	NLA22_OR-10011	Malheur	Becker Ponds	44.03957	-116.96937	NLA22_22BaseFT
10	OR	NLA22_OR-10012	Lane	Fern Ridge Lake	44.11966	-123.29215	NLA22_22BaseFT
10	OR	NLA22_OR-10013	Washington	Valley Memorial Park Lake	45.50404	-122.94387	NLA22_22BaseFT
10	OR	NLA22_OR-10014	Lake	Greaser Reservoir	42.17032	-119.80749	NLA22_22BaseFT
10	OR	NLA22_OR-10015	Union	North Powder Pond Number Two	44.99582	-117.98936	NLA22_22BaseFT
10	OR	NLA22_OR-10016	Klamath	Karen Lake	43.55363	-122.09995	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
10	OR	NLA22_OR-10017	Clatsop	Alder Lake	46.17782	-123.93246	NLA22_22BaseFT
10	OR	NLA22_OR-10018	Lake	Unnamed Lake	43.46192	-120.25319	NLA22_22BaseFT
3	PA	NLA22_PA-10001	Fayette	Seghis Lakes	39.77971	-79.78948	NLA22_17RVT2FT
3	PA	NLA22_PA-10002	Adams	Unnamed Lake	39.98016	-77.17689	NLA22_17RVT2FT
3	PA	NLA22_PA-10003	Wayne	Waynewood Lake	41.39491	-75.36279	NLA22_17BaseFT
3	PA	NLA22_PA-10004	Erie	Unnamed Lake	41.94115	-79.97291	NLA22_17BaseFT
3	PA	NLA22_PA-10007	Susquehanna	Lake Montrose	41.84200	-75.85694	NLA22_22BaseFT
3	PA	NLA22_PA-10008	Wayne	Unnamed Lake	41.50965	-75.33922	NLA22_22BaseFT
3	PA	NLA22_PA-10009	Lycoming	Unnamed Lake	41.23798	-76.91237	NLA22_22BaseFT
3	PA	NLA22_PA-10010	Berks	Trout Run Reservoir	40.33491	-75.70646	NLA22_22BaseFT
3	PA	NLA22_PA-10011	Wayne	Unnamed Lake	41.92842	-75.43960	NLA22_22BaseFT
1	RI	NLA22_RI-10001	Washington	Silver Lake	41.43472	-71.48838	NLA22_17RVT2FT
1	RI	NLA22_RI-10002	Washington	Barber Pond	41.50025	-71.56469	NLA22_17RVT2FT
1	RI	NLA22_RI-10003	Washington	Payne Pond	41.15776	-71.55597	NLA22_17BaseFT
1	RI	NLA22_RI-10005	Washington	Deep Pond	41.56003	-71.76208	NLA22_22BaseFT
1	RI	NLA22_RI-10006	Washington	Thirty Acre Pond	41.48984	-71.54649	NLA22_22BaseFT
1	RI	NLA22_RI-10007	Providence	Unnamed Lake	41.87345	-71.47984	NLA22_22BaseFT
4	SC	NLA22_SC-10001	Williamsburg	Unnamed Lake	33.67812	-79.74744	NLA22_17RVT2FT
4	SC	NLA22_SC-10002	Horry	Bear Swamp	33.81961	-79.05574	NLA22_17RVT2FT
4	SC	NLA22_SC-10003	Colleton	Unnamed Lake	33.05264	-80.91202	NLA22_17BaseFT
4	SC	NLA22_SC-10005	Marlboro	Sandhill Bay	34.51973	-79.68648	NLA22_22BaseFT
4	SC	NLA22_SC-10006	Calhoun	Unnamed Lake	33.80622	-81.04124	NLA22_22BaseFT
4	SC	NLA22_SC-10007	Berkeley	Lower Reserve	33.10229	-79.83940	NLA22_22BaseFT
8	SD	NLA22_SD-10001	Union	Unnamed Lake	42.48984	-96.47912	NLA22_17RVT2FT
8	SD	NLA22_SD-10002	Clark	Reid/Round Lake	45.03031	-97.77080	NLA22_17RVT2FT
8	SD	NLA22_SD-10003	Deuel	Unnamed Lake	44.82086	-96.64930	NLA22_17BaseFT
8	SD	NLA22_SD-10004	Haakon	Unnamed Lake	44.32485	-101.64820	NLA22_17BaseFT
8	SD	NLA22_SD-10005	Faulk	Unnamed Lake	44.95753	-98.92468	NLA22_17BaseFT
8	SD	NLA22_SD-10006	Roberts	Tahana Lake	45.54837	-97.16700	NLA22_17BaseFT
8	SD	NLA22_SD-10007	Meade	Unnamed Lake	44.24947	-102.89160	NLA22_17BaseFT
8	SD	NLA22_SD-10008	Mellette	England Lake	43.69813	-100.95100	NLA22_17BaseFT
8	SD	NLA22_SD-10009	Brown	Unnamed Lake	45.83484	-98.21610	NLA22_17BaseFT
8	SD	NLA22_SD-10010	Hand	Spring Lake	44.26920	-98.92549	NLA22_17BaseFT
8	SD	NLA22_SD-10011	Perkins	Meyers Lake	45.89986	-102.09760	NLA22_17BaseFT
8	SD	NLA22_SD-10012	Harding	Unnamed Lake	45.60268	-103.58550	NLA22_17BaseFT
8	SD	NLA22_SD-10013	Buffalo	Knippling Lake	44.08274	-99.22945	NLA22_17BaseFT
8	SD	NLA22_SD-10014	Corson	Standing Rock Tribe Lake	45.78323	-101.08910	NLA22_17BaseFT
8	SD	NLA22_SD-10021	Roberts	Lake Whipple	45.60915	-97.14636	NLA22_22BaseFT
8	SD	NLA22_SD-10022	Kingsbury	Unnamed Lake	44.36711	-97.40903	NLA22_22BaseFT
8	SD	NLA22_SD-10023	Jerauld	Unnamed Lake	44.05684	-98.73010	NLA22_22BaseFT
8	SD	NLA22_SD-10024	Pennington	Unnamed Lake	43.80275	-102.10998	NLA22_22BaseFT
8	SD	NLA22_SD-10025	Day	Unnamed Lake	45.42528	-97.55571	NLA22_22BaseFT
8	SD	NLA22_SD-10026	Codington	Unnamed Lake	44.85510	-97.41319	NLA22_22BaseFT
8	SD	NLA22_SD-10027	Spink	Alkali Lake	45.14866	-98.68219	NLA22_22BaseFT
8	SD	NLA22_SD-10028	Harding	Unnamed Lake	45.72198	-103.81589	NLA22_22BaseFT
8	SD	NLA22_SD-10029	Marshall	Unnamed Lake	45.71848	-97.38796	NLA22_22BaseFT

