APPENDIX R
SWAC Calculation for Remedial Alternatives

APPENDIX R
SURFACE WEIGHTED AVERAGE CONCENTRATION (SWAC) CALCULATION

This appendix presents the results of Surface Weighted Average Concentration (SWAC) calculations completed for evaluating remedial alternatives developed as part of the Remedial Investigation/Feasibility Study (RI/FS) for the Marine Area portion of the former Weyerhaeuser Mill A (Mill A) Site (Site) in Everett, Washington. The RI/FS identifies and evaluates a range of cleanup action alternatives for addressing contamination identified for the Marine Area portion of the Site to select a preferred cleanup action alternative in accordance with the requirements of the Model Toxics Control Act (MTCA) Cleanup Regulation, Chapter 173-340 Washington Administrative Code (WAC) and the Sediment Management Standards (SMS), Chapter 173-204 WAC.

Determination of SWAC Area

The SWAC area for evaluation of the Marine Area was developed in coordination with the Washington State Department of Ecology (Ecology) by initially evaluating the home-range for crab species at the Site. Based on a literature review, the home-range for crab species was determined to have a minimum radius of 2 kilometers (km) which extends well beyond the limits of the Remedial Investigation (RI) data set. Therefore, as a conservative approach, Ecology agreed that the limits of the SWAC area be set at the maximum extent of the proposed cleanup level (PCUL) exceedances for the protection of benthic organisms (Benthic PCUL) and protection of human health and higher trophic level ecological receptors (Human Health PCUL) The maximum extent of Benthic and Human Health PCUL exceedances based on the results of the RI is shown in Figure R-1.

Selection of Human Health Contaminants of Concern for Use in the SWAC Calculations

Human Health contaminants of concern (COCs) are identified in Section 4.2.2 and summarized in Table 5 of the RI/FS. Inverse distance weight (IDW) mapping of these Human Health COCs and corresponding area weighted concentrations in surface sediment and subsurface sediment in the Marine Area are shown in Figures 55 through 71. Based on the SWAC, Human Health COCs exceeding the PCUL include arsenic, total carcinogenic polycyclic aromatic hydrocarbons (cPAH), total dioxin and furan TEQ and total dioxin-like polychlorinated biphenyl (PCB) TEQ. The SWAC and ER values for these Human Health COCs are presented in Tables R-1 through R-10 and are summarized below:

- Arsenic
  - Human Health PCUL = 12 milligrams per kilogram (mg/kg)
  - SWAC = 13.36 mg/kg
  - ER = 1.11
- Total cPAH TEQ (Driver COC)
  - Human Health PCUL = 0.056 mg/kg
  - SWAC = 0.14 mg/kg
  - ER = 2.50
- Total dioxin and furan TEQ (Driver COC)

- Human Health PCUL = 5 nanograms per kilogram (ng/kg)
- SWAC = 10.29 ng/kg
- ER = 2.06

- Dioxin-Like PCB TEQ
  - Human Health PCUL = 0.38 ng/kg
  - SWAC = 0.59 ng/kg
  - ER = 1.55

The procedure for calculating SWAC for the Marine Area is described in the following sections.

SWAC Calculation

SWAC calculations were used to evaluate both the pre-cleanup action and post-cleanup action condition conditions within the Marine area. The post cleanup action condition was calculated for the ten remedial alternatives identified in the RI/FS.

Methodology

In accordance with Ecology's Sediment Cleanup User's Manual (SCUM) guidance (Ecology 2021), screening for bioaccumulative chemical exposure is completed on an area-wide basis, where sediment concentrations are averaged on an area-weighted basis (i.e., SWAC) for comparison to the PCUL.

To calculate the SWAC, Ecology recommends using the Inverse Distance Weighting (IDW) algorithms integrated into Geographic Information System (GIS) programs or Thiessen polygons. This can be done for the entire site (i.e., the maximum extent of benthic and human health driver PCUL exceedances) or to determine the area-weighted average within individual subunits or Sediment Management Areas (SMAs) comprising the Site. Under SMS, compliance with the PCUL for bioaccumulative compounds can be demonstrated based on SWAC calculations for a site. The cleanup standards are met when the SWAC is equal to or less than the PCUL at the point of compliance throughout a site.

