DEPARTMENT OF ECOLOGY
State of Washington

Standard Operating Procedure
EAP015, Version 1.4

Manually Obtaining Surface Water Samples

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Purpose of this Document

The Washington State Department of Ecology develops Standard Operating Procedures (SOPs) to document agency practices related to sampling, field and laboratory analysis, and other aspects of the agency's technical operations.

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SIGNATURES AVAILABLE UPON REQUEST

The Washington State Department of Ecology's (Ecology's) Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Revision History	Summary of Changes	Sections	Revisers
10/10/2006	1.0	Formatting; signatories	All	Bill Kammin
7/1/2010	1.1	Three-year review	All	Kammin
6/26/2013	1.2	Three-year review	All	Trevor Swanson
7/28/2016	1.3	Three-year review/recertification. Made quite a few changes to update references and links to manuals, SOPs, and websites.	All	Eiko Urmos-Berry
7/18/2019	1.4	Converted SOP to new template, updated Figure 1 photo, added alt text to all figures and photos, updated references and links, and fixed minor grammatical errors.	All	Eiko Urmos-Berry
8-9-2021	1.4	Applied Accessibility standards	All	Joan LeTourneau

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for manually obtaining surface water samples.

1.2 This includes procedures for collecting samples from lotic and lentic waterbodies, wastewater treatment plant access points, and outfalls, pipes, and drains. It also describes procedures for sampling while wading on beaches and from boats and bridges. This SOP does not describe the operation of unattended automated sampling devices, nor does it cover pelagic marine or groundwater sampling.

2.0 Applicability

2.1 This SOP should be followed when manually collecting samples from surface waters as described in section 1.2.

3.0 Definitions

3.1 Composite sample: A sample in one container comprised of discrete sub-samples collected spatially, temporally or both.

3.2 Grab sample: A sample collected during a very short time period at a single location.

3.3 Halocline: The depth where salinity increases rapidly over a relatively short depth interval in a manner similar to temperature in a thermocline.

3.4 Integrated sample: A sample comprised of continuously collected sub-samples from a water column or across a cross section of a waterbody - differentiated from a composite sample by the term ‘continuously collected.’

3.5 Intermediate sampling container: A temporary sampling container used to directly sample water and transfer it to the primary container. Often, 500 or 1000 mL polypropylene containers are used as intermediate containers to collect samples for transfer to smaller bottles, which often contain acids or other preservatives.

3.6 LAR: Laboratory Analysis Request form.

3.7 Lotic: Flowing water systems such as rivers and streams.

3.8 Lentic: Still water systems such as lakes and ponds.

3.9 MEL: Manchester Environmental Laboratory

3.10 Pelagic: Waters of open seas, oceans, or lakes that are not near the shore.

3.11 Thalweg: The line defining the points along the length of a river bed with the greatest volume of moving water.

3.12 Thermocline: A distinct layer in a waterbody in which temperature changes more rapidly with depth than it does in the layers above or below, usually at a rate of 1º C or more for each 1 meter of depth.

3.13 Thiosulfate: A chemical MEL puts into sampling containers to rapidly dechlorinate water samples, especially those taken at wastewater treatment facilities.

4.0 Personnel Qualifications/Responsibilities

4.1 All field staff must comply with the requirements of the EAP Safety Manual (Ecology, 2019). A full working knowledge of the procedures in Chapter 1 - General Field Work, especially the sections titled Working in Rivers and Streams, Working near Traffic and from Bridges, and Fall Protection, is expected. Sampling from a boat requires one person onboard to be a qualified boat operator and all persons onboard must be familiar with Chapter 3 of the EAP Safety Manual - Boating.

4.2 All field staff must be familiar with other standard procedures for sampling water quality parameters described in this SOP. Several water quality parameters have special sample pre-treatment, filtering, post-treatment, and collection procedures applicable to this SOP. If a vertically (depth) integrated sampler is to be used, field staff should read Isokinetic Depth-Integrated Sampling Methods, Chapter A4, section 4.1.3 (USGS, 2006).

4.3 The field lead directing sample collection must be knowledgeable of all aspects of the project's Quality Assurance Project Plan (QAPP) to ensure that credible and useable data are collected. All field staff should be briefed by the field lead or project manager on the sampling goals and objectives prior to arriving to the site.