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EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
8	SD	NLA22_SD-10030	Codington	Unnamed Lake	45.06012	-97.32309	NLA22_22BaseFT
8	SD	NLA22_SD-10031	McPherson	Unnamed Lake	45.72642	-99.55823	NLA22_22BaseFT
8	SD	NLA22_SD-10032	Pennington	Sheridan Lake	43.97316	-103.47133	NLA22_22BaseFT
8	SD	NLA22_SD-10033	Brown	Renzienhausen Slough	45.78772	-97.99893	NLA22_22BaseFT
8	SD	NLA22_SD-10034	Day	Unnamed Lake	45.24518	-97.57969	NLA22_22BaseFT
4	TN	NLA22_TN-10001	Greene	Unnamed Lake	36.19580	-82.74069	NLA22_17RVT2FT
4	TN	NLA22_TN-10002	Marion	Browns Lake	35.00558	-85.58884	NLA22_17RVT2FT
4	TN	NLA22_TN-10003	Dyer	Unnamed Lake	36.16733	-89.39693	NLA22_17BaseFT
4	TN	NLA22_TN-10005	Grundy	Highlander Pond	35.25560	-85.80847	NLA22_22BaseFT
4	TN	NLA22_TN-10006	Bledsoe	Timber Lake	35.65453	-85.02103	NLA22_22BaseFT
4	TN	NLA22_TN-10007	McNairy	Tacker Lake	35.25306	-88.57275	NLA22_22BaseFT
6	NM:TX	NLA22_TX-10001	Loving	Red Bluff Reservoir	31.95055	-103.94050	NLA22_17RVT2FT
6	TX	NLA22_TX-10002	Clay	Lake Arrowhead	33.71431	-98.37163	NLA22_17RVT2FT
6	TX	NLA22_TX-10003	Calhoun	Unnamed Lake	28.16242	-96.78641	NLA22_17BaseFT
6	TX	NLA22_TX-10004	Panola	Martin Lake	32.20116	-94.51782	NLA22_17BaseFT
6	TX	NLA22_TX-10005	Wise	Unnamed Lake	33.36387	-97.41123	NLA22_17BaseFT
6	TX	NLA22_TX-10006	McMullen	Unnamed Lake	28.62651	-98.40695	NLA22_17BaseFT
6	TX	NLA22_TX-10007	McMullen	Unnamed Lake	28.19148	-98.74116	NLA22_17BaseFT
6	TX	NLA22_TX-10008	Jefferson	Utility Department #7 Reservoir	29.90287	-93.94689	NLA22_17BaseFT
6	TX	NLA22_TX-10009	Mills	Soil Conservation Service Site 6 Reservoir	31.50956	-98.91006	NLA22_17BaseFT
6	TX	NLA22_TX-10010	Austin	Unnamed Lake	29.85308	-96.37105	NLA22_17BaseFT
6	TX	NLA22_TX-10011	Dimmit	Bermuda Lake	28.55559	-99.74061	NLA22_17BaseFT
6	TX	NLA22_TX-10012	Walker	Unnamed Lake	30.92462	-95.46998	NLA22_17BaseFT
6	TX	NLA22_TX-10013	Kaufman	Unnamed Lake	32.68214	-96.23475	NLA22_17BaseFT
6	TX	NLA22_TX-10014	Milam	Unnamed Lake	30.50752	-97.09257	NLA22_17BaseFT
6	TX	NLA22_TX-10015	Lamar	Unnamed Lake	33.65809	-95.62379	NLA22_17BaseFT
6	TX	NLA22_TX-10016	Chambers	Blind Lake	29.78289	-94.71014	NLA22_17BaseFT
6	TX	NLA22_TX-10017	Mitchell	Butler Lake	32.40757	-101.03070	NLA22_17BaseFT
6	TX	NLA22_TX-10026	Moore	Unnamed Lake	36.03511	-101.80782	NLA22_22BaseFT
6	TX	NLA22_TX-10027	Henderson	Seven Points Lake	32.27555	-96.23896	NLA22_22BaseFT
6	TX	NLA22_TX-10028	Webb	Biel Lake	27.87813	-98.88690	NLA22_22BaseFT
6	TX	NLA22_TX-10029	Cass	Simpson Lake	32.89648	-94.60379	NLA22_22BaseFT
6	TX	NLA22_TX-10030	McLennan	Waco Lake	31.54347	-97.22381	NLA22_22BaseFT
6	TX	NLA22_TX-10031	Jack	Lake Jacksboro	33.22644	-98.14856	NLA22_22BaseFT
6	TX	NLA22_TX-10032	Jackson	Unknown Menefee Flat Pond	28.81378	-96.58017	NLA22_22BaseFT
6	TX	NLA22_TX-10033	Chambers	Crooked Lake	29.86688	-94.59420	NLA22_22BaseFT
6	TX	NLA22_TX-10034	Lee	Soil Conservation Service Site 1 Reservoir	30.15778	-96.84824	NLA22_22BaseFT
6	TX	NLA22_TX-10035	Archer	McKinney Lake	33.49508	-98.61346	NLA22_22BaseFT
6	TX	NLA22_TX-10036	Shelby	Unnamed Lake	31.92401	-94.08047	NLA22_22BaseFT
6	TX	NLA22_TX-10037	Harris	Unnamed Lake	29.87366	-95.52007	NLA22_22BaseFT
6	TX	NLA22_TX-10038	Fannin	Lake Bonham	33.65389	-96.13948	NLA22_22BaseFT
6	TX	NLA22_TX-10039	Martin	Unnamed Lake	32.41959	-101.70032	NLA22_22BaseFT
6	TX	NLA22_TX-10040	Van Zandt	Soil Conservation Service Site 105 Reservoir	32.65203	-96.00741	NLA22_22BaseFT
6	TX	NLA22_TX-10041	Jefferson	Rhodair Gully	29.90072	-94.05628	NLA22_22BaseFT
6	TX	NLA22_TX-10042	Donley	Greenbelt Reservoir	35.00531	-100.90121	NLA22_22BaseFT

