TABLE 1
SOIL SCREENING LEVELS
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Analyte	Soil Concentration Protective of Groundwater as Marine Surface Water (MTCA Fixed Parameter Three-Phase Partitioning Model) mg/kg	Human Health Direct Contact Pathway (MTCA Method B Standard Formula Value for Unrestricted Land Use) Carcinogen mg/kg	Human Health Direct Contact Pathway (MTCA Method B Standard Formula Value for Unrestricted Land Use) Non-Carcinogen mg/kg	Ecological Indicator Soil Concentration for Protection of Terrestrial Plants and Animals (MTCA Table 749-3) mg/kg	Preliminary Screening Level (Before adjustment for background) mg/kg	Background Concentration (f) mg/kg	Preliminary Screening Level (After adjustment for background) mg/kg	PQL (e) mg/kg	Soil Screening Level (After adjustment for background and PQL) mg/kg
TPH									
Gasoline-Range Petroleum Hydrocarbons	30 (b,c)	--	30 (b,c)	100	30	--	30	5	30
Diesel-Range Petroleum Hydrocarbons	2,000 (b)	--	2,000 (b)	200	200	--	200	5	200
Heavy Oil-Range Petroleum Hydrocarbons	2,000 (b)	--	2,000 (b)	200	200	--	200	10	200
Metals									
Aluminum	NE	--	--	50	50	32,600	32,600	5.0	32,600
Antimony	580	--	32	5	5	--	5	0.2	5
Arsenic	0.057	0.67	24	7	0.057	20 (g)	20	0.2	20
Barium	NE	--	16,000	102	102	--	102	0.3	102
Beryllium	4,300	--	160	10	10	0.6	10	0.1	10
Cadmium	1.2	--	80	4	1.2	1	1.2	0.20	1.2
Chromium III	4,800,000	--	120,000	--	120,000	48 (d)	120,000	2 (d)	120,000
Chromium VI	19	--	240	--	19	--	19	5.0	19
Chromium (Total)	NE	--	--	42	42	48	48	2	48
Cobalt	NE	--	--	20	20	--	20	0.3	20
Copper	1.1	--	3,000	50	1.1	36	36	0.20	36
Lead	1,600	--	250 (b)	50	50	17	50	1.0	50
Manganese	130 (a)	--	11,000	1,100	130	1,200	1,200	0.10	1,200
Mercury	0.026	--	24	0.1	0.026	0.07	0.07	0.020	0.07
Nickel	11	--	1,600	30	11	48	48	0.50	48
Selenium	7.4	--	400	0.3	0.3	--	0.3	0.2 (h)	0.3
Silver	0.32	--	400	2	0.32	--	0.32	0.20	0.32
Thallium	0.67	--	5.6	1	0.67	--	0.67	0.20	0.67
Vanadium	NE	--	560	2	2	--	2	0.20	2
Zinc	100	--	24,000	86	86	85	86	1.0	86
VOCs									
1,1,1-Trichloroethane	3,300	--	72,000	--	3,300	--	3,300	0.001	3,300
1,1,2,2-Tetrachloroethane	0.022	5	--	--	0.022	--	0.022	0.001	0.022
1,1,2-Trichloroethane	0.089	18	320	--	0.089	--	0.089	0.001	0.089
1,1-Dichloroethane	NE	--	16,000	--	16,000	--	16,000	0.001	16,000
1,1-Dichloroethene	0.023	--	4,000	--	0.023	--	0.023	0.001	0.023
1,2-Dichloroethane	0.18	11	1,600	--	0.18	--	0.18	0.001	0.18
1,2-Dichloroethene	NE	--	720	--	720	--	720	0.001	720
1,2-Dichloropropane	0.077	15	--	700	0.077	--	0.077	0.001	0.077
1,3-Dichloropropene (cis-, trans-)	0.11	5.6	2,400	--	0.11	--	0.11	0.001	0.11
2-Butanone (MEK)	NE	--	48,000	--	48,000	--	48,000	0.005	48,000
4-Methyl-2-Pentanone (MIBK)	NE	--	6,400	--	6,400	--	6,400	0.005	6,400
Acetone	NE	--	8,000	--	8,000	--	8,000	0.005	8,000
Benzene	0.13	18	320	--	0.13	--	0.13	0.0014	0.13
Bromodichloromethane	0.089	16	1,600	--	0.089	--	0.089	0.001	0.089
Bromoform	0.92	130	1,600	--	0.92	--	0.92	0.001	0.92
Bromomethane	4.5	--	110	--	4.5	--	4.5	0.001	4.5
Carbon Disulfide	NE	--	8,000	--	8,000	--	8,000	0.001	8,000
Carbon Tetrachloride	0.015	7.7	56	--	0.015	--	0.015	0.001	0.015
Chlorobenzene	14	--	1,600	40	14	--	14	0.001	14
Chloroethane	NE	350	32,000	--	350	--	350	0.001	350
Chloroform	1.5	160	800	--	1.5	--	1.5	0.001	1.5
Chloromethane	0.62 (a)	77	--	--	0.62	--	0.62	0.001	0.62
cis-1,2-Dichloroethene	NE	--	800	--	800	--	800	0.001	800
Dibromochloromethane	0.069	12	1,600	--	0.069	--	0.069	0.001	0.069
Ethylbenzene	18	--	8,000	--	18	--	18	0.025	18
methyl tert-butyl ether (MTBE)	NE	560	69,000	--	560	--	560	0.001	560
Methylene Chloride (Dichloromethane)	2.6	130	4,800	--	2.6	--	2.6	0.002	2.6
Styrene	NE	33	16,000	300	33	--	33	0.001	33
Toluene	110	--	6,400	200	110	--	110	0.025	110
Total Xylenes	9.1	--	16,000	--	9.1	--	9.1	0.075	9.1
Tetrachloroethene (PCE)	0.0041	1.9	800	--	0.0041	--	0.0041	0.001	0.0041
trans-1,2-Dichloroethene	54	--	1,600	--	54	--	54	0.001	54
Trichloroethene (TCE)	0.044	11	24	--	0.044	--	0.044	0.001	0.044
Vinyl Acetate	NE	--	80,000	--	80,000	--	80,000	0.005	80,000
Vinyl chloride	0.015	0.67	240	--	0.015	--	0.015	0.001	0.015
PAHs									
Acenaphthene	65	--	4,800	20	20	--	20	0.0050	20
Anthracene	12,000	--	24,000	--	12,000	--	12,000	0.0050	12,000
Dibenzofuran	NE	--	160	--	160	--	160	0.0050	160
Fluoranthene	89	--	3,200	--	89	--	89	0.0050	89
Fluorene	550	--	3,200	30	30	--	30	0.0050	30
2-Methylnaphthalene	NE	--	320	--	320	--	320	0.0050	320
Naphthalene	140	--	1,600	--	140	--	140	0.0050	140
Pyrene	3,500	--	2,400	--	2,400	--	2,400	0.0050	2,400
Total cPAHs TEC	0.35	0.14	--	12	0.14	--	0.14	0.0038	0.14
SVOCs									
1,2,4-Trichlorobenzene	2.6	--	800	20	2.6	--	2.6	0.020	2.6
1,2-Dichlorobenzene	15	--	7,200	--	15	--	15	0.020	15
1,3-Dichlorobenzene	11 (a)	--	--	--	11	--	11	0.020	11
1,4-Dichlorobenzene	0.080	42	--	20	0.080	--	0.080	0.020	0.080
2,6-Dinitrotoluene	NE	--	80	--	80	--	80	0.100	80
2,4,5-Trichlorophenol	130	--	8,000	4	4	--	4	0.1	4
2,4,6-Trichlorophenol	0.028	91	--	10	0.028	--	0.028	0.00625 (i)	0.028
2,4-Dichlorophenol	1.3	--	240	--	1.3	--	1.3	0.1	1.3
2,4-Dimethylphenol	4.5	--	1,600	--	4.5	--	4.5	0.020	4.5
2,4-Dinitrophenol	14	--	160	20	14	--	14	0.2	14
2,4-Dinitrotoluene	0.020	--	160	--	0.020	--	0.020	0.1	0.1
2-Chloronaphthalene	54 (a)	--	6,400	--	54	--	54	0.020	54
2-Chlorophenol	1.1	--	400	--	1.1	--	1.1	0.020	1.1

