

Sampling and Analysis Plan

PFAS Concentrations in Fish, Shellfish, Invertebrates, and Surface Water from Selected Coastal and Freshwater Locations in Massachusetts

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Prepared for

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Watershed Planning Program**

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ACRONYMS

BAF	bioaccumulation factor
CBI	combined benthic invertebrates
COC	chain-of-custody
DI water	deionized water
DMF	Massachusetts Division of Marine Fisheries
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FEP	fluorinated ethylene propylene
GPS	global positioning system
HASP	health and safety plan
HDPE	high density polyethylene
LDPE	low density polyethylene
MassDEP	Massachusetts Department of Environmental Protection
MassWildlife	Massachusetts Division of Fisheries and Wildlife
Normandeau	Normandeau Associates, Inc.
PCP	personal care products
PDC	pulsed direct current
PE	Performance Evaluation
PFAS	per- and polyfluoroalkyl substances
PPE	personal protective equipment
SAP	sampling and analysis plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control

The original SAP document was developed in May 2024. Subsequent changes to sampling protocols implemented during Phase 1 and Phase 2 sampling activities are indicated in bold red text; strikethroughs indicate deleted text. This updated version was prepared in February of 2025.

1.0 Introduction

In this project, the Massachusetts Department of Environmental Protection (MassDEP) will investigate per- and polyfluoroalkyl substances (PFAS) contamination in fish, shellfish, invertebrates, and surface water from selected lakes, rivers, and coastal locations in Massachusetts. MassDEP selected Eastern Research Group, Inc. (ERG) as the contractor to implement the study.

This sampling and analysis plan (SAP) provides detailed information on the specific steps that field sampling crews will take when collecting, processing, and transporting samples. The Quality Assurance Project Plan (QAPP) provides more general information about project activities (e.g., team member roles and responsibilities, rationale for selecting waterbodies and target species).

1.1 Background

This SAP was developed following U.S. Environmental Protection Agency (EPA) guidance on environmental sampling design, invertebrate collection, and fish collection (EPA, 2000, 2002a, 2002b, 2006, 2019, 2022, 2023) and MassDEP and other agency guidelines for sampling PFAS in fish and other environmental matrices (e.g., MassDEP, 2018; MI EGLE, 2022; ITRC, 2023). It provides a framework for best practices for data collection, data analysis, and quality assurance (QA)/quality control (QC) to ensure that fish, shellfish, invertebrates, and surface water samples are collected efficiently and consistently, ultimately leading to generation of high-quality sampling results.

1.2 Sampling Plan

At freshwater locations, surface water samples, whole-body fish samples, skinless-boneless fish fillet samples, and invertebrate composite samples will be collected and analyzed for PFAS. At coastal locations, surface water samples, skinless-boneless fish fillet samples, and shellfish composite samples will be collected and analyzed. Normandeau Associates, Inc. (Normandeau, subcontractor to ERG) will collect these samples at 30 waterbodies (10 freshwater and 20 coastal locations) across Massachusetts. Sampling will be conducted in two phases. Phase 1 sampling will be completed at 10 waterbodies in May and June 2024. Phase 2 sampling will be completed at 20 waterbodies during the 2025 state fiscal year (see Section 3.1 of the QAPP). The following samples will be collected at each waterbody:

- Freshwater sampling locations:

- Surface water: One unfiltered grab sample will be collected in the immediate vicinity of the location where fish are initially collected (Section 3.6.1.1).
 - Fish: Up to eight fish will be collected and sent to the lab as individual samples, including four whole-body fish and four boneless-skinless fillets (Section 3.6.1.2).
 - Invertebrates: Up to six composite samples will be collected (Section 3.6.1.3).
- Coastal sampling locations:
 - Surface water: One unfiltered grab sample will be collected in the immediate vicinity of the location where finfish are initially collected (Section 3.6.2.1).
 - Fish: Up to six fish will be collected and sent to the lab as individual boneless-skinless fillets (Section 3.6.2.2).
 - Shellfish: Up to 15 shellfish will be collected and sent to the lab as shucked composite tissue samples, each comprised of three to five organisms (Section 3.6.2.3).

1.3 Project Team

Table 1 provides contact information for the key personnel involved in sample collection and analysis. Additional details on roles and responsibilities can be found in Section 2.2 of the QAPP.

Table 1. Project Team Contact List

Name	Organization	Role	Email
Richard Chase	MassDEP	Project Lead	richard.f.chase@mass.gov
Richard Carey	MassDEP	MassDEP Alternate Project Lead	richard.carey@mass.gov
Rama Pulicharla	MassDEP	MassDEP Alternate Project Lead	Rama.Pulicharla@mass.gov
Rebecca DeVries	ERG	ERG Project Manager	rebecca.devries@erg.com
John Wilhelmi	ERG	ERG Deputy Project Manager	john.wilhelmi@erg.com
Anna Stanley-Lee	ERG	Data Manager/ Field Sampling Coordinator	anna.stanley@erg.com
Kortney Kirkeby	ERG	Aquatic Ecologist and Project Advisor	kortney.kirkeby@erg.com
Donna Tedder	ERG	ERG QA Manager	donna.tedder@erg.com
Sean Stimmell	Normandeau	Field Crew Lead	sstimmell@normandeau.com
Corey Francis	Normandeau	Field Crew Lead & Safety Coordinator	cfrancis@normandeau.com
Tim Fitzpatrick	SGS AXYS	Laboratory Project Lead	timothy.fitzpatrick@sgs.com
Sean Campbell	SGS AXYS	Laboratory Technical Lead	sean.campbell@sgs.com

2.0 Project Data Quality Objectives

2.1 Project Objectives and Problem Definition

Section 2.3 of the QAPP describes the project's principal objective, which is to characterize the nature and extent of PFAS contamination in water, fish, and invertebrates from rivers and lakes in the Commonwealth, as well as water, fish, and shellfish along the coastline. That section of the QAPP also describes the anticipated uses of this project's data, which varies by sample location type. Those include:

- Freshwater sampling locations: The principal use of sampling data will be to assess ecological risk to aquatic species, ultimately enhancing MassDEP's understanding of ambient PFAS levels with respect to assessment of the aquatic life designated use and the potential for development of surface water quality standards. A secondary use is derivation of species-specific PFAS bioaccumulation factors (BAFs).
- Coastal sampling locations: The principal use of sampling data will be to assess human exposures and health risk associated with consuming fish and shellfish. A secondary use is derivation of species-specific PFAS bioaccumulation factors.

2.2 Data Management

This project will produce data on PFAS concentrations in surface water, fish, shellfish, and invertebrates from 30 waterbodies in Massachusetts. SGS AXYS will generate these data using SGS AXYS' Method MLA-110, which is equivalent to EPA Method 1633. Sections 2.8 and 3.7 of the QAPP describe how those data will be managed and how final data sets will be provided to MassDEP for use by the Department and other agency partners.

3.0 Field Methods and Procedures

This section describes all steps the field sampling crews will take to collect samples in the field and then prepare those samples for shipment to SGS AXYS for PFAS analysis.

3.1 Permit and Permit Notifications

The field sampling crew cannot begin sampling collection activities until all necessary permits for freshwater and coastal locations have been issued. Normandeau will prepare and submit permit applications to the Massachusetts Division of Fisheries and Wildlife (MassWildlife, freshwater locations) and to the Massachusetts Division of Marine Fisheries (DMF, coastal locations). Additional town-specific permit applications for shellfish will be submitted, as needed. Normandeau will obtain these permits before Phase 1 sampling begins; and they will be updated to include all Phase 2 waterbodies after Phase 1 sampling ends. All final and amended permits will be included in Appendix A. Throughout sample

collection, the field sampling crew will keep copies of all permits on hand and comply with those permits and any applicable Massachusetts fishing and shellfishing requirements.

The field sampling crew will take the following additional steps to comply with requirements:

- The field sampling crew will adhere to all EPA biosecurity protocols described in “Standard Protocols for Maintaining Biosecurity During Biological and Water Quality Surveys” (Appendix B). Before field work, the field sampling crew will review those protocols and Normandeau’s Biosecurity Plan Disinfection Standard Operating Procedures (Appendix C).
- The field sampling crew will notify all authorities listed on the scientific collection permits prior to sample collection (e.g., Environmental Police, local law enforcement authorities).
- The field sampling crew will notify MassWildlife and DMF in advance of sampling events. This notification will identify the specific locations where and times when sampling will occur.
- Additional notifications may be necessary if any selected waterbodies are in state parks or other such jurisdictions.

3.2 PFAS-Specific Sample Collection Considerations

Due to the ubiquitous nature of PFAS in consumer products and the low PFAS concentrations that this project will measure, cross contamination of PFAS is a critical consideration and must be avoided at all steps of sample collection and processing. This section discusses precautions the field sampling crew will take to minimize the potential for cross contamination (and the “false positives” that could result).

PFAS-specific sample collection considerations are based on Commonwealth and other agency guidance for collecting environmental samples of PFAS and related SAPs (e.g., ITRC, 2022; MI EGLE, 2022; MassDEP, 2023). Normandeau’s Field Crew Leads will screen all field sampling materials and equipment to ensure they are “PFAS-free” before these items are used in the field, with ample time ahead of sampling to procure replacements, if needed. All field sampling crew members will be trained in the precautions to avoid PFAS cross contamination shown in Table 2.

Table 2. PFAS-Specific Sampling Precautions

Clothing Precautions
<ul style="list-style-type: none">• Use life jackets made of PFAS-free materials such as polyethylene foam and nylon shell fabric.• Ensure waders are made from PFAS-free materials (such as Neoprene). Do not use waders made of Gore-Tex or other known PFAS-containing materials.• Avoid clothing and boots that have been advertised as being waterproof, water-repellant, or dirt/stain resistant, unless it is confirmed they are made of PFAS-free materials such as

polyvinyl chloride, polyurethane, or rubber (e.g., PVC rain coats, rubber boots).

- Keep clothing and personal protective equipment (PPE) dust--free.
- Wear old, well laundered clothing. Specifically, during sampling activities, field sampling crew members will only be permitted to wear clothing that has been washed at least six times without the use of fabric softener.

Personal Hygiene and Personal Care Products Precautions

- Do not handle or apply personal care products (PCP) in the sampling area. Specifically, field sampling crew members will be instructed to avoid the use of lotions, moisturizers, and cosmetics before and during sampling. Approved sunscreens and insect repellent will be made available.
- Do not handle or apply PCPs while wearing PPE that will be present during sampling.
- Move at least 25 feet away from the sampling area and staging area and remove PPE if applying PCPs becomes necessary. Use PFAS-free sunscreens and insect repellants when necessary. Wash hands thoroughly after the handling or application of PCPs and when finished, put on a fresh pair of powderless nitrile gloves.

Food Precautions

- Do not handle, consume, or otherwise interact with pre-wrapped food, carry-out food, or other food items in the sampling and staging areas.
- When staff require a break to eat or drink, they should first remove gloves and any other PPE, if worn, while in the staging area and then move to a designated area for food and beverage consumption.
- After eating or drinking, staff will wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area, before returning to the sampling area.

Glove Changes

Frequently change powderless nitrile gloves any time there is an opportunity for cross contamination. Examples of when glove changes should occur include:

- Every time sampling equipment is handled.
- Prior to sample collection.
- After handling samples.
- After handling non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.
- During and after decontamination of non-dedicated sampling equipment.

Sample Collection Precautions

- Ensure that no dust or fibers can fall into the sample bag.
- Avoid all contact with the inside of the sample bag.
- When the sample is collected and sealed, place the sample bag in a second individual sealed plastic bag and place the sample bag in the shipping container packed only with ice.
- The sample team will not conduct any sub-sampling in the field.
- All water used for the final rinse when decontaminating equipment will be deionized PFAS-free water (DI water) provided by MassDEP from its Worcester facility. Note that ERG will send one sample of this water to SGS AXYS in February 2024 to confirm that the water is PFAS-free. Assuming the DI water is PFAS-free, it will be used for field blanks and decontamination for the duration of this project.

Compounds and Equipment to Avoid

- Polytetrafluoroethylene, including trademarks Teflon® and Hostafon®, which can be found in many items, including but not limited to the lining of some hoses and tubing, some wiring, certain kinds of gears, and some objects that require the sliding action of parts. Instead, use

products that contain high density polyethylene (HDPE), silicone, polypropylene, or other PFAS-free alternatives.

- Polyvinylidene fluoride, which includes the trademark Kynar®, which can be found in many items, including but not limited to tubing, films and coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Polychlorotrifluoroethylene, including trademark Neoflon®, which can be found in many items, including but not limited to valves, seals, gaskets, and food packaging.
- Ethylene-tetrafluoro-ethylene, including trademark Tefzel®, which can be found in many items, including but not limited to wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.
- Fluorinated ethylene propylene (FEP), including trademarks Teflon® FEP and Hostafion® FEP, and may also include Neoflon®, which can be found in many items, including but not limited to wire and cable insulation and covers, pipe linings, and some labware.
- Low density polyethylene (LDPE) items that will come into direct contact with the sample media. LDPE can be found in many items, including but not limited to containers and bottles, plastic bags, and tubing. However, LDPE may be used if an equipment blank has confirmed it to be PFAS-free. LDPE does not contain PFAS in the raw material but may contain PFAS cross contamination during manufacturing.
- Pipe thread compounds and tape.
- Avoid most soaps (except Alconox® or Liquinox®) and tap water. When cleaning or decontaminating equipment, use DI water provided by MassDEP.
- Do not use gel packs, blue ice, or other chemical ice; use non-chemical ice or frozen water bottles.

Equipment / Supplies Precautions

- Avoid regular/thick size markers (Sharpie® or otherwise).
- Do not use Post-it Notes.
- Do not use waterproof field books.
- Do not use plastic clipboards, notebooks, or binders; use aluminum clipboards instead.

Miscellaneous Allowable Materials

- Materials that are either made of HDPE, polypropylene, silicone, or acetate.
- PFAS-free LDPE bags for fish samples provided by SGS AXYS.
- PFAS-free HDPE jars for water, invertebrate, and shellfish samples provided by SGS AXYS.
- Aluminum foil for fish samples provided by SGS AXYS.
- Powderless nitrile gloves.

3.3 Field Equipment

The field sampling crew will bring all materials and equipment needed for sample collection to each waterbody. They will develop a checklist of materials and equipment, have the Field Crew Leads confirm that none of the items raise concern for PFAS cross-contamination, and acquire materials and equipment well in advance of the first sampling date.

For all field sampling and processing activities, the field team will acquire and maintain, at the minimum, the following equipment:

- Copies of all necessary scientific collection permits
- Camera or cell phone for taking photographs
- Printed copy of Normandeau's Health and Safety Plan (HASP)
- Handheld global positioning system (GPS) device
- Polarized sunglasses
- Ice buckets/livewells
- Ice (contained in plastic [polyethylene] bags [double bagged] in the coolers)
- Fish measuring board and tape measure
- Aluminum clip boards
- Printed copies of all necessary field sheets on PFAS-free paper
- Plain paper for additional notes
- Ball point pens
- Paper towels
- PFAS-free life jackets
- Powderless nitrile gloves
- PFAS-free waders/rubber boots (made with polyurethane or polyvinyl chloride)
- Elbow-length, PFAS-free rubber gloves
- Fishing rods and equipment
- Cut proof gloves
- Bait and tackle
- Wash bottle with PFAS-free DI water
- Hanging scales
- Dip nets with insulated handles
- Trash bags
- Fillet knives
- Electric scale
- Forceps
- Alconox® cleaner
- PFAS-free water for decontamination (DI water provided by MassDEP)
- LPDE bags for whole-body fish and fish fillet samples (provided by SGS AXYS)
- Aluminum foil for whole-body fish and fish fillet samples (provided by SGS AXYS)
- 500 mL HDPE wide-mouth bottles for surface water samples (provided by SGS AXYS)
- 250 mL HDPE wide-mouth bottles for freshwater invertebrate samples (provided by SGS AXYS)
- Sample labels for fish, shellfish, and invertebrate samples (provided by SGS AXYS)
- Sample labels for surface water (provided by MassDEP)
- Coolers (provided by SGS AXYS)

Additionally, for freshwater sampling locations, the field sampling crew will obtain all necessary electrofishing equipment, a handheld water conductivity meter, a 500

micrometer D-frame kick net, and a Ponar grab sampler. For coastal sampling locations, the field team will obtain a seine, a clam rake or fork, a clam measuring gauge, shucking knives, and other equipment that may be necessary for collecting shellfish.