For the Marine Area of the Site, the IDW algorithms utilized by GIS programs were used to determine the pre-cleanup action and post cleanup action SWAC for the Marine Area. Surface sediment concentrations for the Human Health COCs (listed above) within the Marine Area were determined using an IDW interpolation method using the following steps:

- A 10-foot by 10-foot grid was created using GIS software. The grid cells were made to cover the entirety of the Marine Area portion of the Site (SWAC boundary).
- Driver COC concentrations were interpolated using GIS software for each of the grid cells based on the sampling data. Based on the interpolation, a mean concentration was assigned to each grid cell for use in the SWAC calculation.
- The SWAC was calculated by summing the arithmetic mean of each of the individual grid cell value contained within the SWAC boundary.

Sediment Management Areas

To assist in the development and evaluation of remedial alternatives, the Marine Area portion of the Site was divided into multiple SMAs based on observed environmental conditions and other factors that affect the applicability of specific remediation technologies and the feasibility of their implementation as described in Ecology's SCUM guidance. A detailed description of the SMAs established for the Marine Area is presented in Section 7.0 of the RI/FS.

The SMAs established for the Marine Area are shown on Figure 75 of the RI/FS and the limits of contamination in the Marine Area have been divided into thirteen SMAs (SMA1a through 1d, SMA-2a and 2b, SMA-3a through 3c, SMA-4, SMA-5, SMA-6 and SMA-7) which form the basis for technology screening, alternative development and alternative evaluation.

For the individual SMAs established, area-weighted average is equal to the sum the arithmetic mean of each of the individual grid cell values contained within the SMA boundary, weighted (i.e., multiplied) by the proportional areas of the SMA, divided by the total area of the SWAC boundary. SWAC values for each SMA were calculated to represent pre-cleanup action conditions. Additionally, SWAC values were calculated to identify the expected post-cleanup action conditions for each of the ten remedial alternatives being evaluated for the Marine Area. Descriptions of the remedial technologies evaluated, and development of the remedial alternatives are discussed in Sections 8.0 and 9.0 of the RI/FS.

The default assumptions used in the SWAC calculation for each remedial technology are summarized in the following section.

Default Assumptions for Individual Remedial Technologies

In consultation with Ecology, prior to performing the Marine Area SWAC calculations, the default assumptions for the effectiveness of a remedial technology (i.e., full removal, capping, containment/CDF, enhanced natural recovery [ENR] and monitored natural recover [MNR]) on the SWAC calculation were established for each Driver COC.

The default assumptions for the individual remedial technologies are summarized in the following table.

DEFAULT ASSUMPTIONS

Remedial Technology	Default Human Health Driver COC Assumption			
	Arsenic	**Total cPAH TEQ**	**Total Dioxin/Furan TEQ**	**Total Dioxin-Like PCB TEQ**
MNR	Pre-cleanup action Result[1]	Pre-cleanup action Result[1]	Pre-cleanup action Result[1]	Pre-cleanup action Result[1]
ENR	50% Contaminant Reduction	50% Contaminant Reduction	50% Contaminant Reduction	50% Contaminant Reduction
Sediment Capping	PQL	PQL	Natural Background	Natural Background
FR	Native Concentration	Native Concentration	Native Concentration	Native Concentration
FR/BF	PQL	PQL	Natural Background	Natural Background

Remedial Technology	Default Human Health Driver COC Assumption			
	Arsenic	Total cPAH TEQ	Total Dioxin/Furan TEQ	Total Dioxin-Like PCB TEQ
Containment/CDF	Zero[2]	Zero[2]	Zero[2]	Zero[2]
No Action	Pre-cleanup action Result[1]	Pre-cleanup action Result[1]	Pre-cleanup action Result[1]	Pre-cleanup action Result[1]

Notes:

[1] SWAC calculated for the Marine Area portion of the Site based on surface sediment (0-40 cm for intertidal sediment and 0-10 cm for subtidal sediment) RI result.

