DEPARTMENT OF
ECOLOGY
State of Washington

Addendum 6 to Quality Assurance Project Plan

The Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component, 2015 Monitoring at Long-term Stations

August 2015

Publication No. 15-03-117

Publication Information

Addendum

This addendum is on the Department of Ecology's website at
https://fortress.wa.gov/ecy/publications/SummaryPages/1503117.html

This addendum is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search Study ID: PSAMP_LT.

Activity Tracker code

Ecology's Activity Tracker code for this addendum is 01-900.

Original Publication

Quality Assurance Project Plan: The Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component

Publication No. 09-03-121: https://fortress.wa.gov/ecy/publications/publications/0903121.pdf

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August 2015

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1.0 Table of Contents

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2.0 Abstract

This addendum to the 2009 PSAMP Sediment Monitoring Component Quality Assurance Project Plan (QAPP) (Dutch et al., 2009) provides details about sampling locations, parameters, and sampling/analysis schedules for the April 2015 Long-term sampling program. All other quality assurance elements, including sampling methods, quality control, and data management, are as described in Dutch et al., 2009 and remain unchanged for the Long-term sampling program.

4.0 Project Description

Ongoing Sediment Monitoring Programs

The Washington State Department of Ecology (Ecology) Marine Sediment Monitoring Team conducts sediment sampling as part of the Puget Sound Ecosystem Monitoring Program (PSEMP)[1]. The PSEMP Sediment Component consists of three annual monitoring programs:

- Long-term[2] − Conducted at ten stations located throughout Puget Sound and sampled annually each April since 1989 (or longer).
- Regional[3] − Forty stations sampled within one of eight geographic regions annually each June since 1997. Sampling rotates among the regions over a ten-year period. A new set of randomly selected stations are sampled each time a region is revisited. NOTE: Regional sampling will not be conducted in 2015, as per the program's long-range planning schedule.
- Urban Bays[4] − Thirty randomly selected stations sampled within one of six urban bays annually each June since 2007. Sampling rotates among the bays over a six-year period. The same set of randomly selected stations is sampled each time an urban bay is revisited.

2015 Survey at 10 Long-Term Stations

This QAPP addendum provides detailed information about the schedule, budget, measurement quality objectives, parameter list, sampling procedures, and measurement methods for the 2015 sediment survey at the ten Long-term stations that differs from the original QAPP (Dutch, 2009). The numbering scheme for the sections of this addendum reflects Ecology's current required formatting for QAPPs and is not found in the original QAPP.

[1] Formerly known as the "Puget Sound Assessment and Monitoring Program (PSAMP)"
[2] Formerly known as "Long-term/Temporal"
[3] Formerly known as "Spatial/Temporal"
[4] An expansion of Ecology's "Urban Waters Initiative"

4.1 Objectives

The objectives of the 2015 Long-term sediment survey are to:

- Collect long-term data on physical and chemical sediment characteristics and macroinvertebrate communities at 10 long-term monitoring stations chosen from a variety of habitats and geographic locations throughout Puget Sound.
- Evaluate changes over time to these sediment characteristics and macroinvertebrate communities at the 10 long-term stations.
- Evaluate over time the condition of the macroinvertebrate communities in relation to natural and anthropogenic changes in sediment quality.
- Provide data for use by researchers and managers concerned with sediment quality.

4.4 Target Population and Sampling Locations

The target population of the 2015 Long-term sediment survey is the surface soft sediments and sediment-dwelling macroinvertebrate communities at ten Long-term monitoring stations sampled since 1989 (Figure 1).

5.0 Organization and Schedule

5.4 Project Schedule

Key activities for the PSEMP Long-term sediment monitoring work are listed in Table 1.

Table 1. Proposed schedule for completing the field and laboratory work, data entry into EIM, and reports for the 2015 PSEMP Long-term sediment monitoring program.

