DEPARTMENT OF ECOLOGY
State of Washington

Standard Operating Procedure EAP039, Version 1.4

Obtaining Marine Sediment Samples

April 2023
Publication 23-03-205
[Recertified 2021]

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.

Publication Information

This SOP is available on the Department of Ecology's website at https://apps.ecology.wa.gov/publications/SummaryPages/2303205.html.

Ecology's Activity Tracker Code for this SOP is 12-073.

Recommended citation:
Weakland, S. 2021. Standard Operating Procedure EAP039, Version 1.4: Obtaining Marine Sediment Samples. Publication 23-03-205. Washington State Department of Ecology, Olympia https://apps.ecology.wa.gov/publications/SummaryPages/2303205.html. [Recertified 2021]

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Standard Operating Procedures EAP039, Version 1.4
Obtaining Marine Sediment Samples

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Recertified: July. 29.2021

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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	Reviser(s)
1/27/12	1.1	Recertified	All	Kammin
02/11/15	1.2	Recertified	All	S. Weakland
10/18/18	1.3	Update of equipment list; addition of new parameters; Recertified	All	S. Weakland
3/15/19	1.3	edited, formatted, updated for accessibility	All	J. Ponzetti
7/29/2021	1.4	Added detailed field procedures for processing megafauna	All	D. Burgess

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for obtaining marine sediment samples. This SOP covers station positioning, collection of sediment for infaunal, chemistry, and bioassay analyses, and sample handling. Sampling methods will, in general, follow those described in PSEP (1996).

1.2 Personnel from Ecology's Marine Monitoring Unit will lead all sample collection and sample processing.

2.0 Applicability

2.1 This SOP should be followed for all Puget Sound Assessment and Monitoring Program (PSAMP) Marine Sediment Component collection activities performed by Ecology's Marine Monitoring Unit.

3.0 Definitions

3.1 Composite sample — Collection of more than one sample from the same site, such that multiple samples can be analyzed as a single sample.

3.2 Grab sample — Surficial sediment sample obtained using a Van Veen sampler that has the jaws closed, no washout (sample leakage from side or bottom of grab), clear overlying water, undisturbed sediment surface, and sufficient depth of penetration into the seabed (Figure 1)

3.3 Benthic invertebrate sample — The entire contents of one side of the grab sampler that is collected for identification and enumeration of macroinvertebrates residing in the sediment.

3.4 Biomass - The amount of living matter present at any given time, expressed as mass per unit area or volume of habitat.

3.5 Megafauna (Size Class) – Benthic macroinvertebrate weighing more than 2 g.

3.6 SDS — Safety Data Sheets provide both workers and emergency personnel with the proper procedures for handling or working with a particular substance. A SDS includes information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill/leak procedures.

3.7 Van Veen sampler — A double 0.1 m^2 stainless steel sampler consisting of a set of jaws that shut when lowered into the surface of the seabed. It is used to collect surficial sediment samples with minimal disturbance to the sediment surface.

3.8 Wet weight – Refers to the weight of animal tissue including its contained water.

4.0 Personnel Qualifications/Responsibilities

4.1 All field staff must comply with the requirements of the Environmental Assessment Program Safety Manual (EAP, 2019. A full working knowledge of the procedures in Chapter 1, "General Field Work," and Chapter 2, especially the section "Handling

Formaldehyde," is expected. Sampling from an Ecology boat requires one person onboard to be a qualified boat operator as described in Interim Ecology Policy 11-60. All persons onboard must be familiar with Chapter 3 of the EAP Safety Manual, "Boating," and have participated in required EAP Boat Safety Training.

4.2 All field staff must be familiar with other standard procedures described for marine sediment collection and processing in this document. Several marine sediment parameters have special sample collection and post-treatment procedures applicable to this document.

4.3 The Field Lead directing sample collection must be knowledgeable concerning all aspects of the project's Quality Assurance Monitoring Plan (QAMP; Dutch et al., 2018) to ensure that credible and usable data are collected. All field staff should be briefed by the Field Lead on the sampling goals and objectives prior to arriving at the site.