3.4 Sampling Locations

Section 3.1.1 of the QAPP outlines the process for selecting freshwater and coastal sites to be sampled for this project. That section includes a final list of sampling locations for Phase 1 and a proposed list for Phase 2 sampling. **Section 3.1.1 of the QAPP was further updated to reflect the final sampling locations.**

3.5 Targeted Species and Number of Organisms to Collect

Section 3.1.1 of the QAPP outlines target species and the rationale for each. In brief, at each freshwater sampling location, field sampling crews will attempt to collect a total of eight fish to be processed and analyzed as four individual whole-body fish and four individual boneless-skinless fillets, ideally for two of the target species shown in Table 3. Field sampling crews will collect fish of various lengths and per requirements in the scientific collection permits. For species without requirements set in those permits or through applicable state regulations, field sampling crews will generally only keep fish that are at least 150mm in length. Smaller fish will only be kept if field teams are unable to collect fish that meet that size threshold in the allotted sampling time for a given waterbody. Individual fish lengths and weights will be taken and recorded when the fish are processed in Normandeau’s Bedford facility.

Table 3. Targeted Freshwater Fish Species

American shad	Common carp	Rainbow trout
American eel	Common shiner	Redbreast sunfish
Black bullhead	Creek chub	Smallmouth bass
Black crappie	Creek chubsucker	Spottail shiner
Blueback herring	Fallfish	Walleye
Bluegill	Golden shiner	White catfish
Brook trout	Largemouth bass	White perch
Brown bullhead	Longnose sucker	White sucker
Brown trout	Northern pike	Yellow bullhead
Chain pickerel	Pumpkinseed	Yellow perch
Common dace		

At each coastal sampling location, field sampling crews will attempt to collect a total of six fish to be processed and analyzed as individual boneless-skinless fillets, ideally for three of the target species shown in Table 4. These represent species that are commonly caught and kept for consumption by recreational fishers. If field sampling crews collect fish for more than three species shown in Table 4 at a given location, the fish species with the greatest numbers of similarly sized adult fish will be selected for PFAS measurement. The

rationale for this decision is that the fish species caught in greatest numbers, to first and rough approximation, can be assumed to be the fish species most likely to be consumed. To the extent possible, field sampling crews will keep fish that meet the state’s minimum size requirements and that are of the minimum size generally kept by recreational anglers. When this is not possible and if allowed under the scientific collection permit, they will keep fish of smaller sizes to ensure a complete dataset. Individual fish lengths and weights will be taken and recorded when the fish are processed in Normandeau’s Bedford facility.

Table 4. Targeted Marine Fish Species

American shad	Monkfish	Tautog
American eel	Plaice	Weak fish
Atlantic mackerel	Rainbow smelt	White perch
Black seabass	Scup	Winter flounder
Blue fish	Striped bass	Yellow tail flounder
Grey sole	Summer flounder	Atlantic menhaden
Cunner	Silver hake	Skate
Atlantic bonito	Dogfish	Sea robin

At each coastal location, field sampling crews will attempt to collect up to 15 shellfish to be processed and analyzed as up to three composite samples (each comprised of between three and five similarly sized organisms), ideally for at least two of the target species shown in Table 5. “Similarly sized organisms” will be defined to include all shellfish of the same species in which the smallest individual within a composite sample is not less than 75 percent of the length of the largest individual – to the extent possible.

Table 5. Targeted Shellfish Species

Bay scallop	Oyster	Sea urchin
Blue mussel	Quahog	Soft shell clam
Channeled/knobbed whelk	Razor clam	Surf clam

At each freshwater sampling location, field sampling crews will attempt to collect enough benthic macroinvertebrates to be processed and analyzed as six composite samples, each with a minimum mass of five grams but ideally a mass of 15 grams. To the extent possible, they will collect two samples for each of the invertebrate classes of insecta (all aquatic insects combined), crustacea (crayfish only), and gastropoda (snails and clams). If that is not possible, field sampling crews will collect samples that represent all combined benthic invertebrates (CBI). In all cases, the types of organisms contained within each sample will be documented (along with an estimate of the number of organisms), based on what can readily be identified with the naked eye in the field.

3.6 Sample Collection Methods

This section describes the process by which the field sampling crew will collect samples for this project at freshwater sites (Section 3.6.1) and coastal sites (Section 3.6.1.2).

3.6.1 Freshwater Sampling Locations

Prior to departure:

The field sampling crew will confirm that all instruments (e.g., handheld water conductivity meter) are operating properly and prepare all necessary equipment and supplies. All meters will be calibrated according to manufacturer specifications. The field sampling crew will check the charge of batteries and the oil/gas supply in boats (if used at a given site) before deploying to the field. The field sampling crew will use a checklist to ensure that they have the necessary sample collection materials (e.g., fishing poles, HDPE 500mL sample bottles for surface water, 250mL HDPE sample bottles for invertebrates, LDPE bags for fish, ice for storage, adequate DI water for decontamination of equipment used in the field, field sheets).

Upon arrival at waterbody sampling location:

The field sampling crew will set up a clean staging area or other appropriately clean surface, where they can organize sample containers and sampling equipment. At the start of each sampling day and prior to sample collection, the field sampling crew will step through the “tailboard” safety form included in the HASP. Field sampling crews will then don PPE, such as life jackets, waders/rubber boots, and powderless nitrile gloves. Field sampling crews will use PFAS-free PPE approved by the Field Crew Lead (Section 3.3).

Determining appropriate electrofishing voltage:

For sites where electrofishing will occur, the field sampling crew will measure and record the water conductivity. They will then determine the appropriate electrofishing voltage using guidelines in Table 6.

Table 6. Conductivity and Electrofishing Voltage

Water Conductivity Range ($\mu\text{s}/\text{cm}$)	Electrofishing Voltage (V)
150-500	200-300
500-800	150-200
800-1,000	120-180
>1,000	100-150

3.6.1.1 Surface Water Sample Collection

At every freshwater sampling location, a surface water grab sample will be collected in the immediate vicinity of the fish collection site. The field team will adhere to the following procedures when collecting surface water samples, in addition to the PFAS considerations listed in Table 2. Sample bottles will be labeled prior to sample collection (see Section 4.4)

1. Collect a single grab sample from the immediate vicinity of where the first fish samples are collected. Fill two pre-labeled 500 mL and one 60 mL HDPE sample jar to approximately 90 percent full.
 - Remove the collection bottle cap immediately before collecting the sample, making sure not to touch the inside of the cap or the inside of the sample bottle.
 - Submerge the bottle inverted to a depth of approximately 0.5 feet.
 - Recap the bottle underwater.
 - Remove the bottle from the water, uncap it, and pour off enough water to just below the neck of the bottle so that there is air left in the top of the sample bottle.
 - Place samples in a cooler with ice.
2. Store samples at 0 to 6°C and protected from light. This can be accomplished by packing the sampling bottles in wet ice and placing them in a cooler.
3. Complete the first two pages of the River and Coastal Field Sheet (Appendix D) or the Lake Field Sheet (Appendix E) prior to departing the site, including field GPS recording for the precise location where water samples were collected. See Section 4.2 for details on how to populate those forms.
4. Upon returning to Normandeau's Bedford facility, immediately place the surface water samples in the freezer until shipment to the laboratory.
5. Collect water samples immediately prior to and co-located with fish collections.

3.6.1.2 Fish Sample Collection

At every freshwater waterbody, field sampling crews will attempt to collect eight fish. Electrofishing is the most effective method for collecting fish and will be the preferred fish sample collection method for this project, though hook-and-line methods will also be used to help ensure adequate catch and species diversity across waterbodies. All field sampling crew members will be trained/experienced in electrofishing safety precautions and unit operation procedures. Procedures will involve pulsed direct current electrofishing and a two-person team (one operator and one "dip-netter"). For safety reasons, field sampling crew members are required to wear insulated gloves.

Wherever possible, electrofishing will be conducted from a motorboat. At waterbodies that do not allow outboard motor use, electrofishing will be conducted from a cartop boat, raft, or with backpack electrofishing equipment. If the field team is not allowed to conduct electrofishing or is unable to successfully catch the desired minimum number of fish by electrofishing, hook-and-line angling will be used. The field sampling crew will document on the field forms the type of fishing that was used.

The field sampling crew members are highly experienced and qualified in fish collection. Despite this expertise and experience, there is no guarantee that sampling at a given waterbody will yield the desired numbers of fish. At each freshwater location, field

sampling crews will stop fishing once the target number of fish are caught or after 4 hours of trying, whichever comes first.

In addition to the considerations listed in Table 2, the field sampling crew will adhere to the following procedures when collecting fish samples:

1. Mobilize to the location of sample collection. At lakes and ponds, the targeted areas for fish sampling are generally shallow embankments or point bars where one would be expected to catch fish. Within rivers, targeted sampling areas include pools, riffles, banks, and other structures.
2. One field sampling crew member will place the electrofisher in the water.
3. A second team member will collect fish with a dip net with an insulated handle and place the collected fish in live wells. The field team will aim to collect eight fish at each location, ideally four fish for each of two species.
4. If sufficient fish are not captured on the first electrofishing attempt, increase the voltage of the electrofisher and/or increase the sampling area and repeat the previous steps. This process may need to be repeated multiple times. If a sufficient number of fish still are not caught, move to another location in the waterbody and repeat the previous steps. Note that the duration and cycle of electrofishing is based on catch rate, which will vary in an unpredictable manner from one waterbody to the next. If electrofishing is unsuccessful, use hook-and-line angling.
5. Remove selected fish of the same species from the live well and place in PFAS-free bags provided by the laboratory, keeping each individual fish separate and keeping the bags under 30 pounds of ice in a large cooler. Label the bags with the name of the waterbody, the date, and the species.
6. Release all fish not selected for sampling in a humane manner (return unused fish back to the water from the live well).
7. Complete the top portion of the Fish Sampling Log (Appendix F) and record the best, approximate, on-water location(s) where most fish were collected using a handheld GPS device. If sampling areas are widely dispersed, the crew may consider recording supplemental GPS points.
8. Before departing the site, pack bags of fish under ice in coolers for transport to Normandeau's Bedford facility. Also, inspect the location to ensure that no trash is left behind.
9. Upon returning to Normandeau's Bedford facility, immediately place the samples in the refrigerator until they can be processed for shipment to the laboratory (see Section 3.6.1.4).

3.6.1.3 Invertebrate Sample Collection

At each waterbody, benthic macroinvertebrates will be collected following the procedures outlined in this section. To the extent possible, field teams will collect and sort benthic macroinvertebrates into three class-level categories:

- Insecta (all aquatic insects combined)
- Gastropoda (snails and clams)
- Crustaceans (crayfish only)

SGS AXYS requests 15 grams (wet weight) for a single sample but can run PFAS analysis with a minimum of 5 grams. If the collected material yields at least 5 grams of aquatic insects, 5 grams of snails, or 5 grams of crayfish, separate composite samples will be prepared for the groups of invertebrates will sufficient mass. If not, multiple different groups of invertebrates will be grouped together in a composite sample that will be considered “Combined Benthic Invertebrates” (CBI). When that is the case, field teams will note the types of specimens included in each CBI sample.

Sampling procedures for rivers/streams and lakes/ponds are described below.

Invertebrate Sample Collection in Wadeable Rivers and Streams. These freshwater locations will be sampled throughout a segment of a stream or river called a reach. The sampling crew will determine the dominant habitat types of the reach, which will inform sampling location and techniques that will most effectively capture the organisms present. Habitat types may include: riffles, runs, pools, water under overhanging banks or roots, accumulations of organic debris, woody debris, bank margins, aquatic vegetation, and within and between substrate matrices. Not all habitat types will be present in all systems. Best sampling practices for river/stream systems are listed below.

1. Ensure the sampling net and sieve bucket are clean prior to usage.
2. Complete top portion of the field sheet and record field GPS at the best, approximate, on-water location where most specimens were collected. If sampling areas are widely dispersed, field crew members may consider recording supplemental GPS points.
3. Working downstream to upstream, use the kick net frame and feet to disturb the substrate in front of the net aperture, allowing the suspended organisms to flow downstream into the net. Some habitat types with less flow require samplers to use a sweeping motion to collect the suspended organisms from the water. If the net becomes full of sediment or organic material, it should be emptied into a sieve bucket or removed if no organisms are present within the debris.
 - Flat bottomed habitats. Place the net frame flush to the streambed with the frame open to the upstream flow. Check that the nylon mesh is freely trailing immediately downstream of the net frame. This will ensure that once the substrate is disturbed, specimens will be directed into the nylon net. Position yourself next to the kick net and begin to disturb the substrate or vegetation immediately upstream of the net. Disturb the substrate using the heel of your boot or entire foot by kicking to dislodge the upper layer of substrate or vegetation and to scrape the underlying bed. Begin with gentle kicking action to avoid damaging the first few specimens that enter the net and then work up to a more vigorous level of disturbance. Large cobble can

be scraped by hand, if necessary, to remove specimens. Once substrate is thoroughly disturbed, stop kicking and allow the dislodged specimens to drift downstream into the net.

- Woody debris or snag habitats. Jab the kick net into an area of submerged and partially decayed woody debris to dislodge specimens, followed by one to two “cleaning” sweeps through the water column to capture suspended specimens. Scrub larger debris by hand over the opening of the kick net ensuring that the kick net opening is downstream of the point of scrubbing.
- Pools and slow-moving water. If safely wadable, disturb the bottom either by foot or with the net frame. Disturb a distance of about one meter to dislodge organisms, followed by one to two “cleaning” sweeps to collect specimens that are suspended.
- Bank margins. Locate an area of bank within the study reach. Jab the kick net vigorously into the bank for a distance of about one meter to dislodge specimens, followed by one to two “cleaning” sweeps to collect suspended specimens.
- Aquatic vegetation. Sweep the kick net through submerged or emergent vegetation for a distance of about one meter to loosen and capture specimens, followed by one to two “cleaning” sweeps to collect suspended specimens.

If snails, crayfish, larger aquatic insects, or other large specimens are observed visually and can be easily captured in any habitat type, the field sampling crew will capture them either with the net or by using gloves and forceps to hand pick specimens from the stream or river to include in a sample.

Sample Collection in Lakes and Ponds. Lake/pond systems will be sampled along the shorelines and in what is referred to as the “littoral zones.” The littoral zone is the nearshore habitat, usually supporting submerged vegetation habitat. The field sampling crew will determine the dominant habitat types of the littoral zone, which informs sampling location and preferred sampling techniques. Habitat types include: rocky/cobble/large woody debris, macrophyte beds, fines (including mud, sand, or silt), and leaf packs, both within and between substrate matrices. Not all habitat types will be present in all systems. Best sampling practices for lake/pond systems are listed below.

1. Ensure sampling net and sieve bucket are clean prior to usage.
2. Complete the top portion of the field sheet and record field GPS at the best, approximate, on-water location where most specimens were collected. If sampling areas are widely dispersed, field crew members may consider recording supplemental GPS points.
3. Working along the shoreline and littoral zone, use the kick net frame and feet to disturb the substrate in front of the net aperture, suspending the specimens in the water column, where a net will then be swept through to collect them. If the net

becomes full of sediment or organic material during the sampling, it should be emptied into a sieve bucket.