Analyte	Soil Concentration Protective of Groundwater as Marine Surface Water (MTCA Fixed Parameter Three-Phase Partitioning Model) mg/kg	Human Health Direct Contact Pathway (MTCA Method B Standard Formula Value for Unrestricted Land Use) Carcinogen mg/kg	Human Health Direct Contact Pathway (MTCA Method B Standard Formula Value for Unrestricted Land Use) Non-Carcinogen mg/kg	Ecological Indicator Soil Concentration for Protection of Terrestrial Plants and Animals (MTCA Table 749-3) mg/kg	Preliminary Screening Level (Before adjustment for background) mg/kg	Background Concentration (f) mg/kg	Preliminary Screening Level (After adjustment for background) mg/kg	PQL (e) mg/kg	Soil Screening Level (After adjustment for background and PQL) mg/kg
2-Methylphenol	NE	--	4,000	--	4,000	--	4,000	0.020	4,000
3,3'-Dichlorobenzidine	0.00052	2.2	--	--	0.00052	--	0.00052	0.1	0.1
4-Chloroaniline	NE	--	320	--	320	--	320	0.100	320
4-Methylphenol	NE	--	400	--	400	--	400	0.020	400
Benzyl alcohol	NE	--	24,000	--	24,000	--	24,000	0.020	24,000
Bis(2-chloro-1-methylethyl) ether	0.21	14	--	--	0.21	--	0.21	0.020	0.21
bis(2-Chloroethyl)ether	0.0029	0.91	--	--	0.0029	--	0.0029	0.020	0.020
bis(2-Chloroisopropyl) ether	240 (a)	--	3,200	--	240	--	240	0.020	240
bis (2-ethylhexyl) Phthalate	4.9	71	1,600	--	4.9	--	4.9	0.020	4.9
Butylbenzylphthalate	360	--	16,000	--	360	--	360	0.020	360
Carbazole	NE	50	--	--	50	--	50	0.020	50
Diethylphthalate	160	--	64,000	100	100	--	100	0.020	100
Dimethylphthalate	330 (a)	--	80,000	200	200	--	200	0.020	200
Di-n-butylphthalate	100	--	8,000	200	100	--	100	0.020	100
Di-n-octylphthalate	NE	--	1,600	--	1,600	--	1,600	0.020	1,600
Hexachlorobutadiene	19	13	16	--	13	--	13	0.020	13
Hexachlorocyclopentadiene	4400	--	480	10	10	--	10	0.1	10
Hexachloroethane	0.13	71	80	--	0.13	--	0.13	0.020	0.13
Isophorone	3.0	1,100	16,000	--	3.0	--	3.0	0.020	3.0
Nitrobenzene	2.9	--	40	40	2.9	--	2.9	0.020	2.9
N-Nitroso-di-n-propylamine	0.0023	0.14	--	--	0.0023	--	0.0023	0.1	0.1
N-Nitrosodiphenylamine	0.18	200	--	20	0.18	--	0.18	0.020	0.18
Pentachlorophenol	0.048	8.3	2,400	3	0.048	--	0.048	0.00625 (i)	0.048
Phenol	5,000	--	48,000	30	30	--	30	0.020	30
Dioxins/Furans									
Total Dioxins/Furans TEC	2.5E-08 (a)	1.1E-05	--	2.0E-06	2.5E-08	5.2E-06	5.2E-06	5.7E-07	5.2E-06
PCBs									
Total PCBs (sum of Aroclors)	0.00040 (a)	0.5	--	0.65	0.00040	--	0.00040	0.004	0.004
Pesticides									
Aldrin	0.000049	0.059	2.4	0.1	0.000049	--	0.000049	0.0010	0.0010
alpha-BHC	0.00029 (a)	0.16	--	--	0.00029	--	0.00029	0.0010	0.0010
alpha-Chlordane***	0.00080 (a)	2.9	40	1	0.00080	--	0.00080	0.0010	0.0010
beta-BHC	0.00080	0.56	--	--	0.00080	--	0.00080	0.0010	0.0010
4,4'-DDD	0.00029	4.2	--	0.75	0.00029	--	0.00029	0.0020	0.0020
4,4'-DDE	0.00038	2.9	--	0.75	0.00038	--	0.00038	0.0020	0.0020
4,4'-DDT	0.0030	2.9	40	0.75	0.0030	--	0.0030	0.0020	0.0030
Dieldrin	0.000028	0.063	4	0.07	0.000028	--	0.000028	0.0020	0.0020
Endosulfan I**	0.0012 (a)	--	480	--	0.0012	--	0.0012	0.0010	0.0012
Endosulfan II**	0.0012 (a)	--	480	--	0.0012	--	0.0012	0.0020	0.0020
Endosulfan Sulfate**	0.0017 (a)	--	480	--	0.0017	--	0.0017	0.0020	0.0020
Endrin	0.00051	--	24	0.2	0.00051	--	0.00051	0.0020	0.0020
Endrin Aldehyde*	0.00016 (a)	--	24	0.2	0.00016	`	0.00016	0.0020	0.0020
Endrin Ketone*	0.00046 (a)	--	24	0.2	0.00046	--	0.00046	0.0020	0.0020
gamma-BHC (Lindane)	0.0012	0.77	24	6	0.0012	--	0.0012	0.0010	0.0012
gamma-Chlordane***	0.00080 (a)	2.9	40	1	0.00080	--	0.00080	0.0010	0.0010
Heptachlor	0.000015	0.22	40	0.4	0.000015	--	0.000015	0.0010	0.0010
Heptachlor epoxide	0.000065	0.11	1.0	0.4	0.000065	--	0.000065	0.0010	0.0010
Hexachlorobenzene	0.00047	0.63	64	17	0.00047	--	0.00047	0.0010	0.0010
Methoxychlor	0.048	--	400	--	0.048	--	0.048	0.010	0.048
Toxaphene	0.00038	0.91	--	--	0.00038	--	0.00038	0.10	0.10

Notes:

- Screening levels were developed for all constituents analyzed in soil.
- Screening level is based on lowest of soil concentrations protective of groundwater, human health - direct contact (MTCA Method B standard formula values for carcinogens and non-carcinogens), and terrestrial plants and animals, adjusted for background and practical quantification limit (PQL).
- Calculated concentrations protective of groundwater as marine surface water assume unsaturated soil, and are calculated based on groundwater screening levels before adjustment for background and PQLs.
- Shading indicates basis for screening level.

-- = No screening criteria available.
NE = No surface water criterion exists; therefore, soil concentration protective of groundwater as marine surface water is not calculated.
MTCA = Washington State Model Toxics Control Act
PAHs = Polycyclic aromatic hydrocarbons
cPAHs = Carcinogenic polycyclic aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
PQL = Practical quantitation limit
VOCs = Volatile organic compounds
SVOCs = Semivolatile organic compounds
TEC = Toxic equivalent concentration
TPH = Total petroleum hydrocarbons
(a) Values for Kd and/or K_{oc} and/or Henry's Law Constant are not available from CLARC; these values were taken from EPIWIN or ORNL RAIS.
(b) MTCA Method A soil cleanup levels are used for gasoline-range, diesel-range, and heavy oil-range petroleum hydrocarbons, and lead.
(c) Value for gasoline-range petroleum hydrocarbons if benzene is present. If benzene is not present, screening level is 100 mg/kg.
(d) Value is for total chromium.
(e) PQL is lowest available value from Analytical Resources, Inc. (Tukwila, WA) or Frontier Analytical Laboratory (El Dorado Hills, CA).
(f) Metals background values (Puget Sound Region 90th percentile values) are from *Natural Background Soil Metals Concentrations in Washington State* (Ecology Publication #94-115, 1994). Total dioxins/furans TEC background value provided by Ecology in review comments on the April 1, 2010 Draft Supplemental Upland Data Collection Work Plan.
(g) Regulatory background (MTCA Method A) value.
(h) PQL for EPA Method 7740.
(i) PQL for EPA Method 8041.
* Endrin values used for endrin aldehyde and endrin ketone.
** Endosulfan values used for endosulfan I, endosulfan II, and endosulfan sulfate.
*** Chlordane values used for alpha- and gamma-chlordane.