5.0 Equipment, Reagents, and Supplies

General Equipment	Number Required
Double Van Veen grab	1
Weights for grab (with nuts and bolts)	4 in bucket
Hand dolly	1
Grab stand	1
1.0 mm sieve boxes	3
Outboard sieve tables	2
Hoses, 5/8" with flow adjusters and nozzle adapters	3
Spray nozzles	2
Tools (yellow tool box)	1
Adjustable wrenches	1
Channel locks	1
Crimping pliers	1
Duct tape	1
Hammer	1
Knife	1
Nuts and bolts	1

Pliers	1
Screw drivers	1
Set of box end/open end wrenches	1
V file (round metal file for grab hooks and rings)	1
Wire cable	4
Ice chests with extra ice	as many as possible
Deionized water	sm. wash bottle
Paper towels	4 rolls
Stackable modular plastic drawers	multiple
Black electrical tape	3 rolls
Bungee cords	10
Cellular phone and adapters	1
Clean rags (office in boat shed)	15
Clear mailing tape dispenser with 3 rolls	1 and 3
Clipboard with cover	1
Disposable latex gloves	20 pair
Drill, battery charger, and extra battery	1
Garbage bags	1 box
Blank hazardous material labels	10
Hose dividers	1
Indelible ink pens (extra fine and regular sharpies)	1 box
Kimwipes	2 boxes
Pencils	1 box
Pipettes	10 disposable
Razor blades	new package of 5
Refractometer and screw driver	1
Scissors	1

Thermometers with extra batteries	2
Field notebook	1
Field logs (on Rite-in-Rain paper)	
Preprinted vinyl sample labels	
Extra labels for sample containers, ice chest, and buckets	
37% Formaldehyde (100% Formalin)	
Liquinox soap	
Acetone	
Borax	1 box

Permits:

- WDFW Scientific Collection Permit (SCP)
- WDFW Hydraulic Project Approval (HPA)
- DNR Right of Entry
- Shoreline Exemption (applicable cities and counties)
- San Juan Refuge (if applicable)
- Tribal lands

5.2 **Chemistry Sampling Equipment**	**Number Required**
Siphon tubing (5 ft. long)	2
Stainless steel paddles for drill	1 large, 1 small
Stainless steel spatulas	2
Stainless steel spoons	2
Stainless steel pots with lids	2
60-mL plastic syringes with end cut off	6
Sediment Sample Container: (analyses required are project specific) size and type. Note: Number of containers is project specific. Extra containers are required to account for breakage or contamination.	

	Total Organic Carbon — 2-oz or 4-oz glass jars, 200 series, w/o certificate of analysis	
	Grain Size — 8-oz glass jars, 200 series, w/o certificate of analysis or 8-oz polyethylene jars	
	Grain Size Archive — 8-oz glass jars, 200 series, w/o certificate of analysis or 8-oz polyethylene jars	
	Biogenic silica — 50-mL polyethylene centrifuge tubes	
	δ^{13} and δ^{15}N stable isotopes — 50-mL polyethylene centrifuge tubes	
	Carbon and nitrogen — 4-oz glass jars, 300 series, organics-free with Teflon-lined lids, with certificate of analysis	
	Total sulfides — 4-oz glass jars, 300 series, organics-free with Teflon-lined lids, with certificate of analysis	
	Zinc acetate preservative for total sulfides samples — screw-capped vials containing 10 mL of zinc acetate	
	Total Metal — 4-oz glass jars, 300 series, organics-free with Teflon-lined lids, with certificate of analysis	
	PAH/Pesticide/PCB — 8-oz glass jars, 300 series, organics-free with Teflon-lined lids, with certificate of analysis	
	Chemistry archive sample — 16-oz glass jars, 300 series, organics-free with Teflon-lined lids, with certificate of analysis	
	Ice scoops	2
5.3	**Decontamination Equipment**	**Number Required**
	Wash bottles, lg. and labeled for acetone	2
	Pesticide-grade acetone	1 gal.
	Alconox or Liquinox soap	4 oz
	Scrub brushes, sm. (for grab)	2
	Wash bottles, lg. and labeled for Alconox soap	2
	Gloves	
	Small funnel to pour acetone into wash bottle	
5.4	**Infaunal Sample Equipment**	**Number Required**
	Scrub brushes, lg. (for screen boxes)	2