- Flat bottomed habitats. Place the net frame flush to the substrate with the frame open in the direction that the net will be swept after substrate disturbance. Check that the nylon mesh is freely trailing immediately behind the net frame. This will ensure that once the substrate is disturbed, specimens will be directed into the nylon bag. Position yourself next to the kick net and begin to disturb the substrate or vegetation immediately in front of the net. Disturb the substrate using the heel of your boot or entire foot by kicking to dislodge the upper layer of substrate or vegetation and to suspend organisms that may be lodged in the substrate. Begin with gentle kicking action to avoid damaging the first few specimens that enter the net and then, to be thorough, work up to a more vigorous level of disturbance. Large cobble can be scraped by hand, if necessary, to remove specimens. When the substrate is thoroughly disturbed, stop kicking and sweep the kick net over the disturbed area to collect suspended specimens.
- Woody debris or snag habitats. Jab the kick net into an area of submerged and partially decayed woody debris to dislodge specimens, followed by 1-2 “cleaning” sweeps through the water column to capture specimens suspended in the water column. Scrub larger debris by hand over the opening of the kick net, ensuring that the kick net opening or sieve is beneath the point of scrubbing.
- Shoreline or berm/bar habitats. Locate an area of shoreline, berm, or bar within the study reach. Jab the kick net vigorously into the shoreline, berm, or bar for a distance of about one meter to dislodge specimens, followed by one to two “cleaning” sweeps to collect specimens that have been suspended.
- Aquatic vegetation. Sweep the kick net through submerged or emergent vegetation for a distance of about one meter to loosen and capture specimens, followed by one to two “cleaning” sweeps to collect specimens that have been suspended.

If snails, crayfish, larger aquatic insects, or other large specimens are observed and field sampling crews determine they can be easily captured, the crew should capture them either with the net or by using gloves and forceps to hand pick specimens from the lake or pond to include in the sample.

In instances with limited habitat types (e.g., locations with minimal vegetation) or when collecting sufficient sample mass with a kick net is unsuccessful, the field sampling crew may elect to use a hand operated Ponar sampler. The Ponar sampler will take a grab sample of sediment from any soft or loose bottomed system and may capture infauna not as easily captured with a kick net.

Invertebrate Sample Sorting and Storage. Invertebrate samples will be sorted in the field, as follows:

1. Gently wash the contents of the net in source water to allow fine material to pass through the mesh. Wash large debris in net with a squirt bottle (also with source water), looking to make sure no invertebrates are on the debris, and remove the collected invertebrates from the net. Place the invertebrates into sample container, using the spray bottle to clean off excess debris. Specimens that cling to the exterior of the net can be kept as part of the sample.
2. Once large invertebrates have been picked out of the net, transfer remaining material (matrix of specimens and remnant amount of substrate/detritus) from the interior of the net into a sieve and wash (using source water) the sample, removing more debris and picking out more invertebrates. All debris material may be discarded once determined that no invertebrates are present that can be readily separated for the sample. Field sampling crews will not use magnification to identify invertebrates not visible with the naked eye.
3. Place the 250 mL HDPE jar provided by the laboratory on a portable scale and zero the scale.
4. Place collected invertebrate specimens into the sample jars and initially use separate containers for different taxonomic categories: insects, mollusks, crustaceans, etc.. Then complete the Freshwater Invertebrate Sampling Log (Appendix H) based on the material collected. Wherever possible, sample containers should only include specimens from one category; substrate and detritus should be removed.
5. Weigh each sample with the portable scale. If insufficient sample mass is obtained after sorting, continue sample collection and processing efforts until the desired mass is reached. Employ alternate approaches to composting samples if the categories do not have enough mass (e.g., using “Combined Benthic Invertebrates” category, as described above).
6. Upon returning to Normandeau’s Bedford facility, immediately place the samples in the freezer until shipment to the laboratory.

Ponar samples can be processed either by hand using the sieve method described above or with elutriation. The efficiency of processing with elutriation will vary with sediment type. If processing by hand, follow similar methods as for processing kick net samples.

3.6.1.4 Sample Processing Activities

After completing sampling activities at a freshwater waterbody, the field sampling crew will immediately follow the decontamination procedures listed below in Section 3.7 and then return to Normandeau’s Bedford facility, where they will prepare the samples for shipment to the analytical laboratory. The surface water and invertebrate samples will have already been prepared in the field, and the fish samples will be prepared at Normandeau’s facility. If the team is not able to process the fish samples on the same day that they are collected,

the samples will be stored in a refrigerator for processing the following morning. Field Crew Leads will alert the ERG Project Manager or ERG Data Manager of sampling progress and document any issues encountered. The ERG Project Manager will provide updates to the MassDEP Project Manager, as appropriate.

Normandeau's staff will adhere to the following procedures when processing the fish samples:

1. Put on nitrile powderless gloves.
2. Decontaminate all equipment with PFAS-free DI water, including the measuring board, scale, cutting board, and knives that will be used to fillet the fish.
3. Prepare boneless-skinless fillets.
 - Remove a fish from the field sample bag, which will have been stored in either a cooler from the field or in a refrigerator overnight.
 - Assign the fish a sample code on the Fish Sampling Log (Appendix F). Then measure that fish for total length in millimeters and weight in grams and record this information on the log. Record the species, sample type, collection method-gear, and any additional comments (e.g., lesions, mutations, etc.).
 - Place the fish on the cutting board. Fillet one side of the fish by running the fillet knife along the spine from head to tail. Remove flesh from skin and wrap the fillet in PFAS-free aluminum foil provided by the laboratory before placing it in a pre-labeled LDPE sample bag provided by the laboratory.
 - Wash the knife, measuring board, cutting board, and scale with Alconox soap (made with PFAS-free decontamination water) and then triple rinse with PFAS-free decontamination water. Let the equipment air dry and change gloves before preparing the next fish.
 - Repeat these steps until all boneless-skinless fillets from a given waterbody have been prepared.
4. Prepare whole-body fish samples.
 - Remove a fish from the field sample bag, which will have been stored in either a cooler from the field or in a refrigerator overnight.
 - Assign the fish a sample code on the Fish Sampling Log (Appendix F). Then measure that fish for total length in millimeters (mm) and weight in grams (g) and record this information on the log. Record the species, sample type, collection method-gear, and any additional comments (e.g., lesions, mutations, etc.).
 - Wrap the whole fish in PFAS-free aluminum foil provided by the laboratory and put the fish in a pre-labeled LDPE sample bag provided by the laboratory.
 - Wash the measuring board and scale with Alconox soap and then triple rinse with PFAS-free decontamination water. Let the equipment air dry and change gloves before preparing the next fish.

- Repeat these steps until all whole-body fish samples from a given waterbody have been prepared for shipment.
5. Store all fish samples in the freezer until shipment. Note that all tissue samples will be frozen for 24-hours prior to shipment to the lab.

Freshwater invertebrate samples will have already been prepared in the field and in an effort to reduce handling and the potential for cross-contamination, they will not be further processed at Normandeau's facility. However, as an additional quality control check, staff will visibly inspect the sample inside the jar to confirm that it is reasonably free of debris and contains the organisms specified on the field sheet.

After processing the samples and before leaving the Normandeau facility, the field sampling crew will confirm that all field instruments are operating properly and prepare equipment and supplies for the next sampling event. All meters will be calibrated according to manufacturer specifications. The field sampling crew will turn on the electrofishing unit to check the quality of batteries, and they will check the unit's oil and gas supply.

3.6.2 Coastal Locations

Prior to departure:

The field sampling crew will confirm that all instruments are operating properly and prepare all necessary equipment and supplies. All meters will be calibrated according to manufacturer specifications. The field sampling crew will check the charge of batteries and the oil/gas supply in boats (if used at a given site) before deploying to the field. The field sampling crew will use a checklist to ensure that they have the necessary sample collection materials (e.g., fishing poles, HDPE 500mL sample bottles for surface water, LDPE bags for fish, ice for storage, adequate DI water for decontamination of equipment used in the field, field sheets).

Upon arrival at waterbody sampling location:

The field sampling crew will set up a clean staging area or other appropriately clean surface, where they can organize sample containers and sampling equipment. At the start of each sampling day and prior to sample collection, the field sampling crew will step through the "tailboard" safety form included in the HASP. Field sampling crews will then don PPE, such as life jackets, waders/rubber boots, and powderless nitrile gloves. Field sampling crews will use PFAS-free PPE approved by the Field Crew Lead.

Upon arrival at waterbody sampling location:

Same general considerations as freshwater locations (see Section 3.6.1).

3.6.2.1 Surface Water Sample Collection

One unfiltered surface water grab sample will be collected at each site in the same general vicinity as where the fish are caught. Field sampling crews use the same procedures described in Section 3.6.1.1.

3.6.2.2 *Fish Sample Collection*

At every coastal sampling location, field sampling crews will attempt to collect six fish (two of each of three species), which will be prepared as boneless-skinless fillets. Depending on the site, samples will be collected from the shoreline, jetties, piers, and/or docks. In some cases, field sampling crews may also collect samples from boats along the shoreline. Hook-and-line angling will be the primary mode of sample collection, though seine nets will be used where possible and appropriate. In addition to the considerations listed in Table 2, field sampling crews will adhere to the following procedures when collecting fish samples at coastal sites:

1. Mobilize to the location of sample collection.
2. Attempt to collect fish with hook-and-line angling methods.
 - Surf casting rods (heavy tackle, longer casting, larger fish).
 - Use sinker (weight) on bottom of line and hook with bait above sinker.
 - Let sit until fish strike.
 - Light casting rod (smaller fish).
 - Cast bait or artificial tackle.
 - For bait, use sinker and hook, and let sit until fish strike hook.
 - For artificial tackle, cast and retrieve until fish strike.
 - Bait includes clams, squid, shrimp, crustations, and cut bait (herring, bunker, mackerel).
 - Store fish in LDPE bags provided by the laboratory in coolers on ice.
3. Where appropriate, attempt to collect fish using seine methods.
 - Deploy seine by attaching one end to boat with a rope and holding the other end on the shore. Spread seine out as far as possible.
 - With boat, haul seine through the water in a clockwise direction towards the shore in a semi-circle pattern unless conditions do not allow.
 - When both ends of the seine are on shore, haul seine onto the beach keeping the weighted line on the bottom, the float line at or above the water surface, and the bag centered.
 - Sort catch for selected species and process appropriately.
4. Remove selected fish of the same species from the live well and place in PFAS-free bags provided by the laboratory, keeping each individual fish separate and keeping the bags under 30 pounds of ice in a cooler. Label the bags with the name of the waterbody, date, and species.
5. Complete the top portion of the Fish Sampling Log (Appendix F) and record the best, approx., on-water location(s) where most fish were collected using a handheld GPS device. If sampling areas are widely dispersed, the crew will record supplemental GPS points.

6. Upon returning to Normandeau's Bedford facility, immediately place the samples in the refrigerator until they are processed for shipment to the laboratory (see Section 3.6.2.4).

3.6.2.3 Shellfish Sample Collection

At every coastal sampling location where shellfishing is permitted, field sampling crews will attempt to collect enough shellfish to prepare three composite samples (each comprised of three to five individual organisms of the same species). Ideally, they will collect shellfish for three different species at each location, though this will depend on field conditions and what species are encountered. Samples will be collected during low tide and at specific locations estimated to be sampled by recreational fishers. In addition to the considerations listed in Table 2, the field team will adhere to the following procedures when collecting shellfish samples:

1. Collect shellfish based on species-specific processes.
 - Sand-dwelling organisms (e.g., soft shell clams, razor clams, surf clams, quahogs)
 - Locate shellfish by looking for bubbles or indentations in sand.
 - Use a clam rake or clam fork to dig down four to eight inches into the sand.
 - Remove shellfish from sand by hand.
 - Only keep live shellfish with unbroken shells.
 - Replace sand in the hole.
 - Organisms in tidal pools (e.g., sea urchins)
 - Look for shellfish in rocky tidal pools.
 - Collect shellfish by hand or with a shovel.
 - Wear gloves underneath disposable gloves when removing and handling.
 - Organisms attached to other substrates (e.g., blue mussels, oysters)
 - Find and remove by hand from substrates to which they are attached (e.g., rocks, pilings on piers and docks, shells, rock).
2. Group three to five similarly sized shellfish of the same species and place them in a PFAS-free bag provided by the laboratory. Keep individual bags under 30 pounds of ice, and label the bags with the name of the waterbody, the date, and the species. All bags will be stored in a single large cooler. Dispatch all shellfish not selected for sampling in a humane manner.
3. Complete the top portion of the Shellfish Sampling Log (Appendix G) and record the best, approx. location(s) where most shellfish were collected using a handheld GPS device.
4. Upon returning to Normandeau's Bedford facility, immediately place the samples in the refrigerator until they can be processed for shipment to the laboratory (see Section 3.6.2.4).

3.6.2.4 Sample Processing Activities

Following sampling activities and while still in the field, the field sampling crew will immediately follow the decontamination procedures listed below in Section 3.7. The crew will then return to Normandeau's Bedford facility, where they will prepare the fish and shellfish samples for shipment to the analytical laboratory. The surface water samples will have already been prepared in the field. If the team is not able to process samples on the same day that they are collected, the samples will be stored in a refrigerator for processing the following morning.

Normandeau's staff will adhere to the same procedures as described in Section 3.6.1.4 when preparing boneless-skinless fish fillet samples.

1. Put on nitrile powderless gloves.
2. Decontaminate all equipment with PFAS-free DI water, including the measuring board, scale, cutting board, and knives that will be used to fillet the fish.
3. Prepare boneless-skinless fillets.
 - Remove a fish from the field sample bag, which will have been stored in either a cooler from the field or in a refrigerator overnight.
 - Assign the fish a sample code on the Fish Sampling Log (Appendix F). Then measure that fish for total length in millimeters and weight in grams and record this information on the log. Record the species, sample type, collection method-gear, and any additional comments (e.g., lesions, mutations, etc.).
 - Place the fish on the cutting board. Fillet one side of the fish by running the fillet knife along the spine from head to tail. Remove flesh from skin and wrap the fillet in PFAS-free aluminum foil provided by the laboratory before placing it in a pre-labeled LDPE sample bag provided by the laboratory.
 - Wash the knife, measuring board, cutting board, and scale with Alconox soap (made with PFAS-free decontamination water) and then triple rinse with PFAS-free decontamination water. Let the equipment air dry and change gloves before preparing the next fish.
 - Repeat these steps until all boneless-skinless fillets from a given waterbody have been prepared.
4. Store all fish samples in the freezer until shipment. Note that all tissue samples will be frozen for 24-hours prior to shipment to the lab.

For shellfish composite samples, they will complete the following:

1. Put on nitrile powderless gloves.
2. Decontaminate all equipment with PFAS-free DI water, including the measuring board, scale, cutting board, and all knives that will be used to shuck the shellfish.
3. Remove shellfish from the field sample bag. Each bag should be comprised of three to five shellfish of the same species.

4. Assign the shellfish composite sample a sample code on the Shellfish Sampling Log (Appendix G), measure each organism for total length and weight, and record this information on the log. Record the species, sample type, collection method-gear, and any additional comments.
5. Remove the edible portion of each organism from its shell, using species-specific methods.
 - Mussels, clams, oysters, and quahogs
 - Place a shucking knife between the top and bottom shells.
 - Slide the knife while twisting to break the seal from hinge to hinge.
 - Cut the upper abductor muscles and remove the top shell.
 - Slip knife under shellfish meat and slide knife to cut lower abductor muscles.
 - Place all muscle from shellfish for a given composite sample into a single 250-mL HDPE bottle provided by the laboratory.
 - Sea urchins
 - Use scissors to remove beak (mouth) by cutting a circle.
 - Break the shell in half by prying it apart.
 - Remove gonads and rinse with PFAS-free DI water.
 - Place gonads (the only edible portion) for a given composite sample into a single 250-mL HDPE bottle provided by the laboratory.
6. Wash the knives, scissors, measuring board, cutting board, and scale with Alconox® soap (made with PFAS-free decontamination water) and then triple rinse with PFAS-free DI water. Let the equipment air dry and change gloves before preparing the next composite sample.
7. Repeat steps 3-6 until all shellfish are processed and prepared into composite samples for the second species. Repeat this process again for the third species, if necessary.
8. Store all samples in the freezer until shipment. Note that all tissue samples will be frozen for 24-hours prior to shipment to the lab.

After processing the samples and before leaving the Normandeau facility, the field sampling crew will confirm that all field instruments are operating properly and prepare equipment and supplies for the next sampling event.

3.7 Decontamination Procedures

PFAS-free cleaning solutions to be used can include Alconox®, Liquinox®, and Citranox® for equipment decontamination, followed by adequate rinsing with PFAS-free water – which will be provided by MassDEP. Decon 90® will not be used. Sampling equipment will be scrubbed using a polyethylene or polyvinyl chloride brush to remove particulates. Prior to mobilization between sampling sites, the field sampling crew will decontaminate sampling equipment. Clean bulky equipment will be stored on plastic sheeting in uncontaminated areas, and clean small equipment will be stored in plastic bags. If storing any materials

(other than equipment) for more than a few hours, the field sampling crew will cover them with HDPE sheeting.