4.4 All field staff must comply with EAP Procedure 1-15, *Minimizing the Spread of Aquatic Organisms* (EAP, 2010), found at:
http://teams/sites/EAP/EAPProcedures/01-15InvasiveSpecies.pdf
and SOP EAP070, *Minimizing the Spread of Aquatic Invasive Species* (Parsons et al, 2018) found at:
https://apps.ecology.wa.gov /publications/SummaryPages/1803201.html

4.5 This SOP pertains to all Natural Resource Scientists, Environmental Engineers, Environmental Specialists, Hydrogeologists, and Interns and Technicians in WA Department of Ecology's Environmental Assessment Program.

5.0 Equipment, Reagents, and Supplies

5.1 Equipment and Supplies

5.1.1 Intermediate sampling containers and devices (e.g., 500 or 1000 mL bottles, syringe for field filtering, stainless or Teflon dipper, depth integrated sampler, Van Dorn or Kemmerer sampler, appropriate ropes/cables/rods, mobile bridge crane or davit) (Figure 1).

Figure 1
Top (left to right): **Weighted sampler with bottles and dissolved oxygen bucket for bridge sampling; Kemmerer bottle.**
Bottom (left to right): **Van Dorn sampler; DH-76 depth integrated sampler with bottle.**

5.1.2 Sampling extension pole with sampling container attachment.

5.1.3 Glass or polypropylene bottle supplied by the laboratory with appropriate preservatives and filtering devices (Figure 2).

5.1.4 Safety equipment appropriate for the sampling sites: safety vests and lines, personal floatation devices (PFDs), bridge traffic control signs and cones, or boating safety equipment.

5.1.5 Latex gloves for hygienic protection; leather gloves for handling ropes and cables.

5.1.6 Anti-bacterial hand sanitizer or soap.

5.1.7 Coolers.

5.1.8 Ice (Regular, blue, or dry – depending on shipping method).

5.1.9 Deionized water.

5.1.10 Sample tags with sample numbers assigned by MEL

5.1.11 LAR forms.

5.1.12 Field notebook and pens.

5.1.13 Disinfection solutions, brushes, or other equipment necessary to minimize the spread of invasive species from site to site. See EAP Policy 1-15 for more information.

5.1.14 Sampling containers

- The most common containers for sampling surface waters in EAP are made of polypropylene or glass. The MEL manual (MEL, 2016) describes the type of bottle and volume of sample necessary to complete the laboratory analysis. The containers usually come directly from MEL and some may have chemicals to stabilize or neutralize the sample.

Figure 2: Sample containers commonly used for water samples.

- Check bottles for loose lids. Damaged or leaking containers should be recycled or discarded.
- Containers left over from previous projects should be closely inspected before using. Bottles with old or discolored preservative should be sent back to MEL for proper disposal. Fecal coliform sampling bottles, 500 and 1000 mL polypropylene bottles, and 500 mL Teflon metal sampling bottles (and associated Teflon vials with nitric acid preservative) should also be sent back to MEL for reuse. Most other bottles can be recycled or discarded as necessary. Check with MEL if there is a question on whether a bottle can be reused.
- Holding times for sterilized microbiological sample bottles are 6 months. MEL does not guarantee that bottles are sterile after 6 months. Check the MEL manual (MEL, 2016).
- For efficiency, some parameters can be combined into one container. Check the MEL manual (MEL, 2016).

6.0 Summary of Procedure

6.1 Pre-sampling Preparation

6.1.1 File an EAP Field Plan. This plan also includes a section to enter information pertaining to a Float Plan. Forms are available and should be posted on the EA Program SharePoint site at: http://teams/sites/EAP/Field%20Schedules/Forms/AllItems.aspx

6.1.2 Obtain proper sample bottles from the laboratory and arrange for sample analyses. MEL's sample container request and pre-sampling notification forms are available at http://teams/sites/EAP/manlab/LabUsers/SitePages/Home.aspx. MEL will provide lab sample numbers after forms are submitted.

6.1.3 Obtain ropes, extension poles, meters, and intermediate sampling devices through equipment check-out procedures.

6.1.4 Notify the laboratory at least two weeks prior to sampling, especially if special preparations are needed for your samples or the parameters have a short holding time.

6.1.5 Sampling on Thursday through Sunday must be pre-approved with the laboratory for bacteria and other analyses with short holding times.

6.1.6 If the range of concentrations can be estimated before sampling (from past samples or otherwise), inform the lab beforehand or write it on the sample tags so the proper set of dilutions can bracket the range.

6.1.7 If the water is extremely turbid (<25 mL can be filtered) the laboratory may need to modify its analytical method. Call the lab as soon as possible so they can prepare for adjustments.