TABLE 2
GROUNDWATER SCREENING LEVELS
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Analyte	Concentration Protective of Marine Surface Water										Preliminary Screening Level µg/L	PQL (g) µg/L	Groundwater Screening Level (After adjustment for PQL) µg/L
	AWQC for Protection of Aquatic Life (a)		National Toxics Rule (b)			National Recommended Water Quality Criteria (c)			MTCA Method B Standard Formula Value - Protection of Human Health (Consumption of Aquatic Life)				
			AWQC for Protection of Aquatic Life		AWQC for Protection of Human Health	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health					
	Acute µg/L	Chronic µg/L	Acute µg/L	Chronic µg/L	µg/L	µg/L	µg/L	µg/L	Carcinogen µg/L	Non-Carcinogen µg/L			
TPH													
Gasoline-Range Petroleum Hydrocarbons	--	--	--	--	--	--	--	--	--	800 (d,e)	800	250	800
Diesel-Range Petroleum Hydrocarbons	--	--	--	--	--	--	--	--	--	500 (d)	500	250	500
Heavy Oil-Range Petroleum Hydrocarbons	--	--	--	--	--	--	--	--	--	500 (d)	500	400	500
Metals													
Antimony	--	--	--	--	4,300	--	--	640	--	1,000	640	0.2	640
Arsenic	69	36	69	36	0.14	69	36	0.14	0.098	18	0.098	0.2	0.2
Beryllium	--	--	--	--	--	--	--	--	--	270	270	0.2	270
Cadmium	42	9.3	42	9.3	--	40	8.8	--	--	20	8.8	0.20	8.8
Chromium III	--	--	--	--	--	--	--	--	--	240,000	240,000	0.50 (f)	240,000
Chromium VI	1,100	50	1,100	50	--	1,100	50	--	--	490	50	20	50
Copper	4.8	3.1	2.4	2.4	--	4.8	3.1	--	--	2,700	2.4	0.50	2.4
Lead	210	8.1	210	8.1	--	210	8.1	--	--	--	8.1	1.0	8.1
Manganese	--	--	--	--	--	--	--	100	--	--	100	0.50	100
Mercury	1.8	0.025	2.1	0.025	0.15	1.8	0.94	0.3	--	--	0.025	0.020	0.025
Nickel	74	8.2	74	8.2	4,600	74	8.2	4,600	4,600	1,100	8.2	0.50	8.2
Phosphorus	--	--	--	--	--	--	0.10	--	--	--	0.10	16	16
Selenium	290	71	290	71	--	290	71	4,200	--	2,700	71	0.5	71
Silver	1.9	--	1.9	--	--	1.9	--	--	--	26,000	1.9	0.2	1.9
Thallium	--	--	--	--	6.3	--	--	0.47	--	1.6	0.47	0.2	0.47
Zinc	90	81	90	81	--	90	81	26,000	--	17,000	81	4.0	81
VOCs													
1,1-Dichloroethene	--	--	--	--	3.2	--	--	7,100	--	23,000	3.2	0.2	3.2
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--	--	420,000	420,000	0.2	420,000
1,1,2-Trichloroethane	--	--	--	--	42	--	--	16	25	2,300	16	0.2	16
1,1,2,2-Tetrachloroethane	--	--	--	--	11	--	--	4	6.5	--	4	0.2	4
1,2-Dichloroethane	--	--	--	--	99	--	--	37	59	43,000	37	0.2	37
1,2-Dichloropropane	--	--	--	--	--	--	--	15	23	--	15	0.2	15
1,3-Dichloropropene (cis-, trans-)	--	--	--	--	1,700	--	--	21	19	41,000	19	0.2	19
Acrolein	--	--	--	--	780	--	--	290	--	--	290	5.0	290
Acrylonitrile	--	--	--	--	0.66	--	--	0.25	0.4	86	0.25	1.0	1.0
Benzene	--	--	--	--	71	--	--	51	23	2,000	23	0.45	23
Bromodichloromethane	--	--	--	--	22	--	--	17	28	14,000	17	0.2	17
Bromoform	--	--	--	--	360	--	--	140	220	14,000	140	0.2	140
Bromomethane	--	--	--	--	4,000	--	--	1500	--	970	970	0.5	970
Carbon Tetrachloride	--	--	--	--	4.4	--	--	1.6	2.7	97	1.6	0.2	1.6
Chlorobenzene	--	--	--	--	21,000	--	--	1,600	--	5,000	1,600	0.2	1,600

Analyte	Concentration Protective of Marine Surface Water									Preliminary Screening Level µg/L	PQL (g) µg/L	Groundwater Screening Level (After adjustment for PQL) µg/L
	AWQC for Protection of Aquatic Life (a)		National Toxics Rule (b)			National Recommended Water Quality Criteria (c)			MTCA Method B Standard Formula Value - Protection of Human Health (Consumption of Aquatic Life)				
			AWQC for Protection of Aquatic Life		AWQC for Protection of Human Health	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health					
	Acute µg/L	Chronic µg/L	Acute µg/L	Chronic µg/L	µg/L	µg/L	µg/L	µg/L	Carcinogen µg/L	Non-Carcinogen µg/L			
Chloroform	--	--	--	--	470	--	--	470	280	6,900	280	0.2	280
Chloromethane	--	--	--	--	--	--	--	--	130	--	130	0.5	130
Dibromochloromethane	--	--	--	--	34	--	--	13	21	14,000	13	0.2	13
Ethylbenzene	--	--	--	--	29,000	--	--	2,100	--	6,900	2,100	0.42	2,100
Methylene Chloride (Dichloromethane)	--	--	--	--	1,600	--	--	590	960	170,000	590	0.5	590
Toluene	--	--	--	--	200,000	--	--	15,000	--	19,000	15,000	0.48	15,000
Total Xylenes	--	--	--	--	--	--	--	--	--	1,000 (d,f)	1,000	0.78	1,000
Tetrachloroethene (PCE)	--	--	--	--	8.9	--	--	3.3	0.39	840	0.39	0.20	0.39
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	10,000	--	33,000	10,000	0.20	10,000
Trichloroethene (TCE)	--	--	--	--	81	--	--	30	6.7	71	6.7	0.20	6.7
Vinyl chloride	--	--	--	--	530	--	--	2.4	3.7	6600	2.4	0.20	2.4
PAHs													
Acenaphthene	--	--	--	--	--	--	--	990	--	640	640	1.0	640
Anthracene	--	--	--	--	110,000	--	--	40,000	--	26,000	26,000	1.0	26,000
Fluoranthene	--	--	--	--	370	--	--	140	--	90	90	1.0	90
Fluorene	--	--	--	--	14,000	--	--	5,300	--	3,500	3,500	1.0	3,500
Naphthalene	--	--	--	--	--	--	--	--	--	4,900	4,900	1.0	4,900
Pyrene	--	--	--	--	11,000	--	--	4,000	--	2,600	2,600	1.0	2,600
Total cPAHs TEC	--	--	--	--	0.031	--	--	0.018	0.030	--	0.018	0.0076	0.018
SVOCs													
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	70	--	230	70	1.0	70
1,2-Dichlorobenzene	--	--	--	--	17,000	--	--	1,300	--	4,200	1,300	1.0	1,300
1,3-Dichlorobenzene	--	--	--	--	2,600	--	--	960	--	--	960	1.0	960
1,4-Dichlorobenzene	--	--	--	--	2,600	--	--	190	4.9	--	4.9	1.0	4.9
2-Chloronaphthalene	--	--	--	--	--	--	--	1,600	--	1,000	1,000	1.0	1,000
2-Chlorophenol	--	--	--	--	--	--	--	--	--	97	97	1.0	97
2,4-Dichlorophenol	--	--	--	--	790	--	--	290	--	190	190	5.0	190
2,4-Dimethylphenol	--	--	--	--	--	--	--	850	--	550	550	1.0	550
2,4-Dinitrophenol	--	--	--	--	14,000	--	--	5,300	--	3,500	3,500	10.0	3,500
2,4-Dinitrotoluene	--	--	--	--	9.1	--	--	3.4	--	1,400	3.4	5.0	5.0
2,4,5-Trichlorophenol	--	--	--	--	--	--	--	3,600	--	--	3,600	5.0	3,600
2,4,6-Trichlorophenol	--	--	--	--	6.5	--	--	2.4	3.9	--	2.4	0.25 (h)	2.4
3,3'-Dichlorobenzidine	--	--	--	--	0.077	--	--	0.028	0.046	--	0.028	5.0000	5.0
bis(2-Chloroethyl)ether	--	--	--	--	1.4	--	--	0.53	0.85	--	0.53	1.0	1.0
Bis(2-chloro-1-methylethyl) ether	--	--	--	--	--	--	--	--	37	--	37	1.0	37
bis(2-Chloroisopropyl) ether	--	--	--	--	--	170,000	--	65,000	--	42,000	42,000	1.0	42,000
Bis (2-ethylhexyl) Phthalate	--	--	--	--	5.9	--	--	2.2	3.6	400	2.2	1.0	2.2
Butylbenzylphthalate	--	--	--	--	--	--	--	1,900	--	1,300	1,300	1.0	1,300
Diethylphthalate	--	--	--	--	120,000	--	--	44,000	--	28,000	28,000	1.0	28,000
Di-n-butylphthalate	--	--	--	--	12,000	--	--	4,500	--	2,900	2,900	1.0	2,900