The field sampling crew will rinse parts of equipment that coming in direct contact with samples with PFAS-free DI-water supplied by MassDEP; and this rinsing will occur before and after equipment use.

The field sampling crew will adhere to all EPA biosecurity protocols in “Standard Protocols for Maintaining Biosecurity During Biological and Water Quality Surveys” (Appendix B). Before field work, they will review and adopt applicable procedures in the SOP titled “Normandeau Associates, Inc. Biosecurity Plan Disinfection Procedures” (Appendix C). Field teams will adhere to Normandeau’s HASP.

4.0 Sample Documentation and Shipment

Field notes, photographs, field sheets (Appendix D and E), sample logs (Appendix F, G, and H), and chain-of-custody (COC) forms (Appendix I) will be the primary documentation used to record and track information about each sample. Field staff should note any additional information, such as weather, water conditions, whether recreational activities were occurring during the sampling collection, and interactions with officials or the public. Those notes should be documented on field sheets kept in an aluminum clipboard. The field sampling crew will ensure that all entries are legible, written in blue or black ink (using PFAS-free pens), and contain accurate and inclusive documentation of field activities.

The field sampling crew will note any departures from SAP procedures on field sheets or COC forms. Errors in notes or COC forms will be corrected using a single line to cross out the erroneous entry, and the field sampling crew member will date and initial the change that was made. Field personnel will bring loose plain paper in an aluminum clipboard with them in case additional space for documentation is needed. Due to the potential for PFAS cross-contamination, the field sampling crews will not use waterproof/treatment paper or field books for additional notes.

Hard copies of field notes, field sheets, and COCs will be retained in Normandeau’s project files. Field sampling crews will upload scanned copies of these documents to ERG’s SharePoint site after sampling.

4.1 Photographs

The field sampling crew will take digital photographs at all sampling locations. These photos will document field activities (i.e., “action shots”), waterbody characteristics, and any unusual site conditions. Photographs will serve to verify information entered in the field notes form. Field sampling crews will upload photos to ERG’s SharePoint site for each waterbody after sampling.

4.2 River, Lake, and Coastal Sampling Location Field Sheets

The field sampling crew will complete river, lake, and coastal site field sheets provided by MassDEP's WPP; and these forms will be completed in the field, prior to leaving sampling locations. On these sheets, they will document general site conditions at each waterbody. Depending on the type of waterbody being sampled, the field team will use either MassDEP's River/Stream Sampling Location Field Sheet or Lake/Pond and Coastal Sampling Location Field Sheet. Blank copies of these forms can be found in Appendix D and Appendix E, respectively; required fields are highlighted in green.

The following required fields must be populated on the field sheets:

River/Stream and Coastal Sampling Location Field Sheets

- Project: PFAS (2024)
- Site name (STAID): Enter the project-designated numeric ID for the waterbody.
- Waterbody name
- Town
- Alternate station description: Use this to describe deviations from planned sampling locations as described in the project QAPP.
- Field lat/long: Enter location where surface water sample is collected.
- Lat/long method: Select "handheld GPS" (unless another method was used during sampling).
- Survey crew lead
- Other crew
- Date
- Time
- Weather conditions: Select "clear", "mostly sun", "mostly cloudy", "overcast", "fog", "drizzle", "rain", "sleet", or "snow."
- General notes: Use this space for general site visit notes.
- Flow condition: Select "flowing", "no water", "stagnant", "ice covered", or "no access."
- Est. flow velocity: Select "0 fps", "<1 fps", "1-3fps", "3-5 fps", and ">5 fps" based on professional judgement.
- Tidal condition (coastal only): Select "ebb (outgoing tide)", "flood (incoming tide)", "slack" or "indeterminate" for tidal conditions at the time when the surface water sample is collected.
- Samples taken from: Select as many locations as needed from the options provided.
- Samples taken from description: Use this field to provide more detail on where and how samples were collected. For example, this field can specify the type of boat used in the sampling.

Lake/Pond Sampling Location Field Sheets

- Project: PFAS (2024)
- Site name (STAIID): Enter the project-designated numeric ID for the waterbody.
- Waterbody name
- Town
- Alternate station description: Use this to describe deviations from planned sampling locations as described in the project QAPP.
- Field lat/long: Enter the location where the surface water sample is collected.
- Lat/long method: Select “handheld GPS” (unless another method was used during sampling).
- Survey crew lead
- Other crew
- Date
- Time
- Weather: Select “clear”, “mostly sun”, “mostly cloudy”, “overcast”, “fog”, “drizzle”, “rain”, “sleet”, or “snow.”
- General notes: Use this space for general site visit notes.
- Water Level: Select, “low”, “normal”, or “high”
- Dom. Habitat: Select “bedrock”, “boulder”, “cobble”, “gravel”, “sand”, “woody debris”, “organic”, “vegetation”, “other”, or “unobservable.”
- Samples taken from: Select as many locations as needed from the options provided.
- Samples taken from description: Use this field to provide more detail on where and how the samples were collected.

Project-specific OWMID sample ID labels, which are one-time use stickers, will be placed on the forms for each of the surface water samples collected. This log must be completed for every surface water sample collected, including primary samples (collected in the same area as the fish samples), field blanks, and field duplicates. Up to three surface water samples can be documented on a single page.

The log should be filled out as follows:

- Sample-Lab: Place in this field the same pre-printed OWMID label (one-time use sticker) that was placed on the surface water sample bottle.
- Sample type: Select “routine sample” for all parent samples, “blank” for field blanks, “FQC_BLANKRINS” for equipment blank, and “field duplicate” for duplicate samples. This program does not require collection “integrated vertical profile” surface water samples.
- OWMID parent ID: If you selected “field duplicate” for the “sample type”, populate this field with the OWMID for the parent sample. Otherwise, leave this field blank.
- Medium: Select “water.”
- Medium (subdivision): Select “surface water.”
- Relative depth: Select “surface.”

- Start time: Note the date and time that the samples were collected; use military time.
- Gear type: Select “water bottle.”
- Composite (Type): Select “no.”
- Sample notes: Use this field to record any other relevant notes about sample collection or any deviations from the protocols outlined in sections 3.6.1.1 and 3.6.2.1.
- Bottle group: Check “PFAS (PF)” under “planned” and “collected.” Leave the field for “preserved in the field” blank and check “N” for “filtered in the field.”

This form also includes a second page titled “Multi-Probe Information Field Form.” Field sampling crews will select “no” for the “sample collected” field. The rest of the form does not need to be completed.

4.3 Biota Fieldsheets

Field sampling crews will document fish, shellfish, and invertebrate samples on field sheets or logs provided by MassDEP’s WPP. Blank copies are provided in Appendix F (Fish Sample Log), Appendix G (Shellfish Sample Log), and Appendix H (Freshwater Invertebrate Sample Log).

Fish Sample Log

The top portion of the form will be completed in the field. Required data elements include:

- Project: PFAS (2024)
- Waterbody Name/Town
- Date-Time
- Field Lat/Long: Enter GIS coordinates from where the samples were collected
- Lat/Long method: Enter “Handheld GPS”
- FS Login ID: Enter the ID as “N” (for Normandeau), the year, and the site location ID. For example, N2024001, N2024002, N2024003, etc.
- Crew lead
- Crew

The rest of the form will be completed in Normandeau’s Bedford facility while the fish samples are being processed and packaged for shipment to the laboratory. For each individual fish, the following will be documented using standard codes where applicable: sample code (ID), species code, length (mm), weight (g), sex, sample type (“I” for individual), bio part, collection method-gear, and comments.

Shellfish Sampling Log

These forms will document information both for individual shellfish that goes into a composite and for the composite sample that includes those individuals. The top portion of the form will be completed in the field. Required data elements include:

- Project: PFAS (2024)
- Waterbody Name/Town
- Date-Time
- Field Lat/Long: Enter GIS coordinates from where the samples were collected.
- Lat/Long method: Enter “Handheld GPS.”
- FS Login ID: Enter the ID as “N” (for Normandeau), the year, and the site location ID. For example, N2024001, N2024002, N2024003, etc.
- Crew lead
- Crew

The rest of the form will be completed in Normandeau’s Bedford facility while the shellfish samples are being processed and prepared into composites. For each individual shellfish, the following will be documented (using standard codes where applicable): sample code, species code, length (prior to being shucked), weight (prior to being shucked), sample type (typically “C” for composite), bio part, collection method-gear, and comments.

Invertebrate Sampling Log

These forms will document information on each composite benthic macroinvertebrate sample that is prepared in the field. The form will be completed in the field and required data elements include:

- Project: PFAS (2024)
- Waterbody Name/Town
- Date-Time
- Field Lat/Long: Enter GIS coordinates from where the samples were collected.
- Lat/Long method: Enter “handheld GPS.”
- FS Login ID: Enter the ID as “N” (for Normandeau), the year, and the site location ID. For example, N2024001, N2024002, N2024003, etc.
- Crew lead
- Crew
- Sample code
- River/lake
- Class or Group: See options in Appendix H.
- Approx count: Estimate count of individual organisms, if feasible; enter “NA” if not possible.
- Approx total weight (g ww): Enter total weight in grams (wet weight) for the composite sample.
- Sample type: Enter “C” for composite sample.

- Bio-Part (see pick list options in Appendix H; e.g., WORG)
- Collection Method-Gear: Enter “D-frame net”, “Ponar grab sampler”, or “other” (specify).

For combined benthic invertebrate samples, note any predominant group(s) in the comment field.

4.4 Sample Labeling

The field sampling crew will label all samples in a clear and precise way for proper identification in the field and tracking in the laboratory. Details are provided below for assigning surface water (Section 4.4.1), fish (Section 4.4.2), shellfish (Section 4.4.3), and invertebrate (Section 4.4.4) sample IDs.

4.4.1 Surface Water Sample IDs

MassDEP requires unique OWMID sample IDs for surface water samples. These IDs will be provided to the field sampling crew on pre-printed labels. The IDs begin with “20” and then have 4 additional values which are assigned sequentially (e.g., 20-0160, 20-0161, 20-0162). Sample IDs are assigned sequentially regardless of whether they are parent samples, field blanks, or field duplicates. The field sampling crew will apply the pre-printed labels to the sample collection bottles. The same label will also be applied to the surface water sampling log that is attached to the river/lake field sheets.

All sample labels will be covered with clear packing tape that completely encircles the sample bottle to prevent smearing or physical damage to the label.

4.4.2 Fish Sample IDs

Each fish sample that is sent to the laboratory will receive a unique alphanumeric ID to identify the sample location and sample number. These IDs will be assigned by Normandeau when processing the fish samples in their Bedford facility. Fish sample IDs are strings that include characters that denote the contractor that collected the samples, year, location, and species. The IDs will be assigned as follows:

- “N” to indicate Normandeau as the contractor that collected the sample
- “2024” to indicate the sample collection year
- A three-digit code to indicate the sampling location (see Table 7)
- A one-to-three-character string to indicate the species (see Table 8)
- A two-digit code to indicate the sample number for that waterbody, beginning with 01 and increasing sequentially with each additional sample that is prepared for the same sampling location.

Table 7. Sample Location Codes for Sample IDs (Phase 1 only)

Waterbody Name	Freshwater/Coastal	Sample Location Code
Charles River	Freshwater	001
Merrimack River	Freshwater	002
Johns Pond	Freshwater	003
Sheomet Lake	Freshwater	004
Deer Island Sportfishing Pier	Coastal	005
Great Bay (Great Pond) Great Pond	Coastal	006F
Bournes Pond	Coastal	006SF
Merrimack River (Joppa Flats) Plum Island	Coastal	007
Annisquam River (Corliss Landing)	Coastal	008
Wareham River	Coastal	009
Genter Hill Preserve	Coastal	010

Table 8. Freshwater Fish Species Codes for Sample IDs

Fish Species	Fish Species Code
American eel	AE
American shad	AS
bluegill	B
brown bullhead	BB
black crappie	BC
blueback herring	BBH
brown trout	BT
common carp	C
creek chub	CB
creek chubsucker	CCS
common shiner	CS
chain pickerel	CP
dace	LD
eastern brook trout	EBT
fallfish	FF
golden shiner	GS
largemouth bass	LMB
longnose sucker	LS
northern pike	NP
pumpkinseed	P
rainbow trout	RT
smallmouth bass	SMB
spottail shiner	SS
walleye	W
white catfish	WC
white perch	WP
white sucker	WS
yellow bullhead	YB
redbreast sunfish	YBS

Fish Species	Fish Species Code
yellow perch	YP

Table 9. Marine Fish Species Codes for Sample IDs

Fish Species	Fish Species Code
Atlantic bonito	AB
American eel	AE
Atlantic mackerel	AM
Atlantic Menhaden (Peanut Bunker)	PB
American shad	AS
Bluefish	BF
Black Sea Bass	BSB
Cunner	CN
Dogfish	DF
Grey sole	GS
Monkfish	M
Plaice	PL
Silver hake	SH
Striped bass	SB
Scup	SC
Sea robin	SS
Skate	SK
Summer Flounder	SF
Smelt	SM
Tautog	T
Weakfish	WK
Winter Flounder	WF
White perch	WP
Yellowtail flounder	YT

Example fish IDs for four fish samples (two for largemouth bass and two for chain pickerel) for sampling location 001 are as follows:

- N2024001-LMB-01
- N2024001-LMB-02
- N2024001-CP-03
- N2024001-CP-04

When a field duplicate is collected, the sample ID should match the parent sample but have “DUP” added to the end (e.g., N2024001-LMB-01 and N2024001-LMB-01-DUP). Equipment blanks will match the waterbody sample ID but will have a “B” added to the end (e.g., N2024001-B). Sample labels will be affixed to the outside of the sample bags that are shipped to the laboratory and covered completely with clear packing tape.

4.4.3 Shellfish Sample IDs

Each shellfish composite sample that is sent to the laboratory will receive a unique alphanumeric ID to identify the sample location and sample number. These IDs will be assigned by Normandeau when processing the shellfish samples in their Bedford facility. Shellfish sample IDs are strings that include characters that denote the contractor that collected the samples, year, location, and species. The IDs will be assigned as follows:

- “N” to indicate Normandeau as the contractor that collected the sample
- “2024” to indicate the sample collection year
- A three-digit code to indicate the sampling location (see Table 7)
- A one-to-three-character string to indicate the shellfish species (see Table 10)
- A two-digit code to indicate the composite sample number for that waterbody, beginning with 01 and then increasing sequentially with each additional composite sample that is prepared.

Table 10. Shellfish Species Codes for Sample IDs

Shellfish Species	Shellfish Species Code
Soft shell clam	SSC
Quahog	Q
Blue mussel	BM
Oyster	O
Sea urchin	SU
Channeled whelk	CW
Knobbed whelk	KW
Razor clam	RC
Surf clam	SC

4.4.4 Invertebrate Sample IDs

Each freshwater invertebrate composite sample that is sent to the laboratory will receive a unique alphanumeric ID to identify the sample location and sample number. These IDs will be assigned by Normandeau when collecting invertebrate samples in the field as follows:

- “N” to indicate Normandeau as the contractor that collected the sample
- “2024” to indicate the sample collection year
- A three-digit code to indicate the sampling location (see Table 7)
- A one-to-three-character code to indicate the invertebrate type (see Table 11)
- A two-digit code to indicate the composite sample number for that waterbody, beginning with 01 and then increasing sequentially with each additional composite sample that is prepared.

Table 11. Invertebrate Types for Sample IDs

Invertebrate Group	Invertebrate Group Code
Insecta	INS

Invertebrate Group	Invertebrate Group Code
Crustacea	CRU
Gastropoda	GAS
Bivalvia	BI
Combined Benthic Invertebrates	CBI

4.5 Chain-of-Custody Forms

COC forms will be maintained throughout the sampling effort. SGS AXYS will provide COC forms (Appendix I) and the field sampling crew will complete these forms prior to shipment. Any corrections to COC forms will be made by a single-line strike made through the incorrect item; the correct entry will be entered adjacent to the strikeout item, with the date and staff initials to document the change.