2022 NLA Fish Tissue Study Target Sampling Locations (636)[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
8	UT	NLA22_UT-10001	Iron	Modena Draw Reservoir	37.78044	-113.89390	NLA22_17RVT2FT
8	UT	NLA22_UT-10002	Weber	Ogden Bay Spring	41.17782	-112.15460	NLA22_17RVT2FT
8	UT	NLA22_UT-10003	Uintah	Nine Mile Reservoir	39.82802	-109.87850	NLA22_17BaseFT
8	UT	NLA22_UT-10004	Summit	Bear Lake	40.84628	-110.39940	NLA22_17BaseFT
8	UT	NLA22_UT-10005	Garfield	The Baldys Lake	38.04021	-111.41530	NLA22_17BaseFT
8	UT	NLA22_UT-10008	Grand	Intrepid Potash Pond	38.51915	-109.66332	NLA22_22BaseFT
8	UT	NLA22_UT-10009	Salt Lake	Unnamed Lake	40.80043	-112.00315	NLA22_22BaseFT
8	UT	NLA22_UT-10010	Box Elder	Unnamed Lake	41.49557	-112.18598	NLA22_22BaseFT
8	UT	NLA22_UT-10011	Uintah	Unnamed Lake	40.71802	-109.82110	NLA22_22BaseFT
8	UT	NLA22_UT-10012	Beaver	Middle Kents Lake Number Two	38.23533	-112.46242	NLA22_22BaseFT
3	VA	NLA22_VA-10001	Washington	Beaver Creek Reservoir	36.64651	-82.11079	NLA22_17RVT2FT
3	VA	NLA22_VA-10002	James City	Wenger Pond	37.39947	-76.76699	NLA22_17RVT2FT
3	VA	NLA22_VA-10003	Greensville	Beaver Pond	36.62833	-77.61589	NLA22_17BaseFT
3	VA	NLA22_VA-10004	Spotsylvania	Cool Spring Lake	38.29925	-77.65349	NLA22_17BaseFT
3	VA	NLA22_VA-10007	Rappahannock	Unnamed Lake	38.69649	-78.21736	NLA22_22BaseFT
3	VA	NLA22_VA-10008	Albemarle	Unnamed Lake	37.78030	-78.58079	NLA22_22BaseFT
3	VA	NLA22_VA-10009	Halifax	Wade Lake	36.63033	-79.06388	NLA22_22BaseFT
3	VA	NLA22_VA-10010	Northampton	Bulls Pond	37.14896	-75.95533	NLA22_22BaseFT
1	VT	NLA22_VT-10001	Rutland	Unnamed Lake	43.37749	-73.24616	NLA22_17RVT2FT
1	VT	NLA22_VT-10002	Windsor	Unnamed Lake	43.79542	-72.39685	NLA22_17RVT2FT
1	VT	NLA22_VT-10003	Washington	Unnamed Lake	44.43086	-72.43137	NLA22_17BaseFT
1	VT	NLA22_VT-10005	Franklin	Lake Champlain	45.04239	-73.12746	NLA22_22BaseFT
1	VT	NLA22_VT-10006	Windsor	Echo Lake	43.47264	-72.70051	NLA22_22BaseFT
1	VT	NLA22_VT-10007	Orange	Tenney Pond	44.15989	-72.11352	NLA22_22BaseFT
10	WA	NLA22_WA-10001	Whitman	Cherry Cove Lake	47.02138	-117.77000	NLA22_17RVT2FT
10	WA	NLA22_WA-10002	Whatcom	Lake Padden	48.70292	-122.45330	NLA22_17RVT2FT
10	WA	NLA22_WA-10003	King	Larsen Lake	47.60519	-122.14030	NLA22_17BaseFT
10	WA	NLA22_WA-10004	Stevens	Echo Lakes	48.66424	-117.95560	NLA22_17BaseFT
10	WA	NLA22_WA-10005	Walla Walla	Iowa Beef Processors Waste Pond	46.14082	-118.90300	NLA22_17BaseFT
10	WA	NLA22_WA-10006	Mason	Oak Patch Lake	47.47637	-122.91610	NLA22_17BaseFT
10	WA	NLA22_WA-10007	Douglas	Grimes Lake	47.73119	-119.59030	NLA22_17BaseFT
10	WA	NLA22_WA-10008	Spokane	Hog Lake	47.37711	-117.80260	NLA22_17BaseFT
10	WA	NLA22_WA-10009	Lewis	Jess Lake	46.70566	-121.38900	NLA22_17BaseFT
10	WA	NLA22_WA-10010	Grant	Lower Crab Creek Lake	46.95433	-119.25630	NLA22_17BaseFT
10	WA	NLA22_WA-10015	Ferry	Lake Ellen	48.50049	-118.25540	NLA22_22BaseFT
10	WA	NLA22_WA-10016	Grant	Babcock Ridge Lake	47.23551	-119.92509	NLA22_22BaseFT
10	WA	NLA22_WA-10017	Pend Oreille	Oidneys Pond	48.16961	-117.07844	NLA22_22BaseFT
10	WA	NLA22_WA-10018	Thurston	Sunwood Lake	46.96955	-122.77332	NLA22_22BaseFT
10	WA	NLA22_WA-10019	Okanogan	Summit Lake	48.88754	-119.34003	NLA22_22BaseFT
10	WA	NLA22_WA-10020	King	Lake Clarice	47.62490	-121.18531	NLA22_22BaseFT
10	WA	NLA22_WA-10021	Clark	Lancaster Lake	45.85000	-122.74822	NLA22_22BaseFT
10	WA	NLA22_WA-10022	Mason	Isabella Lake	47.17153	-123.11674	NLA22_22BaseFT
10	WA	NLA22_WA-10023	Spokane	Hardesty Road Pond	47.94572	-117.31998	NLA22_22BaseFT
5	MN	NLA22_WI-10001	Goodhue	Sturgeon Lake	44.63935	-92.61577	NLA22_17RVT2FT
5	WI	NLA22_WI-10002	Price	Lake Ten	45.62225	-90.48676	NLA22_17RVT2FT
5	WI	NLA22_WI-10003	Bayfield	Priest Lake	46.35399	-91.53581	NLA22_17BaseFT

2022 NLA Fish Tissue Study Target Sampling Locations (636)[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude	Panel_Use
5	WI	NLA22_WI-10004	Brown	Unnamed Lake	44.59728	-88.02661	NLA22_17BaseFT
5	WI	NLA22_WI-10005	Jackson	Unnamed Lake	44.31349	-90.39660	NLA22_17BaseFT
5	WI	NLA22_WI-10006	Burnett	Lind Lake	45.75032	-92.43545	NLA22_17BaseFT
5	WI	NLA22_WI-10007	Burnett	Fawn Lake	46.03363	-92.17979	NLA22_17BaseFT
5	WI	NLA22_WI-10008	Forest	Ludington Lake	45.47702	-88.76988	NLA22_17BaseFT
5	WI	NLA22_WI-10009	Dane	Lake Belle View	42.87001	-89.54856	NLA22_17BaseFT
5	WI	NLA22_WI-10010	Polk	Rice Lake	45.27248	-92.55141	NLA22_17BaseFT
5	WI	NLA22_WI-10015	Crawford	Unknown Island Number One Hundred Seventy-Two Lake	43.06007	-91.17273	NLA22_22BaseFT
5	WI	NLA22_WI-10016	Burnett	Birch Island Lake	45.93917	-92.15971	NLA22_22BaseFT
5	WI	NLA22_WI-10017	Dunn	Big River Resources Unnamed Pond	45.05083	-91.98766	NLA22_22BaseFT
5	WI	NLA22_WI-10018	Washington	Serendipity Lake	43.21534	-88.17801	NLA22_22BaseFT
5	WI	NLA22_WI-10019	Adams	Camelot Lake	44.20597	-89.75933	NLA22_22BaseFT
5	WI	NLA22_WI-10020	Marathon	Townline Flowage	44.70543	-89.82463	NLA22_22BaseFT
5	WI	NLA22_WI-10021	Oneida	Long Lake	45.78981	-89.49794	NLA22_22BaseFT
5	WI	NLA22_WI-10022	Sheboygan	Elkhart Lake	43.82542	-88.02346	NLA22_22BaseFT
5	WI	NLA22_WI-10023	Columbia	Columbia Energy Center Pond 1	43.49264	-89.41734	NLA22_22BaseFT
3	WV	NLA22_WV-10001	Jackson	Bar Run Lake	38.84854	-81.85081	NLA22_17RVT2FT
3	WV	NLA22_WV-10002	Nicholas	Summersville Lake	38.24675	-80.86071	NLA22_17RVT2FT
3	WV	NLA22_WV-10003	Preston	Unnamed Lake	39.69735	-79.64590	NLA22_17BaseFT
3	WV	NLA22_WV-10005	Lincoln	Mud River Lake	38.15533	-82.05795	NLA22_22BaseFT
3	WV	NLA22_WV-10006	Mercer	Horton Lake	37.27717	-81.17648	NLA22_22BaseFT
3	WV	NLA22_WV-10007	Grant	Stony River Reservoir	39.12445	-79.30738	NLA22_22BaseFT
8	WY	NLA22_WY-10001	Laramie	Unnamed Lake	41.01086	-105.25930	NLA22_17RVT2FT
8	WY	NLA22_WY-10002	Fremont	Unnamed Lake	42.88123	-109.28700	NLA22_17RVT2FT
8	WY	NLA22_WY-10003	Sublette	Sauerkraut Lakes	43.10524	-109.73260	NLA22_17BaseFT
8	WY	NLA22_WY-10004	Natrona	S P Reservoir	42.79375	-106.42590	NLA22_17BaseFT
8	WY	NLA22_WY-10005	Albany	Glade Number 1 Reservoir	41.92218	-105.55290	NLA22_17BaseFT
8	WY	NLA22_WY-10006	Fremont	Lewiston Lakes	42.44411	-108.45990	NLA22_17BaseFT
8	WY	NLA22_WY-10007	Crook	Lone Tree Reservoir	44.92057	-104.24600	NLA22_17BaseFT
8	WY	NLA22_WY-10008	Albany	Twin Buttes Lake	41.23809	-105.86160	NLA22_17BaseFT
8	WY	NLA22_WY-10009	Park	Coe Enlargement Reservoir	44.28174	-109.11020	NLA22_17BaseFT
8	WY	NLA22_WY-10014	Crook	Unnamed Lake	44.82254	-104.14463	NLA22_22BaseFT
8	WY	NLA22_WY-10015	Fremont	Unknown Continental Glacier Lake	43.34200	-109.68715	NLA22_22BaseFT
8	WY	NLA22_WY-10016	Sublette	Upper Silver Lakes	42.81388	-109.36968	NLA22_22BaseFT
8	WY	NLA22_WY-10017	Goshen	Goshen Hole Reservoir	41.88002	-104.28134	NLA22_22BaseFT
8	WY	NLA22_WY-10018	Teton	Unknown Jackass Meadows Lake	44.04085	-111.03434	NLA22_22BaseFT
8	WY	NLA22_WY-10019	Fremont	Unnamed Lake	43.02493	-109.49361	NLA22_22BaseFT
8	WY	NLA22_WY-10020	Sublette	Big Sandy Reservoir	42.27426	-109.43074	NLA22_22BaseFT
8	WY	NLA22_WY-10021	Laramie	Granite Springs Reservoir	41.17702	-105.23435	NLA22_22BaseFT
8	WY	NLA22_WY-10022	Park	Mirror Lake	44.73563	-110.16326	NLA22_22BaseFT

[1] This list of sites is subject to change as the project proceeds. For example, access to some sites may not be granted by property owners. Other sites may not yield fish of suitable size or species. OST maintains the list of valid sites, and this QAPP will **not** be revised just to address changes in the list of sites.