Analyte	Concentration Protective of Marine Surface Water										Preliminary Screening Level µg/L	PQL (g) µg/L	Groundwater Screening Level (After adjustment for PQL) µg/L
	AWQC for Protection of Aquatic Life (a)		National Toxics Rule (b)			National Recommended Water Quality Criteria (c)			MTCA Method B Standard Formula Value - Protection of Human Health (Consumption of Aquatic Life)				
			AWQC for Protection of Aquatic Life		AWQC for Protection of Human Health	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health					
	Acute µg/L	Chronic µg/L	Acute µg/L	Chronic µg/L	µg/L	µg/L	µg/L	µg/L	Carcinogen µg/L	Non-Carcinogen µg/L			
Hexachloroethane	–	–	–	–	8.9	–	–	3.3	5.3	30	3.3	1.0	3.3
Pentachlorophenol	13	7.9	13	7.9	8.2	13	7.9	3.0	4.9	7,100	3.0	0.25 (h)	3.0
Phenol	–	–	–	–	4,600,000	–	–	1,700,000	–	1,100,000	1,100,000	1.0	1,100,000
Dimethylphthalate	–	–	–	–	2,900,000	–	–	1100000	–	72,000	72,000	1.0	72,000
Hexachlorobutadiene	–	–	–	–	50	–	–	18	30	190	18	1.0	18
Hexachlorocyclopentadiene	–	–	–	–	17,000	–	–	1,100	–	3,600	1,100	5.0	1,100
Isophorone	–	–	–	–	600	–	–	960	1,600	120,000	600	1.0	600
Nitrobenzene	–	–	–	–	1,900	–	–	690	–	450	450	1.0	450
N-Nitroso-di-n-propylamine	–	–	–	–	–	–	–	0.51	0.82	–	0.51	5.0	5.0
N-Nitrosodiphenylamine	–	–	–	–	16	–	–	6	9.7	–	6	1.0	6
Dioxins/Furans													
Total Dioxins/Furans TEC	–	–	–	–	1.4E-08	–	–	5.1E-09	–	–	5.1E-09	5.7E-06	5.7E-06
PCBs													
Total PCBs (sum of Aroclors)	10	0.030	–	0.030	0.00017	–	0.030	0.000064	0.00011	–	0.000064	0.01	0.01
Pesticides													
Aldrin	0.71	0.0019	1.3	–	0.00014	1.3	–	0.000050	0.00008	0.017	0.000050	0.00083	0.00083
alpha-BHC	–	–	–	–	0.013	–	–	0.0049	0.0079	–	0.0049	0.00083	0.0049
alpha-Chlordane***	0.090	0.0040	0.090	0.0040	0.00059	0.090	0.0040	0.00081	0.0013	0.092	0.00059	0.00083	0.00083
4,4'-DDD	0.13	0.00100	–	–	0.00084	–	–	0.00031	0.00050	–	0.00031	0.0017	0.0017
4,4'-DDE	0.13	0.0010	–	–	0.00059	–	–	0.00022	0.00036	–	0.00022	0.0017	0.0017
4,4'-DDT	0.13	0.0010	0.13	0.0010	0.00059	0.13	0.0010	0.00022	0.00036	0.024	0.00022	0.0017	0.0017
beta-BHC	–	–	–	–	0.046	–	–	0.017	0.028	–	0.017	0.00083	0.017
delta-BHC	–	–	–	–	–	–	–	0.041	–	–	0.041	0.00083	0.041
Dieldrin	0.71	0.0019	0.71	0.0019	0.00014	0.71	0.0019	0.000054	0.000087	0.028	0.000054	0.0017	0.0017
Endosulfan I**	0.034	0.0087	0.034	0.0087	–	–	–	–	–	58	0.0087	0.00083	0.0087
Endosulfan II**	0.034	0.0087	0.034	0.0087	–	–	–	–	–	58	0.0087	0.0017	0.0087
Endosulfan Sulfate**	0.034	0.0087	0.034	0.0087	–	–	–	–	–	58	0.0087	0.0017	0.0087
Endrin	0.037	0.0023	0.037	0.0023	0.8100	0.037	0.0023	0.060	–	0.1959	0.0023	0.0017	0.0023
Endrin Aldehyde*	0.037	0.0023	0.037	0.0023	0.8100	0.037	0.0023	0.060	–	0.1959	0.0023	0.0017	0.0023
Endrin Ketone*	0.037	0.0023	0.037	0.0023	0.8100	0.037	0.0023	0.060	–	0.1959	0.0023	0.0017	0.0023
gamma-BHC (Lindane)	0.16	–	0.16	–	0.063	0.16		1.8	0.038	6	0.038	0.00083	0.038
gamma-Chlordane***	0.090	0.0040	0.090	0.0040	0.00059	0.090	0.0040	0.00081	0.0013	0.092	0.00059	0.00083	0.00083
Heptachlor	0.053	0.0036	0.053	0.0036	0.00021	0.053	0.0036	0.000079	0.00013	0.12	0.000079	0.00083	0.00083
Heptachlor epoxide	–	–	0.053	0.0036	0.00011	0.053	0.0036	0.000039	0.000064	0.0030	0.000039	0.00083	0.00083

Analyte	Concentration Protective of Marine Surface Water										Preliminary Screening Level µg/L	PQL (g) µg/L	Groundwater Screening Level (After adjustment for PQL) µg/L
	AWQC for Protection of Aquatic Life (a)		National Toxics Rule (b)			National Recommended Water Quality Criteria (c)			MTCA Method B Standard Formula Value - Protection of Human Health (Consumption of Aquatic Life)				
			AWQC for Protection of Aquatic Life		AWQC for Protection of Human Health	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health					
	Acute µg/L	Chronic µg/L	Acute µg/L	Chronic µg/L	µg/L	µg/L	µg/L	µg/L	Carcinogen µg/L	Non-Carcinogen µg/L			
Hexachlorobenzene	--	--	--	--	0.00077	--	--	0.00029	0.00047	0.24	0.00029	0.00083	0.00083
Methoxychlor	--	--	--	--	--	--	0.03	--	--	8.4	0.03	0.0083	0.03
Toxaphene	0.21	0.00020	0.21	0.00020	0.00075	0.21	0.00020	0.00028	0.00045	--	0.00020	0.083	0.083
Conventionals													
Ammonia	230	35	--	--	--	--	--	--	--	--	35	10	35

Notes:

- Screening levels were developed for all constituents analyzed in groundwater.
- Screening level is based on lowest of Federal and State marine surface water concentrations protective of aquatic life and human health - consumption of aquatic life (including MTCA Method B standard formula values for carcinogens and non-carcinogens), adjusted for practical quantification limit (PQL).
- Shading indicates basis for screening level.

