

Memorandum

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CC:	Port of Everett – Erik Gerking Weyerhaeuser – Ken Johnson and Carol Wiseman Washington Department of Natural Resources – Erika Shaffer Floyd Snider – Teri Floyd and Lynn Grochala					
Date:	September 1, 2016					
File:	0676-020-04					
Subject:	Work Plan Addendum No. 1 for Follow-up Sample Collection and Testin Former Mill A Marine Area, Everett, Washington	ng at the				

This memorandum has been prepared as an addendum to the Remedial Investigation/Feasibility Study (RI/FS) Work Plan and Marine Area Sampling and Analysis Plan (SAP) for the Former Mill A Site (Site) (GeoEngineers 2014a). This addendum is being provided on behalf of the Port of Everett and Weyerhaeuser Company and describes additional sample collection for chemical and bioassay testing at the Site. This addendum has been prepared to supplement and meet the RI requirements specified in the Work Plan.

The sample collection and testing described in this addendum is being performed as follow-up to the initial Marine Area sediment investigation performed in October/November 2015. The additional sample collection and testing is based on the results of initial sediment sampling and analysis in addition to discussions with the Washington State Department of Ecology (Ecology). The primary communication points related to this work include the following:

- The results of the initial investigation provided to Ecology in an email to Andy Kallus dated April 8, 2016.
- The memorandum presenting an evaluation of the need for bioassay testing based on the initial investigation results dated July 7, 2016 and titled Evaluation of the Potential Need for Bioassay Testing at the Former Mill A Cleanup Site Marine Area.
- The meeting between representatives of Ecology, Port of Everett, Weyerhaeuser Company and Washington State Department of Natural Resources held on July 26, 2016.

The sediment sample collection and testing described in this addendum includes:

- Collection of surface samples from nine locations for bioassay testing;
- Collection of surface samples from two new locations for conventional and chemical analysis to evaluate compliance with benthic chemical criteria; and
- Collection of surface samples from 18 new locations for carcinogenic polycyclic aromatic hydrocarbon (cPAH) analysis and archiving for potential future PAH fingerprinting chemical analysis to evaluate human health risk.



BIOASSAY TESTING OF CO-LOCATED SURFACE SEDIMENT SAMPLES

The RI/FS Work Plan (GeoEngineers 2014a) specified bioassays may be performed on surface sediment based on the results for wood debris and chemical analysis from the initial Marine Area Investigation to further characterize potential impacts benthic organisms. Sample locations were selected for bioassay testing where the wood debris content was estimated to be greater than 15 percent and/or the chemical concentrations exceeded the Sediment Management Standards (SMS) Sediment Cleanup Objectives based on the protection of the benthic organisms. The results for wood debris and chemical analyses from the initial Marine Area investigation and evaluation of locations for bioassay testing were presented in a memorandum to Ecology titled, *Evaluation of the Potential Need for Bioassay Testing at the Former Mill A Cleanup Site Marine Area.* The results of the evaluation presented in the memorandum are provided in Table 1, which has been updated to include the results from additional chemical analyses at MAF-SS-13, MAF-SS-19, MAF-SS-22 and MAF-SS-35.

Seven locations were initially identified for follow-up bioassay testing based on the presence of wood debris and/or one or more chemicals exceeding the criteria:

- MAF-SS-09 MAF-SS-10
- MAF-SS-11
 MAF-SS-12
- MAF-SS-20
 MAF-SS-21
- MAF-SS-31

MAF-SS-13, MAF-SS-19, MAF-SS-22 and MAF-SS-35 were identified for bioassay testing contingent on the results of chemical analyses of archived surface sediment samples. Archived samples from the four locations collected as part of the initial Marine Area investigation were analyzed for selected SMS chemicals to evaluate the bayward limits of potential benthic impacts. The archived surface sediment samples were analyzed for the following that were selected based on the exceedances of SMS criteria in adjacent sample locations or at the request of Ecology:

- MAF-SS-13 total PCBs;
- MAF-SS-19 total PCBs;
- MAF-SS-22 LPAHs, phenols, miscellaneous extractables and total PCBs; and
- MAF-SS-35 Miscellaneous extractables and total PCBs.