[2] Containment of the contamination would result in the removal of this material from exposure pathways. Therefore, an assumed concentration of zero is being applied as the default assumption.

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
MNR = Monitored Natural Recovery
ENR = Enhanced Natural Recovery
PQL = Practical quantitation limit provided by Analytical Resources, Inc. (ARI) of Tukwila, Washington
FR = Full removal
BF = Backfilling
NA = No action
TEQ = Toxicity equivalency quotient

Default parameter values for laboratory practical quantitation limits (PQLs), native surface concentrations, Natural Background and Reginal Background were also developed in consultation with Ecology for the human health Driver COCs as follows:

- **Laboratory PQL** – Laboratory PQL referenced from the RI/FS Work Plan developed for the Mill A Site (GeoEngineers 2014) and were provided by Analytical Resources Inc. (ARI) of Tukwila, Washington.
- **Native Surface Concentration** – The average COC concentration for native sediment layer samples based on the RI data set.
- **Natural Background** – Natural Background concentrations based on the 90/90 Upper Tolerance Limit (UTL) from the entire Bold Plus dataset (DMMP 2009; Table 10-1, SCUM).
- **Regional Background** – Regional Background concentrations are based on the Port Gardner Bay Background Study (Ecology 2014; Table 10-2, SCUM).

Pre- and Post-Cleanup Action SWAC Evaluation

Using the default parameters and methodologies described above, pre- and post-cleanup action SWAC values were calculated for each of the individual SMAs. Calculated SWAC values for individual SMAs as well as the Site-wide weighted concentration resulting from the remedial technologies applied under each remedial alternative developed are summarized in Tables R-1 through R-10. The results of the SWAC calculations for individual remedial alternatives (combinations of remedial technologies) are summarized on Figure R-2. Tables R-1 through R-10 present the SWAC based on pre-cleanup conditions and using the default assumptions listed above. Table R-1 through R-10 also present the post-cleanup SWAC for the range of remedial technologies considered under Alternatives 1 through 10, respectively.

The post-cleanup SWAC was used to evaluate the overall effectiveness of the alternative in addressing the Marine Area contamination. As shown in Figure R-2, Alternatives 1 through 4 and Alternatives 6 through 9 do not archive a SWAC for one or more of the evaluated Human Health COCs immediately following implementation of the remedy. However, as discussed in Section 9.0 of the RI/FS, the cleanup standards

are expected to be met within a 10-year reasonable restoration timeframe. For Alternatives 5 and 10, the resulting SWAC meets the Human Health PCUL following construction of the remedy.

Hill-Topping

Scum states that a hill-topping methodology can be utilized to simplify the weighted average within individual sediment cleanup units or sediment management areas to determine the remediation area necessary to meet cleanup levels (Section 6.3.4.2; Ecology 2021). Specifically, hill-toping may be performed to determine the extent within the individual sediment cleanup units or sediment management areas is requiring cleanup to meet the Human Health PCUL, considering the effects of sequential removal of the greatest-concentration Human Health PCUL exceedances within the compliance interval that remains after addressing benthic COC exceedances and future site use. The hill-topping process involves the systematic reassignment of grid cell concentrations used to develop the starting from the cell with highest contaminant concentration and sequentially re-assigning cells values in descending order until the target SWAC is equal to or below the cleanup standard.