The SGS AXYS COC form will be pre-populated with contact information for the “report to”, “invoice to”, “project name/number”, and SGS AXYS client number fields. Field teams will need to populate the sampler’s name and signature and details on the samples included in the shipment. The latter includes the sample ID, matrix (tissue or water), sampling date, sampling time, container type, and analyses requested (PFAS Method 1633) for each sample. The bottom of the COC records possession of the samples, which is to be filled out every time the samples are transferred to a new handler.

The field sampling crew will complete one COC form for every cooler shipped to SGS AXYS. They will send the original form with the sample shipment and upload scanned copies to ERG’s SharePoint site.

4.6 Preservation

When initially caught, fish will be placed in an ambient temperature live well in the field. When sample collection is complete, each fish will be placed in a PFAS-free LDPE plastic bag provided by the laboratory and on ice for transport back to Normandeau’s facility. If the fish need to be stored overnight before processing, they will be stored in a refrigerator at 0-6°C. Fish filets and whole-fish will be placed in PFAS-free LDPE bags provided by the laboratory prior to shipment. Invertebrates will be prepared as whole organism composite samples in 250 mL jars in the field and shellfish tissue will be prepared as edible-portion composite samples in PFAS-free LDPE bags at Normandeau’s facility. Once prepared, all tissue samples will be kept frozen at Normandeau’s facility until shipment.

Surface water samples will be immediately placed on ice following collection and kept frozen at Normandeau’s Bedford facility until shipment.

4.7 Packaging and Shipping

Surface water samples must be chilled during shipment and not exceed 6°C during the first 48 hours after collection. When preparing samples for shipment, frozen surface water samples in HDPE bottles will be double-bagged using PFAS-free LDPE bags provided by the laboratory. As much double-bagged wet ice as will fit in the cooler should be used for transporting and shipping these samples. Chemical or blue ice will not be used. Sample temperature must be confirmed to be at 0° to 6°C when the samples are received at the laboratory.

Frozen fish and shellfish tissue samples will be shipped in PFAS-free LDPE bags (fish) and PFAS-free HDPE jars (shellfish) provided by the laboratory, respectively. Frozen invertebrate samples will be shipped in 250 mL HDPE jars provided by the laboratory. The three types of tissue samples will not be shipped until they have been frozen for approximately 18 to 24 hours. In some cases, this may mean holding samples at Normandeau’s facility for an extra day before they are shipped to the laboratory.

Before shipping samples, the field sampling crew will prepare all shipping documents. They will tape completed shipping documents to the exterior of coolers, including forms required by the shipping service (e.g., a Federal Express waybill). A copy of the COC form will be placed inside of the cooler. If the field sampling crew has any questions or concerns regarding the completion of the shipping documentation or packaging of samples, they will contact the ERG Data Manager.

Samples will be shipped to SGS AXYS by Federal Express overnight in coolers provided by the lab. Due to the potential for shipping delays and to reduce the risk of samples arriving at temperatures >6°C, samples will not be shipped on Fridays. Instead, they will be stored in a freezer at Normandeau’s Bedford facility and shipped the following Monday. Normandeau will share Federal Express tracking numbers with ERG. SGS AXYS will send confirmation of receipt within 48 hours of receiving samples. ERG will alert MassDEP of any shipping delays. Samples will be shipped to the locations shown in Table 12.

Table 12. Sample Shipping Locations

Sample Type	Shipping Address
Whole-body fish Invertebrates Shellfish	C/O Sample Receiving SGS Wilmington 5500 Business Drive Wilmington, NC 28405 PH: 910-350-1903
Fish fillets Surface water	C/O Sample Receiving SGS AXYS Analytical Services 2045 Mills Road West Sidney, BC, Canada V8L 5X2 PH: 250-655-5800

The COC forms sent to the lab must be completed with all mandatory information; the pages must be originals (not photocopies); and the COCs must be unique to the samples contained in their corresponding coolers. Upon receipt, the analytical laboratory will confirm that all samples listed are present and then sign the COC.

5.0 Analytical Methods

Water and tissue matrices will be analyzed by SGS AXYS for 40 PFAS in accordance with EPA Method 1633. Tissue samples will be homogenized before they are analyzed following method specifications. SGS AXYS will document any deviations from the proposed analytical method in their laboratory reports and provide sufficient documentation to allow for independent validation and verification of the analytical results. Further information is included in Section 3.3 of the QAPP and SGS AXYS's SOPs.

6.0 Quality Assurance / Quality Control (QA/QC)

6.1 Field and Equipment Blanks

The field sampling crew will collect blank samples at a random 10% of sites. The blanks will be collected with greater frequency during Phase 1 than during Phase 2. This approach might change if blanks show PFAS contamination (i.e., additional blank samples might be collected in Phase 2 if this happens). The type of blank samples will differ by environmental media.

Field blanks for surface water will be collected by transferring PFAS-free DI water into sampling containers in the field. These containers will then be treated in an identical fashion to all other surface water grab samples. The laboratory will analyze the field blanks for the same PFAS contaminants that will be measured in surface water. Field blanks will be collected at two waterbodies during Phase 1 and at one waterbody during Phase 2. Note that MassDEP will provide PFAS-free DI water for field blanks from its MassDEP-WPP-Worcester facility (contingent on this source being verified as PFAS-free throughout the project; an alternate source of PFAS-free water will be used if needed).

Equipment blanks for fish and shellfish tissue will be rinsate samples. These will be collected at Normandeau's Bedford facility when field sampling crews rinse field equipment used to collect and process field samples. For fish, the field sampling crew will pour PFAS-free water over each piece of just-cleaned equipment used to process the fish immediately before (including the measuring board, cutting board, scale, and knives) and collect that water in one of the fish tissue sample collection containers (i.e., a PFAS-free LDPE bag provided by the laboratory). The water will then be transferred from the bag into an HDPE sample bottle, also provided by the laboratory. Equipment blanks will be sent to the laboratory for analysis of the same PFAS contaminants that will be measured in fish tissue. The same process will be used to prepare equipment blanks for shellfish samples (i.e., running water over the cleaned equipment used to process and prepare those

samples immediately before). Equipment blanks for shellfish will be collected for two waterbodies during Phase 1 and for one body during Phase 2. Additional equipment blanks will be added, as needed. Blanks will be collected prior to any fish or shellfish processing for a given day.

Equipment blanks for invertebrate sampling will consist of rinsate samples from equipment used to collect and process invertebrate samples in the field. To collect an equipment blank, the field sampling crew will pour PFAS-free water over each piece of cleaned equipment used to collect and process the invertebrate samples immediately before (including the net, sieve, forceps, boots, Ponar sampler, elutriator, squirt bottle). The field crew members will collect the rinsate water in one of the invertebrate sample collection containers (250 mL HDPE jars). Rinsate blanks will be sent to the laboratory for analysis of the same PFAS contaminants that will be measured in invertebrate samples. When rinsate blanks are collected, they will be collected after processing all invertebrate samples from a given day and completing the decontamination process outlined above. Equipment blanks for invertebrates will be collected for two waterbodies under Phase 1 and one waterbody under Phase 2.

6.2 Field Duplicates

Field duplicate samples will be collected to characterize precision of the sampling and analytical methods. Two types of duplicate samples will be collected, according to these specifications:

- At roughly 25% of the waterbodies sampled, the surface water collected near the fishing location will be collected in duplicate. Meaning, field sampling crews will collect two grab surface water samples at side-by-side locations. Four surface water duplicates will be collected during Phase 1 and four duplicates will be collected during Phase 2.
- At roughly 25% of waterbodies sampled, field duplicates will be collected for fish tissue (boneless-skinless filets); field QC duplicate samples will not be collected for whole fish, invertebrates, or shellfish (information on lab and field precision will be gleaned for these media for replicates collected in the field as part of the study design [with the exception of shellfish]). For fish filets, field teams will prepare duplicate samples from the same fish, with one sample being from right side and the other being from the left side. Duplicate samples will be collected from four locations in Phase 1 and from four location in Phase 2. For shellfish, field teams will attempt to collect enough organisms to create additional replicate samples at two waterbodies in Phase 1 and one waterbody in Phase 2.

6.3 Performance Evaluation QC Samples

MassDEP intends to prepare four performance evaluation QC samples in the fall of 2024 (or as feasible). These samples will be prepared with known concentrations of PFAS, but the magnitude of those concentrations and the sample type will not be known to SGS AXYS (i.e., double-blind). These samples will be used to evaluate the accuracy of the laboratory analyses. MassDEP's WPP/Wall Experiment Station's (WES) will prepare the samples and then deliver them to Normandeau where they will be frozen and then shipped double-blind to the laboratory for analysis of PFAS via EPA Method 1633.

6.4 Interlaboratory Comparison Study

Conditional on the MassDEP's WES preparedness for analyzing samples via EPA Method 1633, Phase 2 of this study will include collection of samples for an interlaboratory comparison study. Duplicate samples will be collected from up to five waterbodies during Phase 2 and sent to SGS AXYS and WES for analysis. At each of the selected waterbodies, a duplicate surface water sample and duplicate fish fillets from up to two fish will be collected using the same methods as field duplicate QC samples (see Section 6.2. Should WES not be able to analyze water or tissue samples immediately, the samples will be frozen for later analysis. MassDEP will arrange for transport of the aforementioned samples between Normandeau's Bedford facility and WES.

During this project period, WES was not able to receive field samples for analysis with method 1633. The interlaboratory comparison study was not conducted.

7.0 References

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MassDEP, 2018. Sampling and Analysis Plan to Evaluate Potential Impacts from Poly- and Per-Fluorinated Alkyl Substances (PFAS) to Cranberries and Surface Water in the Wilson Bogs.

MassDEP, 2023. Sampling and Analysis Plan, Investigation of PFAS Levels in Freshwater Fish at Selected Rivers and Lakes in Massachusetts. March 2023. <https://www.mass.gov/doc/sampling-and-analysis-plan-for-investigation-of-pfas-levels-in-freshwater-fish-at-selected-rivers-and-lakes-in-massachusetts/download>

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EPA, 2022. National Lakes Assessment 2022 Field Operations Manual. EPA-841-B-21-011.

https://www.epa.gov/system/files/documents/2022-07/FOM_NLA2022_%20Version1.2_220519_0.pdf

EPA, 2023. User Manual for Beta Streamflow Duration Assessment Methods for the Northeast and Southeast of the United States. EPA-843-B-23001.

https://www.epa.gov/system/files/documents/2023-11/user-manual-beta-sdam-ne-and-se-v1_1_nov2023.pdf

Appendix A
Scientific Collection Permits



**SPECIAL PERMIT
SCIENTIFIC COLLECTION**

COREY A FRANCIS
NORMANDEAU ASSOCIATES, INC.
74 BUTTERNUT LN
METHUEN, MA 01844

PRIMARY COLLECTOR:
COREY FRANCIS

SECONDARY COLLECTOR(S):
ROBERT GRENIER
CHRISTIAN GAGNE
TYLER PARENT
JOE BATTAGLIA
SEAN STIMMELL

PERMIT #: 186990

ISSUED: 05-07-2024

EXPIRES: 12-31-2024

FTN: 355424

PERMIT HOLDER:

NAME:
COREY A FRANCIS

DOB:

02-16-1964

COLLECTION PURPOSE:

VESSEL(S):

CORPORATE NAME:
NORMANDEAU ASSOCIATES, INC.

VESSEL CAPTAIN(S):

PRIMARY ADDRESS:

74 BUTTERNUT LN
METHUEN, MA 01844

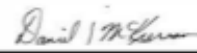
SUMMARY OF AUTHORIZED ACTIVITY:

Collect marine finfish (American Shad, Monkfish, Tautog, Eel, Plaice, Weakfish, Mackerel, Sea Bass, Scup, Winter Flounder, Bluefish, Striped Bass, Yellowtail Flounder, Grey Sole, Fluke) and invertebrates (Bay Scallop, Oyster, Urchin, Blue Mussel, Quahog, Soft Shell Clam, Channeled/Knobbed Whelk, Razor Clam and Surf Clam) for MADEP PFAS study. Up to four (4) of each species will be collected by rod & reel, hand and beach seine from Fore River, Castle Island, Megansett Harbor, Barnstable Harbor, Rock harbor, Popponeset Beach, Bass River, Marblehead Harbor, Pavilion Beach, Apponagansett Bay, Little harbor, Cole River, Plymouth Harbor, South River, Quincy, Newburyport, Wareham, Plymouth, Falmouth, Gloucester, Boston, Marblehead, Duxbury and Dartmouth. Species will be sent to SGS AXYS analytical lab located in Sidney, BC, Canada for PFAS analysis.

CONDITIONS:

- The sale of organisms collected under this permit is prohibited.
- This permit is valid only for the locations and activities listed.
- Contact local Shellfish Constable(s) 24 hours prior to any shellfish digging, collection, or planting.
- An annual report of permitted activities must be submitted.
- This permit does not absolve the permittee from the need to obtain any other required local, state or federal permits or authorizations.

Signature: _____

DIRECTOR: 
Daniel J. McKiernan

Maura Healey, Governor
Commonwealth of Massachusetts

Rebecca L. Tepper, Secretary
Executive Office of Environmental Affairs

Thomas K. O'Shea, Commissioner
Department of Fish and Game



**DIVISION OF
FISHERIES & WILDLIFE**

100 Cambridge Street, 6th Floor | Boston, MA 02114
MASS.GOV/MASSWILDLIFE

Scientific Collection Permit

FISH

VALID

2024

DATE: 4/29/2024

PERMIT#: 131.24SCF

**NORMANDEAU ASSOCIATES
COREY FRANCIS
25 NASHUA ROAD
BEDFORD, NH 03110**

Subpermittee(s): Robert Grenier, Christian Gagne, Tyler Parent, Charlie Dix, Sean Stimmell, Joe Battaglia

Is (are) hereby authorized, in accordance with the provisions of Section 4, Chapter 131 and 131A of the Massachusetts General Laws, to remove from the wild within the Commonwealth, subject to conditions set forth below, the following species and numbers:

MAY TAKE UP TO 4 FISH PER SPECIES OF THE FOLLOWING FISH SPECIES, (2 SPECIES PER SAMPLE LOCATION OR 4 FISH OF A THIRD SPECIES IF 4 FISH CANNOT BE CAPTURED OF THE FIRST TWO SPECIES) AS PART OF FLESH ANALYSIS STUDY FOR PFAS:

American Shad, American Eel, Black Bullhead, Black Crappie, Blueback Herring, Bluegill, Brook Trout, Brown Bullhead, Brown Trout, Chain Pickerel, Common Carp, Common Shiner, Creek Chub, Creek Chubsucker, Fallfish, Golden Shiner, Largemouth Bass, Longnose Sucker, Northern Pike, Pumpkinseed, Rainbow Trout, Redbreast Sunfish, Smallmouth Bass, Spottail Shiner, Walleye, White Catfish, White Perch, White Sucker, Yellow Bullhead, Yellow Perch

- Johns Pond (Carver)
- Merrimack River (North Chelmsford)
- Charles River (Mills)
- Sheomet Lake (Warwick)
- Spectacle Pond (Lancaster)
- Powdermill Brook (Westfield)

MADEP PFAS Phase 2 waterbodies

- Lake Gardner (Amesbury)
- Canoe River (Norton)
- Studley Pond (Rockland)
- Green River (Leyden)

Alternates

- Merino Pond (Webster)
- Brookline Reservoir (Brookline)
- White Pond (North Sudbury)
- Clapps Pond (Provincetown)
- Fourmile Brook (Northfield)
- Lake Lorraine (Chicopee)

DISTRICT MANAGER SHOULD BE NOTIFIED JUST PRIOR TO FIELD SAMPLING.

NHESP species observation forms must be submitted for all state-listed rare species encountered in the field via the Division's online data portal called the Heritage Hub at www.mass.gov/heritagehub. Within 10 days of the first observation of a given state-listed species, a NHESP species observation form must be submitted to the NHESP. All other NHESP species observation forms reporting subsequent observations of a given species shall be submitted by December 31. Also, Prior to releasing any data collected as a part of this permit to individuals or organizations outside of MassWildlife, the permittee must first consult with NHESP.