Based on the results of the additional analyses, bioassays are not warranted at sample locations MAF-SS-13, and MAF-SS-19 as chemical concentrations are less than the screening levels for protection of benthic organisms. However, chemical concentrations for one or more chemicals exceeded the screening levels for protection of benthic organisms in the sample from MAF-SS-22. In addition, sample locations MAF-SS-22 and -35 had elevated total organic carbon (TOC) concentrations (6.3 and 5.5 percent, respectively), which may indicate the presence of wood debris at these locations higher than what was visually observed. Based on the above, bioassays are warranted for MAF-SS-22 and -35.



Work Plan Addendum No. 1 for Follow-up Sample Collection and Testing September 1, 2016 Page 3

Figure 1 identifies the proposed bioassay testing locations and Table 2 provides coordinates for each sampling location and a description.

Three bioassays (two acute and one chronic) will be conducted at each location. Protocol are provided in the Marine Area Investigation SAP and comply with the Puget Sound Estuary Program (PSEP) bioassay methods (PSEP 1995), Ecology's Sediment Cleanup User Manual (SCUM II) guidance and programmatic updates provided in the Sediment Management Annual Review Meeting (SMARM) technical papers. Sediment will be collected at each bioassay location for grain size analysis to allow matching with a reference area sediment sample for bioassay testing.

Rambol, an Ecology-certified laboratory located in Port Gamble, Washington will provide the bioassay testing services and reference area sediment sample collection. It is anticipated that several different reference area samples will be required, due to the range of sediment grain size represented by the proposed bioassay testing locations (3.2 to 57.7 percent fines; see Table 2). Rambol will select reference stations from Carr Inlet or other Ecology-identified reference areas. Grain size will initially be estimated using a field-screen technique. Rambol will submit reference sediment samples for grain size analysis to confirm the field estimate of grain size.

Sediment sampling for bioassay testing will occur as described in the Marine Area Investigation SAP prior to September 16, 2016 to account for potential temperature and low dissolved oxygen stressors on the benthic community.

COLLECTION OF ADDITIONAL SEDIMENT SAMPLES FOR BENTHIC EVALUATION

At the request of Ecology, two new surface sediment locations will be sampled (MAF-SS-37 and MAF-SS-38) northwest of MAF-SS-20 and MAF-SS-21 to further evaluate the extent of potential benthic community impacts. The two new sample locations are shown on Figure 1. These samples will be analyzed for conventional parameters and the chemical analytes that were exceeding the SMS criteria in sediment from adjacent sample locations MAF-SS-20 and MAF-SS-21. The conventional and chemical analyses will include the following:

- Grain size,
- Total solids and total preserved solids,
- TOC,
- TVS,
- Porewater ammonia and sulfides, and
- Phenols.

The type and estimated quantity of wood debris will also be documented based on visual observation of the samples. Sampling and analysis will be performed in accordance with the protocols provided in the Marine Area SAP. The results for chemical analysis will be compared to screening levels for protection of benthic organisms to evaluate compliance with benthic criteria. The need for bioassay testing will be evaluated based on the results of chemical analysis, observations of wood debris, and the results of





Work Plan Addendum No. 1 for Follow-up Sample Collection and Testing September 1, 2016 Page 4

bioassay testing at locations MAF-SS-20 and -21. Bioassay testing, if warranted, would occur at a later time (to be determined) since sample collection at these locations could not be completed before September 16, 2016 and extended holding of bioassay test samples, if collected prior to September 16th, could result in degradation of the test materials that would not be representative of location conditions.