As presented in Section 7.0 of the RI/FS, the Marine Area was subdivided into seven SMAs based on the nature and extent COC/SOCs and compliance intervals identified for the Marine Area to meet the scour and current and future Site use conditions to assist in the development and evaluation of remedial alternatives. The range of remedial technologies evaluated included those listed in SMS (WAC 173-204- 570[4][b]) for the cleanup of contaminated sediment, Environmental Protection Agency (EPA) publications, vendor information, and professional experience gained at similar sites. The screening process (see Table 10) determined the most appropriate technologies and process options based on their expected implementability, reliability, effectiveness, and relative cost. Screening also considered criteria associated with current and future land uses, consideration of potential historical and archaeological remains, and impacts to existing habitat resources.

Hill-topping on a SMA-by-SMA basis was determined to not be applicable and was not completed due to the limited number of remedial technologies that were retained for the majority of the SMAs. In place of hill-topping on a SMA-by-SMA basis, SWACs were calculated on an alternative wide basis to determine compliance with Human Health PCULs.

Attachments:

Table R-1. Surface Weighted Average Calculation - Remedial Alternative 1
Table R-2. Surface Weighted Average Calculation - Remedial Alternative 2
Table R-3. Surface Weighted Average Calculation - Remedial Alternative 3
Table R-4. Surface Weighted Average Calculation - Remedial Alternative 4
Table R-5. Surface Weighted Average Calculation - Remedial Alternative 5
Table R-6. Surface Weighted Average Calculation - Remedial Alternative 6
Table R-7. Surface Weighted Average Calculation - Remedial Alternative 7
Table R-8. Surface Weighted Average Calculation - Remedial Alternative 8
Table R-9. Surface Weighted Average Calculation - Remedial Alternative 9
Table R-10. Surface Weighted Average Calculation - Remedial Alternative 10
Figure R-1. Marine Area PCUL Exceedance Summary Surface Sediment Compliance Interval
Figure R-2. Remedial Alternative SWAC Comparison by Driver COC

Table R-1

Surface Weighted Average Calculation - Remedial Alternative 1

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	1	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	MNR	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	MNR	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	MNR	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	FR	5.27	0.01	0.70	0.06	0.44	0.001	0.06	0.01
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	MNR	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**10.56**	**0.09**	**6.66**	**0.19**	**0.88**	**1.51**	**1.32**	**0.50**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**21%**	**39%**	**35%**	**67%**	**21%**	**39%**	**36%**	**68%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-2

Surface Weighted Average Calculation - Remedial Alternative 2

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER		Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	ENR	8.72	0.09	8.49	0.32	0.73	1.62	1.70	0.84
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	FR	5.27	0.01	0.70	0.06	0.44	0.001	0.06	0.01
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	ENR	5.28	0.02	6.48	0.02	0.44	0.40	1.30	0.05
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**8.58**	**0.07**	**5.01**	**0.14**	**0.71**	**1.22**	**0.99**	**0.37**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**36%**	**51%**	**51%**	**76%**	**36%**	**51%**	**52%**	**76%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-3

Surface Weighted Average Calculation - Remedial Alternative 3

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	3	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	CAP	5.00	0.01	4.00	0.20	0.42	0.09	0.80	0.53
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	FR	5.27	0.01	0.70	0.06	0.44	0.001	0.06	0.01
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	ENR	5.28	0.02	6.48	0.02	0.44	0.40	1.30	0.05
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**8.34**	**0.06**	**4.72**	**0.14**	**0.69**	**1.12**	**0.94**	**0.35**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**38%**	**55%**	**54%**	**77%**	**38%**	**55%**	**54%**	**78%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-4

Surface Weighted Average Calculation - Remedial Alternative 4

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	4	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	FR	5.27	0.01	0.70	0.06	0.44	0.001	0.06	0.01
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	ENR	5.28	0.02	6.48	0.02	0.44	0.40	1.30	0.05
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**8.36**	**0.06**	**4.51**	**0.13**	**0.70**	**1.13**	**0.89**	**0.32**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**37%**	**54%**	**56%**	**78%**	**37%**	**55%**	**57%**	**79%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-5