6.1.8 Prior to collecting sample, prepare sample ID tags containing the project name, sample number, site, date, parameter, and space for time. Also, prepare a field lab book or page with similar information.

6.1.9 Pre-book air transportation for sample coolers if possible. For ground shipments, check on delivery times and last shipment times for the day.

6.2 General Considerations and Cautions

6.2.1 Never compromise your personal safety or that of a field partner to collect a water sample. Always plan ahead to avoid falling and drowning hazards.

6.2.2 If only one sample is taken from a site in a lotic system, collect it in, or as close as safely possible, to the thalweg or predominant downstream current. Avoid back eddies and side channels that would not be representative of the water quality affecting downstream sites. If stratification is present, consider sampling the strata individually.

6.2.3 If collecting samples along a transect while wading, set-up a tag line for safety and to help keep a straight transect.

6.2.4 If only one sample is taken from a site in a lentic or estuarine system, determine the most representative site to safely sample and achieve the goal of the project. Determine if stratification is present with a thermistor, salinometer, or by other means. If stratification is present, consider sampling the strata individually. Note the depth of the halocline or thermocline in the field notebook and the depth where a sample was collected.

6.2.5 Do not rinse a sterilized sample container or one that contains preservative.

6.2.6 Collect water samples after performing other field tasks if they cannot immediately be stored in a cool, dark place.

6.2.7 Be careful not to disturb sediment from the stream bed, particularly in slower moving waters. If sample contamination from stirred sediment is an issue, collect samples from the bank using a sampling extension pole while avoiding touching the stream bottom.

6.2.8 If sampling from a bridge, find the thalweg and determine if the current is too strong for a weighted sampling device to sink and obtain a representative sample.

6.2.9 If sampling from a boat, avoid gas and oil contamination. Collect the sample from near the bow while the boat moves upstream or upwind.

6.2.10 Before leaving the sampling site, inspect and clean all equipment (sampling devices, ropes, boots, etc.) to the level required by EAP070 – Minimizing the Spread of Invasive Species.

6.3 Direct Sampling

6.3.1 Remove stopper/lid from container just before sampling. Be careful not to contaminate the cap, neck, or the inside of the bottle with your fingers, wind-blown particles, or dripping water from your clothes, body, or overhanging structures.

6.3.2 If no preservative is present in the container, face upstream in lotic waters and upwind in lentic waters and proceed as follows:

6.3.3 Hold the container near its base, reach out in front of your body, and plunge it (mouth down) below the surface to about mid-water column. If the water is so shallow that this technique will disturb sediment and contaminate the sample, it may be necessary to collect a surface water sample. Make sure to note your change of methods, if any.

6.3.4 Fill the bottle to the appropriate level depending on the analyte to be tested.

6.3.5 Pour out a small volume if needed to create a headspace for mixing in the lab. Do not create a headspace for some analytes like volatile organics and alkalinity.

6.3.6 If an extension pole is used from a pier, dock, or from shore, securely attach the sample container (with its lid in place) to the holder with the clamps or bands. Remove the container lid, being careful not to contaminate the container, and follow the above procedure. Do not use this method for samples that already have preservative in the container; use methods outlined in 6.4 - Sampling with Intermediate Devices and Containers.

6.3.7 If preservative is present in the container and you can reach the water with your hand, use the following procedure:

6.3.8 Hold the container upright and place the lid over the mouth so that only a small area forms an opening (Figure 3).

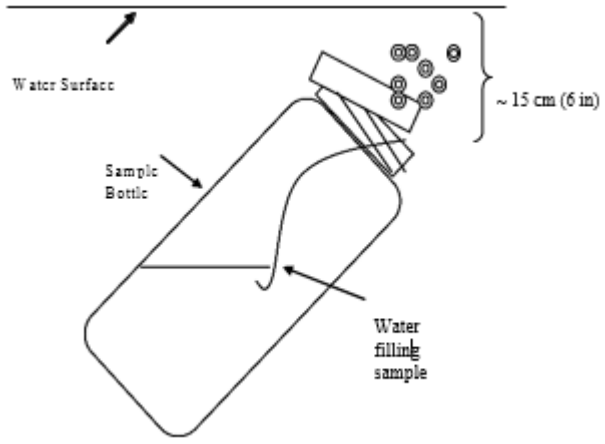

Figure 3: Illustration of the cap position of a sample container that already contains a preservative while filling with a sample.

6.3.9 Immerse the bottle about 15 cm (6 inches) under the water surface while holding the cap in position with your fingers as far away from the opening as possible.