COLLECTION OF ADDITIONAL SEDIMENT SAMPLES FOR HUMAN HEALTH EVALUATION

Based on discussions with Ecology during the meeting held on July 26, 2016, it was agreed that additional surface sediment samples for cPAH analysis may help inform the boundary delineation for the Site, and between the Site and adjacent areas. A total of 18 new surface samples will be collected for cPAH analysis and potential future PAH fingerprinting analyses. The proposed sample locations are shown on Figure 2. Sampling and analysis for cPAHs will be performed in accordance with the protocols in the Marine Area SAP (GeoEngineers 2014a). A separate protocol for fingerprinting analysis will be developed if performed. The results for chemical analysis for cPAHs will be compared to bioaccumulation screening levels for protection of human health and higher trophic level species.

SCHEDULE

The schedule milestones and durations for completion of sampling and testing described in this addendum are the following:

- Revise and obtain approval for Work Plan addendum August 31, 2016
- Finalize field preparation for Work Plan addendum sampling and testing September 1 through 11, 2016
- Perform sample collection September 12 through 15, 2016
- Sample testing:
 - Bioassays September 16 through October 28, 2016
 - Supplemental chemical analysis for benthic evaluation September 16 through October 14, 2016
 - cPAH analyses September 16 through October 14, 2016
- Communication of the results upon completion of sample testing.

REFERENCES

- Ecology 2015. Sediment Cleanup Users Manual II (SCUM II), Ecology Publication No. 12-09-057, March 2015, <u>https://fortress.wa.gov/ecy/publications/documents/1209057.pdf</u>.
- GeoEngineers 2014a. Marine Area Remedial Investigation Sampling and Analysis Plan. Weyerhaeuser Former Mill A Site, Everett, WA. Prepared for the Washington Department of Ecology on behalf of the Port of Everett, Weyerhaeuser Company, and Washington State Department of Natural Resources. October 16, 2014.



Work Plan Addendum No. 1 for Follow-up Sample Collection and Testing September 1, 2016 Page 5

- GeoEngineers 2014b. Remedial Investigation and Feasibility Study Work Plan. Weyerhaeuser Former Mill A Site, Everett, WA. Prepared for the Washington Department of Ecology on behalf of the Port of Everett, Weyerhaeuser Company, and Washington State Department of Natural Resources. October 16, 2014.
- Puget Sound Estuary Protocol 1986. Recommended Protocols for measuring conventional sediment variables in Puget Sound. Prepared by: PTI Environmental Services. Prepared for: U.S. Environmental Protection Agency, Seattle, WA and Puget Sound Water Quality Authority, Olympia, WA. March 1987; minor revision April 2003.
- Puget Sound Estuary Protocol 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Prepared by: PTI Environmental Services. Prepared for: U.S. Environmental Protection Agency, Seattle, WA and Puget Sound Water Quality Authority, Olympia, WA. Revised July 1995.
- Puget Sound Estuary Protocol 1997. Recommended guidelines for measuring organic compounds in Puget Sound water, sediment and tissue samples. Prepared by: PTI Environmental Services. Prepared for: U.S. Environmental Protection Agency, Seattle, WA and Puget Sound Water Quality Authority, Olympia, WA. Revised April 1997.

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Attachments:

Table 1. Selection of Surface Sediment Sample Locations for Bioassay Testing

- Table 2. Surface Sediment Sample Location Information
- Figure 1. Surface Sediment Sample Locations for Bioassay Testing and Benthic Evaluation