-- = No screening criteria available.
µg/L = Micrograms per liter
MTCA = Washington State Model Toxics Control Act
PAHs = Polycyclic aromatic hydrocarbons
cPAHs = Carcinogenic polycyclic aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
PQL = Practical quantitation limit
VOCs = Volatile organic compounds
SVOCs = Semivolatile organic compounds
TEC = Toxic equivalent concentration
TPH = Total petroleum hydrocarbons
(a) Ambient water quality criteria (AWQC) for protection of aquatic life from WAC 173-201A-240.
(b) Ambient water quality criteria (AWQC) for protection of human health from 40 CFR Part 131d (National Toxics Rule).
(c) National Recommended Water Quality Criteria (EPA 2006).
(d) MTCA Method A groundwater cleanup levels are used for gasoline-range, diesel-range, and heavy oil-range petroleum hydrocarbons, and total xylenes and lead.
(e) Value for gasoline-range petroleum hydrocarbons if benzene is present. If benzene is not present, screening level is 1,000 µg/L.
(f) PQL for total chromium.
(g) PQL is lowest available value from Analytical Resources, Inc. (Tukwila, WA) or Frontier Analytical Laboratory (El Dorado Hills, CA).
(h) PQL for EPA Method 8041.
* Endrin values used for endrin aldehyde and endrin ketone.
** Endosulfan values used for endosulfan I, endosulfan II, and endosulfan sulfate.
*** Chlordane values used for alpha- and gamma-chlordane.

TABLE 3
COMPARISON OF PREVIOUS GROUNDWATER DATA TO WASHINGTON STATE DRAFT VAPOR INTRUSION SCREENING LEVELS
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Analyte	Unit	Draft MTCA-B Vapor Intrusion Screening Level for Groundwater	Total Number of Groundwater Results	Number of Detects	Minimum Detected Value	Maximum Detected Value	Number of Detected Exceedances	Number of Non-Detects	Minimum Non-Detect PQL	Maximum Non-Detect PQL	Number of Non-Detect Exceedances
Benzene	mg/l	0.0024	85	4	0.00042	0.0015		81	0.00011	0.009	1
Ethylbenzene	mg/l	2.8	85	4	0.00028	0.0011		81	0.00012	0.009	
o-XYLENE	mg/l	0.44	85	3	0.00027	0.00042		82	9.1E-05	0.009	
Toluene	mg/l	15	92	13	0.0001	0.049		79	0.0001	0.010	
Mercury	mg/l	0.00089	64	36	4E-07	0.002	1	28	2E-06	0.0005	
ALDRIN	ug/l	0.32	41					41	0.00043	0.062	
1,2,4-Trichlorobenzene	ug/l	3,900	83					83	0.016	1.3	
1,2-DICHLOROBENZENE	ug/l	1,800	84					84	0.015	1.3	
1,4-DICHLOROBENZENE	ug/l	7,900	85					85	0.014	1.3	
bis(2-Chloroethyl)ether	ug/l	26	86					86	0.015	4	
Hexachlorobutadiene	ug/l	0.81	127					127	0.02	45	108
Hexachloroethane	ug/l	8.6	86					86	0.019	2.6	
Naphthalene	ug/l	170	128	24	0.0032	20		104	0.02	45	
Nitrobenzene	ug/l	690	86					86	0.0074	1.3	
1,1,1,2-TETRACHLOROETHANE	ug/l	7.4	44					44	1	9	1
1,1,1-TRICHLOROETHANE	ug/l	11,000	86					86	0.099	9	
1,1,2,2-TETRACHLOROETHANE	ug/l	6.2	86					86	0.080	9	1
1,1,2-TRICHLOROETHANE	ug/l	7.9	86					86	0.053	9	1
1,1-DICHLOROETHANE	ug/l	2,300	86	6	0.2	3.2		80	0.10	9	
1,1-Dichloroethene	ug/l	130	86					86	0.14	9	
1,2,4-Trichlorobenzene	ug/l	3,900	44					44	5	45	
1,2,4-Trimethylbenzene	ug/l	24	44					44	1	9	
1,2-DIBROMOETHANE	ug/l	0.74	44					44	1	9	44
1,2-DICHLOROBENZENE	ug/l	1,800	43					43	1	9	
1,2-DICHLOROETHANE	ug/l	4.2	88	2	72	93	2	86	0.084	9	1
1,2-DICHLOROPROPANE	ug/l	28	86					86	0.10	9	
1,3,5-Trimethylbenzene	ug/l	25	44					44	1	9	
1,4-DICHLOROBENZENE	ug/l	7,900	43					43	1	9	
2-BUTANONE	ug/l	350,000	86	3	1.9	10		83	0.46	45	
4-METHYL-2-PENTANONE	ug/l	11,000	86	1	3.2	3.2		85	0.41	45	
Acrolein	ug/l	2.9	44					44	50	450	44
Acrylonitrile	ug/l	16	44					44	5	90	1
Benzene	ug/l	2.4	3	1	0.74	0.74		2	0.20	2	1
BROMODICHLOROMETHANE	ug/l	0.09	86					86	0.075	9	81
BROMOFORM	ug/l	200	86					86	0.063	9	
BROMOMETHANE	ug/l	13	44					44	1	18	1

Analyte	Unit	Draft MTCA-B Vapor Intrusion Screening Level for Groundwater	Total Number of Groundwater Results	Number of Detects	Minimum Detected Value	Maximum Detected Value	Number of Detected Exceedances	Number of Non-Detects	Minimum Non-Detect PQL	Maximum Non-Detect PQL	Number of Non-Detect Exceedances
CARBON DISULFIDE	ug/l	400	93	7	0.17	2		86	0.12	10	
CARBON TETRACHLORIDE	ug/l	0.22	86					86	0.14	9	45
CHLOROBENZENE	ug/l	100	86					86	0.090	9	
CHLOROETHANE	ug/l	12	86					86	0.089	18	1
CHLOROFORM	ug/l	1.2	86					86	0.098	9	1
CHLOROMETHANE	ug/l	5.2	86					86	0.12	18	1
cis-1,2-DICHLOROETHENE	ug/l	160	67	4	0.20	2		63	0.20	9	
DIBROMOCHLOROMETHANE	ug/l	0.22	86					86	0.059	9	45
Ethylbenzene	ug/l	2,800	3					3	0.20	2	
Isopropylbenzene	ug/l	720	44					44	1	9	
Methylene chloride	ug/l	94	93	8	0.10	42		85	0.091	18	
o-XYLENE	ug/l	440	1					1	0.20	0.20	
STYRENE	ug/l	78	86	1	0.20	0.20		85	0.10	9	
TETRACHLOROETHYLENE	ug/l	1	86					86	0.11	9	1
Toluene	ug/l	15,000	3	1	0.90	0.90		2	0.30	2	
trans-1,2-DICHLOROETHENE	ug/l	130	86					86	0.10	9	
TRICHLOROETHENE	ug/l	0.42	88	5	0.14	9.6	3	83	0.11	9	45
TRICHLOROFLUOROMETHANE	ug/l	120	44					44	1	18	
TRICHLOROTRIFLUOROETHANE	ug/l	1,100	44					44	2	45	
Vinyl Acetate	ug/l	7,800	86					86	0.087	45	
VINYL CHLORIDE	ug/l	0.35	88	3	0.12	34	2	85	0.10	18	45

TABLE 4
CONFIRMED CONSTITUENTS OF POTENTIAL CONCERN (COPCs) IN SOIL AND GROUNDWATER*
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Chemical Name	Confirmed Soil COPC	Confirmed Groundwater COPC
Dioxins/Furans		
Total Dioxins/Furans TEC	X	X
PCBs		
Total PCBs (sum of seven Aroclors**)	X	X
SVOCs		
2,4,6-Trichlorophenol		X
bis(2-Ethylhexyl)phthalate	X	X
Pentachlorophenol	X	X
Pyrene	X	
Total cPAHs TEC	X	X
Pesticides		
4,4'-DDD	X	X
4,4'-DDE	X	X
4,4'-DDT	X	X
Aldrin	X	
alpha-Chlordane	X	X
beta-BHC	X	
Dieldrin	X	
Endosulfan I	X	
Endosulfan II	X	
Endosulfan sulfate	X	
Endrin	X	X
Endrin aldehyde	X	X
Endrin ketone	X	X
gamma-BHC (lindane)	X	
gamma-Chlordane	X	
Heptachlor	X	X
Heptachlor epoxide	X	
Hexachlorobenzene	X	

Chemical Name	Confirmed Soil COPC	Confirmed Groundwater COPC
Metals		
Antimony	X	
Arsenic	X	X
Barium	X	
Cadmium	X	X
Chromium	X	
Cobalt	X	
Copper	X	X
Lead	X	X
Nickel	X	
Manganese	X	X
Mercury	X	X
Nickel	X	X
Selenium	X	X
Silver	X	X
Thallium	X	
Vanadium	X	
Zinc	X	
TPH		
Diesel-Range Petroleum Hydrocarbons	X	X
Heavy Oil-Range Petroleum Hydrocarbons	X	
VOCs		
Trichloroethene (TCE)		X
1,2-Dichloroethane (1,2-DCA)		X
Vinyl chloride		X
Conventionals		
Ammonia-N (un-ionized)		X

Notes:

*Based on comparison of existing soil and groundwater data to screening levels listed in Tables 1 and 2. Confirmed COPCs are constituents that were detected above screening levels.

**Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

PCBs = Polychlorinated biphenyls

TEC = Toxic equivalent concentration

TPH = Total petroleum hydrocarbons

VOCs = Volatile organic compounds

TABLE 5
UNCONFIRMED CONSTITUENTS OF POTENTIAL CONCERN (COPCs) IN SOIL AND GROUNDWATER*
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Chemical Name	Unconfirmed Soil COPC	Unconfirmed Groundwater COPC
SVOCs		
1,4-Dichlorobenzene	X	
2,4,6-Trichlorophenol	X	
2,4-Dinitrotoluene	X	
3,3'-Dichlorobenzidine	X	
bis(2-Chloro-1-methylethyl)ether	X	
bis(2-Chloroethyl)ether	X	X
Hexachloroethane	X	
n-Nitroso-di-n-propylamine	X	
n-Nitrosodiphenylamine	X	
Pesticides		
Aldrin		X
alpha-BHC	X	X
beta-BHC		X
delta-BHC		X
Dieldrin		X
Endosulfan I		X
Endosulfan II		X
Endosulfan sulfate		X
gamma-BHC (lindane)		X
gamma-Chlordane		X
Heptachlor epoxide		X
Hexachlorobenzene		X
Methoxychlor		X
Toxaphene	X	X
Metals		
Thallium		X
TPH		
Gasoline-Range Petroleum Hydrocarbons	X	X
VOCs		
Acrylonitrile		X
Tetrachloroethene (PCE)	X	X

Notes:

*Based on comparison of existing soil and groundwater data to screening levels listed in Tables 1 and 2. Unconfirmed COPCs are constituents that were not detected above screening levels, but had a significant number of non-detect results (at least 25 percent of the total number of non-detect results) for which the practical quantitation limits exceeded screening levels.

SVOCs = Semivolatile organic compounds

TEC = Toxic equivalent concentration

TPH = Total petroleum hydrocarbons

VOCs = Volatile organic compounds

TABLE 6
UPLAND DATA GAPS AND PROPOSED INVESTIGATION ACTIVITIES
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Existing Data Gap	Proposed Investigation Activity
Data Gap 1 Groundwater to surface water/sediment pathway (both fresh and marine) is not adequately characterized.	Rayonier shall complete characterization of groundwater to surface water/sediment pathway. Rayonier shall: • Conduct reconnaissance within the Study Area along the upper portion of the intertidal zone during low tide to look for visual evidence of groundwater seeps. • If seeps are observed: o Compare locations of seeps to potential upland source areas (e.g., areas with known or suspected soil contamination (where soil contaminants exceed screening criteria for protection of groundwater (soil contaminants of potential concern, or soil COPCs)) and/or areas where groundwater contaminants exceed surface water criteria (groundwater COPCs)). o At locations where seeps are observed downgradient of potential upland source areas, collect representative samples of groundwater/pore water from intertidal zone sediments in the vicinity of observed seeps. o It is anticipated that groundwater/pore water samples will be collected using temporary, pre-packed well points. o Analyze groundwater/pore water samples collected from intertidal zone sediments. The initial baseline sampling will include all soil and groundwater parameters as listed in Table 2 of Exhibit B in the Agreed Order. The Work Plan will provide criteria for potentially narrowing the list of analytes for subsequent analysis. o To evaluate trends, develop and implement a quarterly seep monitoring program for one year using the pre-packed wells screens. The analyte list will be consistent with the groundwater monitoring program (see Data Gap #10). • If seeps are not observed, evaluate the adequacy of the shoreline monitoring coverage. Install new monitoring wells as described in the Work Plan. • Regardless of whether seeps are observed, collect surface water samples in Ennis Creek downgradient of the Finishing Room area. Analyze for groundwater COPCs.

Existing Data Gap	Proposed Investigation Activity
Data Gap 2 Sources of groundwater contamination are not adequately characterized. For example, the potential sources of pesticide contamination in groundwater throughout the property, and sources of phenol contamination in MW-23 have not been clearly identified.	Rayonier shall complete characterization of the sources of groundwater contamination. Rayonier shall: • Evaluate potential sources to groundwater contamination from on-property soil contamination. The evaluation, to be documented in the Work Plan, shall include, but not be limited to: o Reviewing existing soil data in areas where groundwater COPCs exceed groundwater screening criteria to determine if soil contamination is an ongoing source: ▪ compare existing soil chemistry data to soil concentrations protective of groundwater which discharges to nearby marine surface water, calculated using Ecology's 3-phase partitioning model (referred to herein as protection of groundwater criteria); and ▪ evaluate existing soil sample depths for adequacy in determining potential soil contamination impacts to groundwater. o Reviewing all existing soil data for the upland portion of the Study Area to determine potential sources to groundwater contamination: ▪ compare all existing soil chemistry data to protection of groundwater criteria; ▪ evaluate existing soil sample depths for adequacy in determining potential soil contamination impacts to groundwater; and ▪ evaluate if groundwater monitoring network is adequate in areas of soil contamination. o Providing the results of this evaluation, including the need for additional soil and/or groundwater sampling in the Work Plan. • For groundwater COPCs that do not appear to be related to past mill operations (e.g., pesticides): o assess if the COPCs are related to past mill operations by researching available mill records and interviewing key personnel with direct knowledge of historical facility operations; and o Research potential current or historical off property, upgradient sources (e.g., golf courses, orchards, etc.). o Install upgradient monitoring wells to assess potential on-property migration of COPCs from off-property sources.

Existing Data Gap	Proposed Investigation Activity
Data Gap 3 Soil contamination near process piping has not been adequately characterized. By process piping, Ecology is referring to any and all piping used historically and/or presently to carry or transport hazardous substances within the Study Area.	Rayonier shall complete characterization of soil contamination near identified process piping. Rayonier shall: • Overlay historical underground process piping layout on Study Area base map to compare piping locations to existing soil and groundwater sampling locations. • Based on available information, identify pipe construction materials (e.g., concrete, metal, plastic, etc.) and use/contents of piping for possible hazardous substances, as defined by MTCA. • Using the above-referenced piping overlay, collect and analyze direct-push groundwater grab samples at appropriate intervals to be determined in the Work Plan adjacent to piping runs to screen for potential releases of hazardous substances from the piping, except in areas where existing soil and/or groundwater data can be used to screen for piping releases. Groundwater samples from direct-push borings will be analyzed for the possible hazardous substances carried by the piping including, but not limited to, the potential breakdown products associated with the hazardous substances handled in the piping. • Where groundwater grab sampling results indicate possible piping releases, conduct targeted "pot-holing" excavations using a backhoe, excavator, or vactor truck to expose sections of piping that could potentially contain hazardous substances in those areas where releases are suspected; collect and analyze samples of pipe contents (if present) for the possible hazardous substances carried by the piping. • Where groundwater grab sampling results indicate possible piping releases, conduct targeted soil sampling and analysis as necessary to fill any remaining data gaps following characterization of pipe contents. Soil samples will be analyzed for the possible hazardous substances carried by the piping including, but not limited to, the potential breakdown products associated with hazardous substances handled in the piping or detected in groundwater. • Research available mill decommissioning records for documentation of pipe draining/flushing activities and provide the results of this research in the Work Plan. • Excavate to expose piping previously encountered at sampling location SR23; collect and analyze a sample of the pipe contents (referred to in the RI as "black liquid") for the possible hazardous substances carried by the piping.