Appendix B

2022 NLA Fish Tissue Study Sample Preparation, Homogenization, and Distribution Procedures

Appendix B

2022 NLA Fish Tissue Study Sample Preparation, Homogenization, and Distribution Procedures

I. PURPOSE

This document describes the procedures that the fish sample preparation laboratory (Tetra Tech laboratory at Owings Mills, MD) follows when preparing fish fillet tissue samples for EPA's 2022 National Lakes Assessment (NLA) Fish Tissue Study. Adherence to these procedures ensures that fillet tissue sample preparation activities at the Tetra Tech laboratory are performed consistently across all study samples and in a manner consistent with previous EPA fish tissue studies. The effort is divided into two primary components:

- Fish fillet tissue sample preparation and distribution procedures, including quality control steps (e.g., triplicate lipid analysis of homogenized fillet tissue aliquots), for all fish sample preparation batches.
- Preparation of rinsate and solvent blank samples for mercury, PCBs, and PFAS, and mercury analysis of paired rinsate and solvent blank samples for each fish sample preparation batch.

Each of these components is described in detail below.

II. FISH FILLET TISSUE PROCESSING AND DISTRIBUTION PROCEDURES

The procedures for processing 2022 NLA Fish Tissue Study whole fish samples to prepare fillet tissue samples and distributing fillet tissue samples for mercury, PFAS, PCB, and lipid analyses are described below. This process description is organized into the following components, including the quality control (QC) procedures:

A. Sample Receipt and Storage
B. Sample Handling
C. Filleting and Homogenization Procedures
D. Aliquoting and Distribution Procedures
E. Equipment Cleaning between Fish Samples
F. Lipid Determination for Every Homogenized Fillet Sample
G. Quality Control (QC) Procedures
H. Reporting Requirements
I. Sample Shipping Procedures

The individual tasks in the overall process are presented as a series of numbered steps across the nine components listed above.

Fillet Tissue Processing Definitions

- **Whole Fish Composite Sample:** A whole fish composite sample for the 2022 NLA Fish Tissue Study consists of 5 fish (ideally) of the same species that are similar in size and typically consumed by humans (See Section B1). One whole fish composite sample is collected from each viable NLA whole fish sampling location. There are 636 sites that are designated as whole fish sampling locations for the 2022 NLA Fish Tissue Study.

- **Fish sample preparation batch:** Each fish sample preparation batch consists of 20 whole fish composite samples. The number of whole fish composite samples in the final fish sample

preparation batch (or two) may be adjusted to include a few more than 20 or fewer than 20, depending on what fraction of 20 whole fish composite samples remain for assignment to a batch.

- **Analytical batch:** An analytical batch consists of the 20 fillet tissue aliquots generated for each target chemical (i.e., mercury, PFAS, PCBs, and lipids) during processing of a fish sample preparation batch. The number of fillet tissue samples in the final analytical batch (or two) may be adjusted to include a few more than 20 or fewer than 20, depending on what fraction of 20 fillet sample aliquots remain for assignment to a batch. Note that analytical batches correspond to fish sample preparation batches.

II.A. Sample Receipt and Storage

Field crews are collecting 2022 NLA Fish Tissue Study whole fish samples from May through September (or possibly through October or early November) during 2022. A total of 636 lakes sites are designated as whole fish sampling locations (Appendix A).

Whole fish samples are shipped by priority overnight delivery service from field locations in the lower 48 states to the sample repository at Microbac Laboratories in Baltimore, MD, where they are held in freezers for interim storage at a temperature of less than or equal to -20 °C. All samples are subsequently hand-delivered to the Tetra Tech laboratory in Owings Mills, MD for preparation of fillet tissue samples and interim storage of fillet samples until sample shipment to designated analytical laboratories. The Tetra Tech laboratory must have sufficient freezer space to store **at least 3 batches of unprocessed fish samples** at a temperature of less than or equal to -20 °C from the time of receipt until completion of sample processing and sufficient freezer space to store **homogenized fillet tissue aliquots from up to 60 processed fish samples** (e.g., up to 420 homogenized tissue jars) prior to distribution.

1. Although whole fish samples are delivered frozen, on dry ice, they must be inspected promptly on receipt. As samples are received at Microbac Laboratories, a laboratory representative must:

   - Check that each shipping container has arrived undamaged and verify that samples are still frozen and in good condition.
   - Check the temperature of one of the samples in the cooler using a thermometer that reads to at least -20 ºC, or an infra-red (IR) temperature "gun," and record the reading.
   - Transfer the samples to the freezer for long-term storage.

2. Notify GDIT immediately about any problems encountered upon receipt of samples. GDIT will communicate these problems to the OST Project Manager for resolution.

   Section B3 of the QAPP contains details about sample inspection by the GDIT sample custodian before whole fish samples are transferred to the Tetra Tech laboratory for fillet tissue sample preparation. Following fillet sample processing, the Tetra Tech laboratory must store homogenized fillet tissue sample aliquots frozen to less than or equal to -20 °C until they are distributed to the laboratories designated for fillet tissue analysis.

II.B. Sample Handling

The whole fish samples collected for the 2022 NLA Fish Tissue Study must remain frozen at less than or equal to -20 ºC until the Tetra Tech laboratory receives direction from the OST Fish Sample Preparation and Analysis Technical Leader to begin fish sample preparation. Fish samples must be retrieved from the freezer, with their associated paperwork, and allowed to partially thaw before they can be processed to prepare fillet tissue samples.

3. Prior to beginning fish sample processing, Tetra Tech prepares an Excel spreadsheet with draft fish sample processing instructions and preparation batch assignments for the 2022 NLA Fish Tissue Study and submits these spreadsheets to the OST Fish Sample Preparation and Analysis Technical Leader and OST Project Manager for review. The OST Fish Sample Preparation and Analysis Technical Leader will approve the fish sample preparation batch assignments and fish sample processing instructions with OST Project Manager concurrence.

Processing for a fish sample preparation batch involves the following for each fish sample in the batch:

- Preparation of one homogenized fillet tissue sample (consisting of fillets from both sides of each fish in the sample) according to the sample processing instructions approved by the OST Fish Sample Preparation and Analysis Technical Leader with OST Project Manager concurrence.

Note: Processing a fish sample preparation batch produces a total of 20 homogenized fillet tissue samples that are subdivided into aliquots for target chemical analyses and for long-term storage of archived tissue (Section II.D). Each set of 20 target chemical aliquots (mercury, PFAS, PCBs, and lipids) constitutes an analysis batch for the 2022 NLA Fish Tissue Study.