Surface Weighted Average Calculation - Remedial Alternative 5

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	5	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	ENR	5.95	0.06	4.01	0.09	0.50	1.13	0.80	0.24
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	FR	5.27	0.01	0.70	0.06	0.44	0.001	0.06	0.01
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	FR/BF	5.00	0.01	4.00	0.20	0.42	0.09	0.80	0.53
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**6.04**	**0.04**	**2.86**	**0.10**	**0.50**	**0.68**	**0.56**	**0.25**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**55%**	**72%**	**72%**	**83%**	**55%**	**73%**	**73%**	**84%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-6

Surface Weighted Average Calculation - Remedial Alternative 6

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	6	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	MNR	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	MNR	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	MNR	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	CC	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	MNR	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**10.10**	**0.08**	**6.60**	**0.19**	**0.84**	**1.51**	**1.32**	**0.50**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**24%**	**39%**	**36%**	**68%**	**24%**	**39%**	**36%**	**68%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-7

Surface Weighted Average Calculation - Remedial Alternative 7

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2] 7	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER		Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	ENR	8.72	0.09	8.49	0.32	0.73	1.62	1.70	0.84
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	CC	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	ENR	5.28	0.02	6.48	0.02	0.44	0.40	1.30	0.05
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**8.12**	**0.07**	**4.95**	**0.14**	**0.68**	**1.22**	**0.99**	**0.37**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**39%**	**51%**	**52%**	**76%**	**39%**	**51%**	**52%**	**76%**

Notes

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-8

Surface Weighted Average Calculation - Remedial Alternative 8

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	8	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	CAP	5.00	0.01	4.00	0.20	0.42	0.09	0.80	0.53
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	CC	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	ENR	5.28	0.02	6.48	0.02	0.44	0.40	1.30	0.05
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**7.88**	**0.06**	**4.66**	**0.13**	**0.66**	**1.12**	**0.93**	**0.35**
Target Cleanup Objective Met			No	No	No	No	No	No	No	No	n/a	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			0%	0%	0%	0%	0%	0%	0%	0%	n/a	41%	55%	55%	78%	41%	55%	55%	78%

Notes

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-9

Surface Weighted Average Calculation - Remedial Alternative 9

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2]	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER	9	Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	MNR	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	CC	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	ENR	5.28	0.02	6.48	0.02	0.44	0.40	1.30	0.05
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**7.90**	**0.06**	**4.45**	**0.12**	**0.66**	**1.13**	**0.89**	**0.32**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**41%**	**55%**	**57%**	**79%**	**41%**	**55%**	**57%**	**79%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available