6.3.10 Observe the rate the container is filling and remove it from the water before the headspace area is reached. If overfilling occurs, get a new sample container and repeat.

6.3.11 This procedure does not work well in fast moving, shallow water. Use procedures in section 6.4 if this is the case.

6.3.12 Sample free-falling water from drains, pipes, and outfalls by using an intermediate sampling device if necessary

6.3.13 Replace the lid of the container. Invert it several times to evenly mix any preservative with the sample.

6.3.14 Rinse any large amount of dirt or debris from the outside of the container.

6.3.15 Mark the time on the sample ID tag, and then attach it to the container. Place in appropriate storage.

6.4 Sampling with Intermediate Devices and Container

6.4.1 Triple rinse an intermediate container (Figure 1) with site water and pour the rinsate away from or downstream of the sampling location. If used in a contaminated environment (e.g. wastewater treatment plant, stormwater drain), it should be washed with soap and water and rinsed off-site before use. Some organic and micronutrient sampling procedures require acid and deionized water rinses as well. For especially turbid sites, be sure to inspect and rinse out any sediment or organic debris that may have collected at the bottom of the container. If there is any doubt, use a new and clean container to sample.

6.4.2 Fill the intermediate container with water following the technique described in 6.4.1 as closely as possible. Submerge the container to a depth that does not disturb bottom sediments, but also avoids sampling the surface layer.

6.4.3 For vertically (depth) integrated samples, raise and lower the sampler at a constant rate. If the sample container is overfilled or underfilled, dump the sample and adjust the transit rate or try a different nozzle size (USGS, 2006).

6.4.4 Kemmerer or Van Dorn bottles should be lowered to an appropriate depth and triggered with a messenger. Be aware that messengers may not work if the messenger is too light for the transit depth to the bottle.

6.4.5 Sticks and leaves can be removed from the bucket or dipper if contamination of the sample can be avoided. Gently mix the water in the intermediate container by swirling before pouring it into the sample containers if using an open-top container, or slowly inverting three times if using a closed-top container. From the intermediate container, carefully fill the sample containers, leaving adequate headspace as needed. Do not overfill. Put a note in the field notebook if you suspect that sand or other heterogeneous materials were not adequately represented in the sample.

6.4.6 Release the first 50 - 100 mL from the Kemmerer or Van Dorn sampler outlet before beginning to fill sample containers. Avoid contaminating the sample with your hands or with the outlet extension tube.

6.4.7 Securely replace the stopper/lid of each sample container. Invert several times to evenly mix preservative with the sample.

6.4.8 Rinse any large amount of dirt or debris from the outside of the container.

6.4.9 Attach the ID tag. Place in appropriate storage.

6.5 Samples Collected from Bridges

6.5.1 Follow the guidelines in the EAP Safety Manual chapter, Working near Traffic and from Bridges. Sample from the bridge only if all safety precautions are taken and the risk of injury is negligible.

6.5.2 Pick a spot on the downstream side of the bridge and observe the following:

- Make sure you are over the thalweg of the water body.
- Is the current too swift for the weight of your sampler? Do you have enough rope/rods/cables to break the water's surface and overcome the downstream current velocity? Will you be able to pull a weighted bucket up against the force of the current?

- Are debris moving downstream or is there boat traffic moving upstream or downstream? If conditions warrant, post an observer with a clear view of upstream and downstream conditions.
- If you do not know the depth of water at the site, roughly measure it. This is so the sampling device will not disturb bottom sediments when deployed.
- Clear any loose debris from the bridge railing and make sure the path from the railing to the water's surface is clear of obstructions.

6.5.3 If the DH-76 or other vertical (depth) integrated sampling device is being used, measure both depth and velocity at the transect points on the bridge. Mark transect points or stretch a tape along the bridge for easier reference.

6.5.4 Assemble, secure, and untangle the sampler with ropes/rods/cables and keep feet and legs clear of all ropes/rods/cables. Be aware of bridge traffic.

6.5.5 If the DH-76 or other integrated sampling device is being used, install the correct nozzle size for the depth and velocities at the site.

6.5.6 Place a clean intermediate container or sterilized bottle into the sampler and secure carefully.

6.5.7 Remove the stopper/lid just before lowering the sampler-with-bottle down on the rope, and set it somewhere free of dirt or other sources of contamination.

6.5.8 Wear heavy duty gloves to protect your hands from rope burns. Lower the sampler in such a manner so as not to contaminate the open bottle with dirt or dripping water.