Field and laboratory work		
Field work completed		April 2015
Laboratory analyses completed		Total Organic Carbon – May 2015 Ammonia – May 2015 Total Sulfides – May 2015 Grain size – September 2015 Taxonomy – March 2016
Environmental Information System (EIM) system		
Product	Due date	Lead Staff
EIM data loaded	April 2016	Sandra Weakland
EIM QA	May 2016	Maggie Dutch
EIM complete	June 2016	Sandra Weakland
Final report		
Author lead		MSMT staff to be assigned
Schedule		
Summary statistics, tables and figures generated and posted to web		As they become available: July 2015 – March 2016
Draft due to supervisor		April 2016
Draft due to client/peer reviewer		May 2016
Draft due to external reviewer		May 2016
Final (all reviews done) due to publications coordinator		July 2016
Final report due on web		August 2016

5.6 Budget

The proposed budget for the PSEMP Long-term sediment monitoring is provided in Table 2.

Table 2. Project budget.

Parameter	Number of Samples	Number of QA Samples	Total Number of Samples	Cost Per Sample	Lab/Contractor	Total
TOC	30	3 (field split)	33	$43.60	MEL.	$1,438.80
Research vessel	No. of ship hours	n.a.	110	$160	Bio-Marine Enterprises	$17,600
Total Solids	30	3 (field split)	33	$5.00	Analytical Resources, Inc.	$165.00
Total Sulfides (bulk sediment)	30	3 (field split)	33	$30.00		$990.00
Total Sulfides (porewater)	30	3 (field split)	33	$20.00		$660.00
Ammonia (NH_3) (bulk sediment)	30	3 (field split)	33	$25.00		$825.00
Ammonia (NH_3) (porewater)	30	3 (field split)	33	$15.00		$495.00
Porewater Extraction	30	3 (field split)	33	$75.00		$2,475.00
Archive bottles	30	3 (field split)	33	$2.50		$82.50
Grain Size	30	3 (field split)	33	$80.00	Materials Testing and Consulting, Inc.	$2,640.00
Taxonomic identification	30	to be determined	30	$458.00	Contract Regional Taxonomists	$13,740.00
					Total:	$41,111.30

6.0 Quality Objectives

6.2 Measurement Quality Objectives

The Measurement Quality Objectives (MQOs) for total solids, ammonia, and total sulfides are given in Table 3. MQOs for all other parameters are given in the original QAPP (Dutch et al., 2009) and remain unchanged.

Table 3. Measurement quality objectives for laboratory analysis for total solids, ammonia (NH_3), and total sulfides (TS) in bulk sediments and in porewater.

<table>
<tr><th>Parameter</th><th>Field Blank</th><th>Field Replicate</th><th>Initial Calibration</th><th>Continuing Calibration</th><th>Calibration Blanks</th><th>Laboratory Control Samples</th><th>Matrix Spikes</th><th>Laboratory Replicates</th><th>Method Blank</th></tr>
<tr><td>Total Solids</td><td rowspan="5">Relative Percent Difference (RPD) < 20%</td><td rowspan="5">Duplicate analysis for 10% of samples, RPD < 20%</td><td>Not applicable</td><td>Not applicable</td><td>Not applicable</td><td>Not applicable</td><td>Not applicable</td><td rowspan="5">Triplicate analyses on one of every 20 samples; 20% Relative Standard Deviation (RSD)</td><td rowspan="5">Analyte concentration < PQL</td></tr>
<tr><td>Ammonia (bulk sediments)</td><td rowspan="3">Correlation coefficient for the standard curve > 0.990</td><td rowspan="2">90-110% recovery (calibration verification blank should return a value within 10% of its prepared concentration)</td><td rowspan="2">Analyte concentration < Practical Quantitation Limit (PQL)</td><td rowspan="2">80-120% recovery</td><td rowspan="3">75-125% recovery</td></tr>
<tr><td>Ammonia (porewater)</td></tr>
<tr><td>Total Sulfides (bulk sediments)</td><td rowspan="2">85-115% recovery</td><td rowspan="2">Not applicable</td><td rowspan="2">65-135% recovery</td></tr>
<tr><td>Total Sulfides (porewater)</td></tr>
</table>

7.0 Sampling Process Design

7.1 Study Design

7.1.2 Station Locations

Ten stations will be sampled (Figure 1, Table 4). These same ten sites were originally selected and sampled in 1989. With only a few exceptions, each has been sampled annually.