4. When retrieving samples from the freezer, the Tetra Tech sample custodian must:

- Verify that all associated paperwork stored with the samples is complete, legible, and accurate.
- Compare the information on the label on each fish specimen to the fish sample preparation batch spreadsheet and notify the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager of any discrepancies between the sample labels and the Excel file of sample processing instructions. Problems involving sample paperwork, sample integrity, or custody information inconsistencies for all fish samples should be reported to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager in writing (e.g., by email) within one business day following sample retrieval and inspection. **Do not proceed with sample processing until discrepancies are resolved.**

II.C. Filleting and Homogenization Procedures

The target chemical analyses for mercury, PFAS, PCBs, and lipids are performed on aliquots of homogenized fillet tissue samples prepared from the 2022 NLA Fish Tissue Study whole fish samples. Steps 5 - 9 below must be completed before beginning processing and preparing any fillet samples in the laboratory.

5. Prior to preparing any fillet samples, thoroughly clean utensils and cutting boards using the following series of procedures:

- Wash with a detergent solution (phosphate- and scent-free) and warm tap water
- Rinse three times with warm tap water
- Rinse three times with deionized (DI) water
- Rinse with acetone
- Rinse three times with DI water
- Rinse with (not soak in) 5% nitric acid
- Rinse three times with DI water

To control contamination, separate sets of utensils and cutting boards must be used for scaling fish and for filleting fish.

6. Put on powder-free nitrile gloves before unpacking a whole fish sample for fillet removal and tissue homogenization. After unwrapping, inspect each fish specimen in the sample carefully to verify that

it has not been damaged during collection or shipment. If damage (e.g., tearing the skin or puncturing the gut) is observed, document it in the applicable Fish Sample Preparation Laboratory Bench Sheet (Appendix C) and notify the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager before proceeding further.

7. Weigh each fish to the nearest gram (wet weight) prior to any sample processing. Enter weight information for each specimen into the applicable Fish Sample Preparation Laboratory Bench Sheet (Appendix C). Individual specimen weights will be transferred to spreadsheets for submission to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager.

8. Rinse each fish in the sample with DI water as a precautionary measure to treat for possible contamination from sample handling in the field. Use HDPE (high density polyethylene) wash bottles (not PTFE) for rinsing fish and for cleaning homogenization equipment and utensils.

9. Before beginning the scaling process for each fish in the composite sample, put on new powder-free nitrile gloves. (Gloves must be changed *between* whole fish composite samples.) Fish with scales must be scaled (and any adhering slime should be removed) prior to filleting. Scale the first designated fish by laying it flat on a clean glass cutting board and scraping from the tail to the head using a stainless steel scaler or the blade-edge of a clean stainless steel knife.

10. Continue scaling all of the other fish in the whole fish sample as described in Step 9 above. Filleting of the fish in the sample can proceed after all scales have been removed from the skin and a separate clean cutting board and fillet knife are prepared or available.

11. Put on new powder-free nitrile gloves. Place each fish on a clean glass cutting board in preparation for the filleting process. Note that filleting should be conducted under the supervision of an experienced fisheries biologist. Ideally, fish should be filleted while ice crystals are still present in the muscle tissue. Fish should be thawed only to the point where it becomes possible to make an incision into the flesh. Remove both fillets (lateral muscle tissue with skin attached) from the fish specimen using clean, high-quality stainless steel knives. Include the belly flap (ventral muscle and skin) with each fillet. Care must be taken to avoid contaminating fillet tissues with material released from inadvertent puncture of internal organs. In the event that an internal organ is punctured, rinse the fillet with DI water immediately after filleting and make a note on the laboratory bench sheet that a puncture has occurred. Bones still present in the tissue after filleting should be carefully removed using the tip of the fillet knife or a clean pair of forceps.

12. Whole fillet samples (consisting of the entire right and left fillets) are weighed to the nearest gram (wet weight) and the weight is recorded on the bench sheet prior to homogenization. These samples should be homogenized partially frozen for ease of grinding.

13. Process each whole fillet sample using a size-appropriate homogenization apparatus (e.g., automatic grinder or high-speed blender). Entire fillets (with skin and belly flap) from both sides of the fish must be homogenized. Mix the tissues thoroughly until they are completely homogenized as evidenced by fillet tissue that consists of a uniform color and finely ground texture. Chunks of skin or tissue will hinder extraction and digestion and, therefore, are NOT acceptable. Grinding of tissue may be easier when tissues are partially frozen. Chilling the grinder briefly with a few small pieces or pellets of dry ice may also keep the tissue from sticking to the equipment. Pellets of dry ice also may be added to the tissue as it enters the grinder.

Note: The dry ice pellets used for homogenizing the fillet tissue are classified as food grade and meet the specifications for substances Generally Regarded As Safe as a direct food ingredient in the Food and Drug Administration regulation 184.1240 (21 CFR 184.1240).

14. Grind the entire fillet sample a second time, using the same grinding equipment. This second grinding should proceed more quickly. The grinding equipment does not need to be cleaned between the first and second grinding of the sample. The final homogenized fillet sample must consist of finely ground tissue of uniform color and texture. If there are obvious differences in color or texture, grind the entire sample a third time or more to ensure uniform homogenization.

15. Measure the collective weight of the homogenized fillet tissue from each fish sample to the nearest gram (wet weight) after processing and record the total homogenate weight on the laboratory bench sheet. The total weights of the fillets and weights of the homogenized fillet tissue from each fish sample are transferred to spreadsheets for submission to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. At least 410 g of homogenized tissue will be needed to fill all of the containers in Table 1 below with their minimum acceptable masses. **If a sample does not yield at least 60 g of homogenized tissue, contact the OST Project Manager via email immediately and await instructions.** As appropriate, place any remaining homogenized fillet tissue in the freezer while waiting for instructions, which are likely to involve preparing fewer archive aliquots.

16. After the final (second, third, or higher number) grinding, clean the **grinding equipment and all other sample preparation equipment** using the procedures described in Step 22.

17. Once in every fish sample preparation batch (generally containing 20 whole fish samples), verify the continued absence of equipment contamination and uniformity of homogenization using the procedures described in Steps 25 to 29.

II.D. Aliquoting and Distribution Procedures

18. The sample preparation laboratory prepares the bulk homogenate tissue from one whole fish sample and uses it to fill the pre-cleaned sample containers specified for each type of aliquot listed in Table 1, following the procedures described in Step 19. **Except as noted in Table 1, all containers are provided by the fish sample preparation laboratory.** Documentation of their cleanliness provided by the vendor (i.e., certificates of analysis) must be retained by the fish sample preparation laboratory and provided to EPA on request. The target masses listed in Table 1 are designed to provide enough tissue for multiple analyses of each sample, including tissue for QC purposes, as needed. The fish sample preparation laboratory should not exceed those aliquot target masses when filling the containers. The order of the containers and target masses in Table 1 are important (i.e., they indicate priority order for aliquots) and are designed to ensure that adequate tissue is available for all analyses, as well as for archiving.

Table 1. 2022 NLA Human Health Fish Fillet Tissue Sample Aliquot Requirements

Analysis	Target Mass	Container Type	Destination
Mercury	10 g	50-mL HDPE straight-sided jar, or conical HDPE tube with snap top	ALS Environmental
PFAS	10 g	100-mL HDPE straight-sided jar with **foil-lined lid**, or conical HDPE tube with snap top. ***PTFE lid liners not allowed.***	SGS-AXYS
PCBs	25 g	125-mL straight-sided amber or clear glass jar with PTFE-lined lid	Enthalpy Analytical
Lipids, Fish 1	35 g (prepare 1 aliquot containing 35 g)	60-mL clear glass wide mouth jars	ALS Environmental

Analysis	Target Mass	Container Type	Destination
Lipids, Fish 2 - 20	15 g	60-mL clear glass wide mouth jars	ALS Environmental
Small Archive 1	up to 50 g	125-mL straight-sided amber or clear glass jar with **foil-lined lid**	GDIT Sample Repository
Small Archive 2	up to 50 g	125-mL straight-sided amber or clear glass jar with **foil-lined lid**	GDIT Sample Repository
Bulk Archive 1	up to 250 g	500-mL straight-sided amber or clear glass jar with **foil-lined lid**	GDIT Sample Repository
Total (to the nearest gram)[a]	410-430 g		

[a] In the event that insufficient fish tissue mass exists to prepare the required number of aliquots, contact the OST Project Manager for instructions as per Step 15.