Table R-10

Surface Weighted Average Calculation - Remedial Alternative 10

Weyerhaeuser Mill A Former

Everett, Washington

Area ID[1]	Subarea ID	Surface Area (acres)	Pre-Remedial Action Condition								Remedial Alternative[2] 10	Post-Remedial Action Condition							
			SWAC by Concentration				SWAC by Exceedance Ratio					SWAC by Concentration				SWAC by Exceedance Ratio			
			Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER		Arsenic (mg/kg)	Total cPAH TEQ (mg/kg)	Total Dioxin/ Furan TEQ (ng/kg)	Like PCB TEQ (mg/kg)	Arsenic ER	Total cPAH TEQ ER	Total Dioxin/ Furan TEQ ER	Total Dioxin-Like PCB TEQ ER
SMA-1	SMA-1a	26.8	11.89	0.13	8.02	0.18	0.99	2.26	1.60	0.49	ENR	5.95	0.06	4.01	0.09	0.50	1.13	0.80	0.24
	SMA-1b	5.7	20.90	0.16	14.17	0.58	1.74	2.92	2.83	1.54	ENR	10.45	0.08	7.08	0.29	0.87	1.46	1.42	0.77
	SMA-1c	3.2	14.76	0.12	10.94	0.21	1.23	2.21	2.19	0.54	ENR	7.38	0.06	5.47	0.10	0.62	1.10	1.09	0.27
	SMA-1d	4.5	17.44	0.18	16.98	0.64	1.45	3.24	3.40	1.68	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-2	SMA-2a	1.2	16.51	0.18	13.92	0.51	1.38	3.26	2.78	1.34	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-2b	6.2	8.74	0.11	14.75	0.77	0.73	1.92	2.95	2.04	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-3	SMA-3a	1.1	8.73	0.07	15.48	0.18	0.73	1.28	3.10	0.46	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3b	0.6	13.67	0.10	4.33	0.05	1.14	1.83	0.87	0.13	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
	SMA-3c	0.3	12.77	0.11	1.79	0.04	1.06	2.00	0.36	0.11	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-4	n/a	1.2	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18	NA	5.26	0.02	0.35	0.07	0.44	0.38	0.07	0.18
SMA-5	n/a	6.0	19.30	0.20	10.72	2.96	1.61	3.66	2.14	7.79	CC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SMA-6	n/a	9.7	11.81	0.18	7.83	0.57	0.98	3.16	1.57	1.49	FR	5.27	0.01	0.70	0.06	0.44	0.17	0.14	0.16
SMA-7	n/a	2.9	10.56	0.04	12.97	0.04	0.88	0.80	2.59	0.10	MNF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**69.4**	**13.36**	**0.14**	**10.29**	**0.59**	**1.11**	**2.50**	**2.06**	**1.55**	n/a	**5.38**	**0.04**	**2.63**	**0.09**	**0.45**	**0.67**	**0.53**	**0.23**
Target Cleanup Objective Met			**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	n/a	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Percent Reduction in Contaminant Mass			**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	n/a	**60%**	**73%**	**74%**	**85%**	**60%**	**73%**	**74%**	**85%**

Notes:

[1] Sediment Management Areas (SMAs) are shown on Figure 3 of the FS Report.

[2] Remedial technologies retained and their applicability to the SMAs are presented in the FS Report.

ID = Identification

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PCUL - Proposed Cleanup Level