Table 4. Locations (latitude/longitude) for the 2015 PSEMP Long-term sediment monitoring stations in Puget Sound.

Station	Location	Target (NAD 83, decimal degrees)	
		Latitude	Longitude
3	Strait of Georgia	48.87025	-122.97842
4	Bellingham	48.68397	-122.53820
21	Everett	47.98547	-122.24283
29	Shilshole	47.70075	-122.45403
34	Sinclair Inlet	47.54708	-122.66208
38	Point Pully	47.42833	-122.39363
40	Commencement Bay	47.26130	-122.43730
44	East Anderson Island	47.16133	-122.67358
49	Budd Inlet	47.07997	-122.91347
13R	North Hood Canal	47.83758	-122.62895

7.1.3 Parameters Sampled

Standard sediment quality field measurements, macroinvertebrate abundance, grain size, and total organic carbon will continue to be collected, as per Dutch et al., 2009. Ammonia (NH_3) and total sulfides in bulk sediments and porewater are being added due to their potential toxicity to the benthic invertebrate assemblages (Table 5). A comparison will be conducted to determine differences in the levels of these parameters in the two sediment fractions. Total solids is added to allow for calculation of these ammonia and total sulfide values for bulk sediments in dry weight. Data collected for these parameters will be evaluated to assess their level of correspondence with benthos community data.

As a way to leverage additional scientific knowledge from our field efforts, a small amount of extra sediment will be collected from each station and distributed as a courtesy to various academic partners for pursuit of their own sediment-related research (Table 5).

Table 5. Parameters measured in sediments for the 2015 PSEMP Long-term sediment monitoring stations in Puget Sound.

Field Measurements
Sediment temperature
Salinity of overlying water
Macroinvertebrate Abundance
Total Abundance
Major Taxa Abundance
Taxa Richness
Calculated values:
Pielou's Evenness
Swartz's Dominance Index
Conventionals
Grain size
Total organic carbon
Total solids
Ammonia (NH_3) – in both bulk sediments and porewater
Total Sulfides – in both bulk sediments and porewater
Parameters measured by MSMT partners
Foraminifera - Dr. Liz Nesbitt, University of Washington-Seattle.
Microplastics - Dr. Julie Masura, University of Washington-Tacoma and Dr. Peter Hodum, University of Puget Sound (a potential joint project with the Marine Sediment Monitoring Team)
Alexandrium catenella cysts - Dr. Cheryl Greengrove, University of Washington-Tacoma.
Meiofauna - Dr. Brenda Burd, Vancouver Aquarium-British Columbia.

