

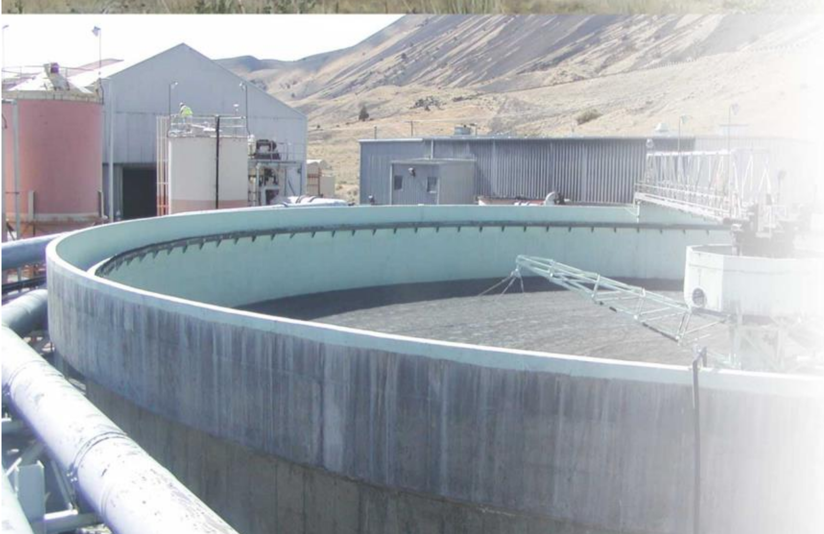


FINAL DRAFT REMEDIAL INVESTIGATION REPORT

VOLUME 2: SOLID WASTE MANAGEMENT UNIT (SWMU) RESULTS AND SUMMARY

Columbia Gorge Aluminum Smelter Site

Revision 0
Goldendale, WA
Facility Site ID #95415874

Agreed Order DE 10483

June 14, 2022

On behalf of:

Lockheed Martin Corporation
6801 Rockledge Drive
Bethesda MD 20817

NSC Smelter LLC
85 John Day Dam Road
Goldendale WA 98620

Prepared by:

Tetra Tech, Inc.
19803 North Creek Parkway
Bothell WA 98011

Blue Mountain Environmental Consulting Inc.
125 Main Street
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P. O. Box 1020
Battle Ground WA 98604

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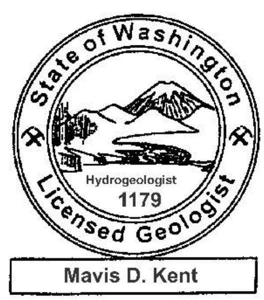

Dr. Mavis Kent
Licensed Geologist, Plateau Geosciences

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Acronyms

AOC	Area of Concern
BAL	Basalt Aquifer – Lower Zone
BAU	Basalt Aquifer – Upper Zone
BMEC	Blue Mountain Environmental Consulting, Inc.
BPA	Bonneville Power Administration
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CAP	Cleanup Action Plan
CDDs	Concentrations for dioxins
CDFs	Concentrations for furans
CLARC	Cleanup Level and Risk Calculation database
COPCs	Chemicals of Potential Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
Ecology	Washington Department of Ecology
EELF	East End Landfill
EHW	Extremely Hazardous Waste
ESI	East Surface Impoundment
FS	Feasibility Study
ft bgs	Feet below ground surface
gpm	Gallons per minute
GPR	Ground-Penetrating Radar
GPS	Global Positioning System
GWAOC	Groundwater Area of Concern
HEAF	High Efficiency Air Filtration
HMW	High Molecular Weight
JARPA	Joint Aquatic Resources Permit Application
Lockheed Martin	Lockheed Martin Corporation
MCLs	Maximum Contaminant Levels
mg/kg	Milligrams per kilogram
mg/L	Milligrams per Liter
MTCA	Model Toxics Control Act
NESI	North of the East Surface Impoundment
NPDES	National Pollutant Discharge Elimination System
NSC	NSC Smelter, LLC
PAAOC	Plant Area – Area of Concern

PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PGG	Plateau Geoscience Group, LLC
PID	Photoionization Detector
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SPL	Spent Pot Liner
SPLP	Synthetic Precipitation Leaching Procedure
SSA	Smelter Sign Area
SWMU	Solid Waste Management Unit
Tetra Tech	Tetra Tech, Inc.
TPH	Total Petroleum Hydrocarbons
TPH-Dx	Total Petroleum Hydrocarbons – Diesel-extended range
TPH-Gx	Total Petroleum Hydrocarbons – Gasoline-extended range
TSS	Total Suspended Solids
TEC	Toxicity Equivalent Concentrations
TTEC	Total Toxicity Equivalent Concentrations
UA	Unconsolidated Aquifer
USACE	U.S. Army Corps of Engineers
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WELF	West End Landfill
WPA	Work Plan Addendum
WSI	West Surface Impoundment

Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)
(Agreed Order No. DE 10483)

Solid Waste Management Units (SWMUs)

NPDES Ponds (SWMU 1)
East Surface Impoundment (ESI) (SWMU 2)
Intermittent Sludge Disposal Ponds (SWMU 3)
West Surface Impoundment (SWMU 4)
Line A Secondary Scrubber Recycle Station (SWMU 5)
Line B, C, D Secondary Scrubber Recycle Stations (SWMU 6)
Decommissioned Air Pollution Control Equipment (SWMU 7)
Tertiary Treatment Plant (SWMU 8)
Paste Plant Recycle Water System (SWMU 9)
North Pot Liner Soaking Station (SWMU 10)
South Pot Liner Soaking Station (SWMU 11)
East SPL Storage Area (SWMU 12)
West SPL Storage Area (SWMU 13)
North SPL Storage Containment Building (SWMU 14)
South SPL Storage Building (SWMU 15)
SPL Handling Containment Building (SWMU 16)
East End Landfill (SWMU 17)
West End Landfill (SWMU 18)
Plant Construction Landfill (SWMU 19)
Drum Storage Area (SWMU 20)
Construction Rubble Storage Area (SWMU 21)
Wood Pallet Storage Area (SWMU 22)
Reduction Cell Skirt Storage Area (SWMU 23)
Carbon Waste Roll-off Area (SWMU 24)
Solid Waste Collection Bin and Dumpsters (SWMU 25)
HEAF Filter Roll-Off Bin (SWMU 26)
Tire and Wheel Storage Area (SWMU 27)
90-Day Drum Storage Area (SWMU 28)
Caustic Spill (SWMU 29)

Paste Plant Spill (SWMU 30)
Smelter Sign Area (SWMU 31)
Stormwater pond and appurtenant facilities (SWMU 32)

Additional Investigation Areas

West SPL Storage Area Ditch
ESI Fence Line Area
Eastern Reconnaissance Area

Areas of Concern (AOCs)

Columbia River Sediments
Groundwater in the Uppermost Aquifer at the Facility
Wetlands
Rectifier Yard
Plant Area

Preface

This Volume (Volume 2 of the revised RI Report) summarizes the RI results for each of the 32 SWMUs at the site. An additional area of investigation was identified to include the southern surface drainage ditch near the West Spent Pot Liner (SPL) Storage Area (SWMU 13). Results for each SWMU are presented in numerical order followed by a summary and recommendation section. The revised RI report consists of the following additional Volumes:

- **Volume 1, Introduction and Project Framework**, presents background information about the site identified data need the site conceptual model, the regulatory framework including screening levels and risk pathway evaluation and calculation approach, and data quality assessment. References for the entire RI report are also included in Volume 1.
- **Volume 3, Rectifier Yard Area of Concern (AOC) and Plant Area AOC Results and Summary** presents the results for the for main footprint of the former plant and includes summarization of RI results for the Rectifier Yard and Plant Area AOCs. This section also includes relevant data from SWMUs and underground conveyance lines within the footprint of the former plant courtyards and south plant area.
- **Volume 4, Areas of Concern Results and Summary,** presents the RI results for the five AOCs including: the Columbia River Sediments AOC, the Groundwater in Uppermost Aquifer AOC, and the Wetlands AOC. A summary and recommendations section is also included at the end of the Volume.
- **Volume 5, Appendices,** includes all Appendices for the RI report including: Appendix A, Derived Screening Levels and Background Concentrations; Appendix B, SWMU Field Logs; Appendix C, Columbia River Sediments AOC; Appendix D, Groundwater in the Uppermost Aquifer AOC; Appendix E, Wetlands AOC; Appendix F, Rectifier Yard AOC; Appendix G, Plant Area AOC; Appendix H, Analytical Results; and Appendix I Data Validation Reports.

Background information regarding the SWMUs and associated RI data needs is briefly summarized in Volume 1 of the RI with further details summarized in the Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b) and the WPA (Tetra Tech et al. 2020a). Analytical results and data validation reports for the SWMUs are provided in Volume 4, Appendices H and I. Field logs for the SWMUs are provided in Volume 4, Appendix B and are organized by SWMU number and the initial RI and WPA data sets.

Figure P-1 and P-2 show the locations of the SWMUs and other plant features and property ownership in the site vicinity.

Legend

Wetlands

N
W E
S

0 500 1,000 2,000

Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure P-1
Primary Site and Vicinity
Features Map

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

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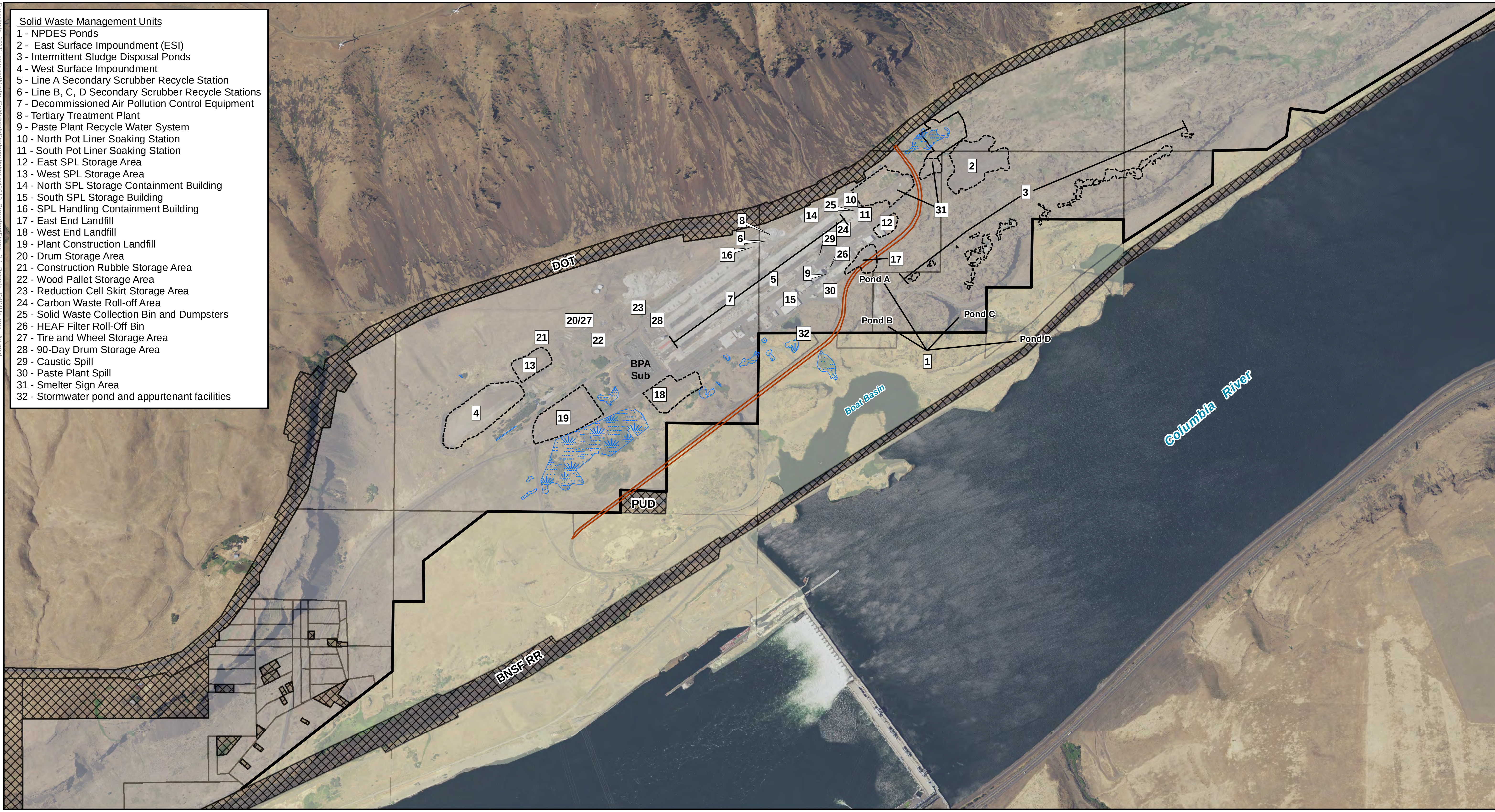


Legend

- NSC Smelter LLC Parcels
- USACE
- Other Ownership
- Klickitat County Road Right-of-Way (John Day Dam Road)
- Property Boundary
- 1 Solid Waste Management Unit
- SWMU Investigation Areas
- Wetlands

N
W E
S

0 500 1,000 2,000
Feet

Imagery Source: NAIP 2017

Figure P-2
Parcel Ownership and
Solid Waste Management Units
and Investigation Areas

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Section 1
NPDES Ponds (SWMU 1)

The National Pollutant Discharge Elimination System (NPDES) Ponds Solid Waste Management Unit (SWMU 1) consists of four former wastewater settling ponds (Ponds A through D) and associated drainage between the ponds that were used for retention and settlement of solids in wastewater from the former aluminum reduction facility. The NPDES ponds (SWMU 1) were constructed during the early 1970s in a natural drainage feature and were gravity-discharged to the Columbia River. Waste streams from the smelter’s air pollution control scrubber systems were discharged under a NPDES permit into Ponds A and B and the discharge from these ponds was historically combined with the plant’s other industrial discharges (e.g., cooling water, stormwater run-off, and treated sewage). NPDES Pond D and a portion of NPDES Pond C are located on property owned by the U.S. Army Corps of Engineers (USACE). The sediment loading rates to the ponds were reduced by a series of wastewater treatment improvements in the late 1970s and 1980s, notably the change from wet to dry air pollution scrubbers in 1978.

As summarized in the Final Remedial Investigation (RI) Phase 1 Work Plan (Tetra Tech et al. 2015a), several environmental investigations have been conducted at the ponds over the years. Most recently, a remedial action was completed at the NPDES Ponds during 2010 (ARCADIS 2011). A total of 55,529 tons of polycyclic aromatic hydrocarbon (PAH)-contaminated sludge were removed from the ponds and the associated drainage ditch. This total mass included 46,812 tons of solid waste and 8,717 tons of extremely hazardous waste (EHW). Portions of the ponds were excavated down to bedrock, and the soil confirmation sample results indicated that the remaining soils met the Model Toxics Control Act (MTCA) Method B soil screening levels for PAHs.

A bypass pipeline was constructed in May 2010 to route process wastewater flows and stormwater around the former ponds. The pipeline generally follows the gravel access road and is equipped with an automated monitoring station and flow controls. The autosampler reportedly controls an emergency bypass (stormwater bypass channel) that discharges to the main NPDES channel between NPDES Ponds B and C in the event of a system upset.

Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for further details regarding the operational history, past investigation, and RI data needs for the NPDES Ponds (SWMU 1).

1.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

This section summarizes the field investigation and approach for the NPDES Ponds (SWMU 1). The NPDES Ponds were investigated in two phases; the first phase during the initial RI field investigation in 2017 and the second phase during the Work Plan Addendum (WPA) Fall 2020 and Spring 2021 field investigations. The scope of the WPA investigation phase was determined based on the initial RI results to address extent of contamination data gaps and to address Washington Department of Ecology (Ecology) and Yakama Nation comments on the Draft RI Report (Ecology and Yakama Nation 2019).

1.1.1 Initial RI Sampling Program

The Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) identified runoff from the discharge pipe at the head of Pond A as having some potential to re-contaminate Pond A soil. As described in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a), the discharge pipe appears to be connected to the old scrubber effluent system and associated line corridor (refer to Volume 3). Investigation and sampling of this discharge outfall was performed as part of the Plant Area – Area of Concern (PAAOC) RI investigation. Results of this investigation are in Volume 3 of this RI Report.

Past pipe discharge water results have shown fluoride consistently above the maximum contaminant level (MCL) of 4.0 milligrams per liter (mg/L) during pre-RI sampling events. The objective of the initial RI sampling was to determine if soils in contact with the discharge pipe runoff have become re-contaminated following completion of the remedial action.

Discharge from the emergency bypass also could potentially re-contaminate the NPDES drainage channels and lower ponds. The objective of the initial RI sampling was to determine current chemical concentrations in the stormwater bypass channel soils and evaluate the recontamination potential of the emergency bypass.

As part of the initial RI characterization, six surface soil samples were collected with a hand-auger from the area of the discharge pipe at the head of Pond A to characterize current conditions. One sample was collected about 10 feet (ft) downstream from the pipe outlet and the other five samples were collected from an area extending downstream about 200 ft from the pipe outlet. The sample stations were located within the drainage channel and the area of white-grey sediment/precipitate that appears to mark an area of standing water that is present during wet periods. In addition, five surface soil samples were collected from the stormwater bypass channel with a hand-auger to characterize current chemical conditions.

The samples were collected at a depth of 0 to 0.5 feet below ground surface (ft bgs). The samples were analyzed for PAHs, total cyanide, fluoride, sulfate, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

1.1.2 WPA Field Program

Initial RI analytical results show the presence of carcinogenic polycyclic aromatic hydrocarbons (cPAHs) above MTCA Method B soil screening levels, soil screening levels for protection of groundwater and terrestrial ecological screening levels in both NPDES Pond A and the stormwater bypass channel. Based on initial RI results, Pond A and the Stormwater Bypass channel are contaminated, but based on the initial data, the extent and source of contamination was unclear, but was thought to be potentially related to the ongoing pipe discharge at the head of Pond A, the nearby East End Landfill (EELF), or residual contamination that was not completely addressed by past remediation activities at the NPDES Ponds during 2010.

Investigation objectives for the WPA included the following:

- Determine the extent of soil contamination in NPDES Ponds A, B, C, and D.
- Determine if the EELF (SWMU 17) is a source of the NPDES Pond A soil contamination.
- Chemical characterization of discharge and flow estimate for discharge pipe at the head of NPDES Pond A (see scrubber effluent and other lines investigation, Volume 3, Section 2.5).

- Determine composition of white crusty material (potential precipitate – possibly gypsum) that coats the bottom of NPDES Pond A and Pond B. The objective was to determine if this material represents a visual marker of contamination (e.g., fluoride minerals or PAHs). It was assumed that this material represents gypsum or carbonate (e.g., caliche) and does not represent a marker of contamination or fluoride salts.

- Reconnaissance of the Unlined Ditch between Ponds B and C.

The WPA data collection effort included collection of soil samples from the following subareas:

- **East End Landfill Slopes**. Collection of 11 surface soil samples from the slopes north of Pond A at a higher elevation that include the footprint of the southern lobe of the East End Landfill (EELF).

- **Pond A Channel, Pond A and Pond A Adjacent Western Slope**. This includes the collection of soil samples at 11 stations and deeper samples at the maximum depth that could be obtained using hand-tools (1.1 and 1.5 ft bgs).

- **Pond B**. Collection of soil samples at 8 stations within Pond B including three deeper samples collected at the maximum depth that could be obtained using hand tools (0.75 ft bgs, 1.5 ft bgs, and 1.8 ft bgs, respectively.)

- **Ponds C and D**. Ten surface soil samples were collected from Ponds C (6 stations) and Pond D (4 stations).

1.2 INVESTIGATION RESULTS

Table 1-1 summarizes the results for the initial RI field program and Table 1-2 summarizes the WPA results. The sample locations and results are shown by area in Figure 1-1, Figure 1-2, and Figure 1-3, respectively.

Tables 1-1 and 1-2 includes comparison against applicable soil screening levels. Because a portion of the NPDES ponds is on land that is not owned by the current smelter owner (Pond D) and portions of the Ponds are zoned as open space (i.e., Ponds B, C, and D), results have been screened against MTCA Method B, MTCA-derived soil screening levels for protection of groundwater, and MTCA terrestrial ecologic soil screening levels protective of plants, soil biota, and wildlife. MTCA Method A and C screening levels and soil background concentrations are also provided for review.

Table 1-1
SWMU 1 - NPDES Ponds Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

						Ecological Indicator						Analytical Results										
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU1-SS1-0.5 6/29/2016	SWMU1-SS1B-0.5 6/30/2016	SWMU1-SS2-0.5 6/29/2016	SWMU1-SS2B-0.5 6/30/2016	SWMU1-SS3-0.5 6/29/2016	SWMU1-SS3B-0.5 6/30/2016	SWMU1-SS4-0.5 6/29/2016	SWMU1-SS4B-0.5 6/30/2016	SWMU1-SS5-0.5 6/29/2016	SWMU1-SS5B-0.5 6/30/2016	SWMU1-SS6-0.5 6/29/2016
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	2.5 UJ	2.1 U	2.4 UJ	2 U	2.5 UJ	2.1 U	2.1 UJ	1.9 U	2.1 UJ	2 U	2.2 UJ
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	95	34	28	28	39	52	63 J	32	55 J	13	70 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	94	32	76	28	160	12	1,200 J	75	240 J	7.7 J	250 J
Polycyclic Aromatic Hydrocarbons (PAHs)																						
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	**3.7**	**0.23**	**1.2**	0.052	**0.14**	0.043	**1.2**	0.024	**2.6**	0.0037 J	**0.12**
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	**5.4**	0.31	**1.8**	0.058	0.19	0.06	1.7	0.025	**3.8**	0.0046	0.14
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	21	2.6	3.6	0.88	0.82	0.32	7.8	0.49	15	0.053	1.1
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.34	0.048	0.33	0.023	0.052	0.01 J	0.29	0.011 J	0.41	0.0014 J	0.056
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	29	7.6	10	1.4	1.1	0.49	12	0.88	24	0.081	1.3
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	160	44	50	13	11	5	66	9.2	140	0.87	21
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	160	67	54	27	12	7.5	81	14	170	1.4	27
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	200	110	71	42	15	13	110	23	210	2.4	43
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	110	58	49	29	10	7.7	71	13	140	1.8	29
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	72	40	23	15	4.4	3.3	42	6.5	98	0.81	11
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	180	100	65	20	17	8.8	97	16	190	1.3	32
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	26	11	8.8	4.5	1.7	1.2	16	2.1	24	0.25	4.9
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	260	53	87	24	19	7	120	12	260	1.4	35
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	8.6	1.4	3.2	0.38	0.36	0.16	3.8	0.21	8.1	0.023	0.38
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	130	57	45	31	12	8	76	13	150	1.8	34
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	**8.8**	0.48	4.1	0.088	0.38	0.061	3.1	0.041	**7**	0.0078	0.21
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	130	19	42	6.2	7.1	1.8	55	2.9	110	0.37	8.6
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	240	49	77	23	18	6.1	110	11	230	1.3	33
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**221**	**94.2**	**74.43**	**37.75**	**16.58**	**10.638**	**113**	**19.54**	**234**	**2.026**	**38.71**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	**467**	**84.668**	**153**	**33.081**	**29.142**	9.944	**205**	16.581	**431**	1.9445	**46.906**
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**1,278**	**536**	**443**	**205**	**101**	**60.6**	**669**	**108**	**1,352**	**11.93**	**235**
Metals																						
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	19,000	15,000	10,000	12,000	12,000	13,000	**29,000**	12,000	24,000	11,000	22,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.5	5.7	3.2	4.3	3.8	4.2	7.2	3.8	5.1	5.8	7
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.59	**0.91**	0.58	0.5	0.61	0.34	**1.2**	0.41	**1.5**	0.35	**1.4**
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	15 J	23	9.2 J	17	11 J	18	25 J	16	26 J	11	22 J
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	22 J	**55**	16 J	36	25 J	22	35 J	20	24 J	25	31 J
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	11	16	5.1	10	7.6	7.9	19	7.5	16	6.3	19
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.013 J	0.034	0.0062 U	0.022	0.016 J	0.014 J	0.038	0.014 J	0.021	0.013 J	0.042
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	25	**64**	16	**41**	22	25	**57**	24	**40**	17	**56**
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**1.6**	**0.81**	**1.1**	**0.76**	**1.5**	**0.62**	**2.4**	**0.62**	**1.2**	**0.81**	**2.1**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	76	**130**	**91**	80	**97**	59	**260**	66	**160**	53	**190**

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Table 1-2
SWMU 1 - NPDES Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020 - Spring 2021