The following method(s) of taking is (are) hereby authorized:

ELECTROFISHING, ROD & REEL

Collection activities under this permit shall be restricted to the following locations, subject to the approval of private landowners

Johns Pond (Carver), Merrimack River (North Chelmsford), Charles River (Mills), Sheomet Lake (Warwick), Spectacle Pond (Lancaster), Powdermill Brook (Westfield), Lake Gardner (Amesbury), Canoe River (Norton), Studley Pond (Rockland), Green River (Leyden)

Alternates

Merino Pond (Webster), Brookline Reservoir (Brookline), White Pond (North Sudbury), Clapps Pond (Provincetown), Fourmile Brook (Northfield), Lake Lorraine (Chicopee)

All specimens secured under this permit shall be donated to the following institutions:

RETAINED FOR FLESH ANALYSIS

No specimen taken under the authority of this permit may be sold. No specimen may be transferred to another not duly licensed.

This permit or a copy thereof shall be carried at all times by the permittee and subpermittee(s) while engaged in the activities authorized herein.

MASSWILDLIFE

This permit does not absolve the permittee from compliance in full with any and all other applicable federal, state and local requirements, including the acquisition of a federal endangered species permit if required.

Upon expiration of this permit, a complete report detailing all collection activities shall be filed with this office and must include a listing of all species taken, numbers of specimens, and the disposition of same.

This permit, unless sooner revoked for cause, shall expire on December 31 of the year of issue.

PLEASE READ AND FOLLOW ATTACHED STANDARD CONDITIONS FOR REPTILE AND AMPHIBIAN SCIENTIFIC COLLECTING PERMITS

Mark Tisa Ph.D., M.B.A., Director

Appendix B
US EPA Standard Protocols for Maintaining Biological Security During Biological and Water Quality Surveys

Standardized Protocols for Maintaining Biological Security During Biological and Water Quality Surveys

By Hilary Snook, USEPA
(snook.hilary@epa.gov)

Purpose: These protocols are to establish formal operating, reporting, and decontamination procedures to prevent the spread of invasive/alien plant or animal species, biological viruses, pathogens, fungi, contaminants, or other detrimental factors from one surveyed water body/sampling location to another during the course of performing biological and water quality surveys.

No protocol can comprehensively cover all of variations of the entities listed above, but these field procedures should minimize the probability of alien/invasive transfers or viral/bacterial infections most prevalent in the New England Region. Strict adherence to these protocols is required while conducting surveys.

Pre-survey Planning

In the process of pre-survey planning, considerations need to be made as to the present disposition of the water bodies to be surveyed. Preliminary inquiries should be made to determine if the water bodies presently contain invasive plant/animal species, or if viral/bacterial agents have been reported or are present. Surveys spanning separate water bodies, or encompassing large contiguous stream/river reaches, especially over consecutive days, should be conducted in a manner whereby the most "pristine" sites are completed first if possible, thereby minimizing possibilities of cross contamination/transfer among sites. This in most cases will mean working from an upstream to downstream direction whenever possible in order to avoid spreading invasives further up into a watershed. Decontamination procedures should take place in all waters where the habitat is suitable for invasives, with the presumption being that they may already exist in the waterbody but as yet have not been detected.

Equipment recommendations

The equipment choices made for surveys may have a large influence on the susceptibility of transfer of environmental contaminants. Avoid absorbent porous material whenever possible. Use of felt soled waders, wading boots, should be replaced with cleated or studded wading boots. Carpeted boat decking and trailer bunks should be replaced with impervious decking material or their use avoided. If use of these types of materials is unavoidable, then extra diligence and care will be necessary during the decontamination process. The use of vessels with hull designs containing thru hull fixtures or hardware that take on and retain water should be minimized.

Decontamination Personal Protection Equipment (PPE)

The PPE for decontaminating equipment should consist of rubber gloves and laboratory safety glasses at a minimum. Long sleeved shirts and pants should be worn when using corrosives (bleach) and a plastic/rubber apron to keep overspray off of the clothing. Avoid contact with skin and clothing.

Decontamination procedures

The decontamination/disinfection products listed have been selected based on their relevancy to known pathogens/contaminants of concern to fisheries in the region and the existence of invasive aquatic plant species presently found in New England. The proper use of these products, along with sound sampling plan designs and equipment choices, should provide a high degree of protection against the transfer and propagation of these environmental stressors/contaminants.

The level of decontamination employed is a hierarchical approach based on the level of perceived risk of transferring invasive or pathogenic entities. Visual inspections of all equipment are to be made at every site before and after the survey, regardless of the condition of the resource. Any survey sites known or suspected to have invasive plant/animal species or pathogens need to follow the procedures listed below. It is the responsibility of the project manager to know the sites and their current disposition, as well as to employ the appropriate decontamination procedure and ensure that field crews have been appropriately trained in these protocols. The procedures used at a site will be recorded in the field log book.

1. All organic matter, plant fragments, and miscellaneous debris should be removed from nets, traps, temporary holding pens, boots & waders, gloves, anchor lines & chains, boat trailers and vehicles, and all other surfaces that have come into contact with ambient water, potentially contaminated sediments, fish, or other aquatic biota. Any material found after leaving the site should be disposed of in the trash and not flushed down any drains.
2. One of two disinfectants may be used as described below. All appropriate small field gear (gloves, waders, nets, anode rings, rat tails, etc.) should be immersed in a large plastic waste barrel utilizing a 2% solution of chlorhexadine diacetate (i.e. Novalsan) for a period of 15 minutes, or one ounce of 65% available Chlorine powder to twenty three gallons of water to obtain a 200 ppm solution. The latter is an inexpensive alternative using a "wetted time" of 20-30 minutes. Equipment that cannot be immersed (i.e. boats and trailers) should be disinfected utilizing a portable hand sprayer.
3. Chlorine solution is corrosive and will deteriorate neoprene, cloth, rubber seals, and other materials. The materials should be thoroughly rinsed in fresh water after soaking. Rubber intake and discharge lines, pumps with rubberized components on vessels, should all be checked frequently for deterioration.
4. Vehicles, boats, and trailers should be power washed at a commercial car laundry in between sites if operating in consecutive days and disinfection procedures

- applied. Live wells, holding tanks, thru hulls, intake lines and discharge lines should be thoroughly flushed with the prescribed chlorine disinfection solution and then subsequently rinsed with fresh water.
5. Outboard motor cooling systems should be flushed out with decontamination solution for the specified minimum of one minute's time then let stand for 15 minutes. It should be flushed again with clean fresh water that has come from a town water supply.
 6. Flush the interior of your boat with the disinfecting solution and then use the bilge pump to expel residual water before opening the bungs if possible. Some residual decontamination solution may be left in the bilges to "slosh" and continue decontaminating during travel provided no below deck equipment will be damaged in the process and the bilge water is disposed of properly. Care must be taken to ensure that this material is not carried over to another water body.
 7. Mats, deck carpeting, anchor lines and other absorbent and porous materials should be thoroughly soaked with decontamination solution, allowing extra time for the solution to fully saturate the item. If possible, avoid using equipment that has these materials on board as part of your surveys. Chlorinated disinfectants will bleach out carpeting and other fabrics.

Invasive/Alien Species reporting

- A comprehensive post survey report will be written describing the species and external disposition of individual fish, or the presence of other aquatic invasives. In most cases for fish this will include species, age class, length, weight, and any signs of physical or behavioral anomalies.
- Fish will be examined for deformities, fin erosions, fungi, lesions, and tumors, external parasites, and visible signs of viral/bacterial hemorrhagic infections. Fish will be retained for further pathological examination at the discretion of the survey fisheries biologist, or with consultation with the state agency biologist whose jurisdiction the survey has taken place. Photos may be taken to accompany voucher collections or pathology.
- All fish collected during a survey will be reported on and submitted to the appropriate state fish & wildlife agency and notations made as to their disposition.

To prevent the spread of viral/bacterial fish infections, the following guidelines should be adhered to:

- Do not transport fish from one body of water to another
- Only put fish back into the water body it was taken from
- Do not dispose of fish carcasses or by-products in any body of water.
- Remove all mud, aquatic plants and animals from all gear, boats, motors and trailers before leaving a body of water;

- Drain your live well, bilge and bait tanks before leaving the water you are fishing or boating on. Any water body known or suspected of being infected or having invasive plant/animal species need to follow the disinfection guidelines.

Resources:

New England Invasive Species:

<http://www.epa.gov/ne/topics/ecosystems/inv/species.html>

Didymosphenia geminata

<http://www.issg.org/database/species/ecology.asp?si=775&fr=1&sts>

USFWS Decontamination protocols

http://www.fws.gov/sacramento/es/documents/crf_survey_guidance_aug2005.pdf

Maine Department of Inland Fisheries and Wildlife. 2005. *Fisheries Staff Biosecurity and Disinfection Guidelines for Field Work (Draft)*.

Maine Atlantic Salmon Commission. 2005. *Disinfection Procedures (Draft)*.

Appendix C

Normandeau Associates, Inc. Biosecurity Plan Disinfection Procedures

Introduction

Invasive species are found throughout the United States. Typical encountered invasives include Eurasian watermilfoil, Hydrilla, Water Chestnut, Asian Clams and Zebra Mussels. To prevent the spread of invasive species by field sampling activities undertaken by Normandeau Associates, Inc. (NAI), the following decontamination policy will apply to all boats and equipment that are used when transporting from one water body to another or across watersheds. At a minimum visual inspection will occur prior to transporting from one water body to another. Remove any obvious materials and discard in appropriate trash receptacles; do not return these materials to the water.

Purpose of Procedure:

Normandeau personnel working with aquatic organisms in the United States will maintain a high standard of biosecurity. All Normandeau field sampling crews will follow NAI's disinfection procedures, in order to prevent the spread of aquatic invasive species and diseases.

Equipment Needed:

- Steam pressure washer
- 2 large (40+gal.) trash cans
- Sprayer bottle
- Bleach or
- A solution of copper sulfate, benzethonium chloride and Formula 409
- Rubbing alcohol
- Garden hose
- 1 Large stiff bristle brush

Alternative Method:

- Box freezer
- Salt water 5% to 10%

Crew Vehicles:

Inspect and wash equipment regularly during field season

Boats and Trailers:

The boats and trailers will be visually inspected for aquatic plants and when found will be removed by hand. All boat hulls, bilges, and trailers will be steam cleaned or washed with 10% bleach to disinfect before use. All outboard motors will be flushed with tap water for 10 minutes before being used.

Field Equipment:

All field equipment will be inspected and disinfected before use between different lakes and river systems or watersheds. Disinfection for most equipment will be accomplished with 10% bleach and water solution in large trash cans (1gal. bleach/10 gal. water). Large equipment will be disinfected with steam when practical (i.e. barge shocker, holding tanks, trap nets, seines). Equipment that comes in constant contact with lake or river water, such as waders, dip nets, gloves, buckets, measuring boards will be placed in a 10% bleach solution and left to soak for at least 10 minutes and then rinsed thoroughly. Solutions of copper sulfate (252 mg/L Cu), or benzethonium chloride (1,940 mg/L), and Formula 409 (50% dilution) may be used to prevent structural damage to waders. When disinfection occurs off site of the NAI offices all solutions shall be collected, stored, and properly disposed of at the NAI offices.

An alternative is to freeze nets and other gear in a box type freezer. Place gear in a freezer below 32 degrees Fahrenheit for a minimum of eight hours, thaw gear and immerse in a solution of 5% to 10% salt water.

Delicate equipment, such as D.O. meters, electronic scales, etc., will be sprayed with ethanol alcohol and air dried.

Safety

Personnel will be made aware of the hot steam generated and the potential to burn skin by steam pressure wash equipment. Appropriate field gear like rubber gloves, rain pants and coats will be worn when using the steam pressure washer.

Personnel will review a Safety Data Sheet for alcohol used to spray equipment prior to use. Alcohol is flammable; no smoking or ignition sources will be nearby when spraying equipment.

Bleach solutions typically Clorox or similar brands may cause skin irritation, nausea or vomiting if ingested. Personnel will review a Safety Data Sheet prior to use.

Copper sulfate can cause eye, skin irritation and respiratory problems and is extremely harmful to aquatic life. Personnel will review Safety Data Sheet prior to use.

Training and Documentation

Employees who are required to perform disinfection procedures will be provided with a copy of this procedure. After reading and acknowledging understanding of the procedure, a sign off sheet will be signed to document this training.

When equipment is disinfected according to the procedure, a log sheet will be kept documenting this activity whether it was performed prior to field, during or after field activities. Documentation will be stored in the NAI Field Operations office at each location

Appendix D
River and Coastal Field Sheet

[Required fields are highlighted in green]

STATION INFORMATION <i>(fill out prior to departure)</i>	
Field Sheet Login #:	Unique ID:
Project:	Site Name (STAID):
Waterbody Name:	Town:
GENERAL SITE INFORMATION	
Alternate Station Description (Does site match description?) <input type="checkbox"/> YES <input type="checkbox"/> NO <i>If not, describe below.</i>	
Alt. Field Lat/Long:	Lat/Long Method <input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Handheld GPS <input type="checkbox"/> Other
Survey Crew Lead:	Other Crew:
Date:	Time: <input type="checkbox"/> - FST - EDT
Weather Conditions:	<input type="checkbox"/> Clear <input type="checkbox"/> Mostly sun <input type="checkbox"/> Mostly cloud <input type="checkbox"/> Overcast <input type="checkbox"/> Fog <input type="checkbox"/> Drizzle <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Snow
Air Temperature <input type="checkbox"/> < 20 °F <input type="checkbox"/> 21-30 °F <input type="checkbox"/> 31-40 °F <input type="checkbox"/> 41-50 °F <input type="checkbox"/> 51-60 °F <input type="checkbox"/> 61-70 °F <input type="checkbox"/> 71-80 °F <input type="checkbox"/> 81-90 °F <input type="checkbox"/> 91-100 °F	
Water Odor <input type="checkbox"/> None <input type="checkbox"/> Musty <input type="checkbox"/> Petrol <input type="checkbox"/> Sewage <input type="checkbox"/> Effluent <input type="checkbox"/> Sulfide <input type="checkbox"/> Fishy <input type="checkbox"/> Chlorine <input type="checkbox"/> Rotten Veg. <input type="checkbox"/> Other <input type="checkbox"/> Unobservable	
Turbidity <input type="checkbox"/> None <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Moderately Turbid <input type="checkbox"/> Highly Turbid <input type="checkbox"/> Unobservable	
Water Color <input type="checkbox"/> None <input type="checkbox"/> Brownish <input type="checkbox"/> Blackish <input type="checkbox"/> Greenish <input type="checkbox"/> Greyish <input type="checkbox"/> Reddish <input type="checkbox"/> Yellowish <input type="checkbox"/> Other <input type="checkbox"/> Unobservable	
Floating Scum <input type="checkbox"/> None <input type="checkbox"/> Algal mat <input type="checkbox"/> Foam <input type="checkbox"/> Oily sheens <input type="checkbox"/> Pollen blankets <input type="checkbox"/> Sewage <input type="checkbox"/> Other <input type="checkbox"/> Unobservable Description:	
General Notes:	
OBSERVATIONS (RIVER ONLY)	
Flow Condition <input type="checkbox"/> Flowing <input type="checkbox"/> No Water <input type="checkbox"/> Stagnant <input type="checkbox"/> Ice Covered <input type="checkbox"/> No Access	
Est. Flow Velocity <input type="checkbox"/> ~0 fps <input type="checkbox"/> < 1 fps <input type="checkbox"/> 1-3 fps <input type="checkbox"/> 3-5 fps <input type="checkbox"/> > 5 fps	
Tidal Condition <input type="checkbox"/> Not Applicable <input type="checkbox"/> Ebb (outgoing tide) <input type="checkbox"/> Flood (incoming tide) <input type="checkbox"/> Slack <input type="checkbox"/> Indeterminate	
% Open Sky: ____% (e.g., total shade=0%, total sun = 100%)	
Dominant Substrates <input type="checkbox"/> Bedrock <input type="checkbox"/> Boulder <input type="checkbox"/> Cobble <input type="checkbox"/> Course gravel <input type="checkbox"/> Sand <input type="checkbox"/> Silt/Mud/Clay <input type="checkbox"/> Unobservable	
Staff Gage Reading (in feet to the 1/100 th): ____ ft	
Discharge (Reference) <input type="checkbox"/> Upstream of a discharge <input type="checkbox"/> Adjacent to a discharge <input type="checkbox"/> Downstream of a discharge <input type="checkbox"/> Unknown	
OBSERVATIONS (RIVER AND LAKE)	
Objectionable Deposits <input type="checkbox"/> None <input type="checkbox"/> Trash <input type="checkbox"/> Flocculent mass <input type="checkbox"/> Other <input type="checkbox"/> Unobservable Description:	
Shoreline Erosion <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/> Unobservable Description:	
Wildlife <input type="checkbox"/> None <input type="checkbox"/> Fish <input type="checkbox"/> Mammals <input type="checkbox"/> Birds <input type="checkbox"/> Amphibians <input type="checkbox"/> Other Description:	
Beneficial Uses <input type="checkbox"/> None <input type="checkbox"/> Swimming <input type="checkbox"/> Boating <input type="checkbox"/> Water intake <input type="checkbox"/> Fishing <input type="checkbox"/> Other Description:	
Pollution Sources <input type="checkbox"/> None <input type="checkbox"/> Outfalls <input type="checkbox"/> Garbage <input type="checkbox"/> Road runoff <input type="checkbox"/> Waterfowl <input type="checkbox"/> Land clearing <input type="checkbox"/> Lawns	
Aesthetics Impaired? <input type="checkbox"/> YES <input type="checkbox"/> NO <i>Based on water odor, clarity, unnatural color, gossamers, scum and/or deposits, is the site impaired?</i>	
Water Level (relative to annual high-water level) <input type="checkbox"/> Low <input type="checkbox"/> Normal <input type="checkbox"/> High Water level, ft above/below ____ ft	