COC = Contaminant of concern

bml = below mudline

MLLW = Mean Lower Low Water

MNR = Monitored Natural Recovery

ENR = Enhanced Natural Recovery

CAP = Capping

FR = Full removal

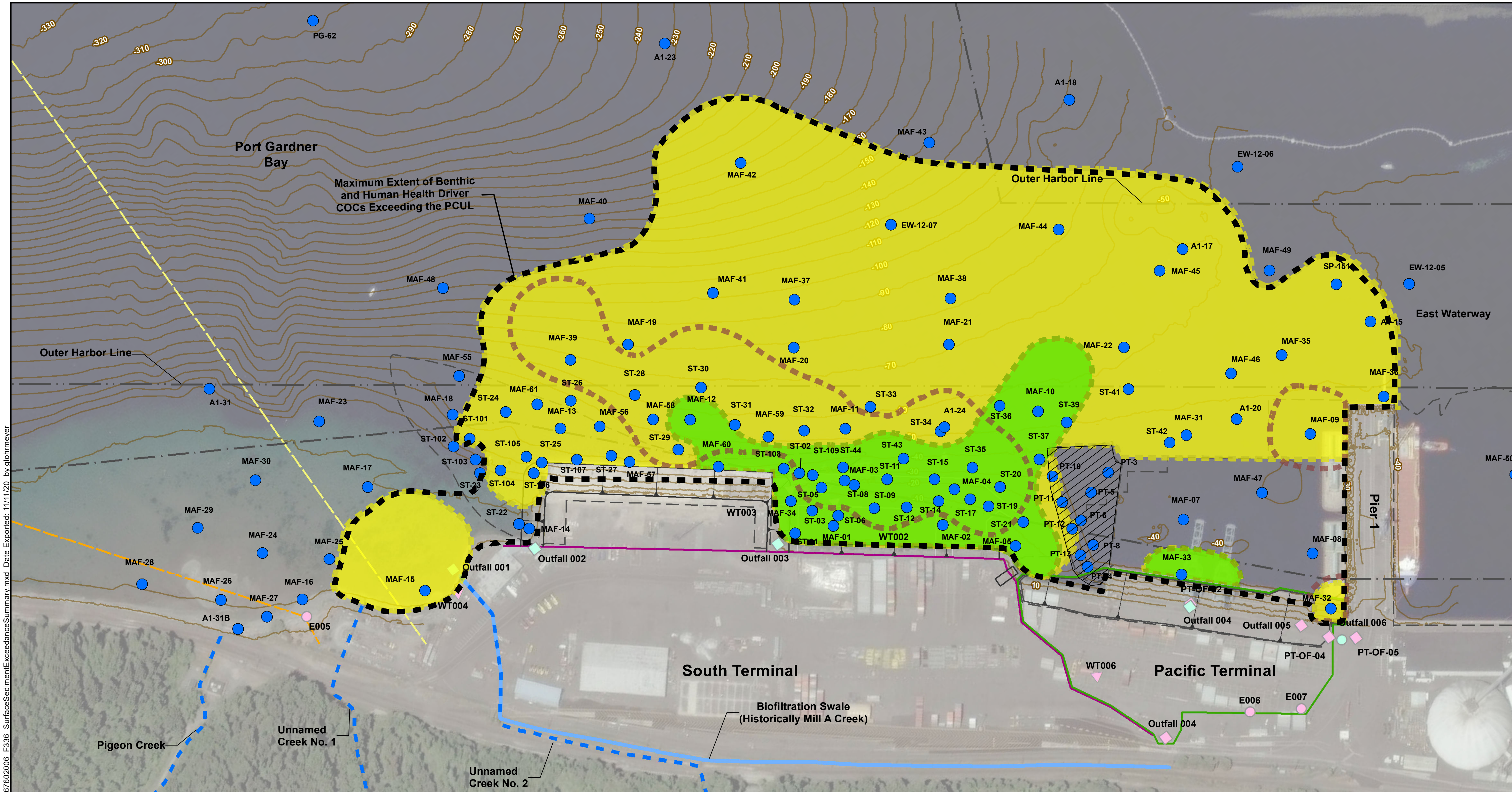
BF = Backfilling

CC = Containment/Confined Disposal Facility (CDF)

NA = No action

TEQ = Toxicity equivalency quotient

n/a = Not available



Legend

- Surface Sediment Sample Location
- Extent of Wood Debris Greater than 15 Percent
- Extent of PCUL Exceedances for Protection of Benthic Organisms
- Extent of PCUL Exceedances for Protection of HumanHealth and Higher Trophic Level Ecological Receptors
- Pacific Terminal Interim Action Dredge Area (Dredged to -42 feet MLLW in 2016/2017)
- Construction Berm
- Historical Piling Area
- Dredged Area
- Nearshore Confined Disposal (NCD) Facility (Former Log Pond)
- Current Kimberly-Clark/City of Everett/ City of Marysville Outfall 100 (Approximate)
- Historical Kimberly-Clark/Weyerhaeuser Outfall SW001 (Approximate)
- Bulkhead
- Topography/Bathymetry Contour (Feet Mean Lower Low Water [MLLW])
- Historical Industrial Outfall (Abandoned)
- Former Combined Sewer Outfall (CSO, Abandoned)
- Former Stormwater Outfall (Abandoned)
- Current CSO
- Current Stormwater Outfall

300 0 300

Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Data Source: Base aerial from ESRI, 2018
Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