Plastic dust pans	1
Stainless steel metric rulers	3
5-gallon buckets with matching airtight lids (labeled with hazardous material stickers)	35
Plastic wide-mouth sample jars, various sizes	100
Pint ziplock sample bags	250
Internal infaunal labels (Rite-in-the-Rain paper)	2 per sample
Squirt bottles, lg.	3
Metal spoons	3
Forceps	3 pairs
37% Formaldehyde (100% formalin)[1] buffered, pre-measured in 100-ml aliquots	2 per site
5-gallon bucket with matching airtight lid, labeled with hazardous material sticker	10
Marble chips	16-oz jar
Spring scales of various sizes	2
Weigh baskets in various sizes	3
Flexible Measuring Tape	1
Field Megafaunal Biomass Data sheet	3

5.5	**Safety Equipment**	**Number Required**
	Life vests	5
	Survival suits (float suits)	5
	Safety goggles (in good condition)	2
	Eyewash stand	1
	Formaldehyde monitoring badges — STEL	6
	Formaldehyde monitoring badges — TWA	6
	First aid kit	1
	Duffel bags	2

	Steel-toed boots	4 pairs
	Rubber gloves	4 pairs
	Leather work gloves	4 pairs
	Hard hats w/chin straps or hat liners	2
	Rain gear	3
5.6	**Laboratory Equipment and Supplies**	**Number Required**
	37% Formaldehyde (100%Formalin)[1]	5 (1-gallon) jugs
	Sodium borate buffer	2 boxes
	Rose bengal crystals	
	100-mL formalin-resistant polyethylene bottles	100

[1] Formalin is known to be carcinogenic. Formalin is harmful if inhaled or absorbed through skin. It causes irritation to skin, eyes and respiratory tract. Formalin may be fatal or cause blindness if swallowed. Formalin cannot be made nonpoisonous. It is flammable as a liquid and a vapor.

6.0 Summary of Procedure

Pre-Sampling Trip Preparation

6.1.1 Throughout the year:

6.1.1.1 Fix any equipment that needs repairs.

6.1.1.2 Order and assemble all supplies (above) needed for next cruise.

6.1.1.3 Apply for collection permits.

6.1.2 At least one month prior to cruise:

6.1.2.1 Update all items in the Field Sampling and Shipping notebooks.

6.1.2.2 Complete and submit Preliminary Analysis and Bottle Request forms to Manchester Environmental Lab.

6.1.2.3 Get lab sample numbers from Manchester Environmental Lab.

6.1.2.4 Prepare all sample containers, ice chests, and buckets.

6.1.2.5 Prepare all labels.

6.1.2.5.1 Labels will have project name, sample number, analysis type, date, and laboratory sample number.

6.1.2.6 Reserve a vehicle for personnel and sample transport during crew shifts (i.e., to and from marina, restaurants, hotels).

6.1.2.7 Solicit volunteer crew members, if necessary.

6.1.2.8 Prepare rescreening schedule.

6.1.2.9 Respirator fit tests for anyone wishing to use respirator during rescreening.

6.1.2.10 File a "Field Work Plan and Contact Person" form.

6.2 Station Location, Positioning and Choosing Alternate Sites

6.2.1 The locations of individual sampling stations within a region are chosen as outlined in the Quality Assurance Monitoring Plan (QAMP; Dutch et al., 2018). Alternate locations are also provided for each station in a numbered sequence.

6.2.2 Positioning will rely on Differential Global Positioning System (DGPS) in NAD 1983 with expected accuracy of better than 5 meters.

6.2.3 If the coordinates provided prove to be inaccessible or there are only rocks and cobbles present at the location, the site will be moved 100 m seaward and tried again. Sites may be moved up to three times (total 300 m) per visit to the site. In some cases the location will be rejected and an alternate set of coordinates sampled.

6.2.4 Alternate locations are provided in a numbered sequence for sites that are inaccessible or are composed of materials that cannot be sampled, i.e., they have a substrate composed of rock, hard clay, cobble, shell and/or large wood waste chunks.

6.3 Formalin Mixing Procedures

6.3.1 Splash goggles and chemical-proof gloves must be worn when handling formalin.

6.3.2 Add 1/8 teaspoon of Rose Bengal crystals and 4 tablespoons of Borax to 1 gallon (3.785 liters) of 37% formaldehyde. Stir until well-mixed.