STATION SPECIFIC PLANT DENSITY <small>None 0% Sparse 1-25% Moderate 25-50% Dense 50-75% Very Dense 75-100% Unobservable</small>	
Overall Aquatic Plants	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U
Floating Aquatic Plants	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U <u>Species:</u>
Emergent Aquatic Plants	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U <u>Species:</u>
Submerged Aquatic Plants	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U <u>Species:</u>
Duckweed	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U
Free-floating algae	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U
ALGAL BLOOM	
Algal Bloom Present <input type="checkbox"/> YES <input type="checkbox"/> NO	
Bloom Type <input type="checkbox"/> Cyanobacteria <input type="checkbox"/> Green Algae <input type="checkbox"/> Other <input type="checkbox"/> Unknown	
Evidence of Bloom (check all that apply) <input type="checkbox"/> Scum <input type="checkbox"/> Color <input type="checkbox"/> Turbidity <input type="checkbox"/> Odor <input type="checkbox"/> Other	
Lakeward Width (in meters) <input type="checkbox"/> <1 m <input type="checkbox"/> 1-5 m <input type="checkbox"/> 5-10 m <input type="checkbox"/> 10-15 m <input type="checkbox"/> >15 m	
Shoreline Length (in meters) <input type="checkbox"/> <1 m <input type="checkbox"/> 1-5 m <input type="checkbox"/> 5-10 m <input type="checkbox"/> 10-15 m <input type="checkbox"/> ≥15 m	
Bloom specific notes:	
SITE SPECIFIC PERIPHYTON <small>None: 0% Sparse: 1-25% Moderate: 25-50% Dense: 50-75% Very Dense: 75-100% Unobservable</small>	
Filamentous <input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U	Color: <input type="checkbox"/> Black <input type="checkbox"/> Brown <input type="checkbox"/> Green <input type="checkbox"/> Grey <input type="checkbox"/> Other Location: <input type="checkbox"/> On plants <input type="checkbox"/> On rocks <input type="checkbox"/> On bottom Location Type: <input type="checkbox"/> Riffle <input type="checkbox"/> Run <input type="checkbox"/> Pool
Film <input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U	Color: <input type="checkbox"/> Black <input type="checkbox"/> Brown <input type="checkbox"/> Green <input type="checkbox"/> Grey <input type="checkbox"/> Other Location: <input type="checkbox"/> On plants <input type="checkbox"/> On rocks <input type="checkbox"/> On bottom Location Type: <input type="checkbox"/> Riffle <input type="checkbox"/> Run <input type="checkbox"/> Pool
Loose Floc <input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U	Color: <input type="checkbox"/> Black <input type="checkbox"/> Brown <input type="checkbox"/> Green <input type="checkbox"/> Grey <input type="checkbox"/> Orange <input type="checkbox"/> White <input type="checkbox"/> Other Location: <input type="checkbox"/> On plants <input type="checkbox"/> On rocks <input type="checkbox"/> On bottom Location Type: <input type="checkbox"/> Riffle <input type="checkbox"/> Run <input type="checkbox"/> Pool
Moss (enter in Rivers section) <input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U	Color: <input type="checkbox"/> Black <input type="checkbox"/> Brown <input type="checkbox"/> Green <input type="checkbox"/> Grey <input type="checkbox"/> Other Location: <input type="checkbox"/> On plants <input type="checkbox"/> On rocks <input type="checkbox"/> On bottom Location Type: <input type="checkbox"/> Riffle <input type="checkbox"/> Run <input type="checkbox"/> Pool

SAMPLE - GENERAL
<p>Sample taken from <input type="checkbox"/> From shore/left bank <input type="checkbox"/> From shore/center stream <input type="checkbox"/> From shore/right bank</p> <p><input type="checkbox"/> Wade in/left bank <input type="checkbox"/> Wade in/center stream <input type="checkbox"/> Wade in/right bank</p> <p><input type="checkbox"/> Bridge upstream <input type="checkbox"/> Bridge downstream</p> <p><input type="checkbox"/> Boat <input type="checkbox"/> Shore (Lake) <input type="checkbox"/> Wading (Lake) <input type="checkbox"/> Dock</p> <p><input type="checkbox"/> Pipe</p> <p><input type="checkbox"/> Other (describe): _____</p>
<p>Sample taken from description</p>

Sample-Lab	<Place OWMID Label here>			<Place OWMID Label here>			<Place OWMID Label here>					
Sample Type	<input type="checkbox"/> FQC_BLANK (Blank) <input type="checkbox"/> FQC_BLANKRINS (Equipment Blank) <input type="checkbox"/> FQC_REP (Field Duplicate) <input type="checkbox"/> FS_IVP (Integrated Vertical Profile) <input type="checkbox"/> FS_ROUTINE (Routine Sample) <input type="checkbox"/> Other:			<input type="checkbox"/> FQC_BLANK (Blank) <input type="checkbox"/> FQC_BLANKRINS (Equipment Blank) <input type="checkbox"/> FQC_REP (Field Duplicate) <input type="checkbox"/> FS_IVP (Integrated Vertical Profile) <input type="checkbox"/> FS_ROUTINE (Routine Sample) <input type="checkbox"/> Other:			<input type="checkbox"/> FQC_BLANK (Blank) <input type="checkbox"/> FQC_BLANKRINS (Equipment Blank) <input type="checkbox"/> FQC_REP (Field Duplicate) <input type="checkbox"/> FS_IVP (Integrated Vertical Profile) <input type="checkbox"/> FS_ROUTINE (Routine Sample) <input type="checkbox"/> Other:					
OWMID Parent												
Medium	<input type="checkbox"/> <u>Water</u> <input type="checkbox"/> Sediment <input type="checkbox"/> Other			<input type="checkbox"/> <u>Water</u> <input type="checkbox"/> Sediment <input type="checkbox"/> Other			<input type="checkbox"/> <u>Water</u> <input type="checkbox"/> Sediment <input type="checkbox"/> Other					
Medium (Subdivision)	<input type="checkbox"/> SW (Surface Water) <input type="checkbox"/> <u>IndEff</u> (Industrial Effluent) <input type="checkbox"/> <u>MunSewEff</u> (Muni. Sewage Effluent) <input type="checkbox"/> <u>StrpW</u> (Stormwater) <input type="checkbox"/> Unknown			<input type="checkbox"/> SW (Surface Water) <input type="checkbox"/> <u>IndEff</u> (Industrial Effluent) <input type="checkbox"/> <u>MunSewEff</u> (Muni. Sewage Effluent) <input type="checkbox"/> <u>StrpW</u> (Stormwater) <input type="checkbox"/> Unknown			<input type="checkbox"/> SW (Surface Water) <input type="checkbox"/> <u>IndEff</u> (Industrial Effluent) <input type="checkbox"/> <u>MunSewEff</u> (Muni. Sewage Effluent) <input type="checkbox"/> <u>StrpW</u> (Stormwater) <input type="checkbox"/> Unknown					
Relative Depth	<input type="checkbox"/> Surface <input type="checkbox"/> Mid-Water <input type="checkbox"/> Near Bottom			<input type="checkbox"/> Surface <input type="checkbox"/> Mid-Water <input type="checkbox"/> Near Bottom			<input type="checkbox"/> Surface <input type="checkbox"/> Mid-Water <input type="checkbox"/> Near Bottom					
Start/End Depth (m)	/			/			/					
Start Time (Date/Time)	/ <input type="checkbox"/> EDT <input type="checkbox"/> EST			/ <input type="checkbox"/> EDT <input type="checkbox"/> EST			/ <input type="checkbox"/> EDT <input type="checkbox"/> EST					
End Time (Date/Time)	/ <input type="checkbox"/> EDT <input type="checkbox"/> EST			/ <input type="checkbox"/> EDT <input type="checkbox"/> EST			/ <input type="checkbox"/> EDT <input type="checkbox"/> EST					
Gear Type	<input type="checkbox"/> Water Bottle <input type="checkbox"/> <u>Tygon Tube</u> <input type="checkbox"/> Sampling Pole <input type="checkbox"/> Auto Sampler <input type="checkbox"/> Van Dorn <input type="checkbox"/> Other <input type="checkbox"/> Basket <input type="checkbox"/> N/A			<input type="checkbox"/> Water Bottle <input type="checkbox"/> <u>Tygon Tube</u> <input type="checkbox"/> Sampling Pole <input type="checkbox"/> Auto Sampler <input type="checkbox"/> Van Dorn <input type="checkbox"/> Other <input type="checkbox"/> Basket <input type="checkbox"/> N/A			<input type="checkbox"/> Water Bottle <input type="checkbox"/> <u>Tygon Tube</u> <input type="checkbox"/> Sampling Pole <input type="checkbox"/> Auto Sampler <input type="checkbox"/> Van Dorn <input type="checkbox"/> Other <input type="checkbox"/> Basket <input type="checkbox"/> N/A					
Gear Serial #												
Composite (Type)	<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> <u>Flow</u> <input type="checkbox"/> <u>Time</u> <input type="checkbox"/> <u>Depth</u>			<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> <u>Flow</u> <input type="checkbox"/> <u>Time</u> <input type="checkbox"/> <u>Depth</u>			<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> <u>Flow</u> <input type="checkbox"/> <u>Time</u> <input type="checkbox"/> <u>Depth</u>					
Field Lat/Long	/			/			/					
Field Lat/Long Method	<input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Other: <input type="checkbox"/> Handheld GPS			<input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Other: <input type="checkbox"/> Handheld GPS			<input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Other: <input type="checkbox"/> Handheld GPS					
Sample Notes												
Bottle Group	Planned	Collected	Preserved in Field	Filtered in Field	Planned	Collected	Preserved in Field	Filtered in Field	Planned	Collected	Preserved in Field	Filtered in Field
Bacteria_(B)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Na ₂ S ₂ O ₃	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Na ₂ S ₂ O ₃	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Na ₂ S ₂ O ₃	<input type="checkbox"/> Y <input type="checkbox"/> N
Nutrient_(N)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₂ SO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₂ SO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₂ SO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N
Metals_(M)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
OrgCarb_(OC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₃ PO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₃ PO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₃ PO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N
Nutrient_(N3)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
Solids_(S)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
Chl a_(I)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
Color/Turb (R)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
PFAS_(PF)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N

Appendix E
Lake Field Sheet

[Required fields are highlighted in green]

STATION INFORMATION (All out prior to departure)	
Field Sheet Login #:	Unique ID:
Project:	Site Name (STAD):
Waterbody Name:	Town:
GENERAL SITE INFORMATION	
Alternate Station Description (Does site match description?) <input type="checkbox"/> YES <input type="checkbox"/> NO. If not, describe below:	
Alt. Field Lat/Long:	Lat/Long Method <input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Handheld GPS <input type="checkbox"/> Other:
Survey Crew Lead:	Other Crew:
Date:	Time: <input type="checkbox"/> EST <input type="checkbox"/> EDT
Weather Conditions: <input type="checkbox"/> Clear <input type="checkbox"/> Mostly sun <input type="checkbox"/> Mostly cloud <input type="checkbox"/> Overcast <input type="checkbox"/> Fog <input type="checkbox"/> Drizzle <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Snow	
Air Temperature: <input type="checkbox"/> < 20 °F <input type="checkbox"/> 21-30 °F <input type="checkbox"/> 31-40 °F <input type="checkbox"/> 41-50 °F <input type="checkbox"/> 51-60 °F <input type="checkbox"/> 61-70 °F <input type="checkbox"/> 71-80 °F <input type="checkbox"/> 81-90 °F <input type="checkbox"/> 91-100 °F	
Water Odor: <input type="checkbox"/> None <input type="checkbox"/> Musty <input type="checkbox"/> Petrol <input type="checkbox"/> Sewage <input type="checkbox"/> Effluent <input type="checkbox"/> Sulfide <input type="checkbox"/> Fishy <input type="checkbox"/> Chlorine <input type="checkbox"/> Rotten Veg. <input type="checkbox"/> Other <input type="checkbox"/> Unobservable	
Turbidity: <input type="checkbox"/> None <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Moderately Turbid <input type="checkbox"/> Highly Turbid <input type="checkbox"/> Unobservable	
Water Color: <input type="checkbox"/> None <input type="checkbox"/> Brownish <input type="checkbox"/> Blackish <input type="checkbox"/> Greenish <input type="checkbox"/> Greyish <input type="checkbox"/> Reddish <input type="checkbox"/> Yellowish <input type="checkbox"/> Other <input type="checkbox"/> Unobservable	
Floating Scum: <input type="checkbox"/> None <input type="checkbox"/> Algal mat <input type="checkbox"/> Foam <input type="checkbox"/> Oily sheens <input type="checkbox"/> Pollen blankets <input type="checkbox"/> Sewage <input type="checkbox"/> Other <input type="checkbox"/> Unobservable Description:	
General Notes:	
OBSERVATIONS (RIVER AND LAKE)	
Objectionable Deposits: <input type="checkbox"/> None <input type="checkbox"/> Trash <input type="checkbox"/> Flocculent mass <input type="checkbox"/> Other <input type="checkbox"/> Unobservable Description:	
Shoreline Erosion: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/> Unobservable Description:	
Wildlife: <input type="checkbox"/> None <input type="checkbox"/> Fish <input type="checkbox"/> Mammals <input type="checkbox"/> Birds <input type="checkbox"/> Amphibians <input type="checkbox"/> Other Description:	
Beneficial Uses: <input type="checkbox"/> None <input type="checkbox"/> Swimming <input type="checkbox"/> Boating <input type="checkbox"/> Water intake <input type="checkbox"/> Fishing <input type="checkbox"/> Other Description:	
Pollution Sources: <input type="checkbox"/> None <input type="checkbox"/> Outfalls <input type="checkbox"/> Garbage <input type="checkbox"/> Road runoff <input type="checkbox"/> Waterfowl <input type="checkbox"/> Land clearing <input type="checkbox"/> Lawns	
Aesthetics Impaired? <input type="checkbox"/> YES <input type="checkbox"/> NO. Based on water odor, clarity, unnatural color, growths, scum and/or	
Water Level (relative to annual high-water level): <input type="checkbox"/> Low <input type="checkbox"/> Normal <input type="checkbox"/> High. Water level, ft above/below: _____ ft	
STATION SPECIFIC PLANT DENSITY: None 0%, Sparse 1-25%, Moderate 25-50%, Dense 50-75%, Very Dense 75-100%, Unobservable	
Overall Aquatic Plants:	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U
Floating Aquatic Plants:	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U Species: _____
Emergent Aquatic Plants:	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U Species: _____
Submerged Aquatic Plants:	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U Species: _____
Duckweed:	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U
Free-floating algae:	<input type="checkbox"/> N <input type="checkbox"/> S <input type="checkbox"/> M <input type="checkbox"/> D <input type="checkbox"/> VD <input type="checkbox"/> U
ALGAL BLOOM	
Algal Bloom Present <input type="checkbox"/> YES <input type="checkbox"/> NO	
Bloom Type: <input type="checkbox"/> Cyanobacteria <input type="checkbox"/> Green Algae <input type="checkbox"/> Other <input type="checkbox"/> Unknown	
Evidence of Bloom (check all that apply): <input type="checkbox"/> Scum <input type="checkbox"/> Color <input type="checkbox"/> Turbidity <input type="checkbox"/> Odor <input type="checkbox"/> Other	
Lakeward Width (in meters): <input type="checkbox"/> <1 m <input type="checkbox"/> 1-5 m <input type="checkbox"/> 5-10 m <input type="checkbox"/> 10-15 m <input type="checkbox"/> >15 m	
Shoreline Length (in meters): <input type="checkbox"/> <1 m <input type="checkbox"/> 1-5 m <input type="checkbox"/> 5-10 m <input type="checkbox"/> 10-15 m <input type="checkbox"/> ≥15 m	
Bloom specific notes:	