19. Prepare the homogenized sample aliquots for **mercury, PFAS, and PCBs** (see Step 20 for lipid aliquot preparation). Weigh an appropriate clean sample container (Table 1) to the nearest 0.5 g and record the weight. Transfer sufficient homogenized fillet tissue to the container to achieve the target mass for that container in Table 1, weigh the container again, record the weight, and determine the weight of the aliquot to the nearest 0.5 g by difference. **The fish sample preparation laboratory must use foil-lined lids for jars containing the fillet tissue aliquots for PFAS analysis and the archived fillet tissue samples, as specified in Table 1.**

    Note: The archive sample jars are not filled until after sufficient volume for lipids determination have been collected, as described in Steps 20 and 21. The archive jars are not filled until the triplicate lipid aliquot (35 g) is collected (see Step 28 for triplicate lipid aliquot preparation, which is used for homogeneity testing).

    When filling jars, leave sufficient space at the top of each jar before sealing with the designated lid to allow for expansion of the tissue as it freezes. *In no case should jars be filled beyond 80% capacity, as this may result in breakage on freezing.* Wipe off the outside of the jars to remove any tissue residue or moisture. Fill out a label for each container using a waterproof marker. Include the following information (at a minimum) on each label:

    - sample identification number,
    - tissue sample type (i.e., homogenized fillet),
    - analysis type (e.g., mercury, PFAS or PCBs),
    - aliquot weight (to the nearest 0.5 gram),
    - preparation batch ID, and
    - preparation date (e.g., mm/dd/yyyy).

    Affix the label to the container with clear wide tape. Place each container inside one heavy-weight food-grade self-sealing plastic freezer bag to avoid sample loss due to breakage. Freeze the tissue samples at -20 ºC and maintain samples in the freezer until directed by the OST Fish Sample Preparation and Analysis Technical Leader with OST Project Manager concurrence to ship them to the analytical laboratories. (The OST Fish Sample Preparation and Analysis Technical Leader will not issue these instructions until equipment rinsate and homogeneity tests described in Steps 24 to 29 have been completed, reported, evaluated, and determined to be acceptable.)

20. After filling the containers with the tissue aliquots for mercury, PFAS, and PCBs, remove 35 g of homogenized fillet tissue from one sample in the batch (for triplicate lipid analysis) and 15 g of homogenized fillet tissue from all other samples in the batch (for single lipid analysis) to be used to

determine the lipid content of each fillet composite sample. Place these aliquots in clean glass or plastic containers of suitable size (provided by the ALS Environmental analytical laboratory) and label each of them with the sample ID number. Store the lipid aliquots in the freezer at -20 °C until they are ready to be shipped to the designated analytical laboratory to perform the lipid determinations in Steps 24, 28, and 29.

21. The archive sample jars are not filled until after sufficient volume for determining lipids has been collected. Once the aliquots for mercury, PFAS, PCBs, and lipids have been collected, the remaining tissue mass is used to create the three archive samples. Begin by transferring 50 g of tissue to the first small archive sample container. Continue by transferring a 50 g aliquot to the remaining small archive container. Ideally, sufficient homogenized fillet tissue mass will remain to produce one bulk archive container. Therefore, transfer 250 g of tissue to the bulk archive sample container. If less than 250 g of tissue is available, transfer all of the remaining homogenized tissue to the bulk archive container and weigh it to determine the tissue mass in the last archive container. Seal and label the containers as described in Step 19 for the other aliquots.

    Note: Step 15 requires that the laboratory contact the OST Project Manager whenever a homogenized fillet sample does not yield at least 60 g of tissue. The OST Fish Sample Preparation and Analysis Technical Leader will provide direction to the laboratory with OST Project Manager concurrence regarding samples yielding less than 60 g of tissue that must be followed at this point in the procedure.

    Any fillet tissue that remains after filling the bulk archive jar may be discarded.

II.E. Equipment Cleaning between Composite Samples

22. All of the homogenization equipment must be thoroughly cleaned between each fish sample. Once all of the fillets from the fish sample have been homogenized, disassemble the homogenization equipment (i.e., blender, grinder, or other device) and thoroughly **clean all surfaces and parts** that contact the sample. Similarly, **clean all knives, cutting boards, and other utensils used**. At a minimum:

    - Wash with a detergent solution (phosphate- and scent-free) and warm tap water
    - Rinse three times with warm tap water
    - Rinse three times with deionized (DI) water
    - Rinse with acetone
    - Rinse three times with DI water
    - Rinse with (not soak in) 5% nitric acid
    - Rinse three times with DI water
    - Allow the components to air dry

23. Reassemble the homogenization equipment and proceed with homogenization of the next fish sample in the batch (e.g., begin with Step 6 above).

II.F. Lipid Determination for Every Homogenized Fillet Sample

The first fish sample in each preparation batch is designated for triplicate lipid analysis for the homogeneity testing process described in Steps 28 and 29. The procedures for determining the lipid content of homogenized fillet tissue from all other fish samples in a fish sample preparation batch are described in Step 24 below.

24. For samples 2 through 20 in each fish sample preparation batch, use the 15 g aliquot of homogenized tissue collected in Step 20 to determine the lipid content of the sample. The analytical laboratory (ALS Environmental) will extract the aliquot using an appropriate method (EPA 3541/NOAA

Method) approved by EPA to determine the lipid content of that aliquot, which is recorded in units of percent (i.e., grams of lipid per gram of tissue x 100). This QAPP will be amended to include a description of this method after the analytical laboratory is selected and their proposed method for lipid analysis is approved.

II.G. Quality Control (QC) Procedures

The QC procedures for fish sample preparation include preparation and testing of equipment rinsate samples and homogeneity testing, using lipids as a surrogate.

During the fish sample preparation process, the Tetra Tech laboratory prepares three sets of aqueous rinsate and solvent blank samples for mercury, PCBs, and PFAS analyses, respectively, (Attachment 1) and one homogenized fillet tissue aliquot for triplicate lipid determinations from each fish sample preparation batch, as described in Steps 25 to 28 below. The batch-specific rinsate and homogeneity results are reviewed by Tetra Tech and GDIT. The Tetra Tech laboratory doing fish sample preparation may continue to process up to 2 additional batches during the QC sample analysis and review process. However, the Tetra Tech laboratory may **not** continue beyond the third batch of fish samples until receiving notification from the OST Fish Sample Preparation and Analysis Technical Leader (with OST Project Manager concurrence) that the review of initial batch rinsate and homogeneity test results is complete, and the results were deemed satisfactory.

Continued sample processing is dependent on both the quality of the Tetra Tech laboratory's efforts and on the timeliness of their delivery of QC results.

Rinsate and Blank Sample Production

25. Once per batch (of usually 20 fish samples) during the fish sample preparation operations, prepare three sets of rinsate and blank solvent samples (see Attachment 1) prior to reassembling the homogenization equipment (Step 23), as follows:

PCB rinsate and blank samples:

- Prepare a **hexane rinsate sample** by pouring a 100-mL portion of pesticide-grade hexane over all parts of homogenization equipment, including the cutting boards and knives, and collect it in a clean glass container. Place an additional 100-mL aliquot of clean hexane in a similar glass container for use as a solvent blank. Allow the solvent to evaporate from the equipment. This set of rinsate and solvent blank samples will be analyzed for all PCB congeners by the laboratory selected at a later date to analyze fillet samples for PCBs, and the rinsate and solvent blank results will be evaluated for contamination based on a subset of PCB congeners. The OST Project Manager will provide the Tetra Tech laboratory with the PCB analysis laboratory name and shipping information as soon as it is available. Label and store the PCB rinsate and blank samples as described Step 26.