6.3.3 Fill at least 2 100-mL plastic jars for each sample to be collected.

6.3.4 Store 100-mL plastic jars in airtight, appropriately labeled plastic bucket for transport.

6.4 Decontamination Procedures

6.4.1 Prior to deployment of the sampler at each new location, scrub the sampler, stainless steel pot and lid, and utensils with site water and Liquinox; rinse with site water; rinse with a small quantity of pesticide-grade acetone; then rinse the stainless steel pot, lid, and utensils with site water. The sampler will be rinsed while traveling through the water when deployed.

6.4.2 After the stainless steel utensils have been used the first time at a station, place them in the homogenization pot with the sample, between grabs.

6.4.3 Cover homogenization pot with the lid between sampler deployments.

6.4.4 Between deployments at a station, rinse the van Veen sampler with site water only.

6.5 Deploying and Retrieving the van Veen Grab Sampler

6.5.1 Personnel deploying the grab will wear life vests, protective helmets, and steel-toed shoes any time the grab is suspended from the deck or at the water's surface.

6.5.2 The grab sampler is deployed and retrieved with a hydraulic winch to control the rate of descent and ascent. All samples are collected in depths of 6 feet or more (mean lower low water), the defined limit of the sampling area.

6.5.3 When retrieved from the water, the grab is immediately placed upon the grab stand and properly secured.

6.5.4 Once secured, the sampler and the contents are visually inspected to determine if the sample is acceptable. The following acceptability criteria, as described in PSEP (1987), should be satisfied:

6.5.4.1 Sediment is not extruded from the upper face of the sampler such that organisms may have been lost.

6.5.4.2 Overlying water is present (indicates minimal leakage).

6.5.4.3 The sediment surface is relatively flat (indicates minimal disturbance).

6.5.4.4 The entire surface of the sample is included in the sampler.

6.5.4.5 A sufficient depth of penetration was achieved. Acceptable minimum depth of penetration varies with sediment type, as follows:

6.5.4.5.1 4 – 5 cm for medium-coarse sand.

6.5.4.5.2 6 – 7 cm for fine sand.

6.5.4.5.3 > 10 cm for muddy sediment.

6.5.5 Unacceptable samples will be dumped overboard at a location away from the station.

6.5.6 Acceptable samples will have station information and a number of visually descriptive assessments and measurements made (salinity, sediment temperature, odor, etc.) and recorded on the field logs.

6.5.7 Prior to deploying the first grab at a station, or after the first acceptable grab is collected, adhere appropriate pre-prepared container labels to containers.

6.5.8 Determine which side of the grab will be used for the benthic macroinvertebrate sample and which for chemistry and other parameters.

6.5.9 Measure and record temperature and salinity for each station from benthic macroinvertebrate side of the grab.

6.5.10 Measure and record grab penetration depth from the benthic macroinvertebrate side of the grab for each grab deployment to collect infauna.

6.5.11 Complete the field log for each station sampled.

6.6 Collecting Sediment for Chemistry and Other Parameters

6.6.1 Samples for sulfides are collected before the overlying water in the grab is removed, to limit exposure of the sediment surface to the air.

6.6.2 Insert the 60-mL syringe vertically into the sediment in the chemistry side of the sampler while simultaneously pulling the plunger back, until the syringe is full. If the depth of sediment in the grab is insufficient, insert the syringe at an angle to fill it.

6.6.3 Place the open end of the syringe into the bottom of the labeled 50-mL glass jar and express the contents with the plunger so that the sediment spreads out in the jar to exclude air, until the jar and neck are completely full, leaving only a few millimeters of headspace. If additional sediment is needed to fill the jar, sample again with the syringe.

6.6.4 Immediately pour the contents of one 10-mL vial of zinc acetate to cover the exposed sediment surface and screw on the jar lid.

6.6.5 Place the sample jar on ice.

6.6.6 From the chemistry side of the sampler, siphon off the overlying water without disturbing the sediment.

6.6.7 To collect a sample for microplastics analysis, scoop the top 1 cm of sediment into a labeled 8-oz glass jar until the jar is full to the shoulder. Screw on the lid.

6.6.8 Place the jar into an ice chest.

6.6.9 Sediment to be composited for chemistry and other parameters (biogeochemistry, stable isotopes, biogenic silica, toxicity, or other parameters) is collected from undisturbed surficial sediment.

6.6.10 Scoop the top 2 – 3 cm of sediment from the grab and immediately place the sediment into a decontaminated stainless steel pot. After all of the surficial sediment is removed from the sampler, all utensils will be placed inside the pot and covered with a fitted lid to minimize oxidation, photo-activation, and contamination between grabs.