6.5.9 When approaching the water surface, lower the sampler to where the bottom of the sampler is touching the water surface. This will clean any debris on the bottom the sampler. If the sampler has a fin on it, the sampler will position itself with the flow. Then lower the sampler quickly to submerge and collect a sample.

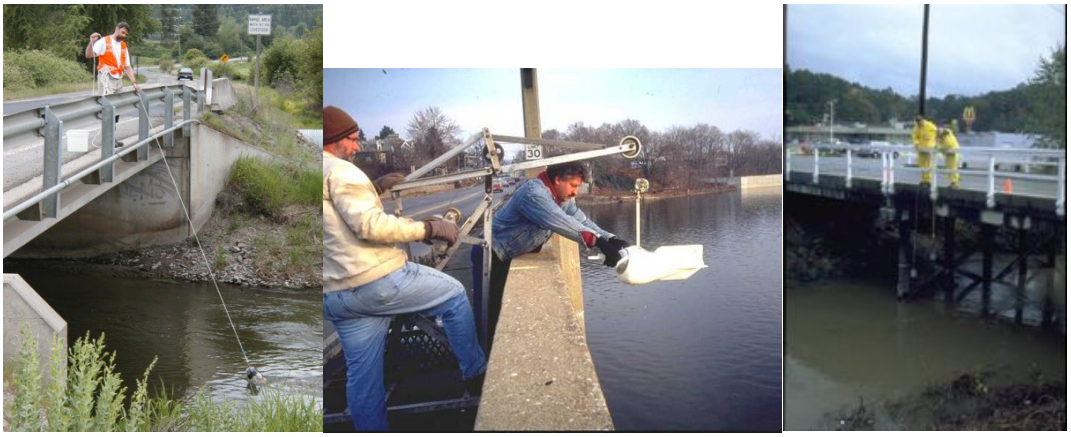

Figure 4: Various methods of collecting water samples from bridges.

6.5.10 Keep the bottle submerged long enough for the container or bucket to fill.

6.5.11 For vertically (depth) integrated samples, raise and lower the sampler at a constant rate. If the sample container is overfilled or underfilled, dump the sample and adjust the transit rate or try a different nozzle size (USGS, 2006).

6.5.12 Be aware that if Kemmerer and Van Dorn bottles are being used from bridges and the river current is swift, the messenger may not be able to trigger the closing mechanism.

6.5.13 Pull up the sampler and bottle; be careful not to contaminate the sample with dirt or water from either the rope or bridge, or other sources of contamination.

6.5.14 Pour out a small amount of the sample to allow for the air space needed for proper mixing at the lab (unless bottle contains preservative).

6.5.15 Replace the stopper/lid.

6.5.16 Rinse any large amount of dirt or debris from the outside of the container.

6.6 Samples Collected from Wastewater/Point Source Effluent

6.6.1 Conduct a reconnaissance of potential sampling sites with assistance from facility personnel. Attend to all safety precautions. Avoid confined spaces.

6.6.2 Locate an appropriate sampling location representative of water being discharged to the receiving water body. In particular, the location should be below any chlorination or ultra-violet (UV) application.

6.6.3 Use a sampling extension pole or dipper (Figure 4) to collect samples without contacting the effluent with your hands. Wear protective clothing and gloves.


a)

b)

Figure 5: a) Dipper and extension pole used from a streambank. b) Syringe and filter used for dissolved nutrient samples

6.6.4 Note residual chlorine concentrations on lab sample tags.

6.6.5 If sampling bacteria at a facility that uses chlorine for disinfecting its effluent, order bottles with thiosulfate from MEL, to neutralize the chlorine

6.7 Samples Collected from Marine Water Bathing Beaches

6.7.1 (Taken from the Beach Environmental Assessment, Communication and Health (BEACH) program guidance). More beach sampling information is available from the Quality Assurance Project Plan: BEACH Program (Sargeant, Lowe, 2014 and Ruffner, 2019).

6.7.2 Wade into roughly 2.5 feet of water.

6.7.3 Fill a water bottle at sampling sites by following procedures 6.3 or 6.4, as appropriate. If possible, use a sampling extension pole (Figure 4) to avoid collecting disturbed sediment.

6.8 Sample Labeling and Storage

6.8.1 After collecting the sample, immediately loop the string attached to the proper sample tag over stopper/lid until secure. Make sure to attach sample tag beneath, not on top of, the aluminum foil cover of microbiology bottles, as the covers can be easily separated from the sample during transport and handling.