Mercury rinsate and blank samples:

- Once the hexane has evaporated from the equipment, prepare the **first DI water rinsate** using 250 mL of DI water. Collect the DI water rinsate in a clean glass or HDPE container. Place a second aliquot of DI water in a separate similar clean container for use as a blank. Acidify these two samples to pH < 2 with nitric acid. Label and store each sample as described in Step 26. These rinsate and blank samples will be analyzed for mercury (see Attachment 1).

PFAS rinsate and blank samples:

- Prepare the **second DI water rinsate** using an additional 250 mL of DI water. Collect this rinsate in a clean glass container **with a non-PTFE lid liner**. Place a second aliquot of DI water in a separate similar clean glass container for use as a blank. This set of rinsate and blank samples

will be analyzed by the laboratory selected at a later date to analyze fillet samples for PFAS, thus the non-PTFE lid liners are essential. The OST Project Manager will provide the Tetra Tech laboratory with the PFAS analysis laboratory name and shipping information as soon as it is available. Label and store these PFAS rinsate and blank samples as described in Step 26.

Note: In order to minimize the number of project samples that might be affected by cross contamination, collect the rinsate and blank samples on the first day that fish samples in a sample preparation batch of 20 are processed. Ideally, the laboratory will vary the point at which the rinsates are collected on that first day over the course of the project (e.g., between the 1st and 2nd samples for one batch, the 2nd and 3rd samples for another batch, etc.).

26. Label each container as either "rinsate -[insert the name of the solvent, either hexane or DI water]" or "blank –[insert the name of the solvent, either hexane or DI water]," and include the date it was prepared (mm/dd/yyyy), the analysis type (Hg, PCBs, or PFAS), and the preparation batch identifier. Store the rinsate and blank samples in a refrigerator at a temperature of <6 °C.

Rinsate and Blank Sample Analyses

27. During the fish sample preparation operations, laboratories under contract to Tetra Tech (to be determined for mercury) and GDIT (PCBs and PFAS) will analyze one set of rinsate and blank samples per batch for:
    - Mercury using EPA Method 245.1, a cold-vapor atomic absorption procedure (Details for this method are described in Attachment 1),
    - PCBs using EPA Method 1668C (Note that the PCB rinsate samples will be analyzed by the laboratory selected for PCB analysis of the 2022 NLA Fish Tissue Study fish fillet tissue samples), and
    - PFAS using EPA Draft Method 1633 (Note that the PFAS rinsate samples will be analyzed by the laboratory selected for PFAS analysis of the 2022 NLA Fish Tissue Study fish fillet tissue samples).

Corrective Actions for Rinsates

The rinsate results will be evaluated based on the mass of each analyte detected, and assuming that all of the apparent contamination could be transferred to a nominal 410-g mass of homogenized tissue. Results for mercury above the anticipated reporting limits for mercury in homogenized fillet tissue samples may be cause for corrective actions by the fish sample preparation (Tetra Tech) laboratory. These corrective actions may include revisions to the laboratory's equipment cleaning procedures, followed by a successful demonstration of the revised cleaning procedures through preparation and analysis of additional rinsate samples.

Lipid Determination to Confirm Homogeneity

28. For one sample in each fish sample preparation batch of generally 20 samples, a laboratory under contract to Tetra Tech will use the 35 g aliquot of homogenized fillet tissue to conduct triplicate analyses of the lipid content of homogenized fillet tissue samples to confirm that they are homogeneous. As with the collection of rinsate samples, the Tetra Tech laboratory should identify and process the fish sample for homogeneity testing during the first day of fish sample preparation operations for each batch.

    Remove 35 g of fillet homogenate from the fish sample designated for homogeneity testing before filling the archive sample containers. Place this aliquot in a glass or plastic container of suitable size and label it with the sample ID number. Transfer the lipid aliquot to the ALS Environmental

analytical laboratory for triplicate lipid determination. This laboratory will use 10 g aliquots of fillet tissue for each of the 3 lipid analyses.

29. From the lipid results, calculate the mean lipid content (in percent), the standard deviation (SD), and the relative standard deviation (RSD) using the formulas below, or the corresponding functions in Excel.

$$\text{mean } \%\text{lipids} = \frac{\sum_{i=1}^{3} (\%\text{lipids})_i}{3}$$

$$\text{SD} = \sqrt{\frac{\sum_{i=1}^{3} (\%\text{lipids}_i - \text{mean lipids})^2}{2}}$$

$$\text{RSD} = \frac{\text{SD}}{\text{mean}}$$

If the RSD of the triplicate results is less than or equal to 15% for triplicate lipid samples with mean lipid values at or above 2.5%, or if the RSD of the triplicate results is less than or equal to 20% for triplicate lipid samples with mean lipid values below 2.5%, then the homogenization effort is judged to be sufficient for all samples in that preparation batch. For this sample analyzed in triplicate, the mean lipid content will be the lipid value reported for that sample, following the requirements described in Step 24.

Corrective Actions for Homogeneity

If the RSD is greater than 15% for triplicate lipid samples with mean lipid values at or above 2.5%, or if the RSD is greater than 20% for triplicate lipid samples with mean lipid values below 2.5%, then corrective action is required for all samples in that preparation batch. Corrective actions will be determined by EPA in direct consultation with the laboratory and Tetra Tech, but the default corrective action consists of regrinding all of the aliquots from each whole fish sample in the affected batch until the RSD criterion is met.

This may entail retrieving all sample aliquots (see Table 1) from the freezer, allowing them to partially thaw, and homogenizing them again, beginning at Step 13. In these instances, all of the equipment cleaning procedures will be repeated between each whole fish sample, new lipid results will be determined for each fish sample, and a new homogenization QC determination (triplicate lipids for one fish sample per batch) will be performed. New sample containers are required for any re-homogenized samples.

II.H. Reporting Requirements

30. The fish sample preparation laboratory prepares a separate weekly progress report to document the status of fish preparation activities for the 2022 NLA Fish Tissue Study and forwards each report electronically to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager. The format of each weekly progress report will be an Excel spreadsheet using the 2022 NLA Fish Tissue Study fish sample preparation reports as a guide for organization of each spreadsheet. For each homogenized sample processed during that period, include at least the following information in the report:

    - site identification number,

- sample identification number,
- specimen numbers of the fish homogenized for the fillet composite sample,
- common name for the fish species (provided to the laboratory in the processing instructions from EPA),
- field-determined length and lab-determined weight of each specimen in a whole fish sample,
- total whole fillet (unhomogenized) weight (to the nearest gram),
- total homogenized fillet composite sample (i.e., homogenate) weight (to the nearest gram),
- analysis type (e.g., mercury, PFAS, PCBs, lipids, and archive samples),
- fillet tissue aliquot weight (to the nearest 0.5 gram),
- fish sample preparation batch ID,
- preparation date (e.g., mm/dd/yyyy),
- QC sample identifiers associated with the batch of homogenized fillet samples, and
- lipid results for each fish sample.

Weekly progress reports will be due by COB Monday (or one day later in the case of holidays), and each report will document fish sample preparation progress for the previous week.

In addition, the laboratory must report the results of the rinsate analyses for mercury and the triplicate lipid results associated with the sample batch. Those results **must** be reported to the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager as soon after the analyses as practical to facilitate timely review of the data from the QC samples and to minimize delays in receiving approval from the OST Fish Sample Preparation and Analysis Technical Leader (with OST Project Manager concurrence) to process future batches.

Note: As specified in the QC section of this QAPP (Section B5.1), the fish sample preparation laboratory may **not** continue beyond the series of 3 fish sample preparation batches until receiving notification from the OST Fish Sample Preparation and Analysis Technical Leader (with OST Project Manager concurrence) that the review of initial batch (in the series of 3 batches) rinsate and homogeneity test results is complete, and the results were deemed satisfactory.