6.6.11 The grab sampler can now be opened to collect the benthic macroinvertebrate sample in the other half of the grab.

6.6.12 Sediment from both sides of the double van Veen grab may be used for chemistry and other parameters in subsequent deployments of the grab, until sufficient sediment has been collected for the composite.

6.6.13 When the appropriate volume of sediment is obtained at a site, composite and homogenize the sediment collected for chemistry and other analyses by stirring with a stainless steel spoon and/or a stainless steel paint stirrer until textural and color homogeneity is achieved.

6.6.14 After homogenization, pour or spoon the homogenized sediment into the appropriate pre-labeled sample jars. Leave a 1-cm headspace below the shoulder in jars that will be frozen (chemistry, chemistry archive), to allow for expansion of contents. Screw on the lids.

6.6.15 Place filled sample containers in appropriate ice chest.

6.7 Collecting and Preserving the Infaunal Sample

6.7.1 The benthic macroinvertebrate sample will be collected from one side of the double van Veen grab, usually from the first deployment.

6.7.2 Open the grab sampler and gently rinse the infaunal sample into a 1.0-mm mesh sieve.

6.7.3 If the sea state is rough enough to jeopardize the immediate sieving of the sample, or if an empty sieve is not immediately available, gently rinse the infaunal sample into a large plastic tub and cover the tub with a fitted lid.

6.7.4 After the inside of the grab and the grab stand are clean, move the 1.0-mm sieve to the sieve stand, and gently rinse (sieve) the sample through the sieve.

6.7.5 If the sample was rinsed into a tub, gently rinse the contents of the tub into and through the 1.0-mm sieve when conditions allow.

6.7.6 While sieving the sample, place all large organisms into a pre-labeled plastic sample container with a small amount of seawater as soon as they are found. This prevents excessive damage to the organisms by water pressure from the wash hose.

6.7.7 **Treatment of megafauna:** Some megafaunal organisms (those weighing >2 g) are easily identified in the field and may therefore be released after taxonomic identification, wet weight, and size measurements are collected. Workup and release of megafauna should take place while the sampling vessel is still on station to minimize holding time and avoid transporting animals to other areas of Puget Sound (Parsons et al., 2016).

Requirements for field ID and release:

- **Organism must weigh over 2 g.** Organisms weighing exactly 2 g on the scale should be preserved and brought back to the lab, as the field scale resolution is not fine enough to determine if they actually qualify as megafauna.

- **Must be able to make a positive field identification.** Some large polychaetes, some bivalves, and other megafaunal organisms with questionable

identifications should be excluded from field ID/measurement and preserved with the rest of the sample to avoid misidentification.

- **Megafaunal live/dead correction factor has been calculated for that species (see EAP043, section 6.7.7.7)**

Once it is determined than an animal has satisfied the requirements for field release, record the species name of the megafaunal organism on the data sheet. If there is more than one organism of a single species, record each individual on a separate line.

Obtain taxon-specific measurements as specified below and record on the data sheet. Using the measuring tape or ruler, measure length AND width/circumference for all specimens (to the nearest mm).

Stylatula elongata: 1. Length; 2. Width at mid-point of "base"

Molpadia intermedia: 1. Length; 2. Circumference at mid-point

Crabs – 1. Length (anterior margin to abdomen); 2. Carapace width at widest point

Bivalves – 1. Length (longest distance between anterior and posterior shell margins); 2. Width at widest point

Brisaster latifrons – 1. Length (not at notch); 2. Width at widest point

Obtain live wet weight of the specimen. Blot specimen for 30 seconds with a paper towel, place onto scale, and then air-dry for 1.5 minutes[1].

Record wet weight on data sheet to as much resolution as the scale will provide. Weights are in grams on the data sheet; measurements will later be converted to mg when data are entered into the database.

Gently release megafaunal organism(s) in a location as close to the original collection site as possible.

6.7.8 Remove messy organisms, such as cerianthid anemones, from the sample immediately and place them in a separate pre-labeled sample container with a small amount of seawater, to prevent entanglement with other organisms.

6.7.9 After as much sediment as possible is washed from the sample, carefully transfer all material retained on the screen to a pre-labeled plastic sample container (or more, as needed). Do not fill containers more than 1/2 to 2/3 full.