Existing Data Gap	Proposed Investigation Activity
Data Gap 4 The extent of residual soil contamination remaining after the interim actions in the Interim Action Areas (Ennis Creek-Finishing Room Area, Fuel Oil Tank No. 1, Hog Fuel Pile, Fuel Oil Tank No. 2, Machine Shop, and Wood Mill) is not clearly delineated.	Rayonier shall complete delineation of residual contamination remaining after previously conducted interim actions in the Interim Action Areas. Rayonier shall: • Overlay interim action verification sampling locations on the Study Area base map to compare locations of soil verification samples to locations of characterization (RI and ESI) soil samples. • At the expected edges of interim action excavation areas, conduct subsurface exploration and soil sampling/analysis to assess the extent of residual contamination beyond the interim action areas; use test pits, direct-push borings, and/or other investigative methods to be defined in the Work Plan as appropriate (except for the Ennis Creek Finishing Room Area, as discussed below). Analyses will be detailed in the Work Plan. • In areas where residual soil contamination appears to be limited in extent (i.e., less than 100 cy total for all areas based on observations during subsurface exploration), remove and appropriately store or dispose of readily accessible contamination during exploration activities (e.g., at utility pole near former Fuel Oil Tank No. 1). • Where indicted by the results of soil sampling, conduct additional groundwater characterization to assess the extent of local groundwater impacts. Groundwater samples will be analyzed for COPCs detected in adjacent soils. • In the Ennis Creek Finishing Room Area, collect additional soil samples to define the volume of petroleum and PCB contaminated soil remaining at the foot of the bridge. Soil boring data from new monitoring wells to be installed downgradient of the Finishing Room Area (see Data Gap #7) may be sufficient to define the volume of residual contamination.
Data Gap 5 The characterization of lateral and vertical groundwater contamination downgradient of the Fuel Oil Tank #2 and Hog Fuel Pile Interim Action Areas is inadequate.	Rayonier shall adequately characterize groundwater laterally and vertically downgradient of the Fuel Oil Tank #2 and Hog Fuel Pile Interim Action Areas. Rayonier shall: • Install two groundwater monitoring wells downgradient of the Fuel Oil Tanks #1 and #2, and the Hog Fuel Pile Interim Action Areas. Locate one well south of MW28. Locate the second well near the shoreline between MW52 and MW28. These locations will provide more complete coverage for groundwater monitoring downgradient of Fuel Oil Tanks #1 and #2, and provide groundwater flow direction and elevation. Monitoring wells will be screened to the top of the glacial till with screen interval not to exceed 20 feet. • Sample and analyze the new monitoring wells as detailed in Data Gap #10.

Existing Data Gap	Proposed Investigation Activity
Data Gap 6 The characterization of lateral and vertical groundwater contamination in the vicinity of MW-11 is inadequate as MW-11 was removed during the 2001 interim action at former Fuel Oil Tank No. 2. Free product was previously observed in this well.	Rayonier shall adequately characterize groundwater laterally and vertically in the vicinity of the prior well location MW-11. Rayonier shall: • Dig a test pit excavation at the location of former well MW-11 to assess soil contamination in the unsaturated zone and shallow saturated zone immediately below the water table. If visible petroleum contamination, collect soil samples for analysis. • Conduct limited removal with appropriate storage or disposal of petroleum contaminated soil and free product if encountered in this area and backfill the excavation with clean fill. • If contaminated soil is encountered, install a monitoring well downgradient of the excavation to document post removal groundwater quality near the location of former MW-11. The monitoring well will be screened to the top of the glacial till with screen interval not to exceed 20 feet. • If petroleum contaminated soil is not encountered, use existing wells MW-23, MW-28, and MW-29 to monitor groundwater immediately downgradient of former MW-11.
Data Gap 7 Groundwater characterization in the area and immediately downgradient of the Finishing Room is inadequate.	Rayonier shall adequately characterize groundwater laterally and vertically in the area and immediately downgradient of the Finishing Room. Rayonier shall: • Install one to two groundwater monitoring wells, as determined in the Work Plan, between the upland Finishing Room interim action area and marine surface water. • Sample and analyze the new monitoring wells as detailed in Data Gap #10.
Data Gap 8 The characterization of lateral and vertical groundwater contamination downgradient of the Fuel Oil Tank #1 is inadequate.	Rayonier shall adequately characterize groundwater laterally and vertically downgradient of the Fuel Oil Tank #1. • The monitoring wells to be installed to address Data Gap #5 are anticipated to be sufficient to address this data gap. • Sampling and analysis is detailed in Data Gap #10.
Data Gap 9 Well construction information has not been evaluated for adequacy to detect dense non-aqueous phase liquids (DNAPLs).	Rayonier shall evaluate well construction information for adequacy to detect DNAPLs. Rayonier shall: • Determine the depth and competency of the "glacial till" layer by: o installing a boring near MW13 to the till layer; and o reviewing available data and literature regarding the competency and continuity of the till layer. • Collect a series of groundwater samples at various depths during boring installation for VOC analysis. • If the till layer is deeper than expected, or if VOCs are detected above groundwater screening levels, then further investigations will be evaluated. The Work Plan shall detail potential follow-up evaluations and decision criteria for Ecology review and approval. • If the till layer is at the expected depth and the dissolved groundwater concentrations are below the groundwater screening levels, then no further investigation is anticipated.

Existing Data Gap	Proposed Investigation Activity
Data Gap 10 Groundwater data is no longer current (last data collected in 2003), nor sufficient for evaluating trends.	Rayonier shall begin quarterly monitoring of groundwater from all existing and new wells. Rayonier shall: • Redevelop and sample existing and new monitoring wells. Groundwater samples will be collected using low-flow sampling techniques. • In the initial baseline sampling, include all soil and groundwater parameters as listed in Table 2 in Exhibit B of the Agreed Order. The Work Plan will provide the criteria for potentially narrowing the list of analytes for subsequent analysis. • The Work Plan shall specify the analytical methods to be used such that the practical quantitation limits (PQLs) do not exceed the screening criteria. Consistent with WAC 173-340-830(2)(e), Ecology may require modifications to the standard analytical methods to provide lower quantitation limits, improved accuracy, greater precision, or to address methods appropriate for the site, the media being analyzed, the hazardous substances being analyzed for, or the anticipated use of the data. Table 2 in Exhibit B of the Agreed Order provides a preliminary list of analytical methods and routine PQLs. The laboratories shall achieve the lowest sample-specific quantitation limits (also referred to as method reporting limits) consistent with the method and any analytical constraints imposed by the sample matrix. • Use data from the baseline sampling, as well as historical groundwater data, to develop and implement a groundwater monitoring program for the Study Area which considers seasonal trends and tidal fluctuations.

TABLE 7
SUPPLEMENTAL UPLAND DATA COLLECTION FIELD PROGRAM
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Investigation Phase*	Agreed Order Exhibit B Data Gap Number(s)	Planned Activities	Anticipated Results/Data Use
Phase 1 Baseline Groundwater Sampling, Seep Survey, Surface Water Sampling	1, 10	• Conduct baseline groundwater sampling event (redevelop and sample existing monitoring wells – analyze for soil and groundwater COPCs). • Conduct seep survey to identify/document seep locations. • Collect Ennis Creek surface water samples downgradient of Finishing Room Area, and upstream surface water samples from Ennis Creek and White Creek near the southern property boundary (analyze for groundwater COPCs).	• Baseline groundwater sampling results will inform: o groundwater grab sampling locations adjacent to process piping (Phase 2). o potential seep sampling locations (Phase 3). o shoreline and potential upgradient and "infill" monitoring well locations (Phases 2 and 4). o quarterly groundwater and seep monitoring program (Phase 5). • Seep survey results will inform the shoreline monitoring well location (Phase 2) and potential seep sampling locations (Phase 3). • Ennis Creek surface water sampling results will inform the monitoring well location between Finishing Room Area and shoreline/marine surface water (Phase 2). • Upstream surface water sampling results will inform potential upgradient monitoring locations (Phase 4).
Phase 2 Groundwater Grab Sampling, Soil Borings, Monitoring Well Installation and Sampling	2, 3, 4, 5, 7, 8 9	• Collect groundwater grab samples adjacent to process piping (analyze for soil and groundwater COPCs). • Collect discrete-depth groundwater grab samples and soil samples adjacent to PA-19 (analyze soil and groundwater for TPH, SVOCs, PCBs, and metals). • Collect soil samples from selected groundwater grab locations to assess vertical extent of soil contamination (analyze selectively for TPH, SVOCs, PCBs, pesticides, metals, and dioxins/furans).	• Groundwater grab sampling results adjacent to process piping will inform the need for, and scope of, piping excavation/pipe contents sampling and soil sampling adjacent to piping (Phase 3). • Groundwater grab sampling results at former MW-13 location will inform the need for, and scope of, additional groundwater characterization for VOCs (Phases 4 and 5). • Sampling results at PA-19 location will inform the need for any additional sampling this area.