II.I. Shipping Samples

31. **No samples (except fish sample preparation mercury rinsate and triplicate lipid QC samples) may be shipped until the OST Fish Sample Preparation and Analysis Technical Leader and the OST Project Manager have reviewed the fish sample preparation batch homogeneity testing and rinsate results and authorized shipment of samples to designated analytical laboratories in writing.** The OST Fish Sample Preparation and Analysis Technical Leader (with OST Project Manager concurrence) will notify the Tetra Tech laboratory by email when specific batches of samples may be shipped, and to whom.

    Samples are shipped in batches (one batch per cooler) to each designated analytical laboratory. When shipping batches of pre-frozen fillet tissue aliquots, keep the individual containers bagged in the food-grade plastic freezer bags. Place these bags in a cooler with adequate space for the tissue containers, packing materials, and dry ice blocks.

    Secure each of the tissue containers with packing materials (e.g., bubble wrap or foam) before adding the block dry ice. Place a layer of bubble wrap and a plastic cooler liner on top of the containers before adding the dry ice, as this can prevent cracking the lids.

    The amount of dry ice required for shipping will depend on the number of homogenized fillet tissue samples in the cooler and the time of year. It should be an adequate supply to keep the tissue samples frozen for 48 hours (i.e., a minimum of 30 pounds of dry ice per cooler for up to 10 pounds of fillet

tissue samples). Only blocks of dry ice are allowed for shipping fish tissue samples. **Do not use dry ice pellets for shipping fillet samples.**

Record the samples contained in the cooler on a shipping form provided by GDIT and place the form in a plastic bag taped to the inside lid of the cooler. Secure the outside of the cooler with sealing tape, address it to the sample recipient identified by the OST Project Manager, and attach a dry ice (dangerous goods) label to the front of the cooler. Ship the cooler via an overnight express carrier on a date that will allow delivery of the cooler to the analytical laboratory on a normal business day (e.g., **no Saturday deliveries and no deliveries on U.S. Federal holidays**). Provide the air bill number for each shipment to GDIT, the OST Project Manager, and the OST Fish Sample Preparation and Analysis Leader via email on the day that the shipment occurs. **GDIT will provide the Tetra Tech laboratory with a third-party FedEx account to which each shipment will be billed.**

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ATTACHMENT 1
ANALYSES OF RINSATES AND BLANKS FOR MERCURY

This attachment describes the analyses of rinsate samples and blank samples generated during the fish sample preparation process. The results of those analyses are important in demonstrating that the Tetra Tech laboratory's equipment cleaning procedures are effective at preventing cross-contamination between fish tissue samples.

A. EQUIPMENT AND MATERIALS:

- Mercury analyzer suitable for aqueous samples using cold-vapor atomic absorption (CVAA) instruments compatible with EPA Method 245.1 (or other suitable analytical procedure and detector system capable of achieving a method detection limit (MDL) of approximately 1 µg/L).
- Assorted glassware, syringes, etc.

B. RINSATE AND BLANK ANALYSES

The three sets of rinsate and blank samples include:

- One DI water rinsate sample and one DI water blank sample for mercury analysis.
- One hexane rinsate sample and one hexane blank sample for analysis of PCB congeners.
- One DI water rinsate sample and one DI water blank sample for PFAS analysis.

During fish sample preparation efforts, the Tetra Tech laboratory will prepare each set of rinsate and blank samples at a frequency of one set for each batch of generally 20 fish samples prepared.

The analytical laboratory (to be determined) will digest and analyze the mercury rinsate and blank samples by CVAA. For each analysis, the laboratory will determine the mass of mercury in the total volume of each rinsate or blank sample, rather than the concentration of mercury. The analytical laboratory will either perform a method detection limit (MDL) study for mercury in aqueous samples or use existing aqueous MDL data for the CVAA instrument employed. The laboratory must be able to achieve a MDL of approximately 1 µg/L. Mercury results will be reported down to the mass equivalent to the mass at the MDL for aqueous samples.

The Tetra Tech laboratory will not be responsible for analysis of rinsate and blank samples for PCBs or PFAS. Tetra Tech will hold these samples in temporary storage until the OST Project Manager identifies the laboratories selected to analyze 2022 NLA Fish Tissue Study fillet samples for PCBs and PFAS, provides shipping information for these laboratories, and notifies Tetra Tech when they can ship these samples.

C. QUALITY CONTROL

The quality control (QC) procedures required for the rinsate and blank analyses include:

- MDL studies, as described above
- Instrument calibration (see Method 245.1)
- Instrument blanks for mercury analysis
- Calibration verification (once per analysis batch) for mercury analysis
- Laboratory control sample (LCS) once per analysis batch (for mercury analysis only)

The mercury rinsate results are reviewed by GDIT and EPA as soon as they become available for each fish sample preparation batch, and the Tetra Tech laboratory will not be authorized to prepare fish tissue

samples beyond a series of 3 fish sample preparation batches until that review is complete and the results are acceptable for the initial batch in each series of 3 fish sample preparation batches.

The matrix for the mercury rinsates is reagent (deionized) water, which should not adversely affect method performance. Therefore, matrix spike samples are not required for mercury. The instrument blanks for mercury take the place of a traditional method blank that would be extracted along with environmental samples.

D. DELIVERABLES

Summary data from the mercury rinsate analyses are to be delivered to EPA in an Excel file. That file must contain the following information, at a minimum:

- Batch ID - assigned by EPA (numerical sequence beginning at 1)
- Sample ID - as described in the instructions for preparing the rinsates (Step 26 in Appendix B)
- Lab sample ID - unique internal identifier used by the laboratory, if any
- Prep date - Date (MM/DD/YYYY) on which the rinsate and solvent blank samples were prepared
- Analysis type - "Mercury"
- Analysis date - Date (MM/DD/YYYY) on which the rinsate and solvent blank samples were analyzed
- Analyte name – Mercury (total)
- Mass of analyte found - in micrograms for mercury
- Lab qualifiers - as needed to describe any analytical concerns. A complete list of the qualifiers and their meanings must be included with each data submission (e.g., in a separate tab on the Excel file).
- Reporting limit for mercury (i.e., the MDL for this study) - in the same mass units used for the mercury results
- Instrument calibration data - Submit as a separate tab in the Excel file. Must include results for the initial calibrations for mercury, as well as any relevant calibration verifications associated with the analyses. Include calibration equations (e.g., regressions) and metrics (e.g., correlation coefficient or calibration factor).

Provide Excel files for the mercury analysis results to the Tetra Tech Project Leader. Raw data supporting mercury analysis (e.g., instrument printouts) must be retained by the laboratory and made available to EPA when requested, at no additional cost. If requested, raw data may be submitted in hard copy, or as a PDF file.

Appendix C

2022 NLA Fish Tissue Study
Sample Preparation Laboratory Bench Sheet

2022 NLA Fish Tissue Study Sample Preparation Laboratory Bench Sheet

Page ___of___

Site ID:		Prep Date (MMDDYYY):		Sum of Fillet Mass (g):	Fish _____
Sample ID:		Filleter:		Homogenate Tissue Mass (g):	
EPA Batch ID:		Fish Processer:		Fillet & Homogenate Mass Difference (g):	

Specimen ID	Species	Fish Length (mm)	Fish Mass (g)	Fillet Mass (g)	Fillet Tissue Recovery	Notes
.01						
.02						
.03						
.04						
.05						
.06						
.07						
.08						
.09						
.10						

Sample Jar	Hg Mass	PFAS	PCB Congeners	Lipids, Fish 1	Lipids, Fish 2-20	Small Archive 1	Small Archive 2	Bulk Archive	
Target Sample Mass (g)	10 g	10 g	25 g	35 g (prepare 3 aliquots)	15 g	up to 50 g*	up to 50 g*	up to 250 g*	*Provide the amount listed unless the sample does not have enough tissue left to fill the jar with that amount. In that case, provide all remaining possible in that jar.
Sample Mass (g)				1. 2. 3.					

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved _____

2022