[1] From Vancouver Aquarium's Coastal Ocean Research Institute's (CORI) SSAMEx proposal: The 1.5-minute waiting period was selected in 2001 after comparing the results of repeatedly weighing organisms using various methods. It was determined that a 1.5-minute waiting period before weighing was unnecessary for smaller organisms.

6.7.10 Fix all benthic macroinvertebrate sample fractions with borax-buffered formalin by adding pre-measured buffered 37% formaldehyde, in the ratio of 100 ml of 37% formaldehyde to a 32-oz/1-L jar. Fill the remainder of the jar to the shoulder with seawater. The volume of fixative and water should be at least twice the volume occupied by the sample. Use more 37% formaldehyde for samples with large amounts of organic material (plant or woody debris). Fill the container with site water to the top.

6.7.11 Add 1/2 teaspoon of marble chips and seal the lid tightly. Gently invert the sample container several times to ensure that all contents are properly preserved.

6.7.12 Place all fixed samples into 5-gallon buckets with airtight lids for safe storage and transport.

6.7.13 Benthic macroinvertebrate samples must possess two labels per container:

1. An internal Rite-in-the-Rain label recorded with a HB graphite pencil.
2. An external vinyl label filled out with indelible ink.

6.7.14 Benthic macroinvertebrate sample labels must possess the following information: station number, replicate number, collection date, and sieve size (e.g., 13 Rep 2, 4/02/2005, 1.0-mm sieve).

6.7.15 Splash goggles and chemical-proof gloves must be worn when preserving samples in formalin.

6.7.16 Ecology personnel will conduct further processing of the 1.0-mm sieve sample (i.e., rescreening, sorting, taxonomic identification, data compilation and analysis) in the lab.

6.8 Sample Handling

6.8.1 Recommended sample sizes, containers, preservation techniques, and holding times for all sediment samples are those listed in the Manchester Environmental Laboratory Lab User's Manual (MEL, 2016) and can be found in the field notebook.

6.8.2 Samples for chemical and other analyses will be stored in appropriate containers and placed in insulated coolers filled with ice. Samples must remain chilled on ice while being stored on the boat.

6.8.3 Chemistry and toxicity samples will be off-loaded from the research vessel and transferred to the walk-in refrigerator at EAP Operations Center (OC) in Lacey.

6.8.3.1 Samples to be transported from the OC by MEL courier:

6.8.3.1.1 Pack samples in regular cubed or crushed ice. Deliver samples to walk-in cooler at OC and leave a copy of the appropriate chain-of-custody with lab analysis–required forms in the "Out" box near the walk-in cooler.

6.8.3.2 Samples shipped via air or ground freight service:

6.8.3.2.1 Samples must be contained in polypropylene containers, not glass. Pack samples using blue or dry ice (check with airline for restrictions on dry ice). Cool to 4°C and store in a 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. Tape a copy of the chain-of-custody form to the inside of the cooler and tape coolers shut after inspection.

6.8.3.2.2 Take the sealed cooler to the Ecology mail room to be shipped to the appropriate analytical laboratories.

7.0 Records Management

7.1 A new field data sheet[2] for recording wet weight biomass will be started at the beginning of each sampling season. Record project name/year at the top of the sheet.

7.2 Maintain all field logs and review them for completeness throughout the sampling day.

7.3 Keep a running inventory list of supplies needed for the following day (including 1-gallon containers for amphipod and urchin bioassays and buckets for infaunal samples).

7.4 Report, by telephone, by noon, to the Cruise Coordinator (or designated lab contact) any sample container and supply needs for the next day or the next crew shift.

7.5 Report, by telephone, after the last sample is collected, to the Cruise Coordinator, with details of sampling progress, any changes to itinerary, and if appropriate, rendezvous time with courier.

7.6 When arriving at the dock at the end of the day, close out the float plan with the designated contact.

8.0 Quality Control and Quality Assurance

8.1 Chain-of-custody procedures will follow those recommended by the PSEP (1997). They will be initiated when the first sample is collected and will be followed until all samples are relinquished to the analytical laboratory. Chemistry, bioassay, and benthic macroinvertebrate chain-of-custody forms designed for this project will provide an unbroken trail of accountability that ensures the physical security of samples, data, and records. At the end of each day, all sample containers are checked against toxicity, chemistry, and benthic macroinvertebrate chain-of-custody forms. It is important to verify the station identification number, collection date, collection time, and if applicable, lab numbers as part of the QA/QC procedures.