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Ecological Indicator: Eco-SSL Soil Biota	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU1-WPA-SS-1 12/2/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-2 12/4/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-3 12/2/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-4 12/2/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-5 12/4/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-6 12/3/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-7 12/3/2020 EELF-Adjacent Slopes	WPA-SS-55 (Duplicate of SWMU1-WPA-SS-7) 12/3/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-8 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-9 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-10 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-11 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-12 12/3/2020 NPDES Pond A
Aluminum Smelter																								
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.12 J	0.53	0.07 U	0.2 J	0.38	0.07 U	0.08 U	0.08 U	0.07 U	0.08 U	0.09 U	0.1 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	**208**	**1,410**	110	**154**	**562**	63.6 J	84.6 J	83.5 J	18.9 J	**194 J**	**154**	**150**	34.3
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	9.7	972	1.5 J	3.7	6.2	30.1	25.3	29.4	39.1	20	910	1,470	10.3
Polycyclic Aromatic Hydrocarbons (PAHs)																								
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	1.4	0.88	0.31	0.3	1.6	0.011	0.078	0.076	0.0005 J	0.0054 J	0.052	0.053	0.00053 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	5.5	2.8	2.2	1.6	6.7	0.081	0.94	0.81	0.0022 J	0.044	0.086	0.039	0.0013 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.13 J	0.051 J	0.022 J	0.032 J	0.15	0.00073 J	0.0095 J	0.011 J	0.00033 U	0.0067	0.12	0.3	0.00042 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	7.3	4.1	2.2	2	8.4	0.072	0.93	1	0.0031 J	0.071	0.31	0.43	0.0019 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	48	41	22	16	40	0.77	12	10	0.037	1.7 J	6.8	6.4	0.026
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	51	46	25	17	42	0.96	15	13	0.054	2.9	35	30	0.042
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	74	75	36	25	60	1.4	22	19	0.084	9.9	70	59	0.079
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	31	33	16	11	24	0.68	8.4	7.6	0.048	6.1	64	57	0.067
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	27	20	13	8.7	19	0.47	6.8	6.5	0.028	2.1 J	27	29	0.03
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	55	49	28	19	44	0.96	15	14	0.051	3.5	26	31	0.045
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	8.9	9.3	4.7	3	7	0.19	2.6	2.3	0.012	1.3 J	1.7	13	0.012
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	86	64	35	28	78	1.2	19	17	0.058	1.5 J	3.9	4.4	0.043
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	2.8	1.5	1.2	0.69	3.4	0.037	0.37	0.34	0.001 J	0.023	0.074	0.053	0.001 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	37	39	19	13	30	0.78	10	9.3	0.053	6.3	63	60	0.064
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	2.8	1.1	0.37	0.36	2.3	0.019	0.1	0.1	0.00092 J	0.0098	0.079	0.11	0.00085 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	43	27	16	13	44	0.52	6.6	6.2	0.018	0.38	0.95	1.2	0.01
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	75	55	31	25	66	1.1	17	16	0.053	1.6 J	4.6	6.7	0.041
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	2.6	0.97	0.67	0.53	3.1	0.022	0.18	0.18	0.00069 U	0.014	0.15	0.16	0.00089 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**71.04**	**64.92**	**34.75**	**23.76**	**58.04**	**1.3306**	**20.49**	**17.85**	0.07591	**5.065**	**52.11**	**47.05**	0.06355
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	**149**	**101**	**57.302**	**45.982**	**145**	1.94073	28.0275	25.537	0.08372	2.0399	5.571	6.585	0.059
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**407**	**367**	**195**	**138**	**332**	**7.31**	**109**	**97.7**	0.42	**35.4**	**298**	**292**	0.406
Metals																								
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	22,100	**90,200**	16,800	24,800	**54,700**	8,390	16,000 J	20,400 J	9,040	14,900	**33,600**	**33,600**	6,430
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.54	**17.8**	3.86	5.04	4	2.4	2.6	2.9	3.9	6.9	**56**	**26.6**	2.1
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.42	0.77	0.226	0.507	**0.859**	0.105	0.259 J	0.36 J	0.168	**1.08**	**4.22**	**3.49**	0.133
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	16.6	**44.7**	14.7	27.6	35.4	7.81	12.7 J	16.1 J	11.2	16.8	23.8	19	6.37
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	32.1	**142**	17.1	24.6	**61.7**	10.6	15.8 J	21.6 J	17.9	16.1	29.3	19.6	13.7
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	19.3	**105**	14.3	16.8	24.7	4.78	10.1 J	13.6 J	6.46	19.4	**309**	**152**	4.43
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.004 J	0.029	0.002 U	0.006 J	0.008 J	0.004 J	0.008 J	0.009 J	0.007 J	0.011 J	0.033	0.041	0.005 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	28.6	**89.8**	13.4	**38.8**	**49.7**	7.47	14.8	17.7	11.8	**57.6**	**523**	**214**	11.1
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.3 J	**4 J**	0.1 J	0.3 J	**0.5 J**	0.2 U	0.2 U	0.2 U	0.2 U	**0.5 J**	**3.5**	**1.5 J**	0.2 U
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	64	71.6	55.5	63.2	55.3	34.9	48.8	48.7	45.9	53.8	**135**	**164**	43.2
Total Petroleum Hydrocarbons (TPHs)																								
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	**1,900**	**2,000**	**800**	**960**	**2,200**	26 J	**390**	260 J	3.1 B	29 J	190 J	190 J	2.8 B
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	**6,800**	**9,600**	**3,300**	**3,600**	**7,900**	100 J	**1,500**	**990 J**	11 B	230	**3,900**	**2,000**	8.3 B

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

EELF = East End Landfill

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NPDES = National Pollutant Discharge Elimination System

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Table 1-2
SWMU 1 - NPDES Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020 - Spring 2021
(Page 2 of 4)

						Ecological Indicator						Analytical Results												
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU1-WPA-SS-13 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-14 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-15 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-16 12/3/2020 NPDES Pond A	SWMU1-WPA-SS-17-0.25 12/4/2020 NPDES Pond A Drainage	SWMU1-WPA-SS-17-1.5 12/4/2020 NPDES Pond A Drainage	SWMU1-WPA-SS-18-0.25 12/4/2020 NPDES Pond A Drainage	SWMU1-WPA-SS-18-1.1 12/4/2020 NPDES Pond A Drainage	SWMU1-WPA-SS-19 12/4/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-20 12/4/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-21 12/4/2020 EELF-Adjacent Slopes	SWMU1-WPA-SS-22-0.25 12/4/2020 NPDES Pond B	SWMU1-WPA-SS-56-0.25 (Duplicate of SWMU1-WPA-SS-22-0.25) 12/4/2020 NPDES Pond B
Aluminum Smelter																								
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.08 U	0.07 U	0.07 U	0.07 U	0.2 J	0.07 U	0.1 J	0.08 U	0.07 U	0.45	0.07 U	0.07 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	60.4	86.5	37.5	103	58.4 J	38.9 J	87.5 J	49.1 J	32.4	**966**	123	20.4 J	21.5 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	8	6.4	2.7	6.2	74.6	30	121	75.7	2.5	12.8	3.1	4.6	4.8
Polycyclic Aromatic Hydrocarbons (PAHs)																								
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0026 J	0.0066	0.0024 J	0.0013 J	0.29	0.077	0.043 J	0.01	0.089	1.2	0.069	0.00081 J	0.00098 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.019	0.036	0.024	0.0067	1.3	0.3	0.31	0.082	0.5	5.8	0.42	0.0035 J	0.0029 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00083 J	0.0099	0.00063 J	0.00054 J	0.046 J	0.01	0.016 J	0.0034 J	0.016 J	0.1	0.016 J	0.00064 J	0.0004 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.026	0.058	0.034	0.008	2	0.47	0.41	0.094	0.65	7.7	0.58	0.0047 J	0.0045 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.39	0.76	0.46	0.088	15	2.9	5.2	1.4	5.2	52	5.1	0.063	0.055
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.54	1.3	0.6	0.12	17	3.4	7.4	1.8	6.3	52	6.2	0.098	0.083
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.96	2.7	0.93	0.18	24	4.9	12	2.9	9.4	78	8.8	0.2	0.16
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.57	2.7	0.48	0.1	12	2.5	6.4	1.6	4.7	30	4.6	0.19	0.14
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.3	0.93	0.33	0.06	8.6	1.7	3.8	0.94	3.1	28	3.3	0.072	0.059
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.59	1.7	0.6	0.11	18	3.6	6.8	1.9	6.4	56	6	0.11	0.089
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.13	0.53	0.13	0.025	3.3	0.7	1.7	0.43	1.3	9	1.3	0.04	0.031
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.59	1.1	0.66	0.14	24	4.8	8	2	8.3	97	8.2	0.11	0.095
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0091	0.018	0.012	0.0035 J	0.78	0.18	0.14	0.034	0.26	2.6	0.23	0.0024 J	0.0022 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.59	2.7	0.55	0.11	13	2.8	7.1	1.8	5.2	37	5.3	0.19	0.14
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0035 J	0.01	0.0035 J	0.0021 J	0.48	0.15	0.059 J	0.013	0.13	1.5	0.092	0.002 J	0.0025 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.17	0.34	0.22	0.054	11	2.3	2.6	0.64	3.8	42	3.6	0.031	0.028
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.57	1.1	0.63	0.13	21	4.2	7.2	2.1	7.3	88	7.2	0.1	0.091
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0055 J	0.017	0.0067	0.0021 J	0.57	0.16	0.08	0.02	0.17	2	0.15	0.0016 J	0.0018 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**0.7829**	**2.079**	**0.846**	0.1674	**23.57**	**4.736**	**10.448**	**2.566**	**8.784**	**72.96**	**8.64**	0.1556	0.12839
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.82103	1.5785	0.95653	0.21614	**39.896**	8.287	11.578	2.8764	13.745	**158**	13.207	0.15505	0.13648
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**4.64**	**14.42**	**4.71**	0.923	**132**	**26.7**	**57.6**	**14.87**	**48.9**	**430**	**47.8**	1.063	0.848
Metals																								
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	11,300	13,500	8,520	10,700	20,600	12,400	16,200	11,000	11,000	**46,600**	11,500	11,200 J	6,470 J
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	4.2	5.6	2.7	3.5	5.1	2.5	3.5	2.7	2.4	3.67	2.26	2.9 J	1.8 J
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.493	0.442	0.158	0.28	0.728	0.334	0.674	0.257	0.192	0.804	0.181	0.261 J	0.133 J
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	10.3	10.4	7.96	11.2	18	7.87	13.2	9.26	8.66	14.7	8.24	11.5 J	6.07 J
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	14.9	16.9	17.1	14	20.4	16.7	20.9	16.3	11.6	37.1	16.5	20.5	19.1
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	6.64	12.4	6.09	5.67	13.6	7.88	14.6	6.89	6.64	25	7.57	7.99 J	4.07 J
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.003 J	0.008 J	0.005 J	0.005 J	0.072	0.004 J	0.015 J	0.007 J	0.002 J	0.018 J	0.003 J	0.002 U	0.002 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	16.2	29.5	29.2	12.4	28.7	15.1	**30.6**	17.6	10.7	**48.6**	12.6	16.1 J	8.75 J
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.3 J	**0.4 J**	0.2 U	0.2 U	**0.8 J**	**0.4 J**	**1 J**	**0.4 J**	0.2 U	**0.4 J**	0.2 J	0.2 J	0.2 U
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	60.5	58.3	51.8	50.1	79.1	55.2	**87.5**	52.7	39.2	**102**	48.5	60.3 J	42.3 J
Total Petroleum Hydrocarbons (TPHs)																								
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	14 J	20 J	11 J	4 B	**480**	81	150 J	29 J	70	**2,100**	80	3.1 J	4.1 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	62 J	150	57 J	11 B	**1,900**	**290**	**640 J**	120 J	**330**	**8,200**	**320**	11 J	13 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
EELF = East End Landfill
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NPDES = National Pollutant Discharge Elimination System
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 1-2
SWMU 1 - NPDES Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020 - Spring 2021
(Page 3 of 4)

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU1-WPA-SS-22-1.5 12/4/2020 NPDES Pond B	SWMU1-WPA-SS-23 12/3/2020 NPDES Pond B	SWMU1-WPA-SS-56 (Duplicate of SWMU1-WPA-SS-23) 12/3/2020 NPDES Pond B	SWMU1-WPA-SS-24 12/3/2020 NPDES Pond B	SWMU1-WPA-SS-25-0.25 12/4/2020 NPDES Pond B	SWMU1-WPA-SS-25-1.8 12/4/2020 NPDES Pond B	SWMU1-WPA-SS-26 12/3/2020 NPDES Pond B	SWMU1-WPA-SS-27 12/3/2020 NPDES Pond B	SWMU1-WPA-SS-28 12/3/2020 NPDES Pond B	SWMU1-WPA-SS-29-0.25 12/4/2020 Stormwater Bypass Channel	SWMU1-WPA-SS-29-0.75 12/4/2020 Stormwater Bypass Channel	SWMU1-WPA-SS-30 3/29/2021 NPDES Pond C
Aluminum Smelter																							
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.07 U	0.08 U	0.08 U	0.07 U	0.08 U	0.08 U	0.07 U	0.08 U	0.08 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	30.4 J	68.1 J	119 J	26.1	13.2 J	6.5 J	131	**157**	62.9	32.8 J	33.2 J	50.3
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	41.8	9.8 J	49 J	7.7	3	56.7	34.1	198	7.8	1.9 J	1.5 J	1.5 B
Polycyclic Aromatic Hydrocarbons (PAHs)																							
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0012 J	0.0016 J	0.0033 J	0.00067 J	0.0015 J	0.00078 J	0.00076 J	0.0052 J	0.0011 J	0.0061	0.0041 J	0.0033 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0044 J	0.0066	0.0098	0.0032 J	0.004 J	0.00038 J	0.0034 J	0.019	0.005 J	0.064	0.033	0.0079 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00057 J	0.0043 J	0.0066	0.00034 U	0.00034 U	0.00029 U	0.00041 J	0.011	0.0018 J	0.0013 J	0.00094 J	0.005 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0072	0.014 J	0.026 J	0.0048 J	0.0044 J	0.00084 J	0.005 J	0.049	0.0095	0.085	0.04	0.15
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.078	0.19 J	0.3 J	0.06	0.054	0.0043 J	0.057	0.71	0.13	0.99	0.48	3.2
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.12	0.52	0.75	0.089	0.076	0.0044 J	0.08	2.1	0.25	1.6	0.74	7.8
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.25	0.98	1.3	0.15	0.13	0.0074	0.15	4.1	0.5	2.5	1.2	13
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.18	1.3 J	2 J	0.094	0.078	0.004 J	0.1	5.2	0.62	1.6	0.72	7.4
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.086	0.4	0.47	0.05	0.043	0.0028 J	0.055	1.3	0.17	0.73	0.35	3.5
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.14	0.36 J	0.92 J	0.09	0.081	0.0053	0.086	1.9	0.32	1.3	0.62	7.7
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.038	0.25	0.36	0.021	0.018	0.00086 J	0.024	0.98	0.096	0.36	0.16	1.5
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.13	0.24 J	0.42 J	0.096	0.09	0.0096	0.092	0.85	0.16	1.4	0.72	1.8
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0028 J	0.004 J	0.007	0.0017 J	0.0031 J	0.00093 J	0.0019 J	0.013	0.0032 J	0.032	0.019	0.0076 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.18	1.2	1.8	0.1	0.081	0.0042 J	0.11	4.7	0.49	1.7	0.78	8.2
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0025 J	0.0023 J	0.0039 J	0.0011 J	0.0037 J	0.0016 J	0.0012 J	0.0077	0.0018 J	0.01	0.0077	0.0048 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.039	0.073 J	0.12 J	0.031	0.034	0.0073	0.03	0.23	0.048	0.47	0.23	0.13
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.12	0.23 J	0.42 J	0.087	0.086	0.008	0.082	0.88	0.16	1.3	0.66	2.5
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.002 J	0.0039 J	0.0071	0.0013 J	0.0026 J	0.0011 J	0.0015 J	0.015	0.0028 J	0.016	0.0096	0.0095 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.1846	**0.8256**	**1.1822**	0.128	0.10941	0.006409	0.12046	**3.298**	**0.3918**	**2.241**	**1.0432**	**10.817**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.18767	0.3458	0.5966	0.13847	0.1407	0.02143	0.13467	1.1849	0.2304	2.0684	1.05474	2.1086
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**1.192**	**5.43**	**8.32**	0.741	0.647	0.04126	0.744	**21.87**	**2.736**	**12.08**	**5.71**	**54.8**
Metals																							
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	7,730	10,300	12,600	10,100	10,300	4,580	10,400	19,600	8,900	9,640	11,200	8,920
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	1.7	6.4 J	**8.4 J**	5.3	3.8	0.94 J	3.4	**12.2**	4	2.3	4.1	2.77
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.12	0.205 J	0.259 J	0.125	0.109	0.068	0.117	0.529	0.127	0.179	0.196	0.297
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	6.8	10.1 J	13.5 J	13.5	11.9	3.6	15.4	18.9	13	7.13	12.2	8.89
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	17	9.99 J	13.4 J	15.1	15.5	20.2	16.7	16.9	11.2	10.3	19.4	12.4
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	4.01	10.5 J	14.8 J	7.66	8.07	1.66	8	25.6	7.57	4.01	5.57	6.15
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.002 U	0.007 J	0.011 J	0.01 J	0.005 J	0.002 U	0.008 J	0.008 J	0.005 J	0.004 J	0.005 J	0.002 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	7.96	21.4 J	27.6 J	13	12.1	4.61	11.8	**73.7**	12.3	11.6	16.4	24.6
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.2 U	0.3 J	0.3 J	0.2 U	0.2 U	0.2 U	0.2 U	**0.5 J**	0.2 U	0.2 U	0.2 J	0.12 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	44	37 J	47.3 J	46.2	43	37.2	46	53.8	37.5	27.7	40.2	54.7
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	5.5 J	9.7 J	14 J	3.9 B	4.2 J	1.9 U	2.9 B	27 J	6.8 B	26 J	12 J	37
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	17 J	69 J	120 J	15 B	11 J	4.1 U	8.8 B	**280**	39 J	160	54 J	260

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

EELF = East End Landfill

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NPDES = National Pollutant Discharge Elimination System

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Table 1-2
SWMU 1 - NPDES Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020 - Spring 2021
(Page 4 of 4)

						Ecological Indicator						Analytical Results													
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU1-WPA-SS-31 3/29/2021 NPDES Pond C	SWMU1-WPA-SS-32-0.25 3/29/2021 NPDES Pond C	SWMU1-WPA-SS-33 3/29/2021 NPDES Pond C	SWMU1-WPA-SS-34 3/29/2021 NPDES Pond C	SWMU1-WPA-SS-35-0.25 3/29/2021 NPDES Pond C	SWMU1-WPA-SS-36-0.25 3/29/2021 NPDES Pond D	SWMU1-WPA-SS-37 3/29/2021 NPDES Pond D	SWMU1-WPA-SS-60 (Duplicate of SWMU1-WPA-SS-37) 3/29/2021 NPDES Pond D	SWMU1-WPA-SS-38-0.25 3/29/2021 NPDES Pond D	SWMU1-WPA-SS-39 3/29/2021 NPDES Pond D	SWMU1-WPA-SS-40-1.5 5/6/2021 NPDES Pond A Deeper Sample	SWMU1-WPA-SS-41-1.5 5/7/2021 NPDES Pond A Deeper Sample	SWMU1-WPA-SS-42-1.5 5/7/2021 NPDES Pond B Deeper Sample
Aluminum Smelter																									
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	23.6	21.8	75	41.3	5 U	4.5	5.1	5.9	8.5	29.7	26.4	29.7	29.1
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	10.5	14.6	235	146	733	1.4 B	1.4 B	1.3 B	1.4 B	4.2	3.3	46.1	47.7
Polycyclic Aromatic Hydrocarbons (PAHs)																									
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00055 J	0.00048 J	0.00039 U	0.0011 J	0.00053 J	0.00043 J	0.00046 J	0.00042 J	0.0017 J	0.00051 J	0.0019 J	0.0071	0.00039 U
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0018 J	0.00047 J	0.00032 U	0.0033 J	0.00039 J	0.00032 U	0.00032 U	0.0003 U	0.0063	0.00033 U	0.014	0.063	0.00057 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00029 U	0.0003 U	0.0003 U	0.00099 J	0.0003 U	0.0003 U	0.0003 U	0.00028 U	0.0023 J	0.00031 U	0.00097 J	0.0039 J	0.00035 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0021 J	0.0013 J	0.00071 J	0.0085	0.00087 J	0.0004 J	0.00045 J	0.00047 J	0.022	0.00032 U	0.021	0.08	0.00092 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0012 B	0.003 B	0.0011 B	0.09	0.0031 B	0.00061 B	0.00076 B	0.00087 B	0.32	0.0015 B	0.21	1.5	0.0068
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.0013 B	0.0076	0.0046 B	0.17	0.0072	0.00041 U	0.00054 B	0.0005 B	0.65	0.0017 B	0.29	2.1	0.0085
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0024 B	0.014	0.008 B	0.34	0.016	0.00041 U	0.0011 B	0.0012 B	1.3	0.0037 B	0.46	3.6	0.017
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0013 B	0.015	0.0094 B	0.42	0.019	0.00046 B	0.0015 B	0.0012 B	1.9	0.0026 B	0.29	2.2	0.016
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00067 B	0.0033 B	0.0022 B	0.094	0.0055 B	0.00026 U	0.00026 U	0.00051 B	0.35	0.001 B	0.16	1	0.0061
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0019 B	0.0052 B	0.0027 B	0.17	0.0068 B	0.00035 B	0.00041 B	0.00073 B	0.69	0.0019 B	0.28	2.1	0.011
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00024 U	0.0023 B	0.0016 B	0.058	0.0035 B	0.00055 B	0.00025 U	0.00035 B	0.28	0.00062 B	0.062	0.47	0.002 J
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.01	0.013	0.0073	0.14	0.0067	0.0016 B	0.0042 B	0.0052	0.49	0.0021 B	0.29	1.7	0.011
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00069 J	0.0006 U	0.0006 U	0.0022 J	0.00061 U	0.00061 U	0.0006 U	0.00057 U	0.0043 J	0.00062 U	0.0058	0.027	0.00077 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0018 B	0.014	0.0091 B	0.37	0.017	0.00039 U	0.001 B	0.00092 B	1.7	0.0026 B	0.29	2.2	0.015
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0011 J	0.00081 J	0.00073 J	0.0017 J	0.00096 J	0.00077 J	0.00082 J	0.00075 J	0.0026 J	0.001 J	0.0035 J	0.011	0.0006 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0069	0.0046 J	0.0016 J	0.036	0.0019 J	0.00078 J	0.00063 U	0.00065 J	0.071	0.00085 J	0.13	0.57	0.005 J
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.0049 B	0.012	0.0064	0.17	0.0071	0.0024 B	0.003 B	0.004 B	0.66	0.0027 B	0.34	2.2	0.015
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0026 J	0.0012 J	0.001 J	0.0022 J	0.0016 J	0.00077 J	0.00074 J	0.00088 J	0.0046 J	0.00065 U	0.0061	0.018	0.00085 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.001938	0.011312	0.006827	**0.2669**	0.011778	0.0003775	0.0008556	0.0008923	**1.0519**	0.002661	**0.411**	**2.998**	0.0133
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.02314	0.02066	0.01034	0.19379	0.01135	0.00398	0.00593	0.00749	0.6002	0.00446	0.46717	2.462	0.01921
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.01547	0.0764	0.0451	**1.882**	0.0852	0.00437	0.00831	0.01028	**7.85**	0.01832	**2.382**	**17.37**	0.0974
Metals																									
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	7,130	5,470	5,920	8,230	5,880	6,560	6,440	6,780	6,210	9,310	9,450	10,100	8,620
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.76	3.66	3.69	4.97	3.76	7.21	2.44	2.44	3.51	2.91	3.69	3.32	4.17
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.057	0.085	0.238	0.134	0.079	0.089	0.1	0.096	0.139	0.106	0.163	0.236	0.131
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	9.33	7.22	8.04	9.95	6.72	7.76	7.65	8.79	7.26	10.6	12.1	9.85	9.48
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	11.2	11.3	11.3	14.4	10.7	11.5	11.8	12.3	10.8	11.8	17.6	19.4	17.8
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.51	4.23	5.69	5.98	4.26	4.88	4.26	4.81	4.82	4.7	6.95	8.05	6.08
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.002 U	0.002 U	0.004 J	0.005 J	0.003 J	0.002 U	0.002 J	0.002 U	0.002 U	0.003 J	0.002 U	0.002 U	0.002 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	9.54	8.53	14	12.8	8.35	8.43	10.7	10.6	16.1	9.33	15.1	15.5	9.07
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.09 U	0.08 U	0.09 U	0.1 J	0.08 U	0.08 U	0.08 U	0.1 U	0.09 U	0.1 U	0.1 J	0.2 J	0.2 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	42.5	44.3	43.3	53.1	42.2	44.7	43	44.2	38.8	41.7	55.7	72.1	52.1
Total Petroleum Hydrocarbons (TPHs)																									
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	3.1 B	2.8 B	2.7 B	6.6 B	2.4 B	2.5 B	2.9 B	2.8 B	7.9 B	3 B	7.4 B	23 J	4.2 B
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	18 B	10 B	8.5 B	52 J	9 B	8.1 B	14 B	14 B	54 J	11 B	27 B	150	12 B

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

EELF = East End Landfill

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NPDES = National Pollutant Discharge Elimination System