Figure 2. cPAH Concentrations and Proposed Sample Locations



Table 1

Selection of Surface Sediment Sample Locations for Bioassay Testing

Former Mill A Marine Area Investigation

Everett, Washington

Locations	Percent Wood	TOC	Metals	ГРАН	НРАН	Phthalates	Chlorinated Organics	Phenols	Misc. Extractables	PCBs	Proposed for Bioassay Testing
Southwest of the	South Terminal										
MAF-SS-14	<1%	0.45%	NE	NE	NE	NE	NE	NE	NE	NE	No
MAF-SS-15	<1%	0.12%	NE	NE	NE	NE	NE	NE	NE	NE	No
MAF-SS-16	<1%	0.29%	NE	NE	NE	NE	NE	NE	NE	NE	No
MAF-SS-17	<1%	0.26%	NE	NE	NE	NE	NE	NE	NE	NA	No
MAF-SS-18	<1%	0.77%	NE	NE	NE	NE	NE ¹	NE	NE	NA	No
MAF-SS-23	<1%	0.16%	NA	NA	NA	NA	NA	NA	NA	NA	No
MAF-SS-24	<1%	0.08%	NE	NE	NE	NE	NE	NE	NE	NA	No
MAF-SS-25	<1%	0.14%	NE	NE	NE	NE	NE	NE	NE	NE	No
MAF-SS-26	<1%	0.14%	NE	NE	NE	NE	NE	NE	NE	NA	No
MAF-SS-27	<1%	0.58%	NE	NE	NE	NE	NE ¹	NE	NE	NE	No
MAF-SS-28	<1%	0.18%	NA	NA	NA	NA	NA	NA	NA	NA	No
MAF-SS-29	<1%	0.11%	NA	NA	NA	NA	NA	NA	NA	NA	No
MAF-SS-30	<1%	0.13%	NA	NA	NA	NA	NA	NA	NA	NA	No
Pacific Terminal N	Navigation and E	Berth Area									
MAF-SS-07	5%	1.35%	NE	NE	NE	NE	NE	NE	NE	NA	No
MAF-SS-08	<1%	0.08%	NE	NE	NE	NE	NE	NE	NE	NA	No
MAF-SS-09	<25%	2.15%	NE	NE	NE	NE	NE	SC0 ²	NE	NA	Yes
MAF-SS-22	<1%	6.34%	NA	NE	NA	NA	NA	SCO/CSL ³	NE	NE	Yes ⁴
MAF-SS-31	10%	4.76%	NE	NE	NE	NE	NE	SCO/CSL ⁵	SCO/CSL ⁶	NA	Yes
MAF-SS-32	40%	1.25%	NE	NE	NE	NE	NE	NE	NE	NE	No ⁷
MAF-SS-33	<1%	1.47%	NE	SCO ⁸	NE	NE	NE	NE	SCO ⁹	NE	No
MAF-SS-35	10%	5.45%	NA	NE	NE	NA	NA	NA	NE	NE	Yes ⁴
MAF-SS-36	<1%	2.12%	NE	NE	NE	NE	NE	NE	NE	NA	No
South Terminal N	lavigation and B	erth Area									
MAF-SS-13	<1%	0.38%	NE	NE	NE	NE	NE	NE	NE	NE	No
MAF-SS-12	15%	0.99%	NE	NE	NE	NE	NE ¹	NE	SCO ¹⁰	SCO ¹¹	Yes
MAF-SS-11	75%	7.32%	NE	NE	NE	NE	NE	SCO/CSL ¹²	NE	NA	Yes
MAF-SS-10	<5%	4.17%	NE	LAET/2LAET ¹³	NE	NE	NE	SCO/CSL ¹⁴	LAET/2LAET ¹⁵	NE	Yes
MAF-SS-19	10%	3.70%	NE	NE	NE	NE	NE	NE	NE	NE	No
MAF-SS-20	1%	3.83%	NE	NE	NE	NE	NE	SCO/CSL ¹⁶	NE	NA	Yes
MAF-SS-21	10%	5.39%	NE	NE	NE	NE	NE	SCO/CSL ¹⁷	SCO ¹⁸	NE	Yes

Notes:

¹ The detection limit for hexachlorobenzene was slightly greater than the SCO when expressed on an organic carbon normalized basis; however, detection limits expressed on a dry weight basis were below the LAET for this chemical.

 2 The concentration of phenol (460 $\mu g/kg$) exceeded the SCO (420 $\mu g/kg$). The CSL for phenol is 1,200 $\mu g/kg$.

³ The concentration of 4-methylphenol was greater than the SCO but was at or less than twice the SCO. The SCO and CSL are the same value for 4-methylphenol.

⁴ Bioassay testing requested by Ecology based on TOC concentration in addition to the results of chemical analysis.