Phase 2 (continued)		• Collect discrete-depth groundwater grab samples at former MW-13 location (analyze for VOCs). The boring will be advanced into the glacial deposits. Soil samples will be collected for VOCs, sieve analysis, and permeability testing. • Collect soil samples from multiple depths at nine soil boring locations to assess vertical extent of soil contamination (analyze selectively for TPH, SVOCs, PCBs, pesticides, metals, and dioxins/furans). • Install and sample two monitoring wells downgradient of Fuel Oil Tanks 1 and 2 Area and Hog Fuel Pile Area (analyze soil for TPH, SVOCs/PAHs, PCBs, and lead; analyze groundwater for soil and groundwater COPCs). • Install and sample one monitoring well downgradient of Finishing Room Area (analyze soil for TPH, SVOCs/PAHs, and PCBs; analyze groundwater for soil and groundwater COPCs). • Install and sample one shoreline monitoring well between the Finishing Room Area and existing well PZ-9 (analyze both soil and groundwater for soil and groundwater COPCs). • Install and sample up to four optional upgradient monitoring wells (analyze both soil and groundwater for soil and groundwater COPCs).	• Soil sampling results from nine soil borings and grab groundwater locations will be used to assess vertical extent of contamination. • Results of monitoring well sampling and groundwater grab sampling adjacent to process piping and at former MW-13 location will inform: o potential seep sampling locations (Phase 3). o potential "infill" monitoring well locations (Phase 4). o quarterly groundwater and seep monitoring program (Phase 5). • Soil sampling results from monitoring well borehole in Finishing Room Area will be used to assess extent of residual contamination in this area.
Phase 3 Seep Sampling, Process Piping Contents/Soil Sampling, Targeted Soil Sampling/Soil Removal in Interim Action Areas and Potential Source Areas	1, 2, 3, 4, 6	• If seeps are identified during Phase 1, install and sample up to seven seep monitoring stations (temporary pre-packed well points installed in intertidal sediments; analyze groundwater/pore water for soil and groundwater COPCs). • Expose process piping at RI sampling location SR23 and sample pipe contents (analyze for TPH, SVOCs/PAHs, VOCs, PCBs, pesticides, metals, dioxins/furans, and ammonia). • If necessary based on results of groundwater grab sampling adjacent to process piping (Phase 2), expose piping (if present) at potential release location(s) and sample pipe contents (analyze for TPH, metals, PCBs, VOCs, SVOCs/PAHs).	• Seep sampling results will inform quarterly groundwater and seep monitoring program (Phase 5). • Soil sampling results will inform potential "infill" monitoring well locations (Phase 4).

Phase 3 (continued)		• If necessary based on results of groundwater grab sampling adjacent to process piping (Phase 2), dig targeted test pits and collect soil samples adjacent to piping to assess potential piping-related source areas (analyze for TPH, metals, VOCs, and/or SVOCs/PAHs). • Dig targeted test pits and collect soil samples in Fuel Oil Tanks 1 and 2, Hog Fuel Pile, Wood Mill, and Machine Shop Areas (including former MW-11 location) to assess extent of residual contamination (analyze for COPCs associated with these areas). (Note: extent of residual contamination in Finishing Room Area will be assessed using soil samples obtained from the monitoring well borehole to be completed in this area during Phase 2.) • Dig targeted test pits and collect soil samples as needed to complete the characterization of hot spots/potential soil-to-groundwater source areas (analyze for COPCs associated with hot spots/potential soil-to-groundwater source areas). • Conduct limited removal of contaminated soil (up to 100 cy total) and/or free product if encountered in piping excavations/test pits.	
Phase 4 "Infill" Monitoring Well Installation and Sampling, Additional Groundwater Characterization for VOCs	1, 2, 4, 6, 9	• If necessary based on soil/groundwater sampling results from Phases 1 through 3, install and sample "infill" monitoring wells (including a new well at the location of MW-11, if needed) (analyze for soil and groundwater COPCs). • If needed, complete additional groundwater characterization for VOCs near former MW-13.	• Results of monitoring well sampling (and additional groundwater characterization for VOCs, if needed) will inform quarterly groundwater and seep monitoring program (Phase 5).
Phase 5 Quarterly Groundwater and Seep Monitoring	1, 10	• Develop and implement quarterly groundwater and seep monitoring program (analyze for COPCs selected based on soil/groundwater sampling results from Phases 1 through 4).	• Results of ongoing quarterly groundwater and seep monitoring will inform potential future modifications to the monitoring program.

*Note: results from each investigation phase will be submitted and discussed with Ecology as soon as possible following the field effort, and an updated/refined plan for subsequent phase(s) will be presented for Ecology review and discussion before proceeding with the next phase.

TABLE 8
CONSTRUCTION DETAILS FOR EXISTING MONITORING WELLS
PORT ANGELES RAYONIER MILL SITE
PORT ANGELES, WASHINGTON

Well ID	Northing (a)	Easting (a)	Date Installed	Ground Elevation (ft NGVD 29)	Casing Elevation (b) (ft NGVD 29)	Screened Interval (ft bgs)		Well Installed By
						Top of Screen	Bottom of Screen	
MW-23	417783	1011276	2/21/1991	12.9	11.10	4.0	13.0	Landau
MW-28	417745	1011088	6/12/1991	10.4	9.79	5.0	15.3	Landau
MW-29	417791	1011174	6/12/1991	11.4	10.88	5.1	15.5	Landau
MW-51	418288	1011799	2/26/1998	--	13.36	13.0	23.0	Landau
MW-52	417610	1010635	2/25/1998	--	14.10	13.0	23.0	Landau
MW-53	417990	1011135	2/14/2001	9.4	11.91	8.0	14.0	Landau
MW-54	418173	1011250	2/14/2001	10.9	13.59	7.0	23.0	Landau
MW-55	418282	1011322	2/13/2001	10.0	13.84	9.5	27.5	Landau
MW-56	418194	1012044	2/14/2001	10.6	10.86	12.0	32.0	Landau
MW-57	418069	1011468	11/21/2002	12.1	14.06	5.0	30.0	Landau
MW-58	417926	1011911	11/21/2002	10.1	12.05	5.0	20.0	Landau
MW-59	417190	1013376	11/22/2002	12.0	14.02	4.0	19.0	Landau
PZ-2	417932	1011234	8/5/1993	11.13	10.77	4.0	19.0	Harding Lawson Associates (HLA)
PZ-3	418244	1011484	8/4/1993	10.77	10.60	4.0	19.0	Harding Lawson Associates (HLA)
PZ-4	417726	1011547	8/9/1993	9.07	8.81	4.0	19.0	Harding Lawson Associates (HLA)
PZ-5	417284	1012067	8/10/1993	10.13	9.91	4.0	14.0	Harding Lawson Associates (HLA)
PZ-6	416878	1011841	8/2/1993	15.43	15.26	4.0	14.0	Harding Lawson Associates (HLA)
PZ-7	417068	1012258	8/3/1993	20.73	20.49	4.5	19.5	Harding Lawson Associates (HLA)
PZ-9	417397	1012941	8/5/1993	9.58	9.26	3.5	21.5	Harding Lawson Associates (HLA)
PZ-10	417164	1012938	8/10/1993	10.60	10.33	4.0	19.0	Harding Lawson Associates (HLA)
PZ-11	416754	1012559	8/3/1993	28.20	27.91	6.0	15.0	Harding Lawson Associates (HLA)
PZ-12	416547	1012281	8/10/1993	30.51	30.21	7.0	22.0	Harding Lawson Associates (HLA)
PZ-13	416876	1013854	8/6/1993	10.68	11.60	4.0	19.0	Harding Lawson Associates (HLA)
PA-19	417221	1012402	8/21/2009	--	--	10.0	15.0	Brown and Caldwell

Notes:

(a) Coordinates listed are relative to the Washington Coordinate System of 1983, North Zone [NAD 83(91)]. Surveys conducted by Northwestern Territories Inc. in Feb. 2001 and Nov. 2002.

(b) Casing elevation based on 2001 survey data, not information on original boring log.

ft bgs = Feet below ground surface.

ft NGVD 29 = Feet above National Geodetic Vertical Datum of 1929.

-- = Information not available.