NE = Not Established

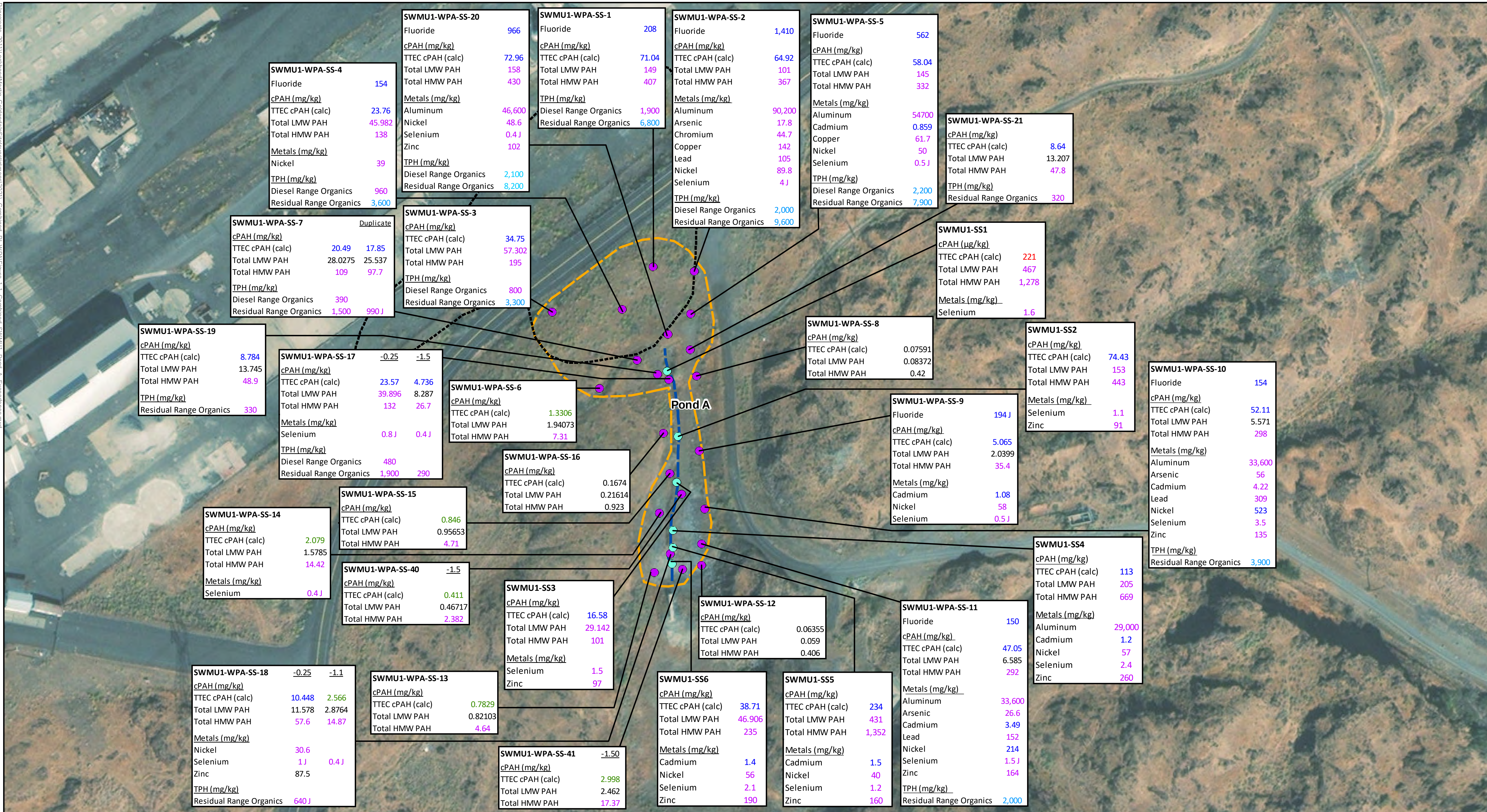
NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration



Legend

- RI Sample Location
- WPA Sample Location
- East End Landfill
- Approximated Lateral Extent of Soil Screening Level Exceedances
- Drainage Channel

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
green: Exceeds MTCA Method B Soil Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

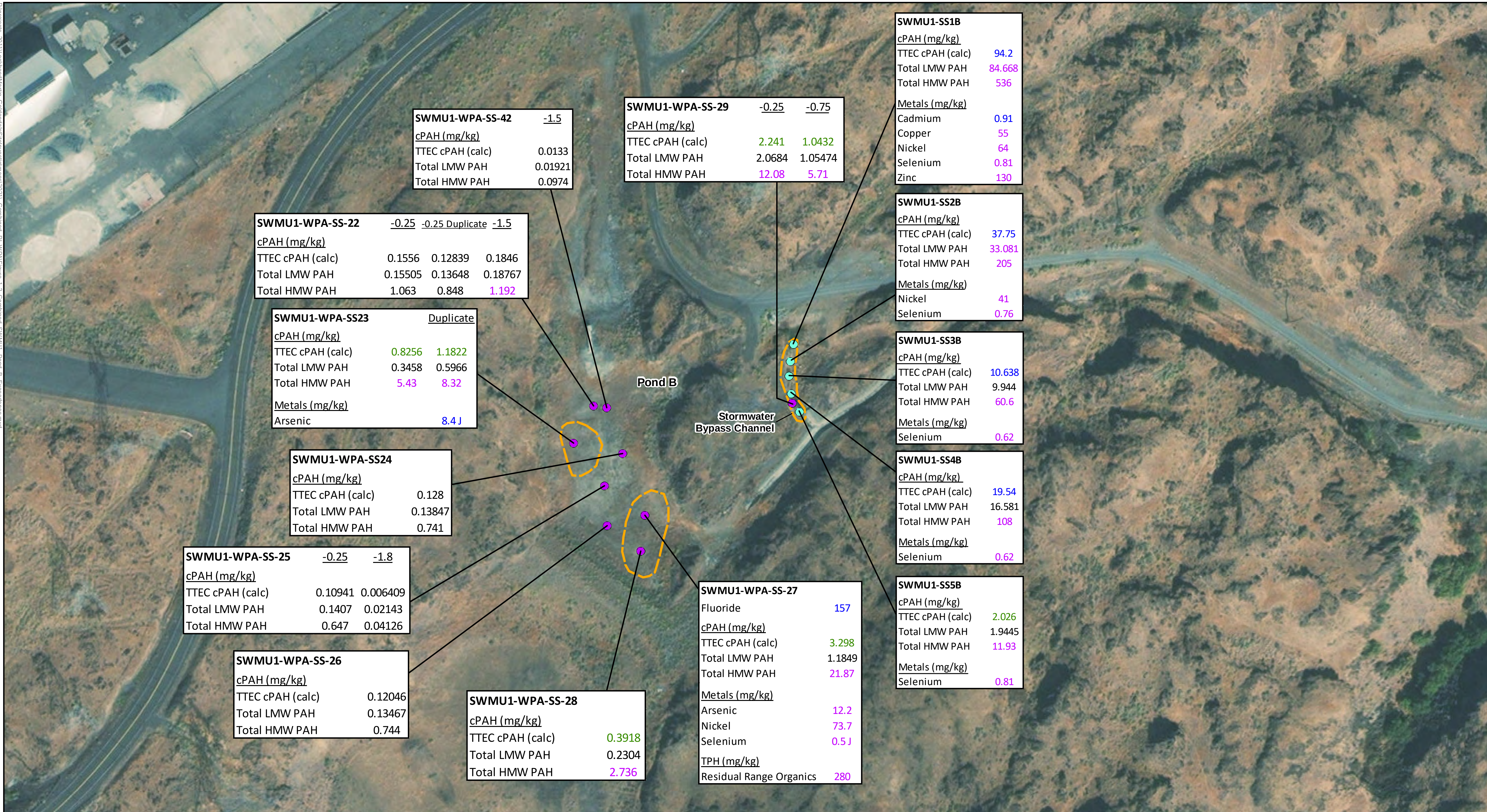
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 1-1
SWMU 1
NPDES Pond A
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Legend

- RI Sample Location
- WPA Sample Location
- Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
green: Exceeds MTCA Method B Soil Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

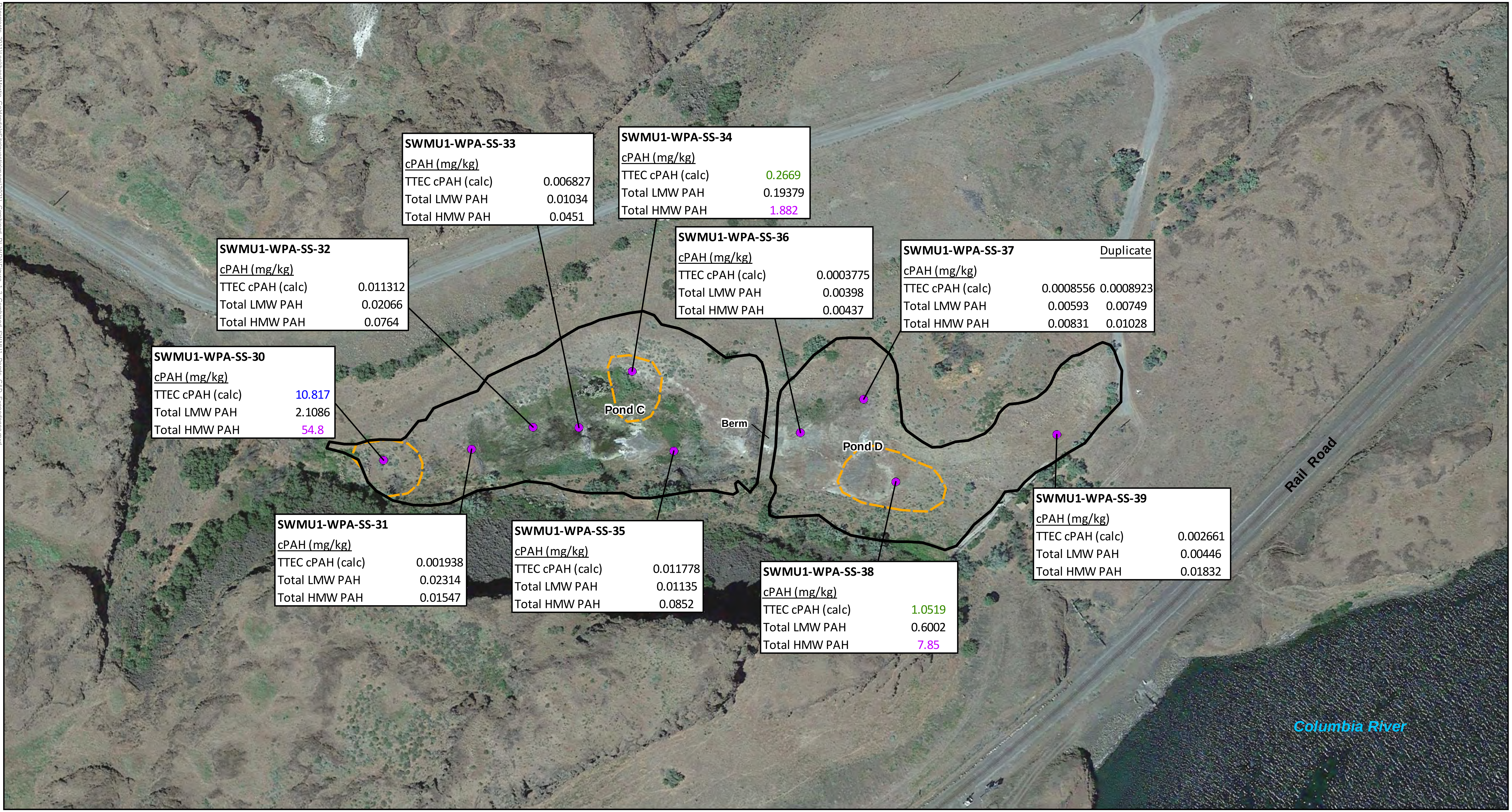
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 1-2
SWMU 1
NPDES Pond B
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Legend

Former Excavation Area

WPA Sample Location

Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
green: Exceeds MTCA Method B Soil Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 1-3
SWMU 1
NPDES Ponds C and D
Sample Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Soil samples collected during both the initial RI and WPA field investigation, were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables.

Completed sampling logs are provided in Volume 5, Appendix B-1. The initial RI laboratory data reports and data validation reports for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively. The WPA laboratory and data validation reports are presented in Volume 5, Appendix H-3 and I-3, respectively.

1.2.1 East End Landfill Slopes

The adjacent slopes of north of Ponds A and B were sampled (11 soil sampling stations) during the fall 2020 WPA field investigation (refer to Figure 1-1). This area is upslope (at a higher elevation than Ponds A and B) and north of Pond A. Reconnaissance of the area shows the presence of smelter wastes and stained surface soils in the EELF landfill footprint and extending downward to the paved plant access tunnel “mouse hole” roadway. As documented in Section 17 of this volume, the southern lobe of the EELF is covered with a thin (less than 2-ft) layer of fine-grained fill that is underlain by plastic sheeting and smelter waste in at least one location (Station SWMU-TP8). There are a substantial thickness of mixed smelter wastes and solid wastes (up to about 15 ft thick) in the lobe of the EELF south of John Day Dam Road and north of Pond A.

Results for this area show the widespread presence of PAHs above screening levels including MTCA Method B screening, MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecologic screening levels. Fluoride was detected above MTCA-derived soil screening levels for protection of groundwater in 5 of 11 samples in this area. Metals (Al, As, Cd, Cr, Cu, Pb, Ni, Se and Zn) were also detected above terrestrial ecologic and/or soil screening for protection of groundwater investigation in 4 of 11 samples from the EELF slopes. Diesel-range organics and residual-range organics were detected at concentrations above terrestrial screening levels and/or MTCA Method A Industrial screening levels in 10 of 11 samples. Total cyanide and sulfate concentrations were below screening levels in all the collected samples.

Some of the surface soil samples collected from the EELF slopes did not exhibit visible signs of contamination, however, detected concentrations of PAHs and fluoride were above screening levels.

The highest concentrations and greatest frequency of detection of above screening levels for fluoride, PAHs, and petroleum hydrocarbons at SWMU 1 occur on the slopes topographically above Pond A and including the EELF footprint. These results suggest that the EELF (SWMU 17) represents a likely source of re-contamination for NPDES Ponds A and B.

1.2.2 Pond A Drainage Channel and Pond A

The Pond A drainage channel was observed to be vegetated with unconsolidated soils ranging from 0.2 ft to a few feet thick overlying bedrock. Water was present in the channel, but not in NPDES Pond A during the June 2016 initial RI sampling event and May 2021 WPA sampling. Refer to Figure 1-1 for the Pond A vicinity sample locations. No water was observed during the December 2020 WPA sampling event. During winter 2017, while sampling nearby well BAMW-4 during a snow-melt event, Ponds A and B were observed to be largely full and the maximum water depth was estimated to be 8 to 10 ft.

The bottoms of Ponds A and B are seasonally characterized by white-gray precipitate that coats the base of the former excavation and pond and appears to coincide with areas of ponded water that occur in the wet season. Field observations during the initial RI and WPA field programs suggest that the pipe at the head of the Pond A drainage discharges water to the head of Pond A from about late November through May of a typical year.

Based on comparison of the excavation drawings (URS 2011) with the sample location map (Figure 1-1), it appears that the uppermost portion of the drainage channel extending downstream 50 to 100 ft from the drainage pipe outlet was not within the excavation area of Pond A.

Soils consisted of dark-gray, gravelly, coarse sand and dark-brown silt with gravel. A white-gray precipitate was present in samples that were collected from the downstream end of the channel within Pond A.

Results within the Pond A and Pond drainage channel are summarized as follows:

- PAHs were detected at concentrations above MTCA Method B formula value and terrestrial ecologic screening levels in most of the collected samples (17 of 19 samples). PAHs were detected above the MTCA Method C in one sample at the top end of the drainage channel (SWMU1-SS1).

- Sulfate and total cyanide did not exceed screening levels in any of the samples from Pond A or Pond A channel.

- Fluoride was detected at concentrations above MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in 3 of 19 samples (maximum of 194 J, mg/kg in sample SWMU1-WPA-SS9).

- Metals (including Al, As, Cd, Pb, Ni, Se, and Zn) exceed terrestrial ecologic screening levels, MTCA screening levels for protection of groundwater (Ni and Cd only), and background concentrations in 11 of 19 samples collected from this area.

1.2.3 Stormwater Bypass Channel

During field reconnaissance of this area, the ground surface and surface soils were observed to consist of boulders, cobbles, and bedrock with interspersed silty soils. Refer to Figure 1-2 for the sampling stations in the Stormwater Bypass Channel and Pond B vicinity. Bedrock was found within a few inches of the ground surface at some of the sampled locations. The channel was dry at the time of sampling and there was no evidence of recent runoff (e.g., sedimentation or erosion). It was difficult to find areas with sufficient soil for sample collection.

The stormwater bypass channel (termed the Side Ditch in 2011 remedial action report) was reportedly excavated down to bedrock during the 2010 remedial action (URS 2011). As part of site restoration, slopes of the side ditch were reportedly stabilized by pushing down material with an excavator and seeding the sidewalls (URS 2011). Based on field observations during the WPA, there are large boulders in this area that would make potential future excavation difficult.

The initial RI sample results show elevated concentrations of PAHs of MTCA Method B in all six samples. In addition, various metals including copper (maximum of 55 mg/kg), nickel (maximum of 64 mg/kg), selenium (maximum of 0.81 mg/kg), and zinc (130 mg/kg) exceeded terrestrial ecological soil screening levels and background concentrations. Cadmium (maximum of

0.91 mg/kg) exceeded the MTCA-derived soil screening level for protection of groundwater of 0.69 mg/kg in one sample collected in this area.

A single station was sampled from the surface and at a depth of 0.75 ft bgs during the WPA to confirm the initial RI results and confirm the thickness of the soils. The WPA results are consistent with the earlier sample results and show PAHs above MTCA Method B and terrestrial ecologic soil screening levels in both samples.

1.2.4 NPDES Pond B

This area was not sampled during the initial RI characterization effort but was included for sampling as part of the WPA based on the initial RI results for Pond A, the stormwater bypass channel, and Ecology and Yakama Nation comments. Eight stations were sampled that included collection of 12 samples including field duplicates (see Figure 1-2). Two samples were collected at deeper depths (1.5 to 1.8 ft bgs) to evaluate the vertical extent of contamination. PAHs were detected above screening levels in 5 of 12 samples collected from Pond B. For the samples with PAHs above screening levels, the PAHs concentrations were lower than in Pond A or the EELF slopes. Fluoride was detected above the MTCA-derived screening level for protection of groundwater in one of 12 samples. Metals (As and Se) were detected above screening levels in two of 12 samples.

1.2.5 Drainage Channel between Ponds C and D

Site reconnaissance of this area was performed during May 2021 and there was no appreciable accumulation of sediments in this area, therefore no sampling was conducted.

1.2.6 Ponds C and D

Ponds C and D were sampled during the Spring 2021 field mobilization based on the results of the initial RI field investigation and in response to Ecology and Yakama Nation comments. Refer to Figure 1-3 for the sampling locations.

There was no standing water present in Ponds C and D at the time of sampling during May 2021 and standing water was not observed during the initial RI field investigation. The presence of vegetation, and white-gray precipitate in Pond C suggests that runoff or groundwater may accumulate in Pond C during some seasonal conditions. No evidence of recent sediment accumulation was noted in the pond. Evidence of small areas of gray soil-staining were noted and sampled, suggesting that there may be some residual contamination remaining from the 2011 removal action.

Three of 10 soil samples collected from Ponds C and D exceeded screening levels for PAHs including two stations at Pond C and one station in Pond D (Figure 1-3). All three of the stations (SWMU1-WPA-SS-30, SWMU1-WPA-SS-34, SWMU1-WPA-SS-34) exceeded MTCA Method B and terrestrial ecologic screening levels. Maximum concentrations [Total Toxicity Equivalent Concentrations (TTEC) cPAHs of 10.817 milligrams per kilogram (mg/kg)] were detected in soil sample SWMU1-WPA-SS-30 that also exceeds the soil screening level for protection of groundwater. No other chemicals exceeded screening levels in either Pond C or D.

1.3 CONCLUSIONS AND RECOMMENDATIONS

Results of the RI soil sampling show that PAH concentrations in the Pond A drainage channel and the stormwater bypass channel and all four ponds exceed MTCA Method B soil screening levels, terrestrial ecologic soil screening levels, and soil screening levels for protection of groundwater with some samples at Pond A exceeding MTCA Method C industrial screening levels.

Based on these results, it appears that soils could have become re-contaminated following completion of the 2010 remedial action and the EELF slope north and upslope of Pond A represents a likely source. In addition, there appears to have been residual contamination left in place following the 2010 remedial action in the stormwater bypass channel as well as potentially all four ponds. The white-crusty precipitate does not appear to represent fluoride or a definitive marker of contamination in the Ponds.

The pipe discharge at the head of Pond A may be contributing contamination and/or transporting contamination within the Pond A drainage and Pond A footprint. The southern lobe of the EELF (SWMU 17) appears to represent a likely source of re-contamination for Ponds A and B through run-off on the EELF slopes.

NPDES pond soils are recommended to be further evaluated in the Feasibility Study (FS).

The scrubber effluent system outfall that drains water into the NPDES ponds will also be further evaluated in the FS to assess remedial alternatives to reduce or eliminate discharge of potentially contaminated water into NPDES Pond A. RI and WPA characterization of this drainage system was performed as part of the PAAOC (refer to Volume 3, Section 2.5. WPA characterization of the interactions of shallow groundwater with the line systems in the former plant footprint are summarize in Volume 4, Section 2.5.

Section 2
East Surface Impoundment (SWMU 2)

The East Surface Impoundment (ESI) was not included in the RI field program because this unit (SWMU 2) was formerly investigated and closed under Resource Conservation and Recovery Act (RCRA) (refer to Figure P-1). The RCRA ESI post-closure plan, and associated modifications has required long-term inspection, maintenance, and monitoring. The last round of groundwater sampling under the ESI post-closure plan was completed in 2017 (Tetra Tech 2018b) and the last year of scheduled post-closure inspections and reporting also ended in 2017. For a summary of previous investigations and remediation work completed at the ESI (SWMU 2), refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a). Lockheed Martin has voluntarily continued the operations and maintenance inspections and annual reporting and plans to continue these activities at the ESI in the future.

During an annual ESI post-closure inspection, Lockheed Martin observed and documented an area(s) of discolored (gray to dark gray) soils inside and outside the southeastern corner of the ESI fence line. In 2018, these shallow PAH-contaminated soils were sampled, excavated and removed offsite for disposal, and reported to Ecology as maintenance activity in an ESI post-closure monitoring report (Tetra Tech 2018b). In December 2018, Lockheed Martin was notified by Ecology (Ecology 2018b) that the ESI soil removal activity should have been performed as an interim action under the 2014 Agreed Order No. 10483 (Ecology 2014). Ecology required Lockheed Martin to prepare an interim action work plan that details and fully documents this activity to be submitted concurrently with the draft RI Report. This site, named the ESI Fence Line Area, was further investigated as part of the Ecology-approved WPA field program as an additional investigation area. Results for ESI Fence Line Area are summarized in Section 34 of this Volume.

2.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

A field investigation was not performed at this SWMU as part of the RI consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

2.2 INVESTIGATION RESULTS

No additional RI data was collected at the ESI (SWMU 2). Site-wide groundwater monitoring and characterization results for the ESI vicinity are presented in Volume 4 as part of the Groundwater in the Uppermost Aquifer Area of Concern (AOC).

2.3 CONCLUSIONS AND RECOMMENDATIONS

The ESI is closed under RCRA and maintained under established post-closure plans (see above). Site-wide groundwater monitoring results, including the ESI vicinity are summarized and will be addressed as part of the Groundwater in the Upper Most Aquifer AOC (refer to Volume 4, Section 2 of this report). Groundwater contamination at the ESI will be evaluated in the FS.

Ecology required Lockheed Martin to prepare an interim action work plan that details and fully documents the 2018 soil removal maintenance activity to be submitted concurrently with the draft RI Report, which was done in 2019 (Tetra Tech et al. 2019b). Characterization results of the ESI Fence-Line Area are summarized as an additional investigation area as specified in the WPA in Section 34 of this volume. The ESI Fence Line Area will be evaluated in the FS.

Section 3
Intermittent Sludge Disposal Ponds (SWMU 3)

The Intermittent Sludge Disposal Ponds (SWMU 3) was not included in the initial RI field program because this unit was formerly investigated, and an independent soil removal action was completed in 2007 (refer to Figure P-1). SWMU 3 was previously remediated through removal of PAH-contaminated materials to MTCA Method A Soil Cleanup Levels for Unrestricted Land Use in all 13-subareas, and to MTCA Method A Industrial Soil Cleanup Levels in lateral or adjacent locations to this SWMU (URS 2008b). For a summary of previous investigations and remediation work completed at SWMU 3 please refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

Comments received (Ecology and Yakama Nation 2019) regarding the Draft RI Report (Tetra Tech et al. 2019a), requested consideration of additional soil screening levels appropriate for unrestricted land use for this area, consistent with the current open space or extensive agriculture zoning and to address treaty-protected tribal uses.

Following closure of the ESI in 1985, additional areas east of the smelter were discovered that had been used for the disposal of sludge from the NPDES ponds. Thirteen small deposits of sludge with no standing water were found. The Intermittent Sludge Disposal Ponds (SWMU 3) was investigated in 2006 (ARCADIS 2007) and an independent soil removal action was completed in 2007 (URS 2008a). Figure 3-1 shows the remediation areas and historical confirmation sample locations.