Sample-Lab	<Place OWMID Label here>				<Place OWMID Label here>				<Place OWMID Label here>			
Sample Type	<input type="checkbox"/> FQC_BLANK (Blank) <input type="checkbox"/> FQC_BLANKRINS (Equipment Blank) <input type="checkbox"/> FQC_REP (Field Duplicate) <input type="checkbox"/> FS_IVP (Integrated Vertical Profile) <input type="checkbox"/> FS_ROUTINE (Routine Sample) <input type="checkbox"/> Other:				<input type="checkbox"/> FQC_BLANK (Blank) <input type="checkbox"/> FQC_BLANKRINS (Equipment Blank) <input type="checkbox"/> FQC_REP (Field Duplicate) <input type="checkbox"/> FS_IVP (Integrated Vertical Profile) <input type="checkbox"/> FS_ROUTINE (Routine Sample) <input type="checkbox"/> Other:				<input type="checkbox"/> FQC_BLANK (Blank) <input type="checkbox"/> FQC_BLANKRINS (Equipment Blank) <input type="checkbox"/> FQC_REP (Field Duplicate) <input type="checkbox"/> FS_IVP (Integrated Vertical Profile) <input type="checkbox"/> FS_ROUTINE (Routine Sample) <input type="checkbox"/> Other:			
OWMID Parent												
Medium	<input type="checkbox"/> <u>Water</u> <input type="checkbox"/> Sediment <input type="checkbox"/> Other				<input type="checkbox"/> <u>Water</u> <input type="checkbox"/> Sediment <input type="checkbox"/> Other				<input type="checkbox"/> <u>Water</u> <input type="checkbox"/> Sediment <input type="checkbox"/> Other			
Medium (Subdivision)	<input type="checkbox"/> SW (Surface Water) <input type="checkbox"/> <u>IndEff</u> (Industrial Effluent) <input type="checkbox"/> <u>MunSewEff</u> (Muni. Sewage Effluent) <input type="checkbox"/> <u>StpW</u> (Stormwater) <input type="checkbox"/> Unknown				<input type="checkbox"/> SW (Surface Water) <input type="checkbox"/> <u>IndEff</u> (Industrial Effluent) <input type="checkbox"/> <u>MunSewEff</u> (Muni. Sewage Effluent) <input type="checkbox"/> <u>StpW</u> (Stormwater) <input type="checkbox"/> Unknown				<input type="checkbox"/> SW (Surface Water) <input type="checkbox"/> <u>IndEff</u> (Industrial Effluent) <input type="checkbox"/> <u>MunSewEff</u> (Muni. Sewage Effluent) <input type="checkbox"/> <u>StpW</u> (Stormwater) <input type="checkbox"/> Unknown			
Relative Depth	<input type="checkbox"/> Surface <input type="checkbox"/> Mid-Water <input type="checkbox"/> Near Bottom				<input type="checkbox"/> Surface <input type="checkbox"/> Mid-Water <input type="checkbox"/> Near Bottom				<input type="checkbox"/> Surface <input type="checkbox"/> Mid-Water <input type="checkbox"/> Near Bottom			
Start/End Depth (m)	/				/				/			
Start Time (Date/Time)	/ <input type="checkbox"/> EDT <input type="checkbox"/> EST				/ <input type="checkbox"/> EDT <input type="checkbox"/> EST				/ <input type="checkbox"/> EDT <input type="checkbox"/> EST			
End Time (Date/Time)	/ <input type="checkbox"/> EDT <input type="checkbox"/> EST				/ <input type="checkbox"/> EDT <input type="checkbox"/> EST				/ <input type="checkbox"/> EDT <input type="checkbox"/> EST			
Gear Type	<input type="checkbox"/> Water Bottle <input type="checkbox"/> <u>Tygon</u> Tube <input type="checkbox"/> Sampling Pole <input type="checkbox"/> Auto Sampler <input type="checkbox"/> Van Dorn <input type="checkbox"/> Other <input type="checkbox"/> Basket <input type="checkbox"/> N/A				<input type="checkbox"/> Water Bottle <input type="checkbox"/> <u>Tygon</u> Tube <input type="checkbox"/> Sampling Pole <input type="checkbox"/> Auto Sampler <input type="checkbox"/> Van Dorn <input type="checkbox"/> Other <input type="checkbox"/> Basket <input type="checkbox"/> N/A				<input type="checkbox"/> Water Bottle <input type="checkbox"/> <u>Tygon</u> Tube <input type="checkbox"/> Sampling Pole <input type="checkbox"/> Auto Sampler <input type="checkbox"/> Van Dorn <input type="checkbox"/> Other <input type="checkbox"/> Basket <input type="checkbox"/> N/A			
Gear Serial #												
Composite (Type)	<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> <u>Flow</u> <input type="checkbox"/> <u>Time</u> <input type="checkbox"/> <u>Depth</u>				<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> <u>Flow</u> <input type="checkbox"/> <u>Time</u> <input type="checkbox"/> <u>Depth</u>				<input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> <u>Flow</u> <input type="checkbox"/> <u>Time</u> <input type="checkbox"/> <u>Depth</u>			
Field Lat/Long	/				/				/			
Field Lat/Long Method	<input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Other: <input type="checkbox"/> Handheld GPS				<input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Other: <input type="checkbox"/> Handheld GPS				<input type="checkbox"/> GETAC F110 Tablet <input type="checkbox"/> Other: <input type="checkbox"/> Handheld GPS			
Sample Notes												
Bottle Group	Planned	Collected	Preserved In Field	Filtered In Field	Planned	Collected	Preserved In Field	Filtered In Field	Planned	Collected	Preserved In Field	Filtered In Field
Bacteria_(B)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Na ₂ S ₂ O ₃	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Na ₂ S ₂ O ₃	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Na ₂ S ₂ O ₃	<input type="checkbox"/> Y <input type="checkbox"/> N
Nutrient_(N)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₂ SO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₂ SO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₂ SO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N
Metals_(M)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
OrgCarb_(OC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₃ PO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₃ PO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> H ₃ PO ₄	<input type="checkbox"/> Y <input type="checkbox"/> N
Nutrient_(N3)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
Solids_(S)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
Chl a_(I)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
Color/Turb (R)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N
PFAS_(PF)	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Y <input type="checkbox"/> N

Appendix F
Fish Sample Log

[Required fields are highlighted in green]

Freshwater Species

Code	Common Name	Scientific Name
AE	American eel	<i>Anguilla rostrata</i>
AS	American shad	<i>Alosa sapidissim</i>
B	bluegill	<i>Lepomis macrochirus</i>
BB	brown bullhead	<i>Ameiurus nebulosus</i>
BC	black crappie	<i>Pomoxis nigromaculatus</i>
BBH	Blueback herring	<i>Alosa aestivali</i>
BT	brown trout	<i>Salmo trutta</i>
C	common carp	<i>Cyprinus carpio</i>
CB	creek chub	<i>Erimyzon oblongus</i>
CCS	creek chubsucker	<i>Semotilus atromaculatus</i>
CS	common shiner	<i>Luxilus cornutus</i>
CP	chain pickerel	<i>Esox niger</i>
EBT	eastern brook trout	<i>Salvelinus fontinalis</i>
FF	fallfish	<i>Semotolus corporalis</i>
GS	golden shiner	<i>Notemigonus crysoleucas</i>
LD	common dace	<i>Leuciscus leuciscus</i>
LMB	largemouth bass	<i>Micropterus salmoides</i>
LS	longnose sucker	<i>Catostomus catostomus</i>
NP	northern pike	<i>Esox Lucius</i>
P	pumpkinseed	<i>Lepomis gibbosus</i>
RT	rainbow trout	<i>Oncorhynchus mykiss</i>
SMB	smallmouth bass	<i>Micropterus dolomieu</i>
SS	spottail shiner	<i>Notropis hudsonius</i>
W	walleye	<i>Stizostedion vitreum</i>
WC	white catfish	<i>Ameirus catus</i>
WP	white perch	<i>Morone americana</i>
WS	white sucker	<i>Catostomus commersonii</i>
YB	yellow bullhead	<i>Ameiurus natalis</i>
YBS	redbreast sunfish	<i>Lepomis auritus</i>
YP	yellow perch	<i>Perca flavescens</i>

Marine Species

Code	Common Name	Scientific Name
AB	Atlantic bonito	<i>Sarda sarda</i>
AE	American eel	<i>Anguilla rostrata</i>
AM	Atlantic mackerel	<i>Scomber scombrus</i>
AS	American shad	<i>Alosa sapidissim</i>
BF	Bluefish	<i>Pomatomus saltatrix</i>
BSB	Black Sea Bass	<i>Centropristis striata</i>
C	Cunner	<i>Tautoglabrus adspersus</i>

Code	Common Name	Scientific Name
AB	Atlantic bonito	<i>Sarda sarda</i>
DF	Smooth dogfish	<i>Mustelus canis</i>
GSO	Grey sole	<i>Glyptocephalus cynoglossus</i>
M	Monkfish	<i>Lophius piscatorius</i>
PB	Atlantic menhaden/peanut bunker	<i>Brevoortia tyrannus</i>
PL	Plaice	<i>Hippoglossoides platessoides</i>
RS	Rainbow Smelt	<i>Osmerus mordax</i>
SB	Striped bass	<i>Morone saxatilis</i>
SC	Scup	<i>Stenotomus chrysops</i>
SF	Summer Flounder	<i>Paralichthys dentatus</i>
SH	Silver hake/whiting	<i>Merluccius bilinearis</i>
SK	Little Skate	<i>Leucoraja erinacea</i>
SS	Striped sea robin	<i>Prionotus evolans</i>
T	Tautog	<i>Tautoga onitis</i>
WK	Weakfish	<i>Cynoscion regalis</i>
WF	Winter Flounder	<i>Pseudopleuronectes americanus</i>
WP	White perch	<i>Morone americana</i>
YT	Yellowtail flounder	<i>Limanda ferruginea</i>

Sex

Code	Sex
M	Male
F	Female

Sample Type

Code	Type
I	Individual (Grab)
C	Composite

Collection Method-Gear

SHOCK: Backpack
SHOCK: Boat
SHOCK: Pram
SHOCK: Stream-side
Netting: Gill Net
Netting: Other (Specify)
Rod and Reel
Hook and Line
Trot line
Trap
Other: (Specify)

Bio_Part_Name

Code	Bio Part
FF-R-SOFF	Fish fillet, right, skin off
FF-R-SON	Fish fillet, right, skin on
WF-SOFF	Whole fish, homog., skin off
WF-SON	Whole fish, homog., skin on
WORG	Whole organism
<i>Specify in comments</i>	Other

**MassDEP/DWM/Watershed Planning Program
Shellfish Toxics Field/Bench Sheet (2024)**

**Appendix G
Shellfish Sample Log**

[Required fields are highlighted in green]

**MassDEP/DWM/Watershed Planning Program
Shellfish Toxics Field/Bench Sheet (2024)**

MassDEP/DWM/Watershed Planning Program
Shellfish Toxics Field/Bench Sheet (2024)

Project: PFAS (2024)			Waterbody Name/Town:				Unique ID:		
Date-Time:			Field Lat/Long: /				Lat/Long Method:		
FS Login ID:			Crew Lead:			Crew:			
Sample Code	Species	Length (mm)	Weight (g)	Sex (M or F)	Sample Type (I or C)	Bio Part Name	Collection Method-Gear	Comments	
								<i>Composite sample</i>	
								<i>Composite sample</i>	

**MassDEP/DWM/Watershed Planning Program
Shellfish Toxics Field/Bench Sheet (2024)**

MassDEP/DWM/Watershed Planning Program
Shellfish Toxics Field/Bench Sheet (2024)

Project: PFAS-2024			Waterbody Name/Town:				Unique ID:	
Date-Time:			Field Lat/Long: /				Lat/Long Method:	
FS Login ID:			Crew Lead:			Crew:		
Sample Code	Species	Length (mm)	Weight (g)	Sex (M or F)	Sample Type (I or C)	Bio Part Name	Collection Method-Gear	Comments
								<i>Composite sample</i>
								<i>Composite sample</i>

Marine Shellfish Species			
Code	Common Name	Species	Family
SSC	Soft shell clam	<i>Mya arenaria</i>	Mydae
Q	Quahog	<i>Mercenaria mercenaria</i>	Veneridae
BM	Blue mussel	<i>Mytilus edulis</i>	Mytilidae
O	Oyster	<i>Crassostrea virginica</i>	Ostreoidea
SU	Sea urchin	<i>Lytechinus variegatus</i>	Echinidae
CW	Channeled whelk	<i>Busycotypus canaliculatus</i>	Buccinidae
KW	Knobbed whelk	<i>Busycon carica</i>	Buccinidae
RC	Razor clam	<i>Ensis leei</i>	Pharidae
SC	Surf clam	<i>Spisula solidissima</i>	Mactridae

Sample Type

Code	Type
I	Individual (Grab)
C	Composite

Collection Method - Gear

Rake
Other: (Specify)

Bio_Part_Name

Code	Type
EP	Edible portion
WORG	Whole organism
G	Gonads (sea urchins)
<i>Specify in comments</i>	Other

Appendix H
Benthic Macroinvertebrate Sample Log

[Required fields are highlighted in green]

**MassDEP/DWM/Watershed Planning Program
Benthic Macroinvertebrate Toxics Field/Bench Sheet (2024)**

Class or Group

Code	Class	Common names included (specify in field sheet)
IN	Insecta	Beetles, springtails, true flies, mayflies, true bugs, moths, scorpion flies, dobson flies, alderflies, lacewings, dragonflies, damselflies, stoneflies, and caddisflies
CRU	Crustacea	Crayfish
GAS	Gastropoda	Snails and clams
CBI	Combined	Combined benthic invertebrates

Sample Type

Code	Type
I	Individual (Grab)
C	Composite

Collection Method/Gear

Code	Method/Gear
D	D-Frame net
P	Ponar sampler
Other	Specify in notes

Bio-Part

Code	Bio_Part_Name
WORG	Whole organism

Appendix I
Chain-of-Custody Form



2045 Mills Road West TEL: (250) 655-5800
 Sidney, British Columbia, Canada V8L 5X2 FAX: (250) 655-5811

CHAIN OF CUSTODY

AXYS CLIENT #:

REPORT TO:			INVOICE TO:			ANALYSIS REQUESTED				
Company _____			Company _____							
Address _____			Address _____							
_____			_____							
Contact _____			Contact _____							
Phone _____			Phone _____							
FAX _____			FAX _____							
E-mail _____			E-mail _____							
Project Name/Number: _____			Sampler's Name: _____							
			Signature: _____							
Client Sample Identification	Matrix	Sampling Date	Sampling Time	Container Type/No.	AXYS Lab Sample ID (Lab use only)					
Relinquished by (Signature) _____			Received by (Signature) _____			Courier _____		Waybill No. _____		
Date _____ Time _____			Date _____ Time _____							
Relinquished by (Signature) _____			Received by (Signature) _____			Sample Receipt				
Date _____ Time _____			Date _____ Time _____							
Remarks								Cooler		
						Temp °C				
						Custody Seal #				
						Seal Intact Y / N				
						Sample Tags		Y / N		