7.2 Maps

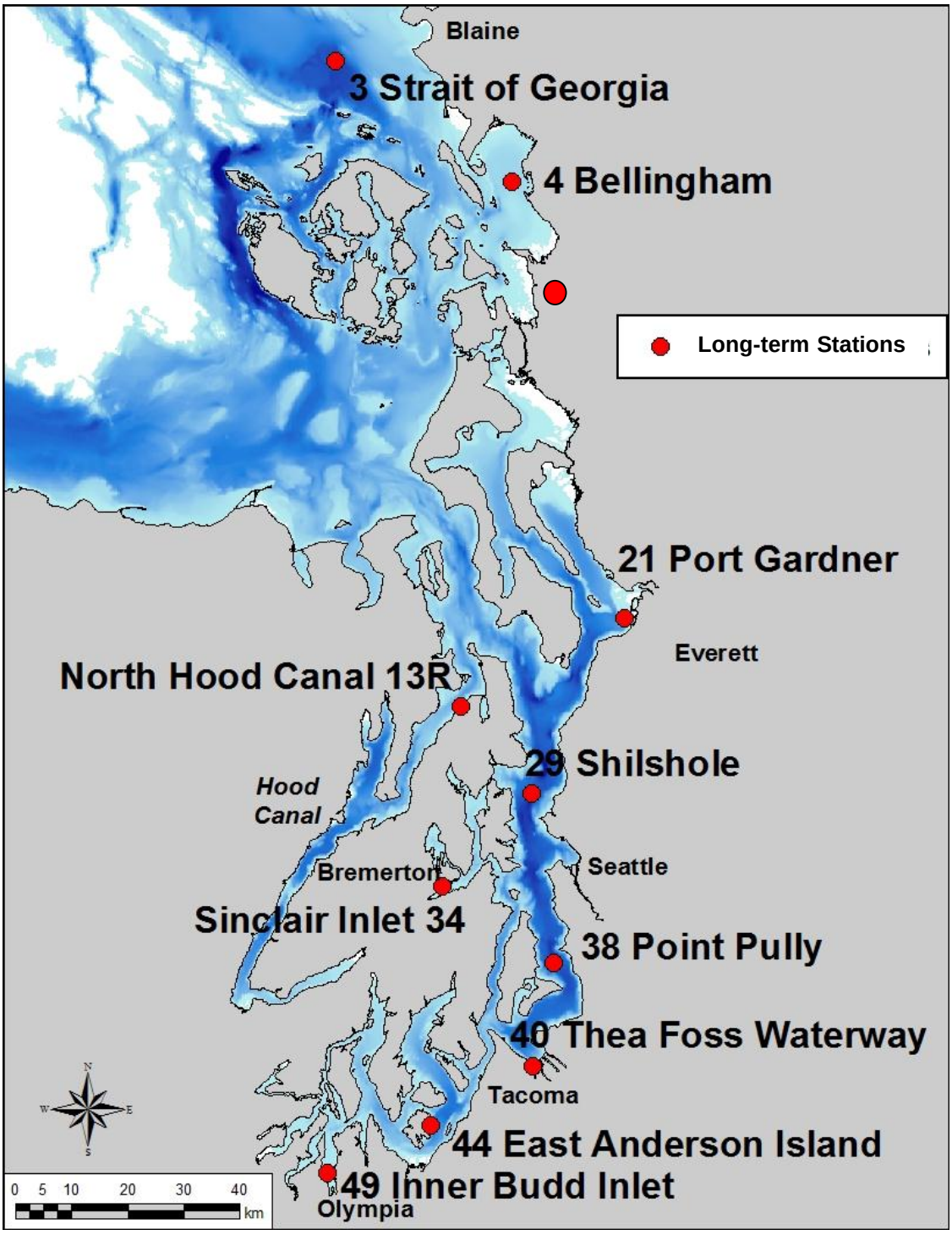

Figure 1. Ten PSEMP Long-term sediment monitoring stations in Puget Sound.

8.0 Sampling Procedures

8.2 Containers, Preservation Methods, Holding Times

Sample collection and preservation of sediment samples for analyses for total solids, ammonia, and total sulfides are given in Table 6. Sample collection and preservation of sediment samples for all other analyses are given in the original QAPP (Dutch et al., 2009).

9.0 Measurement Methods

9.2 Lab Procedures

Laboratory analysis and reporting requirements for analyses for total solids, ammonia, and total sulfides are given in Table 7. Laboratory analysis and reporting requirements for all other analyses are given in the original QAPP (Dutch et al., 2009).

Table 6. Sample collection and preservation for analyses for ammonia (NH_3) and total sulfides (TS) in bulk sediments and in porewater, and for analyses for pharmaceuticals and personal care products (PPCPs) and perfluoroalkyl substances (PFASs) in homogenized sediment.