Confirmation samples collected from within the remediated excavations during the 2007 remediation met MTCA Method A Soil Cleanup Levels for Unrestricted Land Use of 0.1 mg/kg for PAHs; however, 28 of 36 lateral extent samples collected from outside of the excavation limits exceeded the MTCA Method A Soil Cleanup Level for Unrestricted Land Use of 0.1 mg/kg. However, all of the lateral extent samples, except two, met MTCA Method A Industrial Soil Cleanup Levels of 2.0 mg/kg for PAHs.

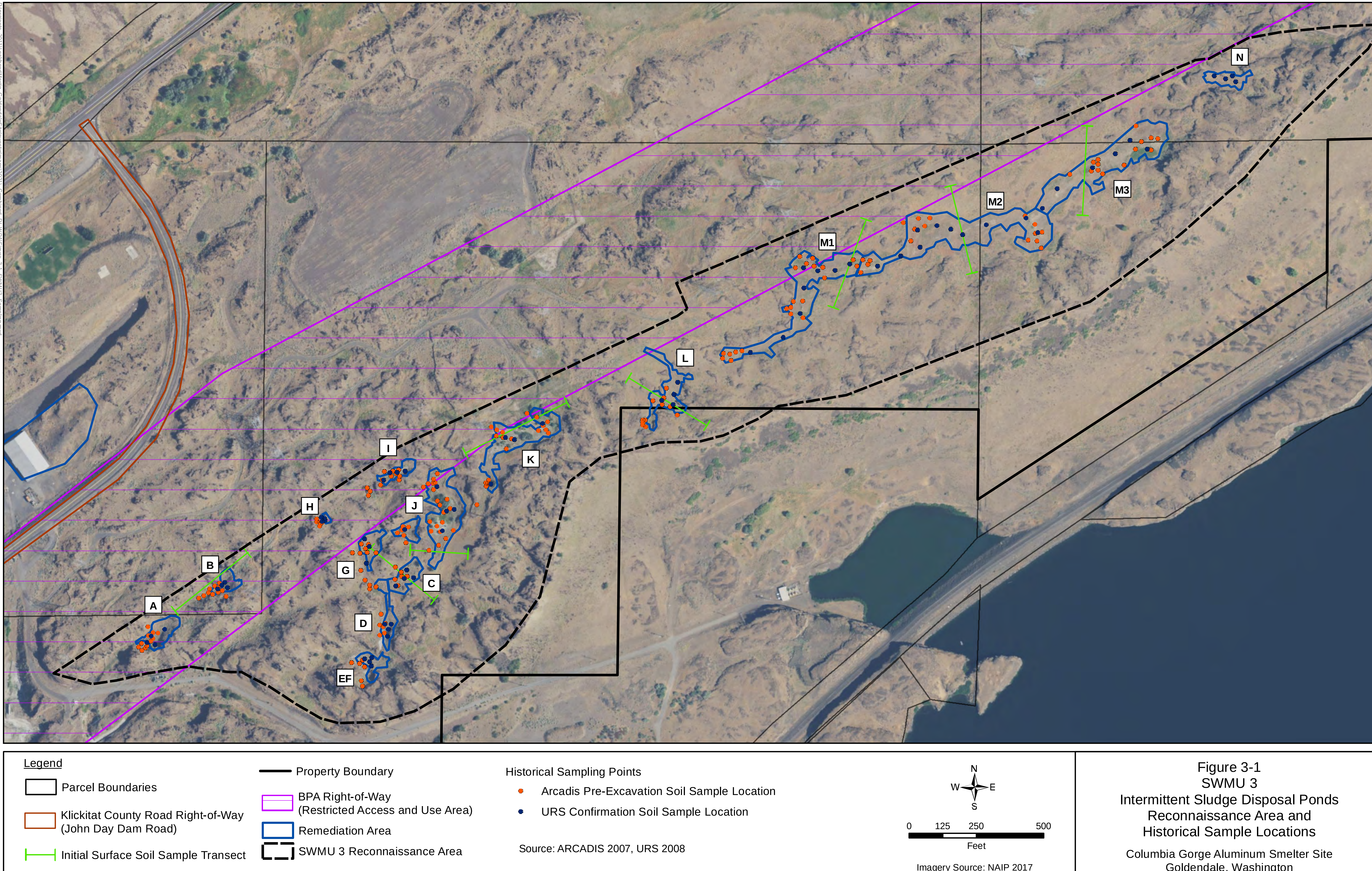


Figure 3-1
SWMU 3
Intermittent Sludge Disposal Ponds
Reconnaissance Area and
Historical Sample Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The intermittent sludge disposal ponds (SWMU 3) are located primarily on land owned by NSC Smelter, LLC (NSC) with a combination of extensive agriculture and open-space zoning. A small corner of remediation area L is located on land owned by the USACE and is zoned as open space.

3.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No initial RI field investigation was planned or performed at SWMU 3 as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b). Investigation of SWMU 3 was performed as part of the WPA field activities during Fall 2020 and Spring 2021 to address comments on the Draft RI Report.

3.1.1 WPA Investigation Objectives

Objectives for this investigation include the following:

- Further evaluation of historical remedial action soil confirmation results to identify remaining areas with soil contamination above MTCA screening levels for Unrestricted Land Use.
- Field reconnaissance to verify the absence of aluminum smelter-related wastes and stained soils and to approximately locate the 36 lateral extent sample stations (2007 investigation) for placement of the soil sampling transects.
- Perimeter soil sampling to determine the lateral extent of soil contamination outside of excavation areas.
- Determine composition of white-crusty material (potential precipitate – possibly gypsum) noted by the Yakama Nation in WPA comments based on coloration in aerial photographs. The objective is to determine if this material represents a visual marker of contamination (e.g., fluoride minerals or PAHs). It is assumed that this material represents gypsum or carbonate (e.g., caliche) and does not represent a marker of contamination or fluoride salts.

3.1.2 Field and Analytical Program Summary

The remediation areas A through N and adjacent areas were inspected to verify the absence of waste and stained soils and to approximately locate historical lateral extent soil sample stations. Areas between and adjacent to the remediated subareas were also inspected. Figure 3-1 shows historical sample locations and the areas that were addressed by site reconnaissance and inspection. Additional sampling was performed in areas of waste or discolored soils that were identified.

Grab surface soils were initially collected during the fall 2020 field mobilization from outside the perimeter of the excavation areas at 8 transect locations (shown on Figure 3-1) that extend across the excavation areas. The transect locations were selected based on the historical lateral extent sample results and to provide adequate spatial coverage. The intent of the transect sampling is to verify the extent of soil contamination near the excavation boundaries. The assumption was the PAH concentrations should decrease moving away from the excavation boundaries if the contamination was directly related to a specific deposit that was not adequately addressed. Because indications of area-wide contamination was found, supplemental step-out sampling was performed.

The transects targeted areas where there was soil present outside of the excavation limits (i.e., excavation edges that appear to be primarily terminated in rock outcrops were to be sampled). The transect locations were adjusted based on the results of the field reconnaissance. Samples were collected at increments from the edge of the former excavation at intervals of 20 and 75 ft (i.e., 4 samples per transect with 8 transects representing 32 soil sample stations). The transect that extended into the corner of USACE land was not sampled until Spring 2021 after a property use authorization permit was obtained from USACE.

Based on the Fall 2020 site reconnaissance activities, which showed the presence of suspected residual contamination, and the initial transect sample results that showed areas outside of the former excavation remediation areas with residual contamination present, additional samples were collected to better define the extent of contamination during April 2020. Based on those results, additional site reconnaissance and discussions during an on-site meeting with Ecology in April 2021, additional sampling was performed within each former excavation area and adjacent areas to provide better spatial coverage.

All the collected soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and diesel/oil-range organics. One test was performed to determine the composition of the white-gray crusty material (potential precipitate). The material was tested with dilute hydrochloric acid to determine its reactivity. A positive reaction indicates the presence of carbonate (e.g., caliche) in the sample. The sample consisted of a scraping of the precipitate layer to determine if it has elevated concentrations of site chemicals of potential concern (COPCs). In addition, the surface scrapings of the precipitate layer were analyzed for calcium and sulfur.

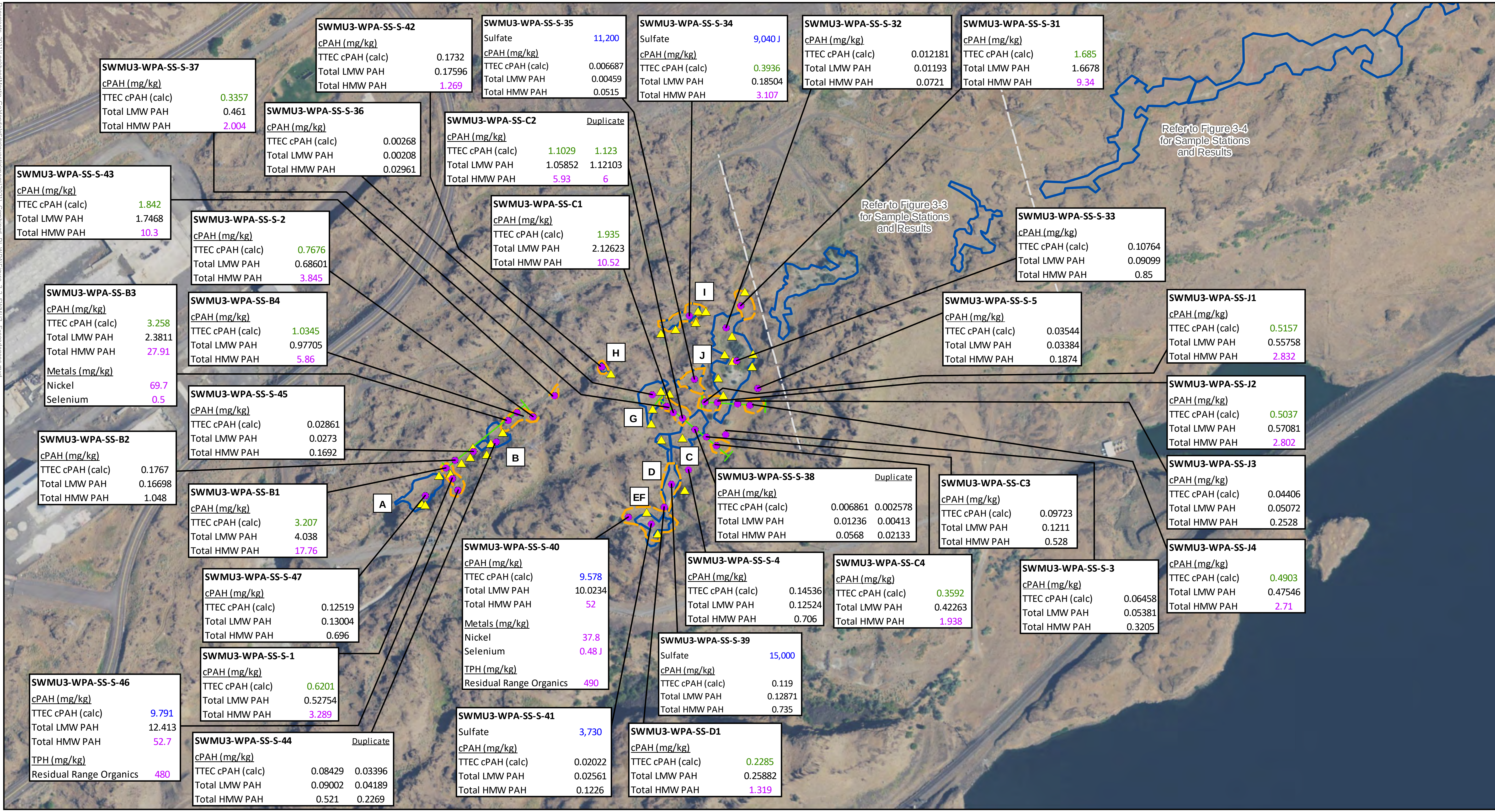
3.2 INVESTIGATION RESULTS

Site reconnaissance activities showed visual indications of likely residual soil contamination (e.g., fine-grained gray staining) both within and adjacent to the former excavations and haul roads (refer to Figures 3-1 and 3-2). This finding is not unexpected, given that the understanding at the time of the 2007 removal action is that SWMU 3 represented an industrial property. No new contaminated areas (i.e., additional disposal ponds) were found during the WPA site reconnaissance. The site reconnaissance transects and representative photographs are included in Volume 5, Appendix B-3. Field sampling logs are included as Volume 5, Appendix B-3. The WPA laboratory and data validation reports for SWMU 3 are presented in Volume 5, Appendix H-3 and I-3, respectively.

Within the former excavation areas, most of the visually contaminated soil occurs in close contact with basalt bedrock outcrops with only a few inches to a foot of soil remaining in the interstices of the bedrock and boulders. From the site reconnaissance observations, it appears that the bedrock surfaces were not thoroughly scraped in all cases during past remediation activities. This observation is consistent with typical soil removal action operational practices that include consideration of the following cost factors: increased disposal costs from hauling mixed soil and bedrock, time-consuming operations of scraping bedrock, and increased maintenance costs for equipment during excavation/ripping of mixed rock and soil.

The grayish-white material within the excavations (e.g., remediation area/Pond D) was tested in the field using hydrochloric acid and was reactive, which suggests that the material represents caliche (calcium carbonate). Other gray-white material found in Pond K near a very small cave was tested and found to contain elevated concentrations of sulfate, fluoride, PAHs, and metals (As, Cd, Pb, Ni, and Se).

Based on zoning, ownership, and past Ecology and Yakama Nation comments, soil sample results have been compared against MTCA Method B soil screening levels for unrestricted land use, soil screening levels for protection of groundwater, and terrestrial soil screening for all three receptor categories (plants, soil biota, and wildlife). Analytical results are summarized in Table 3-1. Figure 3-2, Figure 3-3, and Figure 3-4 show the sample locations and soil sample exceedances of relevant screening levels by subarea (west, central, east) as well as the estimated extent of soil contamination.



Legend

- Remediation Area
- WPA Sample Location
- Area of Visible Soil Staining or Field Indications of Potential Residual Waste
- Initial Surface Soil Sample Transect
- Approximated Lateral Extent of Soil Screening Level Exceedances
- Figure Detail Areas

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
green: Exceeds MTCA Method B Soil Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

Figure 3-2
SWMU 3
Intermittent Sludge Disposal Ponds - West
Sample Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 3-1
SWMU 3 - Intermittent Sludge Disposal Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2020 - Spring 2021

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU3-WPA-SS-B1 11/3/2020	SWMU3-WPA-SS-B2 11/3/2020	SWMU3-WPA-SS-B3 11/3/2020	SWMU3-WPA-SS-B4 11/3/2020	SWMU3-WPA-SS-C1 11/3/2020	SWMU3-WPA-SS-C2 11/3/2020	SWMU3-WPA-SS-C40 (Duplicate of SWMU3-WPA-SS-C2) 11/3/2020	SWMU3-WPA-SS-C3 11/3/2020	SWMU3-WPA-SS-C4 11/3/2020	SWMU3-WPA-SS-D1 11/12/2020	SWMU3-WPA-SS-J1 11/3/2020	SWMU3-WPA-SS-J2 11/3/2020
Aluminum Smelter																							
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.2	0.07 U	0.1	0.09	0.3	0.17	0.15	0.07 U	0.07 U	0.1	0.07 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	20.7 J	21.1 J	19.6 J	12.9 J	13 J	11.4 J	10.3 J	13.7 J	7.6 J	35.4	12.7 J	16.7 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	4.74 J	5.5 J	5.54 J	2.11 J	6.83 J	9.76 J	8.64 J	2.56 J	4.43 J	18.8	4.29 J	4.42 J
Polycyclic Aromatic Hydrocarbons (PAHs)																							
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.014	0.00086	0.0063	0.0026	0.0063	0.0034	0.0036	0.0009	0.0019	0.0012	0.0013	0.0014
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.14	0.0037	0.072	0.031	0.067	0.034	0.033	0.0036	0.014	0.0063	0.012	0.014
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.002	0.00032	0.0018	0.00065	0.00093	0.00062	0.00053	0.0003 U	0.00043	0.00032	0.00048	0.00051
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.19	0.0049	0.087	0.035	0.08	0.039	0.042	0.005	0.016	0.008	0.017	0.017
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.7	0.073	1.2	0.49	1	0.52	0.54	0.049	0.19	0.11	0.25	0.25
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	2.3	0.12	1.8	0.73	1.4	0.79	0.81	0.07	0.26	0.16	0.37	0.36
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	3.5	0.23	4.6	1.1	2	1.2	1.2	0.1	0.38	0.27	0.56	0.55
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	2	0.16	7.3	0.83	1.2	0.69	0.68	0.058	0.21	0.16	0.3	0.3
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.2	0.078	1.5	0.4	0.74	0.42	0.41	0.04	0.13	0.083	0.21	0.2
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	2.1	0.09	2.7	0.65	1.3	0.69	0.7	0.063	0.24	0.16	0.35	0.35
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.46	0.027	0.91	0.17	0.28	0.16	0.16	0.014	0.048	0.036	0.072	0.072
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	2.6	0.12	1.6	0.66	1.4	0.7	0.75	0.079	0.28	0.18	0.4	0.4
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.07	0.0016	0.033	0.013	0.032	0.016	0.016	0.0019	0.007	0.0033	0.0048	0.0054
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	2 J	0.15 J	6.1 J	0.82 J	1.2 J	0.76 J	0.75 J	0.063 J	0.22 J	0.17	0.33 J	0.33 J
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.022	0.0016 B	0.011	0.0048	0.01	0.0055	0.0059	0.0017 B	0.0033 B	0.0017	0.002 B	0.0025 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	1	0.034	0.57	0.23	0.53	0.26	0.27	0.029	0.1	0.058	0.12	0.13
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	2.5	0.12	1.8	0.67	1.4	0.7	0.75	0.071	0.26	0.17	0.39	0.39
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.037	0.0011	0.019	0.0072	0.017	0.0082	0.0082	0.0013	0.0041	0.002	0.0031	0.0034
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**3.207**	0.1767	**3.258**	**1.0345**	**1.935**	**1.1029**	**1.123**	0.09723	**0.3592**	**0.2285**	**0.5157**	**0.5037**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	4.038	0.16698	2.3811	0.97705	2.12623	1.05852	1.12103	0.1211	0.42263	0.25882	0.55758	0.57081
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**17.76**	1.048	**27.91**	**5.86**	**10.52**	**5.93**	**6**	0.528	**1.938**	**1.319**	**2.832**	**2.802**
Metals																							
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	14,500	11,100	18,100	10,500	13,200	10,900	10,500	8,370	8,790	6210	11,800	14,100
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.11	2.48	5.35	2.33	3	2.89	2.77	2.6	2.62	5.01	2.74	2.85
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.218	0.136	0.483	0.157	0.233	0.184	0.163	0.127	0.132	0.135	0.173	0.163
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	15.7 J	13.6 J	17.7 J	11 J	14.7 J	13.1 J	12.5 J	12.2 J	12.9 J	9.79	13.2 J	14.9 J
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	16.8	15.5	19.2	16.9	17.4	15.2	15.9	14.2	15.3	15.1	15.7	16.6
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	9.29	4.94	25.3	5.87	10.3	8.23	7.05	4.65	4.94	3.45	7.16	6.94
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.015	0.011	0.015	0.012	0.019	0.014	0.016	0.013	0.014	0.004	0.013	0.012
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	18.2	11.6	**69.7**	12.9	19.6	14.5	13.8	11.4	11.9	10.6	11.3	12.4
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.1	0.1	**0.5**	0.11	0.2	0.1	0.1	0.1	0.11	0.1	0.09 U	0.12
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	58.3	46.5	64.6	48	64.3	54.8	52	43.2	43	30.5	56.5	54.5
Total Petroleum Hydrocarbons (TPHs)																							
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	35	3	26	10	21	11	13	2.6	6.7	4.9	6.1	5.2
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	200	17	240	56	160	80	94	8.8	41	26	33	23
Other Parameters																							
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	90,000	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	130	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Table 3-1
SWMU 3 - Intermittent Sludge Disposal Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2020 - Spring 2021

						Ecological Indicator						Analytical Results										
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU3-WPA-SS-J3 11/3/2020	SWMU3-WPA-SS-J4 11/3/2020	SWMU3-WPA-SS-K1 11/3/2020	SWMU3-WPA-SS-K2 11/3/2020	SWMU3-WPA-SS-K3 11/3/2020	SWMU3-WPA-SS-K4 11/3/2020	SWMU3-WPA-SS-L1 11/3/2020	SWMU3-WPA-SS-L2 11/3/2020	SWMU3-WPA-SS-M1-1 11/3/2020	SWMU3-WPA-SS-M1-2 11/3/2020	SWMU3-WPA-SS-M1-41 (Duplicate of SWMU3-WPA-SS-M1-2) 11/3/2020
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.07 U	0.08	0.08	0.14	0.07 U	0.07 U	0.11	0.07 U	0.09
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	8.9 J	15.8 J	10.5 J	19.8 J	15.4 J	9.9 J	15 J	18.8 J	9.4 J	31.5	36
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	3.5 J	2.25 J	1.81 J	3.92 J	**8,500 J**	16.5 J	3.24 J	1.51 J	3.49 J	2.5	1.9
Polycyclic Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00067	0.00098	0.0018	0.0028	0.0012	0.0025	0.00075	0.00054	0.001	0.00058	0.00061
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0014	0.011	0.015	0.025	0.0067	0.018	0.0027	0.0011	0.0059	0.001	0.0016
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0003 U	0.00038	0.0004	0.0005	0.0005	0.00066	0.0003 U	0.00029 U	0.0003 U	0.00029 U	0.00029 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0022	0.011	0.019	0.034	0.0096	0.029	0.0031	0.0013	0.0074	0.0015	0.0018
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.02	0.23	0.21	0.38	0.13	0.24	0.044	0.023	0.079	0.015	0.018
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.031	0.35	0.3	0.53	0.23	0.35	0.072	0.039	0.11	0.022	0.024
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.047	0.54	0.5	0.87	0.5	0.66	0.18	0.078	0.19	0.037	0.043
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.035	0.31	0.28	0.53	0.51	0.6	0.15	0.055	0.11	0.022	0.024
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.019	0.2	0.17	0.32	0.19	0.22	0.08	0.027	0.071	0.012	0.016
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.028	0.33	0.29	0.5	0.22	0.4	0.085	0.042	0.12	0.023	0.027
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0068	0.07	0.064	0.13	0.1	0.12	0.035	0.012	0.022	0.0045	0.005
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.032	0.35	0.31	0.54	0.19	0.38	0.066	0.034	0.13	0.026	0.029
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00085	0.0033	0.0077	0.013	0.0034	0.01	0.0012	0.0006 U	0.0033	0.00082	0.001
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.035 J	0.33 J	0.3 J	0.58 J	0.48 J	0.54 J	0.16 J	0.056 J	0.099 J	0.021	0.023
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0016 B	0.0018 B	0.0029 B	0.0052	0.0023 B	0.0043	0.0016 B	0.0012 B	0.0019 B	0.0012 B	0.0012 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.012	0.097	0.12	0.2	0.058	0.15	0.02	0.0089	0.046	0.0095	0.011
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.031	0.35	0.3	0.52	0.18	0.36	0.063	0.035	0.12	0.025	0.028
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.00084	0.0021	0.0041	0.0071	0.0021	0.0065	0.00088	0.00063 U	0.0019	0.00062 U	0.00062 U
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.04406	**0.4903**	**0.4273**	**0.763**	**0.3722**	**0.532**	0.12275	0.05902	0.1573	0.03118	0.03477
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.05072	0.47546	0.4768	0.8205	0.2717	0.59446	0.09535	0.04704	0.1955	0.0406	0.04621
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.2528	**2.71**	**2.414**	**4.36**	**2.54**	**3.49**	0.869	0.367	0.921	0.1815	0.208
Metals																						
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	8,780	11,500	11,200	12,500	9,240	9,700	9,540	9,640	7,270	10,600	11,100
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.82	2.86	3.23	3.12	2.88	3.62	3.27	3.19	3.77	3.89	3.96
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.146	0.166	0.204	0.233	0.213	0.206	0.165	0.17	0.111	0.162	0.147
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	12.1 J	15.5 J	16.4 J	16.4 J	10.7 J	10.9 J	13.4 J	13.7 J	8.17 J	13.6	14.4
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	13.6	15.9	16	16.2	13.9	15	13.3	15	11.3	13.9	14.8
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	6.52	6.63	6.73	8.17	7.7	7.8	6.43	5.86	6.59	6.62	6.67
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.013	0.009	0.015	0.016	0.021	0.014	0.011	0.011	0.013	0.012	0.012
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	11.4	12.2	15.5	20.7	15.9	16.8	12.8	11.9	9.39	11.1	11
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.09 U	0.1	0.1	0.1	0.3	0.1	0.1	0.11	0.1	0.12	0.1
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	50.6	55.3	51.9	56.7	46.6	49.4	53.9	53.1	43.8	51.7	51.4
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	3.1	5.5	6.4	10	9	11	3.7	2.4	6.2	1.9 U	1.9 U
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	17	23	32	65	55	92	23	9	45	7.2	6.2
Other Parameters																						
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 3-1
SWMU 3 - Intermittent Sludge Disposal Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2020 - Spring 2021