[2] http://teams/sites/EAP/MarineSediments/Sampdocs/Field%20Data%20Sheet_Megafaunal%20Biomass.xlsx?d=w5d4fae58091b4500bcc105d74a93eed3

9.0 Safety

9.1 Knowledge of the contents of this standard operating procedure is required. Follow general procedures for safety found in the Environmental Assessment Program Safety Manual (EAP, 2017).

9.2 The following forms must be completed to document field personnel, sampling locations, overnight lodging, itinerary, contact person(s), and emergency contacts:

9.2.1 Float plan

9.2.2 Contact person designation

9.2.3 Field sampling notification

9.3 Read the Formaldehyde Safety Data Sheets (SDS) before beginning this procedure. Ecology employees can find Chemical Safety Data Sheets (SDSs) for all chemicals used in the procedures outlined in this SOP on the internal EAP Quality Assurance SharePoint site.

9.4 Read the Ecology Chemical Hygiene Plan (Ecology, 2019), which includes laboratory safety orientation, job-specific orientation, and chemical safety procedures. The Standard Operating Procedures in Section 16 of the Chemical Hygiene Plan must be followed.

9.5 Also, binders containing SDSs can be found in all field vehicles, vessels, Ecology buildings, or other locations where potentially hazardous chemicals may be handled. EAP staff that follow Ecology SOPs are required to familiarize themselves with these SDSs and take the appropriate safety measures for these chemicals.

9.6 Read this standard operating procedure and discuss any questions with her/his supervisor or task team leader.

9.7 Participate in Ecology formalin safety training.

9.8 Never compromise your personal safety or that of a field partner to collect a sample. Always plan ahead to avoid falling and drowning hazards. Always wear appropriate safety gear such as life vests and steel-toed boots.

10.0 References

Burgess, D. 2018b. Standard Operating Procedure EAP128, Version 1.1: Standard Operating Procedure for Taxonomic Standardization of Benthic Invertebrate Data. Washington State Department of Ecology, Olympia.

CORI (Vancouver Aquarium's Coastal Ocean Research Institute). 2015. Proposal to PSEMP sediment group for harmonization of benthic invertebrate and sediment conventionals monitoring with SSAMEx.

Dutch, M., S. Weakland, V. Partridge, D. Burgess, and A. Eagleston. 2018. Quality Assurance Monitoring Plan: Revisions to the Puget Sound Sediment Monitoring Program. Publication 18-03-105. Washington State Department of Ecology, Olympia.

EAP [Environmental Assessment Program]. 2019. Environmental Assessment Program Safety Manual. Washington State Department of Ecology. Olympia, WA.

Ecology [Washington State Department of Ecology]. 2019. Chemical Hygiene Plan. Environmental Assessment Program Operations Center, Washington State Department of Ecology, Olympia.

MEL [Manchester Environmental Laboratory]. 2016. Manchester Environmental Laboratory Lab Users Manual, Tenth Edition. Manchester Environmental Laboratory, Washington State Department of Ecology, Manchester, WA.

Parsons, J., Hallock,D., Seiders, K., Ward, B., Coffin, C., Newell, E., Deligeannis, C., and K. Welch. 2016. Standard Operating Procedures to Minimize the Spread of Invasive Species. Version 2.1. Environmental Assessment Program, Washington State Department of Ecology.

PSEP [Puget Sound Estuary Program]. 1987. Recommended Protocols for Sampling and Analyzing Subtidal Benthic Macroinvertebrate Assemblages in Puget Sound: Final Report. Prepared by Tetra Tech, Inc. for U. S. Environmental Protection Agency Region 10, Office of Puget Sound.

PSEP [Puget Sound Estuary Program]. 1996. Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Prepared by Tetra Tech, Inc. for U. S. Environmental Protection Agency Region 10, Office of Puget Sound.

PSEP [Puget Sound Estuary Program]. 1997. Recommended Quality Assurance and Quality Control Guidelines for the Collection of Environmental Data in Puget Sound. Prepared by Tetra Tech, Inc. for U. S. Environmental Protection Agency Region 10, Office of Puget Sound.