Parameter	Size of Sediment Sample	Container	Preservation	Maximum Holding Time
Total Solids (bulk sediments)	4 oz (50g for lab work)	4 oz wide-mouth glass jar with Teflon-lined lid	Refrigerate at 4ºC	14 days
Ammonia (bulk sediments)	4 oz (25g for lab work)	4 oz wide-mouth glass jar with Teflon-lined lid	Refrigerate at 4ºC, sample should not be homogenized in field, no headspace or air pockets should remain	7 days
Total Sulfides (bulk sediments)	2 oz (50g for lab work)	2 oz wide-mouth glass jar with Teflon-lined lid	4°C, 5ml of 2 N zinc acetate for a 250 ml sample, sample should not be homogenized in field, no headspace or air pockets should remain	7 days
Ammonia/ Total Sulfides (porewater)	32 oz (600g for lab work)	32 oz wide mouth glass jar with Teflon-lined lid	Refrigerate at 4ºC, sample should not be homogenized in field, no headspace or air pockets should remain	7 days

Table 7. Laboratory analysis and reporting requirements for ammonia (NH_3) and total sulfides (TS) in bulk sediments and in porewater, and for pharmaceuticals and personal care products (PPCPs) and perfluoroalkyl substances (PFASs) in sediments.

Parameter	Extraction Method	Clean-up Method	Analysis Method	Technique/ Instrument	Expected Range of Results	Required Reporting Limit
Total Solids	Not applicable	Not applicable	PSEP, 1986/ASTM D-422	Muffle furnace – 550°C	0.01 – 100%	0.01%
Ammonia (bulk sediments)	Not applicable	Not applicable	Plumb, 1981/EPA 350.1M (sed); Standard Methods, 1995 4500-NH_3 H or EPA 350.1M (water)	Automated phenate, flow injection analysis (FIA). Measures ammonia as NH_3-N under alkaline conditions.	Unknown	0.1 mg/Kg
Ammonia (porewater)	Centrifugation of bulk sediments (DMMP/SMS, 1998)	Not applicable			0.01 – 1.00 mg/L	0.01 mg/L
Total Sulfides (bulk sediments) (PSEP, 1986)	Sediment is acidified under anoxic conditions to release sulfide as H_2S. The released H_2S gas is then trapped in zinc acetate solution to precipitate sulfide (as zinc or sodium sulfide). Finish analysis is conducted on the trapping solution.	Not applicable	Plumb, 1981; Standard Methods, 1995 4500-S^{2-} D-00; PSEP, 1986	Iodometric titration and methylene blue colorimetry	1.0 mg/kg	10.0 mg/kg dry weight (to nearest 0.1 unit)
Total Sulfides (porewater)	Centrifugation of bulk sediments (DMMP/SMS, 1998)	Not applicable			0.05 mg/L	

DMMP/SMS. 1998. DMMP Clarification Paper/SMS Technical Information Memorandum: Tributyltin Analysis: Clarification of Interstitial Water Extraction and Analysis Methods – Interim. Prepared by Erika Hoffman (EPA Region 10) for the DMMP agencies.

Standard Methods for the Examination of Water and Wastewater. 1995. 19th Ed.

Puget Sound Estuary Program (PSEP). 1986. Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound. Prepared for U.S. Environmental Protection Agency Region 10, Office of Puget Sound, Seattle, WA and Puget Sound Water Quality Authority, Olympia, WA by Tetra Tech, Inc., Bellevue, WA. 25 pp.

Plumb, R.H., Jr. 1981. Procedure for Handling and Chemical Analysis of Sediment and Water Samples, Technical Report EPA/CE-81-1, prepared by Great Lakes Laboratory, State University College at Buffalo, Buffalo, N.Y., for the U.S. Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. Published by the U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Mississippi.

15.0 References

Dutch, M., V. Partridge, S. Weakland, K. Welch, and E. Long. 2009. Quality Assurance Project Plan: The Puget Sound Assessment and Monitoring Program Sediment Monitoring Component. Washington State Department of Ecology, Olympia, WA. Publication No. 09-03-121. https://fortress.wa.gov/ecy/publications/SummaryPages/0903121.html