						Ecological Indicator						Analytical Results										
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU3-WPA-SS-M1-3 11/3/2020	SWMU3-WPA-SS-M1-4 11/3/2020	SWMU3-WPA-SS-M2-1 11/4/2020	SWMU3-WPA-SS-M2-2 11/4/2020	SWMU3-WPA-SS-M2-3 11/4/2020	SWMU3-WPA-SS-M2-4 11/4/2020	SWMU3-WPA-SS-M3-1 11/4/2020	SWMU3-WPA-SS-M3-42 (Duplicate of SWMU3-WPA-SS-M3-1) 11/4/2020	SWMU3-WPA-SS-M3-2 11/4/2020	SWMU3-WPA-SS-M3-3 11/4/2020	SWMU3-WPA-SS-M3-4 11/4/2020
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.12	0.07	0.07	0.1	0.11	1.36	0.07 U	0.07 U	0.07 U	0.09	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	25.8	27.8	19.7	19.4	39.3	15.6	15.9 J	19.8 J	10.3	48.9	34.6
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	3.6	1.9	1.2	2.5	5	4.6	4	3.3	2.3	1.9	2.5
Polycyclic Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00062	0.00067	0.00087	0.00071	0.00084	0.00062	0.00082	0.00059	0.00098	0.0009	0.00074
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.00082	0.0013	0.0035	0.0018	0.0039	0.00051	0.0026	0.0016	0.0012	0.0024	0.00033
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0003 U	0.0003 U	0.0003 U	0.00029 U	0.0003 U	0.00029 U	0.0003	0.00029 U	0.00034	0.00039	0.0003 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.00082	0.0016	0.0047	0.002	0.0049	0.00046	0.0032	0.0018	0.0014	0.003	0.00035
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0084	0.025	0.043	0.022	0.066	0.0044	0.037 J	0.022 J	0.011	0.036	0.0039
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.013	0.065	0.061	0.035	0.11	0.0066	0.057 J	0.037 J	0.018	0.057	0.006
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.027	0.13	0.1	0.063	0.29	0.012	0.087 J	0.057 J	0.025	0.13	0.011
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.023	0.098	0.056	0.039	0.36	0.0072	0.051	0.034	0.014	0.095	0.0066
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.011	0.042	0.038	0.025	0.11	0.0041	0.036 J	0.022 J	0.0092	0.042	0.0039
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.017	0.042	0.066	0.038	0.17	0.0073	0.055 J	0.033 J	0.016	0.069	0.0063
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0036	0.019	0.012	0.0082	0.06	0.0013	0.011	0.0075	0.0023	0.017	0.0013
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.015	0.034	0.075	0.037	0.1	0.0068	0.058 J	0.034 J	0.02	0.063	0.0065
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0006 U	0.00077	0.0023	0.0011	0.0019	0.00059 U	0.0014	0.00077	0.0014	0.0014	0.0006 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.021	0.096	0.056	0.037	0.31	0.0066	0.051	0.034	0.013	0.086	0.0061
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0013 B	0.0014 B	0.0017 B	0.0014 B	0.0021 B	0.0013 B	0.0017 B	0.0013 B	0.0014 B	0.0017 B	0.0015 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0053	0.0093	0.031	0.014	0.029	0.0029	0.02 J	0.012 J	0.014	0.017	0.0026
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.015	0.041	0.071	0.037	0.11	0.0073	0.058 J	0.033 J	0.02	0.068	0.0071
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.00063 U	0.00063 U	0.0015	0.00068	0.0013	0.00063 U	0.00087	0.00063 U	0.0013	0.001	0.00063 U
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.02027	0.09662	0.08656	0.0509	**0.1953**	0.009513	0.07975	0.05158	0.02421	0.08879	0.008683
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.02386	0.04904	0.11907	0.05801	0.14264	0.01259	0.08802	0.05206	0.04072	0.08979	0.01202
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.139	0.558	0.503	0.3042	**1.586**	0.0568	0.443	0.2795	0.1285	0.6	0.0522
Metals																						
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	9,180	10,200	7,560	7,310	9,630	8,090	9,320	9,670	8,200	10,700	9,900
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.47	2.94	2.95	3.54	3.91	3.31	3.2	3.16	3.39	3.37	3.08
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.164	0.153	0.159	0.147	0.196	0.149	0.167	0.162	0.145	0.181	0.165
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	11.7	13.2	8.84	9.58	11.1	10.5	13.8	14.2	10.2	14	14.1
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	13.8	15.1	13.1	11.8	11.4	12.6	14.1	14.5	14.1	14.2	15
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.9	5.83	6.08	6.43	11.1	5.58	6.46	6.34	6.59	7.58	5.68
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.012	0.014	0.011	0.009	0.011	0.012	0.013	0.013	0.011	0.014	0.012
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	11.5	10.3	8.85	9.36	23.1	10	10.8	11.1	10.5	14.8	10.8
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.11	0.1	0.12	0.1	0.2	0.1	0.11	0.1	0.1	0.1	0.11
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	48.1	57.5	55.4	52.6	48	46	52.8	54.3	49.4	52.7	51.2
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	4.5	4.1	5	2.2	10	3.1	3.6	2.5	3.3	5.4	2.5
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	30	26	29	14	63	14	22	18	19	25	7.8
Other Parameters																						
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 3-1
SWMU 3 - Intermittent Sludge Disposal Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2020 - Spring 2021

						Ecological Indicator						Analytical Results										
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU3-WPA-SS-S-1 4/2/2021	SWMU3-WPA-SS-S-2 4/2/2021	SWMU3-WPA-SS-S-3 4/2/2021	SWMU3-WPA-SS-S-4 4/2/2021	SWMU3-WPA-SS-S-5 4/2/2021	SWMU3-WPA-SS-S-6 4/2/2021	SWMU3-WPA-SS-S-7 4/2/2021	SWMU3-WPA-SS-L3 4/2/2021	SWMU3-WPA-SS-L4 4/2/2021	SWMU3-WPA-SS-S-10 4/2/2021	SWMU3-WPA-SS-S-11 4/2/2021
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	39.2 J	37.4 J	9.9 J	5.9 J	29.5 J	14.8 J	13.5 J	22.8 J	34.4 J	23.3 J	28.1 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	1.6 B	1.6 B	1.6 B	1.3 B	1.6 B	23	5.9	1.6 B	1.6 B	1.5 B	1.5 B
Polycyclic Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0017 J	0.0024 J	0.00065 J	0.00064 J	0.00064 J	0.00047 J	0.0006 J	0.0023 J	0.00063 J	0.00038 J	0.00056 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.017	0.022	0.0016 J	0.0028 J	0.0013 J	0.001 J	0.0013 J	0.018	0.0016 J	0.00076 J	0.0019 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00054 J	0.00051 J	0.0003 U	0.00032 U	0.00031 U	0.0003 U	0.0003 U	0.001 J	0.00031 U	0.00029 U	0.00029 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.018	0.026	0.0016 B	0.0044 J	0.001 B	0.0012 B	0.0016 B	0.02	0.002 J	0.00084 B	0.0018 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.24	0.32	0.024	0.059	0.014	0.018	0.021	0.29	0.031	0.017	0.042
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.45	0.57	0.048	0.11	0.026	0.038	0.041	0.53	0.06	0.032	0.08
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.65	0.8	0.067	0.14 J	0.037	0.062	0.071	1.2	0.12	0.062	0.2
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.46	0.44	0.04	0.078	0.025	0.046	0.059	1	0.081	0.04	0.18
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.22	0.25	0.022	0.047	0.012	0.019	0.028	0.47	0.039	0.02	0.081
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.32	0.41	0.033	0.076	0.02	0.03	0.034	0.53	0.056	0.031	0.091
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.089	0.095	0.0085	0.017	0.0044 J	0.0085	0.012	0.19	0.017	0.0078	0.031
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.36	0.45	0.036	0.088	0.022	0.028	0.03	0.44	0.051	0.028	0.071
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0073	0.011	0.00086 J	0.0013 J	0.00063 U	0.00061 U	0.00078 J	0.0086	0.00079 J	0.00058 U	0.0009 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.47	0.47	0.041	0.083	0.025	0.041	0.06	1.1	0.087	0.042	0.18
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.003 J	0.0041 J	0.0011 J	0.0011 J	0.0013 J	0.00095 J	0.0011 J	0.0044 J	0.00092 J	0.00079 J	0.0011 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.12	0.17	0.012	0.027	0.0076	0.0088	0.011	0.14	0.015	0.0074	0.018
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.39 J	0.49 J	0.037 J	0.096 J	0.024 J	0.029 J	0.031 J	0.48 J	0.053 J	0.03 J	0.079 J
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0041 J	0.0059	0.00069 J	0.00085 J	0.00067 U	0.00064 U	0.00063 U	0.0057	0.00069 J	0.00061 U	0.00094 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**0.6201**	**0.7676**	0.06458	0.14536	0.03544	0.05315	0.06054	**0.8603**	0.08996	0.04719	0.13431
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.52754	0.68601	0.05381	0.12524	0.03384	0.04042	0.04638	0.6343	0.07194	0.03817	0.09526
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**3.289**	**3.845**	0.3205	0.706	0.1874	0.2915	0.357	**5.79**	0.544	0.2818	0.964
Metals																						
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	10,700	11,400	7,880	7,430	10,700	8,400	7,260	12,200	10,400	7,990	9,950
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.91	2.91	2.8	2.06	3.26	2.78	2.35	2.68	2.36	2.87	3.04
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.187	0.165	0.128	0.127	0.159	0.133	0.119	0.211	0.139	0.146	0.187
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	15.1	15	11.2	8.89	14.8	12.7	9.09	12.7	11.7	9.26	9.1
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	13.8	14.9	13.5	12.9	15.2	19.3	12.3	13.4	13.1	11.4	11.4
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.89	6.18	4.7	3.32	5.57	5.98	4.74	7.85	5.45	5.73	6.96
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	11.7	11.8	10.3	7.48	11.2	10.2	10.3	15.6	9.54	9.19	12.5
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.13 J	0.16 J	0.11 J	0.17 J	0.15 J	0.2 J	0.12 J	0.16 J	0.12 J	0.1 J	0.14 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	49.7	48	38.9	34.7	48.2	45.9	41.4	57.8	47.5	50.3	59.5
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	4.7 J	6.8 J	2.9 J	3.3 J	2.1 U	3.4 J	3 J	12 J	4.2 J	2.3 J	3.7 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	23 J	37 J	16 J	15 J	9.4 J	19 J	17 J	100 J	27 J	13 J	24 J
Other Parameters																						
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 3-1
SWMU 3 - Intermittent Sludge Disposal Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2020 - Spring 2021
(Page 5 of 8)

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Ecological Indicator: Eco-SSL Soil Biota	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU3-WPA-SS-S-12 4/2/2021	SWMU3-WPA-SS-S-62 (Duplicate of SWMU3-WPA-SS-S-12) 4/2/2021	SWMU3-WPA-SS-S-13 5/11/2021	SWMU3-WPA-SS-S-14 5/11/2021	SWMU3-WPA-SS-S-15 5/11/2021	SWMU3-WPA-SS-S-16 5/11/2021	SWMU3-WPA-SS-S-17 5/11/2021	SWMU3-WPA-SS-S-66 (Duplicate of SWMU3-WPA-SS-S-17) 5/11/2021	SWMU3-WPA-SS-S-18 5/11/2021	SWMU3-WPA-SS-S-19 5/11/2021
Aluminum Smelter																					
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.113 J	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	21.7 J	16.7 J	61.6	31.8	33.4	14.3	7.7 J	9.9 J	3.7 J	3.3 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	1.5 B	1 U	4	1 U	2.3	1.2 J	1 J	1 U	1 U	1.2 J
Polycyclic Aromatic Hydrocarbons (PAHs)																					
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0005 J	0.0004 J	0.00038 U	0.0004 U	0.00037 U	0.00039 U	0.00038 U	0.00039 U	0.00069 J	0.00048 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.00093 J	0.00077 J	0.00031 J	0.00033 U	0.00032 J	0.00032 U	0.0004 J	0.00031 U	0.00075 J	0.00058 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00029 U	0.00029 U	0.00029 U	0.00031 U	0.00028 U	0.0003 U	0.00029 U	0.00029 U	0.00048 J	0.0004 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0011 B	0.0011 B	0.00071 J	0.00032 U	0.00084 J	0.00031 U	0.0003 U	0.0003 U	0.0005 J	0.0011 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.012	0.013	0.012	0.00078 B	0.016	0.0021 J	0.0011 B	0.0017 B	0.00091 B	0.0013 B
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.023	0.024	0.026	0.00041 U	0.031	0.0031 J	0.0022 J	0.0022 J	0.00039 U	0.0011 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.04	0.05	0.21	0.0019 J	0.17	0.006	0.0048 J	0.0056	0.0011 J	0.0021 J
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.026	0.035	0.5	0.002 J	0.47	0.006	0.021	0.015	0.0008 J	0.0016 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.012	0.015	0.23	0.0007 J	0.089	0.0019 J	0.0013 J	0.0018 J	0.00032 J	0.00075 J
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.021	0.027	0.049	0.0013 J	0.089	0.0037 J	0.0018 J	0.0027 J	0.00065 J	0.0014 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0046 J	0.006	0.11	0.00049 J	0.076	0.0011 J	0.0025 J	0.002 J	0.00024 J	0.00043 J
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.022	0.022	0.015	0.00078 J	0.02	0.0034 J	0.0015 J	0.0028 J	0.0012 J	0.0023 J
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00059 U	0.00058 U	0.00058 U	0.00062 U	0.00057 U	0.0006 U	0.00059 U	0.00059 U	0.001 J	0.0009 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.026	0.035	0.54	0.0023 J	0.42	0.0057	0.016	0.012 J	0.00086 J	0.0016 J
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.00096 J	0.00075 J	0.00049 J	0.00051 U	0.00058 J	0.00051 J	0.00049 U	0.00049 U	0.00057 J	0.00056 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0074	0.007	0.0052	0.00064 U	0.0067	0.001 J	0.00094 J	0.0012 J	0.0011 J	0.002 J
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.023 J	0.024 J	0.015	0.0007 J	0.024	0.0036 J	0.0012 J	0.0025 J	0.001 J	0.0019 J
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.00062 U	0.00061 U	0.00061 U	0.00065 U	0.00087 J	0.00063 U	0.00062 U	0.00062 U	0.0013 J	0.0011 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.03267	0.03617	0.13669	0.000835	0.10899	0.004817	0.004788	0.004537	0.0005445	0.001732
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.03289	0.03202	0.02171	0.00078	0.02844	0.00491	0.00284	0.004	0.00629	0.00832
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.1876	0.229	**1.692**	0.01017	**1.385**	0.0332	0.0519	0.0455	0.00588	0.01218
Metals																					
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	7,260	7,500	16,400	13,700	9,570	9,640	9,940	9,460	8,720	10,800
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.54	2.64	4.72	4.17	2.22	2.54	1.87	1.91	3.33	3.49
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.122	0.122	0.252	0.154	0.125	0.129	0.109	0.103	0.104	0.12
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	8.9	9.3	16.1	18	10.1	11.5	11.6	11.4	10.7	11
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	9.83	9.53	16	17.7	10.5	14.7	11.7	11.4	11.8	13.4
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	4.87	4.84	12.3	5.82	6.19	4.34	4.57	4.5	5.13	5.05
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.002 U	0.002 U	0.003 B	0.002 B	0.001 U	0.002 U	0.024 J	0.002 UJ	0.002 U	0.002 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	8.64	8.83	**32.4**	13.5	15	9.72	10.2	10.2	10.4	9.95
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.11 J	0.09 J	0.26 J	0.1 J	0.19 J	0.15 J	0.1 J	0.1 J	0.15 J	0.1 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	39.7	39.1	53.8	51.2	45.3	42.3	42.8	42.2	42.8	43.4
Total Petroleum Hydrocarbons (TPHs)																					
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	2.6 J	2.6 J	7.2 J	2.2 J	4.6 J	2.8 J	2.2 J	2.4 J	2 J	2.7 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	17 J	18 J	37 J	13 B	22 B	16 B	10 B	10 B	8.6 B	8.8 B
Other Parameters																					
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU3-WPA-SS-S-20 5/11/2021	SWMU3-WPA-SS-S-21 5/11/2021	SWMU3-WPA-SS-S-22 5/11/2021	SWMU3-WPA-SS-S-23 5/11/2021	SWMU3-WPA-SS-S-24 5/11/2021	SWMU3-WPA-SS-S-25 5/11/2021	SWMU3-WPA-SS-S-26 5/11/2021	SWMU3-WPA-SS-S-27 5/12/2021	SWMU3-WPA-SS-S-28 5/12/2021	SWMU3-WPA-SS-S-29 5/12/2021	SWMU3-WPA-SS-S-67 (Duplicate of SWMU3-WPA-SS-S-29) 5/12/2021
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.06 U	0.13 J	0.07 U	0.06 U	0.06 U	0.07 U	0.11 J	0.19	0.15 J	0.14 J
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	1.8 J	60.8	60.8	2.1 J	27.3	76.4	7.7	**166**	27.9	52.7 J	40 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	1 U	19.5	5.5	1 U	1.3 J	19.9	1 U	**121,000**	211	**4,130 J**	**2,440 J**
Polycyclic Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00079 J	0.0008 J	0.0025 J	0.00038 U	0.00048 J	0.0025 J	0.00038 U	0.0093	0.00099 J	0.00053 J	0.00046 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.001 J	0.0042 J	0.023	0.00076 J	0.0033 J	0.011	0.00031 U	0.046	0.0048 J	0.00037 U	0.00036 U
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00071 J	0.001 J	0.0014 J	0.00029 U	0.00032 J	0.0047 J	0.00029 U	0.024	0.0006 J	0.00034 U	0.00033 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0013 J	0.012	0.029	0.0021 J	0.0038 J	0.031	0.0003 U	0.19	0.0071	0.00036 U	0.00035 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0018 J	0.46	0.5	0.14	0.068	0.79	0.0012 B	3	0.13	0.0043 J	0.0026 J
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.0022 J	0.6	0.88	0.13	0.098	2.3	0.0011 J	8	0.24	0.008	0.0031 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0035 J	2.8	1.8	0.18	0.22	8.3	0.0027 J	18	0.54	0.021	0.014
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0023 J	3.8	3.8	0.18	0.19	16	0.0024 J	56	0.5	0.02 J	0.013 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0013 J	1.1	0.7	0.18	0.084	9.5	0.001 J	7.5	0.14	0.0057 J	0.0034 J
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0023 J	1.7	1.1	0.18	0.11	3.2	0.0016 J	11	0.23	0.011 J	0.006 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00059 J	0.61	0.48	0.18	0.04	3.3	0.00053 J	8.8	0.088	0.0034 J	0.0022 J
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.0034 J	0.41	0.68	0.066	0.11	1.2	0.002 J	4.1	0.22	0.0066	0.0035 J
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0019 J	0.0022 J	0.011	0.00065 J	0.0013 J	0.0061	0.00059 U	0.042	0.0028 J	0.00069 U	0.00068 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0024 J	3.6	3.2	0.2 J	0.2 J	16 J	0.0024 J	53	0.47	0.021	0.014
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.00059 J	0.0017 J	0.0044 J	0.00048 U	0.001 J	0.0058	0.00048 U	0.015	0.0014 B	0.00081 B	0.00066 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0026 J	0.062	0.21	0.0046 J	0.03	0.23	0.00061 U	0.95	0.052	0.0021 J	0.0016 J
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.0029 J	0.63	0.81	0.077	0.1	1.8	0.0019 J	4.6	0.23	0.0063	0.0031 J
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0023 J	0.0042 J	0.009	0.00062 U	0.00099 J	0.018	0.00062 U	0.07	0.0024 J	0.00073 U	0.00071 U
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.003182	**1.474**	**1.559**	**0.2198**	0.1603	**6.121**	0.001899	**17.14**	**0.3791**	0.01365	0.00678
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.01229	0.4939	0.9613	0.07411	0.1502	1.4911	0.002	5.3763	0.28969	0.01004	0.00622
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.01929	**15.3**	**13.27**	**1.447**	**1.11**	**61.19**	0.01483	**170**	**2.568**	0.1007	0.0614
Metals																						
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	9,180	14,800	15,000	10,500	8,530	23,700	10,600	14,400	10,200	6,530	6,800
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.51	7.32	6.05	3.56	4.45	**11**	2.93	**13.6**	3.21	4.6	4.94
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.116	0.338	0.419	0.125	0.189	**0.891**	0.126	**1.01**	0.139	0.109	0.115
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	11.6	14.4	14.6	12.8	8.65	15.1	14.3	8.39	12.4	6.59	6.77
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	13.5	14.2	14.1	12.7	9.93	13.9	13	13.7	18.9	12.9	13
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.43	20.9	23	5.71	6.7	**55.4**	4.73	**67.8**	5.68	2.27	2.3
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.008 J	0.009 J	0.005 U	0.006 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	10.8	**56.2**	**59.2**	9.98	11	**157**	10.6	**187**	13.5	6.35	6.48
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.15 J	**0.42 J**	**0.4 J**	0.14 J	0.13 J	**1.1**	0.2 J	**1.66**	**0.59 J**	**0.6 J**	**0.6 J**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	41.6	54.5	59.3	50.2	57.2	74.9	42.5	43	38	30.8	31.6
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	2.8 J	7.5 J	16 J	2.8 J	5.2 J	21 J	1.8 U	78 J	17 J	3.5 J	3.9 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	13 B	54 J	120	17 B	17 B	**400**	6.5 B	**910 J**	140	18 J	17 J
Other Parameters																						
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 3-1
SWMU 3 - Intermittent Sludge Disposal Ponds WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2020 - Spring 2021
(Page 7 of 8)