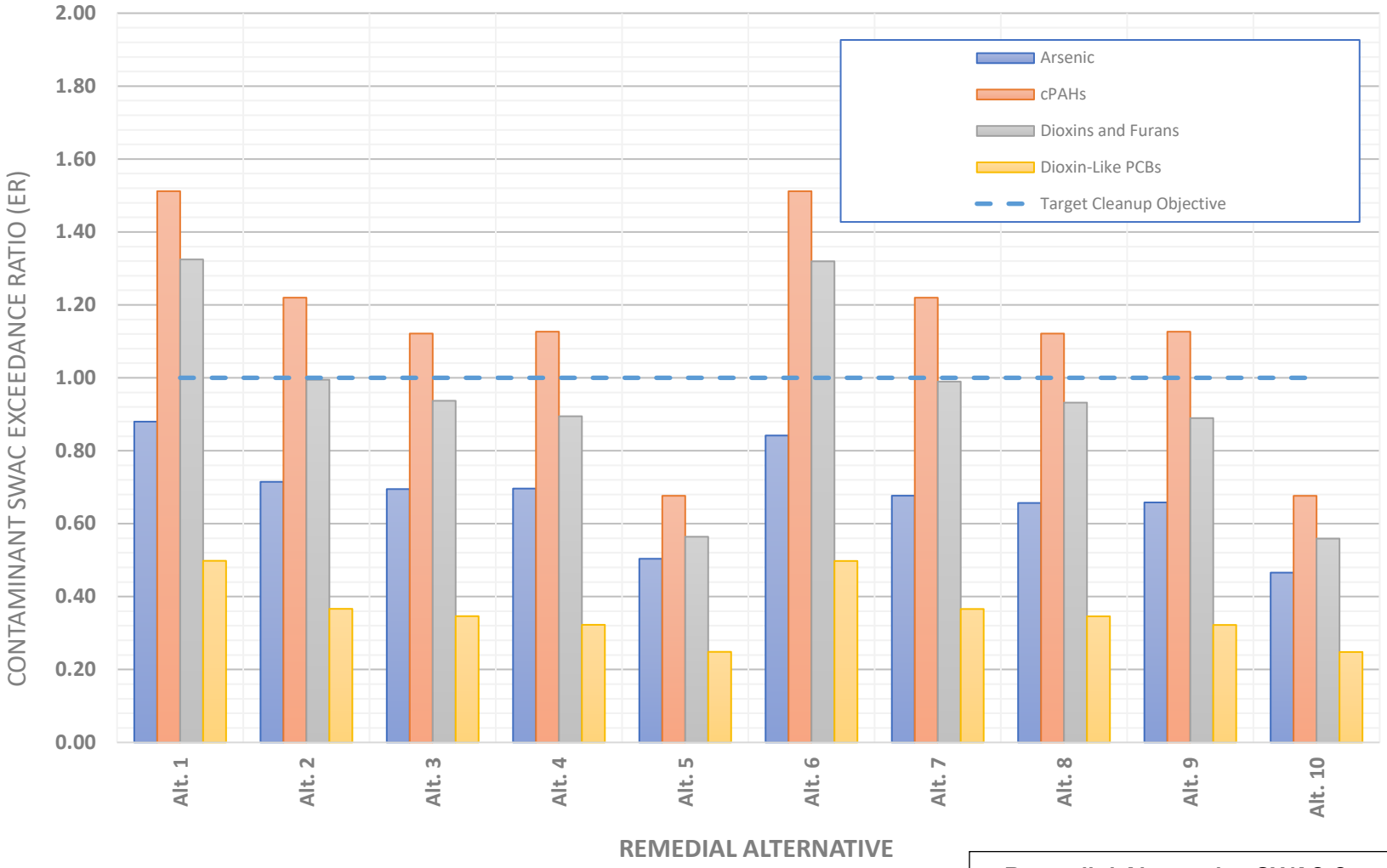
P:\0\0676020\GIS\MXD\MarineArea_RI_Report\067602006_F336_SurfaceSedimentExceedanceSummary.mxd Date Exported: 11/11/20 by glohrmeyer

Marine Area PCUL Exceedance Summary Surface Sediment Compliance Interval

Weyerhaeuser Mill A Former
Everett, Washington

GeoEngineers

Figure R-1



Remedial Alternative SWAC Comparison by Driver COC

Weyerhuaser Mill A Former
Everett, Washington

GeoEngineers

Figure R-2

Notes:

1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Appendix S – Tables S-1 through S-10.