⁵ The concentrations of 2,4-methyphenol and 4-methylphenol were greater than the SCO but were at or less than twice the SCO. The SCO and CSL are the same value for 2,4-methyphenol and 4-methylphenol.

⁶ The concentration of benzoic acid (730 μg/kg) was greater than the SCO (650 μg/kg) but was less than twice the SCO. The SCO and CSL are the same value for benzoic acid.

⁷ MAF-SS-32 is located on an armored slope. The sample collected from this location is likely representative of a small area on the face of the slope that is composed of armor rock.

⁸ The concentration of acenaphthene (17 mg/kg OC) was slightly greater than the SCO (16 mg/kg OC) and less than the CSL (57 mg/kg OC). The concentration of acenaphthene in the duplicate sample (12 mg/kg OC) was less than the SCO.

⁹ The concentration of dibenzofuran (17 mg/kg OC) was slightly greater than the SCO (15 mg/kg OC) and less than the CSL (58 mg/kg OC). The concentration of dibenzofuran in the duplicate sample (12 mg/kg OC) was less than the SCO.

¹⁰ The concentration of dibenzofuran (16 mg/kg OC) was greater than the SCO (15 mg/kg OC) but less than the CSL (58 mg/kg OC).

¹¹ The concentration of total PCBs (19.6 mg/kg 0C) was greater than the SCO (12 mg/kg 0C) but less than the CSL (65 mg/kg 0C).

¹² The concentration of 4-methylphenol (720 µg/kg) was greater than the SCO. The SCO and CSL are the same value for 4-methylphenol (670 µg/kg). The concentration of phenol (440 µg/kg) also exceeded the SCO (420 µg/kg). The CSL for phenol is 1,200 µg/kg.

¹³ The concentrations of several LPAHs were greater than their respective LAETs. The LAET and 2LAET are the same values for LPAHs. The concentrations of LPAHs that were greater than the LAET were less than twice the LAET.

¹⁴ The concentrations of 2,4-methyphenol and 4-methylphenol were greater than the SCO but were less than twice the SCO. The SCO and CSL are the same value for 2,4-methyphenol and 4-methylphenol.

 15 The concentration of dibenzofuran (800 µg/kg) was greater than the LAET (540 µg/kg) but less than twice the LAET. The LAET and 2LAET are the same value for dibenzofuran.

 16 The concentration of 4-methylphenol (740 μ g/kg) was greater than the SCO. The SCO and CSL are the same value for 4-methylphenol (670 μ g/kg).

¹⁷ The concentration of 4-methylphenol (1,400 µg/kg) was greater than the SCO. The SCO and CSL are the same value for 4-methylphenol (670 µg/kg). The concentration of phenol (820 µg/kg) also exceeded the SCO (420 µg/kg). The CSL for phenol is 1,200 µg/kg.

¹⁸ The concentration of dibenzofuran (17 mg/kg OC) in the duplicate sample from this location was slightly greater than the SCO (15 mg/kg OC). However, the concentration of the parent sample (8.2 mg/kg OC) was below the SCO. The CSL for dibenzofuran is 58 mg/kg OC.

NA = Sample was not analyzed for the identified parameters.

- NE = There were no exceedances of the screening levels for the identified parameters.
- PAA = The archived sample from this location has been proposed for analysis of the identified parameters.
- LAET = Lowest Apparent Effects Threshold
- 2LAET = Second Lowest Apparent Effects Threshold
- LPAHs = Low Molecular Weight Polycyclic Aromatic Hydrocarbons
- HPAHs = High Molecular Weight Polycyclic Aromatic Hydrocarbons

mg/kg OC = Milligram/kilogram normalized to organic carbon

mg/kg = Milligram/kilogram

- μ g/kg = Microgram/kilogram
- CSL = Cleanup Screening Level
- SCO = Sediment Cleanup Objective
- TOC = Total organic carbon
- PCBs = Polychlorinated Biphenyls

Yellow highlighting indicates analytical result for specified parameter was greater than the screening level.