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU3-WPA-SS-S-30 5/12/2021	SWMU3-WPA-SS-S-31 5/12/2021	SWMU3-WPA-SS-S-32 5/12/2021	SWMU3-WPA-SS-S-33 5/12/2021	SWMU3-WPA-SS-S-34 5/12/2021	SWMU3-WPA-SS-S-35 5/12/2021	SWMU3-WPA-SS-S-36 5/12/2021	SWMU3-WPA-SS-S-37 5/12/2021	SWMU3-WPA-SS-S-38 5/12/2021	SWMU3-WPA-SS-S-68 (Duplicate of SWMU3-WPA-SS-S-38) 5/12/2021	SWMU3-WPA-SS-S-39 5/12/2021
Aluminum Smelter																						
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.09 J	0.099 J	0.07 U	0.08 U	0.07 U	0.07 U	0.07 U	0.07 J	0.07 U	0.06 U	0.09 J
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	21.1	18.7	6	29.9	18.4 J	10.8	17.3	23.2	1.7 J	2.9 J	14
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	**4,560**	4.3	2.3	694	**9,040 J**	**11,200**	13.5	3.7	4 J	6 J	**15,000**
Polycyclic Aromatic Hydrocarbons (PAHs)																						
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00044 U	0.0055	0.00039 U	0.00044 U	0.00082 J	0.0004 U	0.00037 U	0.0021 J	0.00038 U	0.00037 U	0.00061 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.00035 U	0.053	0.00031 U	0.0022 J	0.0035 J	0.00032 U	0.0003 U	0.018	0.0004 J	0.0003 U	0.0025 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00033 U	0.0013 J	0.00029 U	0.00033 U	0.00052 J	0.0003 U	0.00028 U	0.0011 J	0.00029 U	0.00028 U	0.00031 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.00034 U	0.058	0.0003 U	0.0028 J	0.0057 J	0.00031 U	0.00029 U	0.018	0.00033 J	0.00029 U	0.0032 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0022 J	0.81	0.0054	0.038	0.087	0.0022 J	0.00091 J	0.18	0.005 J	0.0019 J	0.055
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.0029 J	1.2	0.0085	0.066	0.22	0.0038 J	0.0011 J	0.23	0.0037 J	0.0014 J	0.081
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0071	1.9	0.014	0.13	0.5	0.0083	0.0043 J	0.41	0.012 J	0.0042 J	0.16
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0059	1.1	0.011	0.24	0.85	0.012	0.008	0.23	0.0077	0.0033 J	0.084
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.002 J	0.57	0.0044 J	0.043	0.19	0.0038 J	0.0019 J	0.13	0.0039 J	0.0014 J	0.045
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0041 J	1.1	0.0081	0.074	0.19	0.0047 J	0.0039 J	0.23	0.0071	0.0025 J	0.1
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0011 J	0.26	0.0022 J	0.028	0.14	0.0021 J	0.0012 J	0.054	0.0017 J	0.00073 J	0.018
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.0033 J	1.1	0.0089	0.062	0.13	0.0028 J	0.0013 J	0.29	0.0082 J	0.0026 J	0.094
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00067 U	0.023	0.00059 U	0.0013 J	0.002 J	0.00061 U	0.00057 U	0.0086	0.00058 U	0.00057 U	0.0013 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.007	1.2	0.01	0.17	0.8	0.012	0.0071	0.26	0.0083 J	0.0033 J	0.092
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.00055 U	0.007	0.00053 B	0.00069 B	0.0015 B	0.00069 B	0.00047 U	0.0032 J	0.00053 B	0.00053 B	0.0011 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0012 J	0.42	0.0025 J	0.022	0.041	0.0011 J	0.00078 J	0.12	0.0029 J	0.001 J	0.026
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.0032 J	1.2	0.0085	0.061	0.13	0.0026 J	0.0012 J	0.28	0.0074	0.0026 J	0.1
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0007 U	0.013	0.00062 U	0.0011 J	0.0023 J	0.00064 U	0.0006 U	0.0048 J	0.00061 U	0.0006 U	0.00084 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.004881	**1.685**	0.012181	0.10764	**0.3936**	0.006687	0.00268	**0.3357**	0.006861	0.002578	0.119
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.0045	1.6678	0.01193	0.09099	0.18504	0.00459	0.00208	0.461	0.01236	0.00413	0.12871
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.0355	**9.34**	0.0721	0.85	**3.107**	0.0515	0.02961	**2.004**	0.0568	0.02133	0.735
Metals																						
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	8,170	7,720	10,200	10,600	10,200	8,580	12,100	10,700	7,620	6,990	7,290
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	7.35	3.05	1.99	2.3	4.14	3.12	3.24	2.89	2.33	2.5	4.78
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.136	0.146	0.119	0.121	0.135	0.117	0.149	0.161	0.085	0.095	0.119
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	7.05	10.3	11.5	9.4	10.2	10.6	16.6	15.1	12.6	13	8.49
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	15	11.6	14.5	15.2	14.8	11.5	17.4	14.2	9.55	10.3	12.5
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	2.28	5.74	4.42	3.64	4.49	3.5	6.05	6.12	4.29	4.48	2.59
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.004 U	0.005 J	0.004 J	0.005 J	0.005 U	0.006 J	0.005 U	0.008 J	0.005 U	0.004 U	0.005 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	6.73	11.4	9.98	8.91	12.4	7.55	14.2	11.8	9.83	10.1	6.5
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**0.45 J**	0.13 J	0.11 J	0.2 J	0.2 J	0.1 J	0.13 J	0.16 J	0.08 U	0.08 J	0.2 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	28.8	47.2	42	29.1	40.7	40.5	55.2	52.5	37.9	38.4	34.4
Total Petroleum Hydrocarbons (TPHs)																						
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	7 J	13 J	3 J	5.8 J	7.2 J	2.5 J	2.3 J	7.1 J	2 J	2.3 J	8.5 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	24 J	66 J	10 J	33 J	34 J	16 J	14 J	34 J	6.8 J	6.7 J	30 J
Other Parameters																						
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Ecological Indicator: Eco-SSL Soil Biota	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU3-WPA-SS-S-40 5/12/2021	SWMU3-WPA-SS-S-41 5/12/2021	SWMU3-WPA-SS-S-42 5/12/2021	SWMU3-WPA-SS-S-43 5/12/2021	SWMU3-WPA-SS-S-44 5/12/2021	SWMU3-WPA-SS-S-69 (Duplicate of SWMU3-WPA-SS-S-44) 5/12/2021	SWMU3-WPA-SS-S-45 5/12/2021	SWMU3-WPA-SS-S-46 5/12/2021	SWMU3-WPA-SS-S-47 5/12/2021
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.16 J	0.07 U	0.06 U	0.12 J	0.06 U	0.06 U	0.06 U	0.283	0.06 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	53.2	16.9	14.3	22.1	8 J	12.4 J	26.3	73.8	17.8
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	40.8	**3,730**	3.1	2.6	1.8 J	1.8 J	1.8 J	3.5	1.7 J
Polycyclic Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.021	0.00043 U	0.00072 J	0.0038 J	0.00037 U	0.00044 J	0.00052 J	0.029	0.00065 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.3	0.00079 J	0.0035 J	0.049	0.0021 J	0.001 J	0.00069 J	0.37	0.0026 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0044 J	0.00033 U	0.00052 J	0.0029 J	0.00028 U	0.00029 U	0.00028 U	0.013	0.00029 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.33	0.00086 J	0.0043 J	0.057	0.0024 J	0.001 J	0.00071 J	0.49	0.0043 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	4.5	0.01	0.078	0.9	0.039 J	0.017 J	0.012	5	0.058
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	6.9	0.014	0.11	1.3	0.057 J	0.022 J	0.02	7.1	0.089
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	10	0.023	0.22	2	0.1 J	0.044 J	0.031	10	0.14
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	6.8	0.016	0.27	1.2	0.075 J	0.034 J	0.025	5.8	0.084
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	3.2	0.0073	0.071	0.71	0.034 J	0.015 J	0.011	3.4	0.047
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	5.8	0.016	0.13	1.2	0.059 J	0.027 J	0.019	6.1	0.079
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.3	0.0033 J	0.04	0.29	0.016 J	0.0069 J	0.0052	1.3	0.019
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	6.7	0.017	0.13	1.2	0.064 J	0.029 J	0.019	8.2	0.092
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.14	0.00066 U	0.002 J	0.019	0.00094 J	0.00058 U	0.00057 U	0.17	0.0015 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	7.2	0.017	0.21	1.4	0.078 J	0.034 J	0.025	6.6	0.09
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.028	0.00056 B	0.00092 B	0.0051 J	0.00058 B	0.00075 J	0.00068 J	0.041	0.00099 J
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	2.5	0.0064	0.034	0.41	0.02 J	0.0097 J	0.0057	3.1	0.028
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	6.3	0.016	0.14	1.3	0.063 J	0.027 J	0.021	7.4	0.09
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.073	0.00069 U	0.0019 J	0.011	0.00072 J	0.00061 U	0.0006 U	0.09	0.0012 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**9.578**	0.02022	0.1732	**1.842**	0.08429	0.03396	0.02861	**9.791**	0.12519
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	10.0234	0.02561	0.17596	1.7468	0.09002	0.04189	0.0273	12.413	0.13004
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**52**	0.1226	**1.269**	**10.3**	0.521	0.2269	0.1692	**52.7**	0.696
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	14,900	6,940	10,300	13,100	8,850	10,500	9,340	13,800	10,200
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	4.9	6.11	2.87	3	2.63	2.57	2.47	3.17	2.63
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.362	0.136	0.195	0.199	0.117	0.129	0.128	0.267	0.159
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	14.1	13.4	16.7	17.4	12.9	13.6	12.4	15.7	14.2
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	12.8	15.7	16.3	15.2	13.8	14.2	14.2	16.3	16.2
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	18.1	3.57	5.65	6.82	4.85	4.36	4.38	11.1	5.04
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.011 J	0.006 U	0.005 U	0.059	0.004 J	0.009 B	0.008 B	0.019 B	0.008 B
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	**37.8**	11.5	12.5	14.6	10.4	11.1	9.88	15.7	10.5
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**0.48 J**	0.1 J	0.13 J	0.12 J	0.12 J	0.14 J	0.14 J	0.13 J	0.17 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	61.2	31.5	60.3	58.2	40.5	42.4	41.3	67.9	55.8
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	86	2.2 U	4.4 J	18 J	4 J	3.3 J	2.1 J	110	3.1 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	**490**	5.2 J	24 J	89 J	19 J	13 J	12 J	**480**	16 J
Other Parameters																				
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

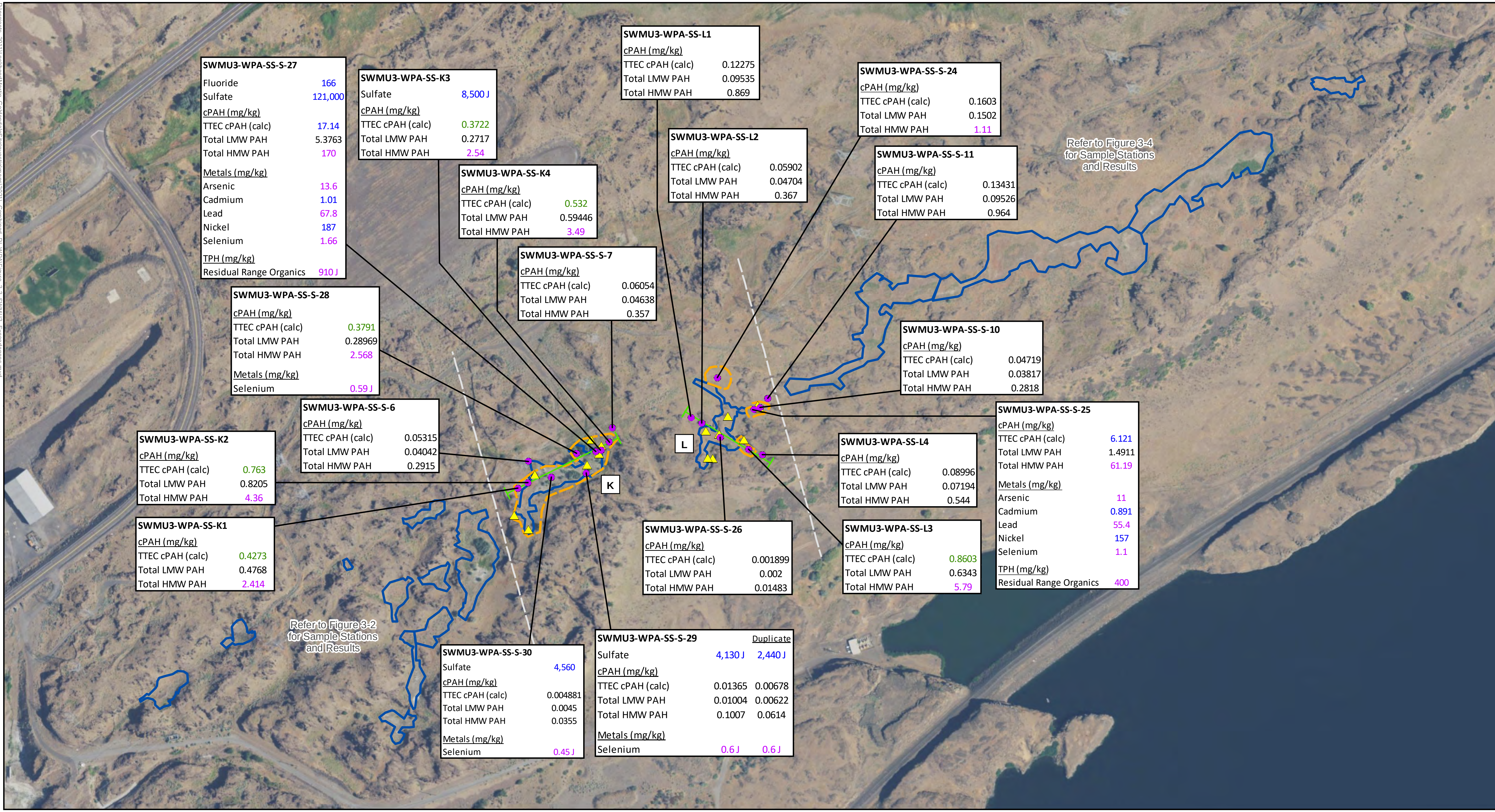
NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration



Legend
Remediation Area
WPA Sample Location
Area of Visible Soil Staining or Field Indications of Potential Residual Waste
Initial Surface Soil Sample Transect
Approximated Lateral Extent of Soil Screening Level Exceedances
Figure Detail Areas
red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
green: Exceeds MTCA Method B Soil Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

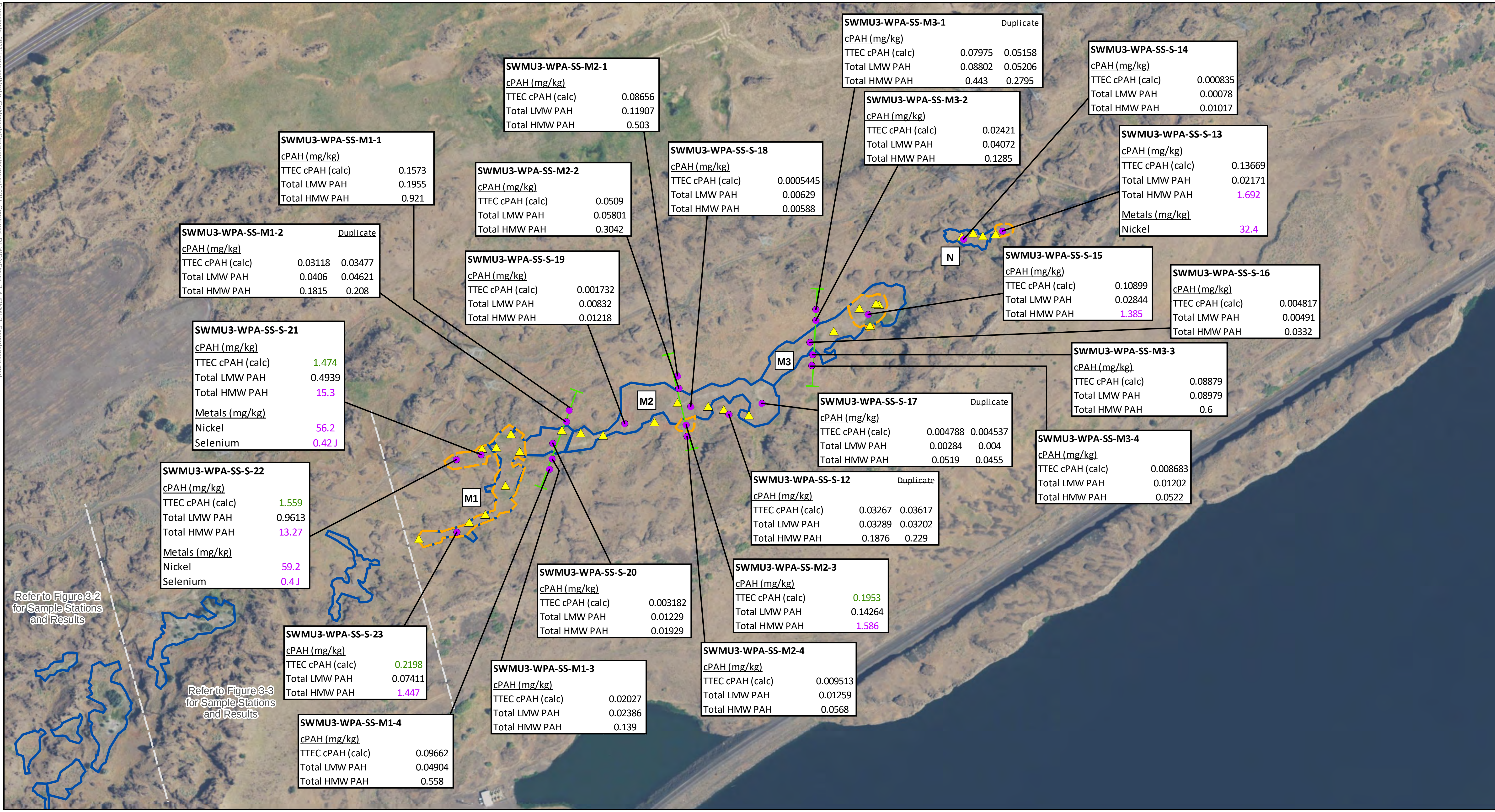
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 125 250 500
Feet

Figure 3-3
SWMU 3
Intermittent Sludge Disposal Ponds - Central
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Legend

- Remediation Area
- WPA Sample Location
- Area of Visible Soil Staining or Field Indications of Potential Residual Waste
- Initial Surface Soil Sample Transect
- Approximated Lateral Extent of Soil Screening Level Exceedances
- Figure Detail Areas

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
green: Exceeds MTCA Method B Soil Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 125 250 500
Feet

Figure 3-4
SWMU 3
Intermittent Sludge Disposal Ponds - East
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Analytical results show widespread presence of PAHs above screening levels including MTCA Method B screening levels, terrestrial ecological screening levels, and MTCA-derived screening levels for protection of groundwater. There were areas both within the former excavations and outside the excavations with residual contamination. For the base of the former excavations, excavation areas D, EF, I, K, M1, and M3 exceed screening levels for PAHs, sulfate and/or metals. In general, the residual contamination outside of the excavations was limited to within about 75 ft of the excavation edges and was also present in low-lying areas between the remediation areas that also represent probable past haul roads for the remediation project. In general, the highest concentrations of fluoride, metals, and PAHs were found in soils from outside the former excavations, while most of the sulfate concentrations that exceeded screening levels came from within the excavations.

There are some locations outside of the former excavation areas that are not visibly stained but did exceed screening levels. However, based on the supplemental samples collected from these areas, the contamination is located primarily in relatively localized area along the edges of the excavation or along the haul roads between the historical excavation areas.

3.3 CONCLUSIONS AND RECOMMENDATIONS

The site reconnaissance and analytical results show that there is residual soil contamination present within the former excavations and adjacent areas. In general this contamination appears to be residual contamination remaining from the 2007 removal action. For this reason, the Intermittent Sludge Disposal Ponds (SWMU 3) will be carried forward into the FS for evaluation of remedial alternatives.

Section 4
West Surface Impoundment (SWMU 4)

The West Surface Impoundment (WSI) was not included in the RI field program because this unit (SWMU 4) was formerly investigated and closed under RCRA (refer to Figure P-1). A Closure and Post-Closure Plan was prepared in November 2004, including provisions for long-term maintenance and groundwater monitoring (Parametrix 2004c). The latest round of groundwater sampling under the WSI post-closure plan was completed in July 2021 (GeoPro 2021).

For a summary of previous investigations and remediation work completed at the WSI (SWMU 4) please refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

4.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No RI field investigation was performed at SWMU 4 as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

4.2 INVESTIGATION RESULTS

No additional RI data was collected at the WSI (SWMU 4). Site-wide groundwater monitoring and characterization results for the WSI vicinity are presented in Volume 3 as part of the Groundwater in the Uppermost Aquifer AOC.

4.3 CONCLUSIONS AND RECOMMENDATIONS

The WSI is a closed SWMU under RCRA and the cap is maintained under established post-closure plans (see above). Site-wide groundwater monitoring results, including the WSI vicinity are summarized and will be addressed as part of the Groundwater in the Upper Most Aquifer AOC (refer to Volume 4, Section 2 of this report). SWMU 4 will not be evaluated in the FS, as it is a capped and closed RCRA unit. In addition, removal of SWMU 4 is included in the current plan for the Pumped Storage Project (ERM West 2021).

Section 5
Line A Secondary Scrubber Recycle Station (SWMU 5)

Line A Secondary Scrubber Recycle Station (SWMU 5) was one part of the plant air emission pollution control system and was located in the west-central portion of the main plant area near Courtyard A3 (refer to Figure P-1). The Line A Secondary Scrubber Recycle Station system consisted of a screen box, cyclone separators, a 36-ft diameter clarifier, and overflow recycle tanks. About 6,000 gallons per minute (gpm) of contaminated scrubber water was treated at the recycle station to remove solids and adjust pH. After treatment, some of the water was recycled back to the wet roof scrubbers and the rest of the treated water was pumped to the 130-ft diameter clarifier associated with Line B, C, D Secondary Scrubber Recycle Station (SWMU 6). The clarifier and all above-ground structures have been demolished. Secondary fugitive emissions from the Production Buildings were moved by the building ventilation system into the roof scrubbers to remove fluoride and particles from gases. Resultant spray-water containing particulates, fluoride, and other pollutants including sulfur dioxide flowed to the recycle station for further treatment.

Investigation objectives included characterization of COPCs concentrations in soil and determination of whether a release above relevant screening levels has occurred.

5.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

In accordance with the approved Phase 2 Work Plan, the preliminary investigation step was system identification. Site plans were reviewed to identify construction details for the recycle station including underdrains, piping, connections with other lines, and associated structures. The existing clarifier foundation was inspected for cracks or other indicators of leakage that may have occurred prior or during plant demolition activities. Ground-penetrating radar (GPR) was used in support of underground utility location to identify pipes and other subsurface structures. The boring locations and vertical intervals for sampling were modified slightly based on the results of review of site plans, interviews with facility personnel, and utility clearance results including GPR and standard conductance methods.

The recycle station was investigated with three soil borings located around the perimeter of the clarifier pad (refer to Figure 5-1). The soil borings were completed to a depth of up to 10 ft or refusal. Discrete soil samples were collected at depths of 0.5 ft bgs, 2 ft bgs, and the base of each boring. Soil samples were analyzed for PAHs, total cyanide, fluoride, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), sulfate, and pH.

A shallow temporary well (RI-GW5) was installed at one of the boring locations (SWMU05-SB01) at SWMU 5 to determine if a release has occurred to shallow groundwater and to help characterize the nature and extent of groundwater contamination.

Difficult drilling conditions were encountered in this area and are summarized as follows: 1) an active high-voltage underground powerline is located along the northern edge of the access road immediately south of SWMU 5 that limits access, 2) there is miscellaneous subsurface piping, electrical conduit, and other subsurface anomalies in this area, 3) the concrete pad/footings in this area are over 3 ft thick with rebar, and required coring, 4) the underlying soils consisted of dense, gravelly, silt and silty gravel with cobbles that made hollow-stem auger drilling ineffective due to refusal. For these reasons, drilling and sampling in this area was delayed until October-November 2016.

Based on the occurrence of underground utilities and other subsurface structures, the sampling locations were altered as much as 20 ft from the locations specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Boring SWMU5-SB02 was installed with a hand auger due to the presence of suspected underground utilities in the immediate area and refusal occurred at a shallow depth of 1-ft bgs at this location. Boring SWMU5-SB01 was drilled to a depth of 18.5 ft bgs using sonic drilling techniques and completed as temporary well RI-GW5. Boring SWMU5-SB03 was drilled to a depth of about 18 ft bgs also using sonic drilling methods. Note that the shallowest sampled intervals at SWMU5-SB01 and SWMU-SB03 were collected from just below the concrete pad/footing, while the shallow interval in SWMU5-SB02 represented surface soil in an area where no footing was present.

Legend

- Well
- RI Soil Boring

red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

N W E S

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Imagery Souce: NAIP 2017

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

Figure 5-1
SWMU 5
Line A Secondary Scrubber Recycle Station
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

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5.2 INVESTIGATION RESULTS

Soil samples collected in October-November 2016, were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Soil boring lithologic logs are provided in Volume 5, Appendix B-5. The laboratory data report and data validation report for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively.

The RI soil sample analytical results for SWMU 5 are summarized in Table 5-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, and MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecological screening levels for wildlife protection. Site soil background concentrations are also provided in Table 5-1 for comparison. Figure 5-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

Soils at this site consisted of dense silty gravel (GM) and gravelly silt (ML) with cobbles to depth of about 14 ft bgs. Fractured and vesicular basalt bedrock was encountered at a depth of about 14 ft bgs at the RI-GW5 boring. GPR readings showed the presence of a large amount of subsurface piping and other anomalies in this area to depths typically less than 7-ft bgs.

The results for SWMU 5 are summarized as follows:

- cPAHs were detected in sample SWMU05-SB2-0.5 at a concentration (70.67 mg/kg) that exceeded the soil screening level for protection of groundwater of 3.9 mg/kg as well as terrestrial ecological screening levels.
- Fluoride (maximum of 240 mg/kg) was detected above the MTCA-derived soil screening level for protection of groundwater in 2 of 8 samples, while sulfate (maximum of 420 mg/kg) was detected at low concentrations below MTCA-derived screening levels for protection of groundwater.
- Total cyanide was not detected in any of the soil samples. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.

Table 5-1
SWMU 5 - Line A Secondary Scrubber Recycle Station Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Fall 2016

				Ecological Indicator				Analytical Results							
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU05-SB01-0.5 10/28/2016	SWMU05-SB01-2.0 10/28/2016	SWMU05-SB40-2.0 (Duplicate of SWMU05-SB01-2.0) 10/28/2016	SWMU05-SB01-10 10/28/2016	SWMU05-SB02-0.5 11/3/2016	SWMU05-SB03-0.5 10/28/2016	SWMU05-SB3-2.0 11/1/2016	SWMU05-SB3-10.0 11/1/2016
Aluminum Smelter															
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	1.8 UJ	2.1 UJ	2 UJ	2.8 UJ	2.3 U	2.1 UJ	1.9 U	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	17 J	**220 J**	42 J	88 J	**240**	26 J	76	66
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	7.5 J	9.4 J	8.1 J	420	34	7.2 J	11	26
Polycyclic Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00067 J	0.00065 U	0.0006 U	0.0012 J	**0.58**	0.0009 J	0.00061 U	0.00055 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.001 B	0.00057 B	0.00052 B	0.0013 B	0.81	0.00098 B	0.00053 J	0.00051 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0041 J	0.00062 U	0.00057 U	0.00083 UJ	4.4 J	0.0061	0.0016 J	0.00052 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00054 J	0.00052 U	0.00048 U	0.0013 J	0.28	0.00067 J	0.00048 U	0.00043 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0088	0.00077 J	0.00057 U	0.004 J	7.8	0.013	0.0032 J	0.00065 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.2	0.0073	0.0045 J	0.0065 J	38	0.18	0.021	0.0095
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.28	0.017 J	0.0063 J	0.0083 J	44	0.28	0.028	0.017
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.61	0.045 J	0.018 J	0.044 J	110	0.56 J	0.054	0.024
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.35	0.037 J	0.012 J	0.031 J	65	0.43	0.034	0.025
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.2	0.015 J	0.0066 J	0.013 J	23	0.18	0.023	0.009
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.31	0.013	0.0089	0.016 J	57	0.29	0.041	0.013
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.063	0.0061	0.0023 J	0.0067 J	16	0.072	0.0047 J	0.0023 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.19	0.0071	0.0073	0.016 J	79	0.23	0.042	0.017
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0017 J	0.00052 U	0.00048 U	0.00069 UJ	2.8	0.0023 J	0.00048 U	0.00043 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.4	0.033 J	0.011 J	0.039 J	74	0.44 J	0.037	0.023
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0011 B	0.00082 U	0.0015 B	0.0016 B	1	0.0014 B	0.00087 J	0.00077 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.037	0.0021 J	0.0018 J	0.0051 J	32	0.05	0.013	0.0022 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.19	0.0068	0.0072	0.012 J	68	0.23	0.039	0.023
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.4304	0.02777	0.010629	0.01938	**70.67**	0.4261	0.04238	0.02391
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.24491	0.01054	0.01112	0.0305	**129**	0.30535	0.0612	0.02113
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**2.603**	0.1802	0.0768	0.1765	**495**	**2.662**	0.2817	0.1458
Metals															
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	3,900	3,900	3,800	12,000	34,000	3,400	4,300	7,600
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	1.5	1.4	1.5	6.9	**14**	1.4	1.6	1.8
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.13	0.11	0.11	0.48	**9**	0.13	0.18	0.43
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	5.2 J	4.7 J	4.7 J	11 J	46	3.9 J	5.6 J	1.7 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	18	14	13	27	66	11	14	19
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	2.8	2.7	2.5	4.5	80	2.6	2.5	2.4
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.006 U	0.0061 U	0.0057 U	0.0094 J	0.15	0.006 U	0.0058 U	0.0063 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	7.3	8.5	7.5	16	**170**	7.8	12	15
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.79**	**0.74**	**0.7**	**1.7**	**1.3**	**0.61**	**0.83**	**0.78**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	41	39	38	75	**810**	42	120	190

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

- For metals, arsenic, cadmium, and nickel exceeded MTCA-derived soil screening levels for protection of groundwater and site background concentrations in one surface sample (SWMU5-SB02-0.5). Zinc concentrations exceeded the terrestrial ecologic screening level for protection of wildlife in this same sample. Selenium exceeded the terrestrial ecologic screening level for protection of wildlife and site background in all the collected soil samples.