6.8.2 Check the tag to ensure accurate location and analytical information. Record the time the sample was collected on the tag and enter relevant data into the field notes. Use waterproof ink or pencil.

6.8.3 Place labeled sample bottle in a cooler with ice. It is important to cool most samples to 6˚C immediately and store them in the dark.

6.9 Sample Transport

6.9.1 Samples transported from the EAP Operations Center (OC) by MEL courier.

6.9.2 Pack samples in regular cubed or crushed ice. Deliver samples to walk-in cooler at EAP OC and leave Lab Analysis Requested (LAR) forms in the "Out" box near the walk-in cooler. Make sure the LAR form contains the project name, station names, sample numbers, date, times, and parameters. The LAR form is available at: http://teams/sites/EAP/manlab/LabUsers/SitePages/Home.aspx. Carbon copy forms can be requested from the MEL courier.

6.9.3 Samples shipped via air or ground freight service

6.9.4 If glass containers are shipped to MEL, make sure they are adequately wrapped in "bubble" packing material to prevent breakage. Pack samples using blue ice. Cool to 4˚C and store in dark cooler. In warmer weather (80˚F and above), use ten to twelve blue ice packs per cooler. In cooler weather (below 80˚F) use six to eight blue ice packs, to avoid freezing samples. If you have access to dry ice, you may use it to ship **frozen** samples only. Be sure to contain the dry ice in newspaper or cardboard and to use packing materials around the sample containers. Also, use a well sealed container and include blue ice to keep the dry ice cold.

6.9.5 Put LAR form in a waterproof bag or tape it to the inside of the cooler lid and tape coolers shut after inspection. For air shipments, coolers must first be inspected by TSA. Make sure that coolers are taped shut after inspection.

7.0 Records Management

7.1 Specifically list forms to be used and locations of files.

7.2 Each sample collection will be fully described in the field notebook with waterproof ink (e.g., date, time, location identification, sample laboratory identification number, sample type, analyses to be performed, and ancillary data). Entries will be kept neat and concise. Measures will be taken to avoid losing the field notebook.

7.3 Sample locations will be described in enough detail to find on an Environmental Information Management (EIM) System map cover. Otherwise, a global positioning system (GPS) unit will be used to record an accurate location. Coordinates will be recorded as per EIM requirements.

7.4 Information for each laboratory sample will be entered onto a LAR form when the samples are submitted to MEL or other analytical facility.

8.0 Quality Control and Quality Assurance

8.1 QA/QC procedures will be addressed thoroughly on a project-by-project basis in the QAPP for the project.

9.0 Safety

9.1 Identify products, supplies, reagents, and activities that pose a safety hazard of any kind. Refer to EAP HQ Safety Manual when appropriate.

9.2 All field staff must comply with the requirements of the EAP Safety Manual, especially Chapter 1 - General Field Work, which includes special circumstances like fall protection, working on bridges, and working in rivers and streams. Sampling from a boat requires one person onboard to be a qualified boat operator and all persons onboard must be familiar with Chapter 3 of the EAP Safety Manual, Boating.

9.3 For further field health and safety measures refer to the EAP Safety Manual: http://teams/sites/EAP/safety/FieldOpsandSafetyManual.docx

9.4 Heavy duty gloves will protect hands from rope burns when lowering intermediate sampling equipment from bridges. Care is necessary on bridges to keep lines, ropes, and cables clear of other equipment, legs, and traffic.

9.5 Preferably, latex gloves should be worn to avoid bacterial or chemical exposure while performing direct sampling. If gloves are not worn, hands should be cleaned using anti-bacterial soap or hand sanitizer after each sampling station. Before ingesting food or drink, dirty over-clothes should be changed and hands should be washed.

10.0 References

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10.4 Parsons, J. et al., 2018. Standard Operating Procedures EAP070, Version 2.2: Minimize the Spread of Invasive Species, Environmental Assessment Program, Olympia, WA. 33 pp. https://apps.ecology.wa.gov /publications/SummaryPages/1803201.html

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10.6 Quality Assurance internet site: https://ecology.wa.gov/About-us/How-we-operate/Scientific-services/Quality-assurance

10.7 Ruffner, J., 2018. Addendum to Quality Assurance Project Plan: Beach Environmental Assessment, Communication, and Health (BEACH) Program: Monitoring Washington State Marine Beaches. Environmental Assessment Program, Olympia, WA. 9 pp. https://apps.ecology.wa.gov /publications/SummaryPages/1803108.html

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