Blue highlighting indicates archived sample analysis was performed to identify whether the location is proposed for bioassay testing. The blue highlighting also indicates the analytical parameters tested as part of archived sample analysis to evaluate potential benthic impacts and need for bioassay testing.



Table 2

Surface Sediment Sample Location Information

Former Mill A Marine Area Investigation

Everett, Washington

Sample Location ¹	Sample Identification	Sample Coordinates ² Washington State Planes (NAD83)		Mudline Elevation	Sampling	Grain Size
Bioassay Sampling Locations		Easting Northing		(ft MLLW)	Method	(% Fines)
MAF-SS-09	MAF-SS-09_0-10	1299688.88	360174.17	-44.5	Power Grab	19.5
MAF-SS-10	MAF-SS-10_0-10	1299120.00	359536.15	-51.7	Power Grab	45.1
MAF-SS-11	MAF-SS-11_0-10	1298800.90	359022.33	-48.5	Power Grab	46.3
MAF-SS-12	MAF-SS-12_0-10	1298485.67	358651.86	-55.6	Power Grab	52.5
MAF-SS-20	MAF-SS-20_0-10	1298500.72	359045.76	-77.2	Power Grab	57.7
MAF-SS-21	MAF-SS-21_0-10	1298784.67	359439.42	-67.7	Power Grab	30.5
MAF-SS-22	MAF-SS-22_0-10	1299121.88	359872.04	-61.3	Power Grab	3.2
MAF-SS-31	MAF-SS-31_0-10	1299458.99	359861.82	-41.8	Power Grab	11.3
MAF-SS-35	MAF-SS-35_0-10	1299438.45	360251.12	-52.9	Power Grab	10.0
New Benthic Eval	uation Locations			•	•	•
MAF-SS-37	MAF-SS-37_0-10	1298382.39	359137.54	TBD	Power Grab	TBD
MAF-SS-38	MAF-SS-38_0-10	1298672.98	359530.50	TBD	Power Grab	TBD
New Human Heal	th Evaluation Locations					•
MAF-SS-39	MAF-SS-39_0-10	1298110.77	358465.10	TBD	Power Grab	NA
MAF-SS-40	MAF-SS-40_0-10	1297793.70	358778.24	TBD	Power Grab	NA
MAF-SS-41	MAF-SS-41_0-10	1298211.97	358947.04	TBD	Power Grab	NA
MAF-SS-42	MAF-SS-42_0-10	1297939.80	359260.29	TBD	Power Grab	NA
MAF-SS-43	MAF-SS-43_0-10	1298244.15	359770.16	TBD	Power Grab	NA
MAF-SS-44	MAF-SS-44_0-10	1298704.48	359929.61	TBD	Power Grab	NA
MAF-SS-45	MAF-SS-45_0-10	1298997.48	360105.07	TBD	Power Grab	NA
MAF-SS-46	MAF-SS-46_0-10	1299388.61	360089.89	TBD	Power Grab	NA
MAF-SS-47	MAF-SS-47_0-10	1299744.80	359942.44	TBD	Power Grab	NA
MAF-SS-48	MAF-SS-48_0-10	1297692.13	358281.71	TBD	Power Grab	NA
MAF-SS-49	MAF-SS-49_0-10	1299203.43	360388.33	TBD	Power Grab	NA
MAF-SS-50	MAF-SS-50_0-10	1300175.50	360609.85	TBD	Power Grab	NA
MAF-SS-51	MAF-SS-51_0-10	1299680.71	361139.37	TBD	Power Grab	NA
MAF-SS-52	MAF-SS-52_0-10	1299528.01	361830.04	TBD	Power Grab	NA
MAF-SS-53	MAF-SS-53_0-10	1300557.45	361516.97	TBD	Power Grab	NA
MAF-SS-54	MAF-SS-54_0-10	1300652.93	360961.42	TBD	Power Grab	NA

Notes:

 1 Sampling locations are shown on Figure 1 and/or Figure 2.

TBD = To be determined based on the results of sample collection and analysis.

NA = Not analyzed

NAD83 = North American Datum of 1983

MLLW = mean lower low water