- Soil pH is this area was generally neutral (6.1 to 8.1) and was not indicative of a release.

Concentrations of fluoride (maximum of 17 mg/L) in nearby shallow temporary well RI-GW5 consistently exceeded the MCL of 4 mg/L and there is a shallow fluoride groundwater plume located in the main plant area (refer to Volume 4, Section 2.4). The fluoride groundwater contamination at this location may be related to the nearby scrubber effluent line in Courtyard A or the lines/and piping associated the Line A Secondary Scrubber Recycle Station and/or the lines and piping that connected the unit to the Tertiary Treatment Plant.

Groundwater contamination in this area and the lines and shallow groundwater interactions are summarized in Volume 4, Section 2.4. The soil contamination in this area of the Courtyards is further evaluated and summarized in Volume 3, Section 2.3.

5.3 CONCLUSIONS AND RECOMMENDATIONS

PAH surface soil contamination at SWMU 5 is discussed in Volume 3, Section 2.3, and will be evaluated in the FS in conjunction with adjacent areas of the PAAOC. Historical releases from SWMU 5 from piping will be further evaluated in the FS as part of the Groundwater Area of Concern (GWAOC) and/or PAAOC as appropriate.

Section 6
Line B, C, D Secondary Scrubber Recycle Stations (SWMU 6)

Line B, C, D Secondary Scrubber Recycle Station (SWMU 6) is in the northcentral portion of the main plant adjacent to the Tertiary Treatment Plant (SWMU 8) (Figure P-1). The Recycle Station system consisted of a 130-ft diameter clarifier, a backup 90-ft diameter clarifier, two recycle tanks, three bulk reagent/recycle tanks, and appurtenant pipes (Ecology 2014). The clarifiers and all above ground structures have been demolished. Only the clarifier and associated caustic tank foundations remain.

Similar to the SWMU 5 Recycle Station, the SWMU 6 Recycle Station was part of the site air pollution control system and treated spray water from roof scrubbers to remove particulates, fluoride, and other pollutants including sulfur dioxide. After treatment, some of the water flowed from the clarifier to recycle tanks and were then recycled to the roof scrubbers. Some of the water and solids slurry from the clarifiers flowed through the Tertiary Treatment Plant for further treatment, with the water discharge under the plant NPDES permit.

Investigation objectives included characterization of COPC in soil and determination of whether a release above relevant screening levels has occurred.

6.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The system identification was the first step of the investigation process. Site plans were reviewed to identify construction details for the recycle station including underdrains, piping, connections with other lines, and associated structures. The existing clarifier foundations were inspected for cracks or other indicators of leakage. GPR was used in support of underground utility location to identify pipes and other subsurface structures. The boring locations and vertical intervals for sampling were modified slightly based on the results of review of site plans, interviews with facility personnel, and utility clearance results including GPR and standard conductance methods. SWMU 6 was investigated with four soil borings located to the north and south of the two clarifiers, and adjacent to the caustic tank foundations (Figure 6-1). The soil borings were completed to depths of up to 10 ft or refusal.

Discrete soil samples were collected at depths of 0.5 ft bgs, 2 ft bgs, and the base of each boring. Soil samples were analyzed for PAHs, total cyanide, fluoride, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), sulfate, and pH. If the boring was less than 4 ft deep due to auger refusal, samples were collected at 0.5 ft and the base of the boring.

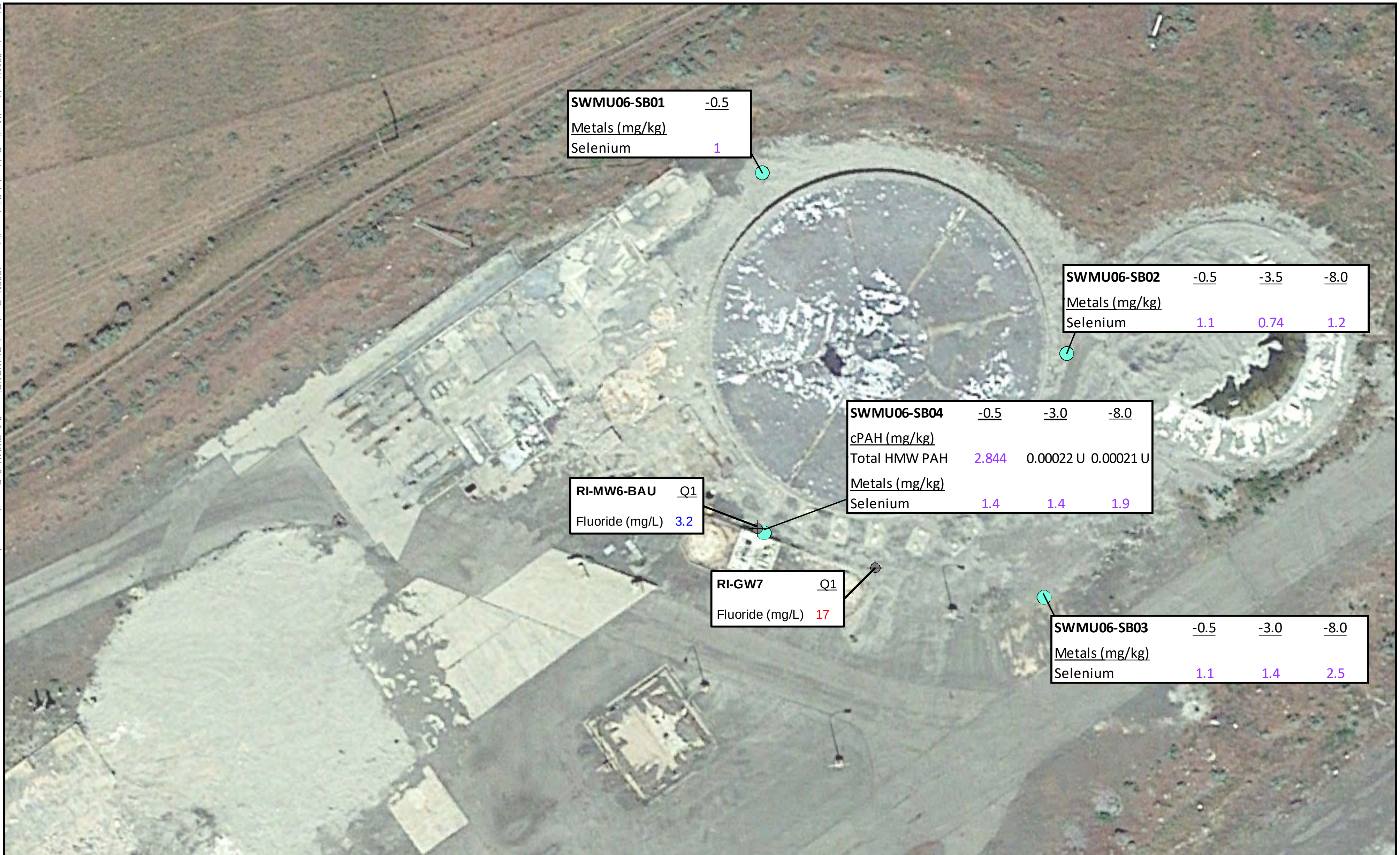
Three of the four borings were drilled and sampled using hollow-stem auger drilling techniques. Soil samples were collected and logged at selected intervals ranging from 1.0 to 2.5 ft using a heavy-duty, Dames & Moore style, stainless-steel, split-spoon sampler. Drilling conditions were difficult at SWMU 6 with refusal encountered at 2.5 ft bgs, 10.5 ft bgs, and 8 ft bgs in borings SWMU6-SB01, -02, and -03, respectively. The bedrock contact was encountered at about 10.5 ft bgs in RI-MW6-BAU.

The fourth boring (SWMU6-SB03) was completed as a monitoring well (RI-MW6-BAU) screened in the Basalt Aquifer – Upper Zone (BAU). A shallow temporary well (RI-GW7) was also installed to determine if a release has occurred to shallow groundwater and to help characterize the nature and extent of groundwater contamination. Both wells were drilled using sonic drilling methods, which were needed to penetrate to the fill/bedrock contact and into the basalts. The sonic drilling method produced a continuous core used for logging and sampling purposes.

6.2 INVESTIGATION RESULTS

Soil samples collected in December 2015 were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Soil boring lithologic logs are provided in Volume 5, Appendix B-6. The laboratory data report and data validation reports for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively.

Soils in this area generally consisted of dense silty and clayey gravel (GM and GC) with cobbles. Basalt bedrock was encountered at about 5 ft bgs to 10 ft bgs in this area based on the well logs for RI-GW7 and RI-MW6-BAU.



Legend

Well

RI Soil Boring

red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon

N W E S

0 25 50
Feet
Imagery Souce: NAIP 2017

Figure 6-1
SWMU 6
Lines B, C, D Secondary Scrubber Recycle Stations
Sample Locations and
Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

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The RI soil sample analytical results for SWMU 6 are summarized in Table 6-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA Method A Industrial, and MTCA-derived soil screening levels for protection of groundwater. Site soil background concentrations are also provided in Table 6-1 for comparative review. Figure 6-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

Most of the soil at SWMU 6 remains covered by concrete slab/footings and in some areas the ground surface is covered by crushed concrete rubble. The slab of the clarifiers appeared to be generally uncracked. However, based conversations with plant personnel, the large clarifier had historically leaked and was part of the reason for construction of the smaller secondary clarifier (BMEC, personal communication, April 2021). GPR readings showed the presence of a large amount of subsurface piping and other anomalies in this area.

None of SWMU 6 soil samples exceeded the soil screening levels and results are summarized as follows:

- PAHs were detected at low concentrations that are generally below screening levels. One surface soil sample (SWMU06-SB04-0.5) exceed the terrestrial ecological screening levels.
- Total cyanide was not detected in any of the soil samples. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.
- Fluoride (maximum of 68 mg/kg) and sulfate (maximum of 150 mg/kg) were detected at low concentrations significantly below MTCA-derived screening levels for protection of groundwater.
- Polychlorinated biphenyls (PCBs) were not detected.
- Except for selenium, all metals were detected below screening levels. Selenium (maximum of 2.5 mg/kg) exceeded the terrestrial ecological screening level for wildlife protection and site background concentrations in all of the collected samples.
- Soil pH is this area appear alkaline (7.5 to 9.13) and below hazardous pH levels (12.5).

Table 6-1
SWMU 6 - Line B, C, D Secondary Scrubber Recycle Stations Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2015

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU06-SB01-0.5 12/9/2015	SWMU06-SB02-0.5 12/9/2015	SWMU06-SB02-3.5 12/9/2015	SWMU06-SB02-8.0 12/9/2015	SWMU06-SB03-0.5 12/9/2015	SWMU06-SB03-3.0 12/9/2015	SWMU06-SB03-8.0 12/9/2015	SWMU06-SB04-0.5 12/17/2015	SWMU06-SB04-2 12/17/2015	SWMU06-SB04-10 12/17/2015
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	1.9 U	1.9 U	2.7 U	2.2 U	1.9 U	2.2 U	2.1 U	1.9 U	2 U	1.9 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	11 J	17 J	1.3 J	6.8 J	18 J	33 J	68 J	44	7.8	16
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	3.9 U	13	150	41	7 J	5.3 J	7.1 J	19	8.2 J	6.1 J
Polycyclic Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0016 U	0.0016 U	0.0021 U	0.0089 J	0.082 U	0.0019 U	0.0017 U	0.033 J	0.0017 U	0.0016 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0021 U	0.0022 J	0.0027 U	0.013	0.11 U	0.0025 U	0.0023 U	0.044 J	0.0022 U	0.0021 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.00064 U	0.011	0.00082 U	0.012	0.033 U	0.00076 U	0.0008 J	0.031 J	0.00067 U	0.00062 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00053 U	0.00054 U	0.00069 U	0.0074	0.027 U	0.00063 U	0.00058 U	0.0054 U	0.00056 U	0.00052 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.00093 J	0.011	0.00082 U	0.03	0.033 U	0.00076 U	0.0016 J	0.029 J	0.00067 U	0.00062 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0068 J	0.097	0.0021 U	0.017	0.082 U	0.0019 U	0.019	0.3	0.0017 U	0.0016 U
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.012	0.13	0.00055 U	0.012	0.099 J	0.0016 J	0.023	0.37	0.00044 U	0.00041 U
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.02	0.2	0.0021 U	0.036	0.22 J	0.0025 J	0.057	0.5	0.0017 U	0.0016 U
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.016	0.12	0.00069 U	0.017	0.13 J	0.0017 J	0.029	0.32	0.00056 U	0.00052 U
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0078	0.053	0.00082 U	0.012	0.083 J	0.001 J	0.016	0.18	0.00067 U	0.00062 U
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.014	0.12	0.0021 U	0.025	0.082 U	0.0019 U	0.038	0.37	0.0017 U	0.0016 U
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00021 U	0.025	0.00027 U	0.0045 J	0.011 U	0.00025 U	0.0064	0.084	0.00022 U	0.00021 U
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.014 J	0.16	0.0067 U	0.036	0.27 U	0.0062 U	0.041	0.48	0.0054 U	0.0051 U
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.00053 U	0.0043 J	0.00069 U	0.026	0.027 U	0.00063 U	0.00071 J	0.015 J	0.00056 U	0.00052 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.012	0.1	0.00082 U	0.015	0.087 J	0.0014 J	0.029	0.27	0.00067 U	0.00062 U
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00085 U	0.0031 J	0.0011 U	0.0034 J	0.044 U	0.001 U	0.00093 U	0.0086 U	0.00089 U	0.00083 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0054 J	0.055	0.0021 U	0.037	0.095 J	0.0019 U	0.012	0.19	0.0017 U	0.0016 U
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.012 J	0.15	0.006 U	0.034	0.24 U	0.0056 U	0.034	0.45	0.0049 U	0.0046 U
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.0168105	0.1787	0.000591	0.0207	0.14306	0.002207	0.03612	0.5071	0.0004765	0.0004455
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.02033	0.2466	0.00069 U	0.1737	0.095	0.00063 U	0.05611	0.822	0.00056 U	0.00052 U
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.1006	0.995	0.00027 U	0.1725	0.619	0.0082	0.2514	**2.844**	0.00022 U	0.00021 U
Polychlorinated Biphenyls (PCBs)																	
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	NA	NA	NA	NA	NA	NA	NA	0.0081 U	0.0083 U	0.008 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0046 U	0.0047 U	0.0045 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0054 U	0.0055 U	0.0053 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0018 U	0.0017 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0032 U	0.0032 U	0.0031 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	NA	NA	NA	NA	NA	NA	NA	0.0016 U	0.0017 U	0.0016 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	NA	NA	NA	NA	NA	NA	NA	0.0021 U	0.0021 U	0.002 U
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	NA	NA	NA	NA	NA	NA	NA	0.0016 U	0.0017 U	0.0016 U
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	3,200	4,800	16,000	7,300	2,900	10,000	6,000	5,900	7,800	6,600
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	0.54	4	7.1	1.9	1.1	6.2	4.4	1.5	2.3	2.2
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.13	0.16	0.18	0.15	0.12	0.34	0.16	0.17	0.15	0.15
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	2.3 J	17 J	8.6 J	16 J	3.7 J	15 J	7.8 J	55	4.3	3.4
Copper	mg/Kg	NA	140,000	217	280	217	28.4	9.6	19	32	23	12	20	12	16	21	21
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	1.5	5.2	2.7	2.1	1.6	13	3.7	3.1	2.1	1.4
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0058 U	0.006 U	0.019 J	0.0063 U	0.0062 U	0.0075 U	0.0063 U	0.0062 U	0.0067 U	0.0063 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	2	12	3.5	11	5.4	17	4.8	45	4.6	4.4
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1**	**1.1**	**0.74**	**1.2**	**1.1**	**1.4**	**2.5**	**1.4**	**1.4**	**1.9**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	28	64	40	38	33	59	47	42	44	46
pH	SU	NE	NE	NE	NE	NE	NE	8.5	9.13	7.6	7.86	8.17	7.5	7.74	8.91	8.58	8.49

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Concentrations of fluoride (maximum of 17 mg/L) in nearby shallow temporary well RI-GW7 consistently exceeded the MCL of 4 mg/L, and there appears to be a widespread fluoride plume in the shallow aquifer zones in this area. In RI-MW6-BAU, concentrations of fluoride (maximum of 4.2 mg/L) also slightly exceeded the fluoride MCL in the BAU zone. From the groundwater fluoride distribution, it appears that there may be a source of groundwater contamination near SWMU 6 and SWMU 8 (see Section 8 for discussion regarding SWMU 8).

6.3 CONCLUSIONS AND RECOMMENDATIONS

While the levels of contamination in SWMU 6 soils are generally low, there is a groundwater fluoride and sulfate contaminant plume in the Unconsolidated Aquifer (UA) and BAU zones in the central portion of the plant area (refer to Volume 4, Section 2.4). The source of groundwater contamination appears to be related to scrubber treatment system small-diameter piping releases associated with the Line A Secondary Scrubber Recycle Station (SWMU 5); Line B, C, and D Secondary Scrubber Recycle Stations (SWMU 6); Tertiary Treatment Plant (SWMU 8); and specifically including the South Dry/Wet $S0_2$ scrubber and associated piping beneath Passage no. 4; and the area of the clarifiers east of the Tertiary Treatment Plant. Refer to Volume 4, Section 2.4 for a summary of the lines and water-level elevations and groundwater contaminant distribution in this area.

A significant amount of piping at SWMU 6 and nearby SWMU 8 could have resulted in releases to shallow groundwater at the site, as well as into the flow top of basalt bedrock in the site vicinity. Groundwater contamination in this area will be further evaluated as part of the GWAOC and lines evaluation in Volume 4, Section 2.

Section 7
Decommissioned Air Pollution Control Equipment (SWMU 7)

The Decommissioned Air Pollution Control Equipment (SWMU 7) does not have a specific ground footprint and will, therefore, be investigated and addressed as part of the PAAOC investigation. A brief description of SWMU 7 is provided for context and convenience, based on the more detailed description included in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

Prior to the 1983 installation of the dry alumina air scrubber equipment at the smelter, air emissions from Line A and B were removed using wet electrostatic precipitators. There were approximately 20 units housed on the roof between the Production Buildings A and B and included redwood towers and concrete bubblers. The equipment was removed around 1997. Emissions from these units along with other historic operations and potential sources could have potentially impacted soils in the vicinity of the Courtyards and plant area. A summary of the PAAOC investigation is included in Volume 3, Section 2.

Section 8
Tertiary Treatment Plant (SWMU 8)

The former Tertiary Treatment Plant (SWMU 8) was located adjacent to Line B, C, and D Secondary Scrubber Recycle Stations (SWMU 6) (Figure P-1) in the north-central part of the main plant. The plant building, and associated structures have been demolished and their foundations remain. The treatment plant was the final process step of the plant's liquid portion of the air pollution control system and consisted of a 12-ft thickener vessel, a 28-ft diameter reactor/clarifier, reaction and surge tanks, sand filters, pumps, and appurtenant pipes. The plant was designed to treat the combined blowdown from the two-scrubber water recycle systems and two wet sulfur dioxide scrubbers to remove fluoride, PAH compounds, and total suspended solids (TSS), and meet the NPDES permit effluent limitations. The Tertiary Treatment Plant was designed to treat up to 150 gpm of combined scrubber water blowdown. The treatment process consisted of: 1) chemical precipitation of fluoride as calcium fluoride, 2) flocculation to increase TSS settling, 3) clarification to remove TSS, and 4) deep bed filtration to remove residual TSS prior to discharge. Water from the treatment process was recycled back through the SWMU 5 and SWMU 6 Recycle Stations to use as make-up water or discharged under the plant NPDES permit. In later years of plant operation, solids from the treatment process were disposed offsite.

The water treatment process was conducted primarily inside the Tertiary Treatment Plant building. A sump is located at the southwest corner of the building, two recycle tanks were located along the northeastern side of the building, and a filter press was located along the northwest side of the building. Various scrubber system treatment small-diameter pipelines enter and exit at the southeast side of the Tertiary Treatment Plant building.

8.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The investigation objectives for the Tertiary Treatment Plant (SWMU 8) include characterization of COPC in soil and determination of whether a release has occurred.

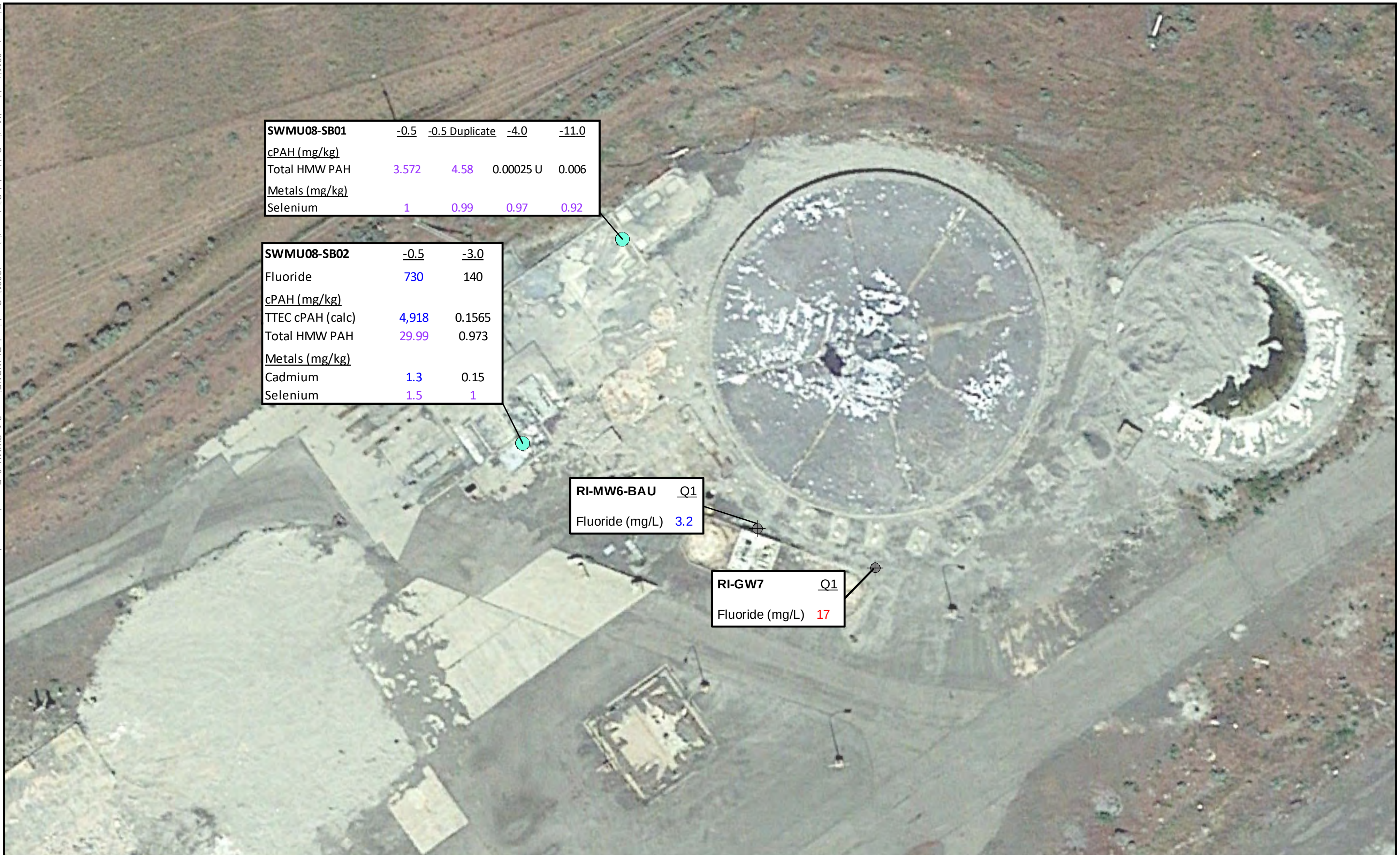
The system identification was the first step of the investigation process. Site plans were reviewed to identify construction details for the plant including underdrains, piping, connections with other lines, and associated structures. The existing foundations were inspected for cracks. GPR methods were employed to locate underground piping in the vicinity of SWMU 8. Sample locations were slightly modified based on findings from the site plan review and GPR findings.

SWMU 8 was investigated with two soil borings located to the north and south of the two clarifiers, and adjacent to the caustic tank foundations (Figure 8-1). The soil borings were planned to be completed to depths of up to 10 ft or refusal. Boring SWMU08-SB01 was extended to 16.5 ft bgs to characterize shallow groundwater for the temporary well installation program and to verify the depth of the basalt bedrock contact.

Discrete soil samples were planned to be collected at depths of 0.5 ft bgs, 2 ft bgs, and the base of each boring. Soil samples were analyzed for PAHs, total cyanide, fluoride, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), sulfate, and pH. These vertical sampling intervals were altered slightly based on the depth of the boring and sample recovery.

The borings were drilled and sampled using hollow-stem auger drilling techniques. Soil samples were collected and logged at selected intervals ranging from 1.0 to 2.5 ft using a heavy-duty, Dames & Moore style, stainless-steel, split-spoon sampler. Drilling conditions were difficult at SWMU 8 with auger refusal encountered at 16.5 ft bgs and 3 ft bgs in borings SWMU08-SB01 and SWMU08-SB02, respectively. The bedrock contact was encountered at about 10.5 ft bgs in RI-MW6-BAU and refusal in bedrock was suspected at SWMU08-SB01 near the base of the boring at around 16 ft bgs.

A shallow temporary well (RI-GW7) was also installed to determine if a release has occurred from SWMU 6 and SWMU 8 to shallow groundwater, and to help characterize the nature and extent of groundwater contamination. A monitoring well (RI-MW6-BAU) that was completed in the BAU



Legend

Well

RI Soil Boring

red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 25 50
Feet
Imagery Souce: NAIP 2017

Figure 8-1
SWMU 8
Tertiary Treatment Plant
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

aquifer zone was also installed in the area and included soil sampling for SWMU 8. Both wells were drilled using sonic drilling methods, which were needed to penetrate to the fill/bedrock contact and into the basalts.

8.2 INVESTIGATION RESULTS

This section summarizes results for SWMU 8. Soil samples collected in December 2015 were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Soil boring lithologic logs are provided in Volume 5, Appendix B-8. The laboratory data report and data validation report for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively.

Soils in this area generally consist of dense silty gravel with cobbles. Basalt bedrock was encountered at about 5 ft bgs to 16.5 ft bgs in this area based on the lithologic logs for RI-GW7, RI-MW6-BAU, and boring SWMU08-SB-01.

The RI soil sample analytical results for SWMU 8 are summarized in Table 8-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecological soil screening levels for wildlife protection. Site soil background concentrations are also provided in Table 8-1 for comparative review. Figure 8-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

Most of the soil remains covered in concrete slab/footings and in some areas the ground surface is covered by crushed concrete rubble. Soils at SWMU 8 consist of dense silty gravel with cobbles to a depth of about 16.5 ft bgs. Fractured and vesicular basalt was encountered at a depth of about 14 ft bgs at the RI-GW7 boring. GPR readings showed the presence of a large amount of subsurface piping and other anomalies in this area.

Soil screening level exceedances were largely limited to one sample (SWMU08-SB02-0.5) that was the surface soil sample collected on the southwest side of the former plant building.

Table 8-1
SWMU 8 - Tertiary Treatment Plant Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2015

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU08-SB01-0.5 12/9/2015	SWMU08-SB40-0.5 (Duplicate of SMW08-SB01-0.5) 12/9/2015	SWMU08-SB01-4.0 12/9/2015	SWMU08-SB01-11.0 12/9/2015	SWMU08-SB02-0.5 12/10/2015	SWMU08-SB02-3.0 12/10/2015
Aluminum Smelter													
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2 U	2 U	2.2 U	2.4 U	1.9 U	2.2 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	25 J	12 J	48 J	3 J	**730**	140
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	120 J	170 J	24	830	33	22
Polycyclic Aromatic Hydrocarbons (PAHs)													
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.017 J	0.016 U	0.0019 U	0.0018 U	0.04 J	0.0017 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.021 U	0.021 U	0.0025 U	0.0045 J	0.065	0.0022 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0063 U	0.0062 U	0.00076 U	0.00074 U	0.31	0.0099
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0053 U	0.0052 U	0.00064 U	0.00061 U	0.013 J	0.00097 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.038 J	0.044 J	0.00076 U	0.00074 U	0.35	0.0095
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.21 J	0.3 J	0.0019 U	0.0018 U	3.3	0.1
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.34 J	0.43 J	0.00051 U	0.00049 U	3.5	0.11
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.76 J	0.85 J	0.0019 U	0.006 J	5.4	0.18
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.55 J	0.69 J	0.00064 U	0.00061 U	3.2	0.11
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.26 J	0.26 J	0.00076 U	0.00074 U	1.5	0.05
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.54 J	0.7 J	0.0019 U	0.0018 U	3.9	0.12
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.092 J	0.12 J	0.00025 U	0.00025 U	0.69	0.023
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.43 J	0.71 J	0.0062 U	0.006 U	6.4	0.2
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0053 U	0.0052 U	0.00064 U	0.00061 U	0.21	0.0049 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.39 J	0.52 J	0.00076 U	0.00074 U	2.9	0.1
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0091 J	0.0083 U	0.001 U	0.00098 U	0.074	0.0018 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.12 J	0.22 J	0.0019 U	0.0059 J	2.1	0.064
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.43 J	0.71 J	0.0056 U	0.0054 U	5.6	0.18
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.5166	0.642	0.000543	0.0010305	**4.918**	0.1565
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.6141	0.974	0.00064 U	0.0104	9.562	0.29107
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**3.572**	**4.58**	0.00025 U	0.006	**29.99**	0.973
Metals													
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	5,600	5,100	10,000	11,000	10,000	4,800
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.3	1.9	3.7	2.5	4	1.7
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.28	0.24	0.24	0.24	**1.3**	0.15
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	19 J	14 J	2.4 J	1.7 J	21 J	7.1 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	30	36	19	12	19	12
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	3.3	2.9	3.3	2.2	7.2	2.9
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0059 U	0.0062 U	0.007 U	0.0083 J	0.0086 J	0.006 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	16	16	4.3	4.7	90 J	5.5 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1**	**0.99**	**0.97**	**0.92**	**1.5**	**1**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	59	50	44	21	81	31

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Sample results are summarized as follows:

- PAHs were detected at concentrations that are above MTCA-derived soil screening levels for protection of groundwater and terrestrial ecologic soil screening levels at two surface soil stations.

- Fluoride (maximum of 730 mg/kg) was detected above the MTCA-derived screening levels for protection of groundwater in surface soil at one location (SWMU08-SB02-0.5).

- Total cyanide was not detected in any of the soil samples. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.

- Sulfate (maximum of 150 mg/kg) was detected at low concentrations below MTCA-derived screening levels for protection of groundwater.

- Of metals, cadmium (maximum of 1.3 mg/kg) was detected at low concentrations above MTCA-derived screening levels for protection of groundwater and site background concentrations in one surface soil sample. Selenium (maximum of 1.5 mg/kg) exceeded the soil terrestrial screening level for wildlife protection and site background in all six collected samples.

- Soil pH in this area appear alkaline (7.58 to 11.6), and below the hazardous pH level (12.5 units).

Concentrations of fluoride (maximum of 17 mg/L) in nearby shallow temporary well RI-GW7 consistently exceeded the MCL of 4 mg/L, and there appears to be a widespread fluoride plume in the shallow groundwater in this area. In RI-MW6-BAU, concentrations of fluoride (maximum of 4.2 mg/L) also slightly exceeded the fluoride MCL in the BAU zone. From the groundwater fluoride distribution, it appears there's a source of groundwater contamination in the vicinity of SWMU 6 and SWMU 8 and other nearby areas such the Crucible Cleaning Room and SPL Handling Containment Building (SWMU 16) (refer to Volumes 3 and 4 for further discussion of the underground lines and shallow groundwater contamination in this area) that may be related to historical leakage from subsurface piping in the area as well as the clarifiers.

A significant amount of piping at SWMU 6 and nearby SWMU 8 is present that could have resulted in releases to shallow groundwater in the site as well as into the flow top of basalt bedrock in the site vicinity.

8.3 CONCLUSIONS AND RECOMMENDATIONS

Based on the soil results, surficial soil with elevated fluoride and PAH concentrations above MTCA will be further evaluated in the FS. While the levels of contamination in SWMU 8 soils are generally low surficial, there is a groundwater fluoride and sulfate contaminant plume in the UA and BAU zones in the central portion of the plant area (refer to Volume 4, Section 2.4). The source of groundwater contamination appears to be related to scrubber treatment system small-diameter piping releases associated with the Line A Secondary Scrubber Recycle Station (SWMU 5), Line B, C, and D Secondary Scrubber Recycle Stations (SWMU 6), and Tertiary Treatment Plant (SWMU 8), and specifically including the South Dry/Wet $S0_2$ scrubber and associated piping beneath Passage no. 4 and the area of the clarifiers east of the Tertiary Treatment Plant. Refer to Volume 4, Section 2.4 for a summary of the lines and water-level elevations and groundwater contaminant distribution in this area.

Section 9
Paste Plant Recycle Water System (SWMU 9)

The Paste Plant Recycle Water System (SWMU 9) and the associated scrubber and cooling tower structures were near the east end of the Paste Plant Building where the water system was located (refer to Figure P-1). The Paste Plant was in the southeastern portion of the main production area and produced carbon paste for use in the reduction cells. The anode paste briquette production and extrusion process required a final quenching step in which water was sprayed onto the newly-formed briquettes. The quenching process was performed using conveyors on the eastern side of the Paste Plant Building. Water from the quenching process was recycled using several large water-settling tanks and also an associated recycle sump located just east of the main Paste Plant Building.

In addition to quenching the anode paste briquettes, water was also used in several fume scrubbers located within the Paste Plant Building. Both the quench water and the scrubber blow down were cooled and recycled back to the Paste Plant as part of the Paste Plant Recycle Water System.

The recycle sump, settling tanks, or other appurtenant facilities had not been previously investigated prior to the RI. Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for further details regarding the operational history, past investigation, and RI data needs for Paste Plant Recycle Water System (SWMU 9).

9.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The Paste Plant Recycle Water System (SWMU 9) field investigation was conducted in December 2015 in accordance with the Ecology-approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The RI objectives for SWMU 9 included:

- Inspection to locate the recycle water system sump and other related features that are part of the Paste Plant Recycle System, with sampling to include at least one process solids sample from sump (if found) and up to six soil samples from two soil boring locations.
- Installation of a shallow temporary well to evaluate associated groundwater quality was planned as part of the Groundwater in the Upper Most Aquifer AOC.

During the December 2015 site inspection, no evidence of the recycle sump or associated features were identified. However, the presence of two large mounds (each about 20 ft in diameter) of concrete demolition debris was encountered in the vicinity of SWMU 9 during inspection. The concrete demolition mounds were too large to move and may have visually obstructed some of the site features at the time of inspection. The mounded concrete rubble material remains on site (as originally encountered) at the time of this report.

The Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) specified drilling two soil borings to depths of up to 10 ft bgs or refusal, with discrete soil sample intervals at depths of 0.5 ft bgs, 2 ft bgs, and the base of the boring. During the December 2015 RI field effort, the locations of one of the two soil borings (i.e., SWMU09-SB01) was altered slightly (moved about 20 ft to the south) due the presence of the mounded concrete demolition debris in this area. The two soil borings were drilled using hollow-stem auger drilling techniques. Soil samples were collected and logged at selected intervals ranging from 1.0 to 2.0 ft using a heavy-duty, Dames & Moore style, stainless-steel, split-spoon sampler.

A shallow temporary well was also planned as part of the Groundwater in the Upper Aquifer AOC investigation if shallow groundwater was found during drilling at SWMU 9. The two borings were drilled to a depth of 15.5 ft bgs (SWMU09-SB01) and 16.2 ft bgs (SWMU09-SB02), which is deeper than specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). This additional depth was to verify that shallow groundwater was not present. The basalt bedrock contact was identified at 15 to 16 ft bgs at this SWMU, and shallow groundwater was not encountered. The unconsolidated materials overlying bedrock at this location consisted primarily of poorly graded sand (SP) underlain by silty gravel (GM).

The analytical program for the soil samples included PAHs, total cyanide, fluoride, sulfate, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn). Based on field observation (i.e., chemical odor) and field screening results [i.e., photoionization detector (PID) reading of 7.9 ppm], an additional sample was collected and analyzed for volatile organic compounds (VOCs) only at a depth 5.25 ft bgs at sample location SWMU09-SB01-5.25.

9.2 INVESTIGATION RESULTS

Soil samples collected in December 2015 were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Completed soil boring lithologic logs are provided in Volume 5, Appendix B-9. The laboratory data report and data validation report for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively.

The RI soil sample analytical results for SWMU 9 are summarized in Table 9-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, and MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecologic screening levels for wildlife protection. Site soil background concentrations are also provided in Table 9-1 for comparative review. Figure 9-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

The results show that concentrations of cPAHs exceed the MTCA Method C Toxicity Equivalent Concentrations (TEC) value of 130 mg/kg in one of six samples (SWMU09-SB02-4.0). The MTCA-derived soil screening levels for protection of groundwater and/or terrestrial ecologic screening levels for wildlife protection were also exceeded in five of the seven samples (refer to Table 9-1 and Figure 9-1). Fluoranthene, 1-methylnaphthalene, 2-methylnaphthalene individually exceeded MTCA-derived soil screening levels protective of groundwater in two samples. These chemicals are not included in the various summed total PAH categories and have therefore been individually screened.

Total cyanide was not detected. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.

Fluoride (maximum concentration of 9.8 mg/kg) and sulfate (maximum concentration of 300 mg/kg) were detected at low concentrations below screening levels.

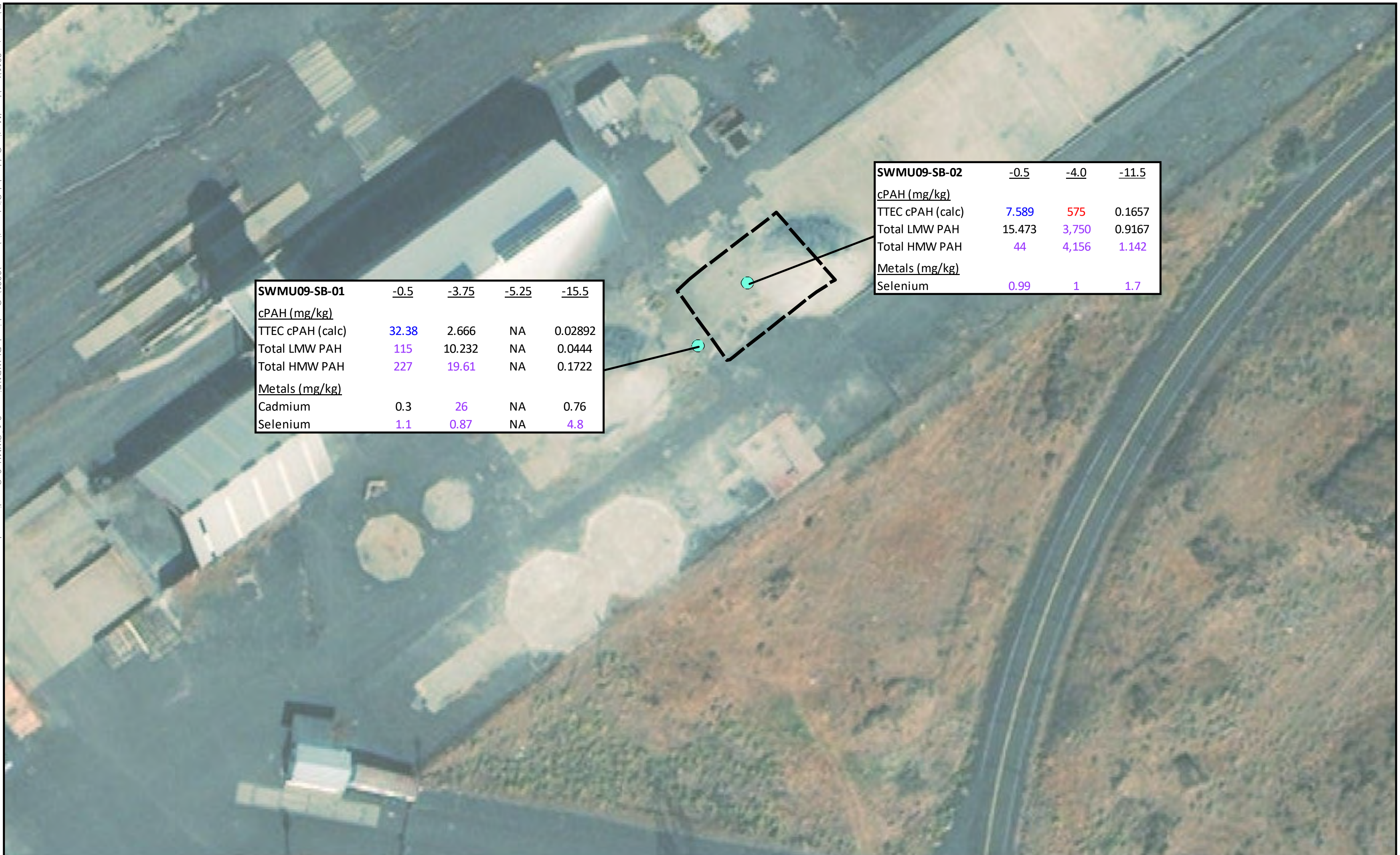
Table 9-1
SWMU 9 - Paste Plant Recycle Water System Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2015

				Ecological Indicator				Analytical Results						
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU09-SB01-0.5 12/2/2015	SWMU09-SB01-3.75 12/2/2015	SWMU09-SB01-5.25 12/2/2015	SWMU09-SB01-15.5 12/2/2015	SWMU09-SB02-0.5 12/2/2015	SWMU09-SB02-4.0 12/2/2015	SWMU09-SB02-11.5 12/2/2015
Aluminum Smelter														
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2 U	2 U	NA	2.5 U	2.1 U	2.2 U	2.4 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	8.8	5.8	NA	2.5	9.8	7	3.7
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	300	240	NA	34	250	270	19
Polycyclic Aromatic Hydrocarbons (PAHs)														
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	**0.098 J**	0.045	NA	0.0021 U	0.018 J	**2.7 J**	0.0017 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.12	0.061	NA	0.0027 U	0.027 J	**3.8 J**	0.0026 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	1.6	0.38	NA	0.0019 J	0.24	79 J	0.019
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.053 J	0.01	NA	0.00069 U	0.0054 U	0.45 J	0.00058 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	4.3	0.31	NA	0.0021 J	0.7	180 J	0.053
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	23	2	NA	0.013 J	4.9	420 J	0.14
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	23	1.8	NA	0.021	5.5	430 J	0.12
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	36	3.7	NA	0.03	7.9	520 J	0.16
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	15	1.1	NA	0.019	3.9 J	230 J	0.067
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	12	1.1	NA	0.01	2.7 J	190 J	0.056
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	29 J	3.5 J	NA	0.03 J	5.9 J	390 J	0.12 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	3.9	0.31	NA	0.0052 J	0.9 J	36 J	0.016
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	85	7.3	NA	0.03	11	**2,100 J**	0.52
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.86	0.16	NA	0.0011 B	0.15	82 J	0.021
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	16	1.2	NA	0.018	3.9 J	240 J	0.073
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.15	0.066	NA	0.0011 U	0.038 J	2.5 J	0.0011 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	23	1.9	NA	0.0093 J	3.3 J	1,300 J	0.3
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	69	4.9	NA	0.026 J	8.4	**1,700 J**	0.39
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**32.38**	2.666	NA	0.02892	**7.589**	**575**	0.1657
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	**115**	10.232	NA	0.0444	15.473	**3,750**	0.9167
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**227**	**19.61**	NA	0.1722	**44**	**4,156**	**1.142**
Metals														
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	12,000	9,000	NA	23,000	10,000	10,000	9,900
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	6.2	4.5	NA	4	4.5	3.7	3.2
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.3	**26**	NA	0.76	0.17	0.25	0.083 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	35 J	21 J	NA	13 J	19 J	18 J	7.7 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	70 J	27 J	NA	35 J	26 J	25 J	17 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	6.1	4.1	NA	7.8	4.2	5.5	4.8
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.041 J	0.02 J	NA	0.023 J	0.099 J	0.12 J	0.022 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	22	12	NA	22	12	10	8.8
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.1**	**0.87**	NA	**4.8**	**0.99**	**1**	**1.7**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	120 J	75 J	NA	130 J	83 J	100 J	45 J
Volatile Organic Compounds (VOCs)														
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	NA	NA	0.00028 UJ	NA	NA	NA	NA
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	NA	NA	0.0016 J	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	NA	NA	0.004 J	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	0.00084 J	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	0.0006 J	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	NA	NA	0.00028 UJ	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	NA	NA	0.00023 J	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	NA	NA	0.00028 UJ	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	NA	NA	0.00037 UJ	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	NA	NA	0.00028 UJ	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	NA	NA	0.00028 UJ	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds



Legend

RI Soil Boring

SWMU 9 Approximate Boundary

N W E S

0 50 100

Feet

Imagery Souce: NAIP 2017

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
NA = Not Analyzed
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

Figure 9-1
SWMU 9
Paste Plant Recycle Water Systems
Sample Locations and Soil
Screening Level Exeedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

For metals, cadmium was detected above the MTCA-derived soil screening level, terrestrial ecologic screening level for wildlife protection, and site background concentrations (SWMU09-SB01-3.75 at 26 mg/kg). Selenium was detected at low concentrations (maximum of 4.8 mg/kg) above terrestrial ecological screening levels and background concentrations in all of the collected samples.

Sample SWMU09-SB01-5.25 was identified for VOC analyses during drilling based on slight odor and elevated PID field-screening results. No VOCs were detected above associated soil screening levels in this sample (refer to Table 9-1).

9.3 CONCLUSIONS AND RECOMMENDATIONS

Elevated concentrations of cPAHs above MTCA Method C soil screening levels were detected at 0.5 ft bgs in boring SWMU09-SB01-0.5 and a depth of 4 ft bgs in boring SWMU09-SB02-4.0. Based on detection of elevated PAHs concentration in soils SWMU 9 is recommended for further evaluation in the FS.

Section 10
North and South Pot Liner Soaking Station (SWMUs 10 and 11)

Although identified as separate SWMUs, the North and South Pot Liner Soaking Stations (SWMUs 10 and 11, respectively) have been previously investigated together (URS 2008e) and were accordingly addressed together in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). As such, both SWMUs 10 and 11 are combined here for further discussion.

The Pot Liner Soaking Stations operated between 1971 and 1990 and were composed of two concrete basins in which steel Hall Cells (i.e., aluminum smelting pots) were soaked with water (i.e., "quench water") to remove refractory SPL material (refer to Figure P-1 for locations). This SPL residue represents a listed hazardous waste (K088) because it can contain cyanide. Due to the potential for leaching cyanide from the pot liners, quench water was treated with hypochlorite to oxidize the cyanide. Excess quench water that overflowed the cathode or leaked through holes in the steel shell was collected and directed back to the recycle sump. No documented historic spills or leaks have been reported for these SWMUs, and in 1990 the concrete basins were removed (URS 2008e).

A soil investigation of SWMUs 10 and 11 was conducted in 2008, and included eight shallow soil test pits, one shallow soil boring, and three deeper soil borings (URS 2008e). Most soil samples were collected at depths of about 1 to 1.5 ft. Soil samples were analyzed for PAHs, total cyanide, fluoride, sulfate, metals, and PCBs. PAHs were detected in 10 soil samples, but only the two samples from an unpaved area south of the Soaking Stations exceeded the associated MTCA Method C soil screening level for cPAHs. The area of PAH-impacted soil was estimated at about 14,400 square feet (ft^2), with a conservative average depth of about 3 ft bgs, or about 1,600 cubic yards (URS 2008e).

For further details regarding the operational history, past investigation, and RI data needs for the SWMUs 10 and 11 please refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

10.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The North and South Pot Liner Soaking Stations were investigated as part of the initial RI field investigation during June 2016. Based on findings from the June 2016 field investigation, Ecology and Yakama Nation on the Draft RI, and changes in the screening levels used for the RI, additional site characterization was performed in this area as part of the WPA field investigation field activities in December 2020.

10.1.1 Initial RI Field Investigation

The initial RI field effort for the North (SWMU 10) and South (SWMU 11) Pot Liner Soaking Stations was conducted in June 2016 in accordance with the Ecology-approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The primary initial RI objective was to further delineate the horizontal and vertical extent of soil contamination (particularly PAHs-impacted soil) previously documented in association with these SWMUs (URS 2008e).

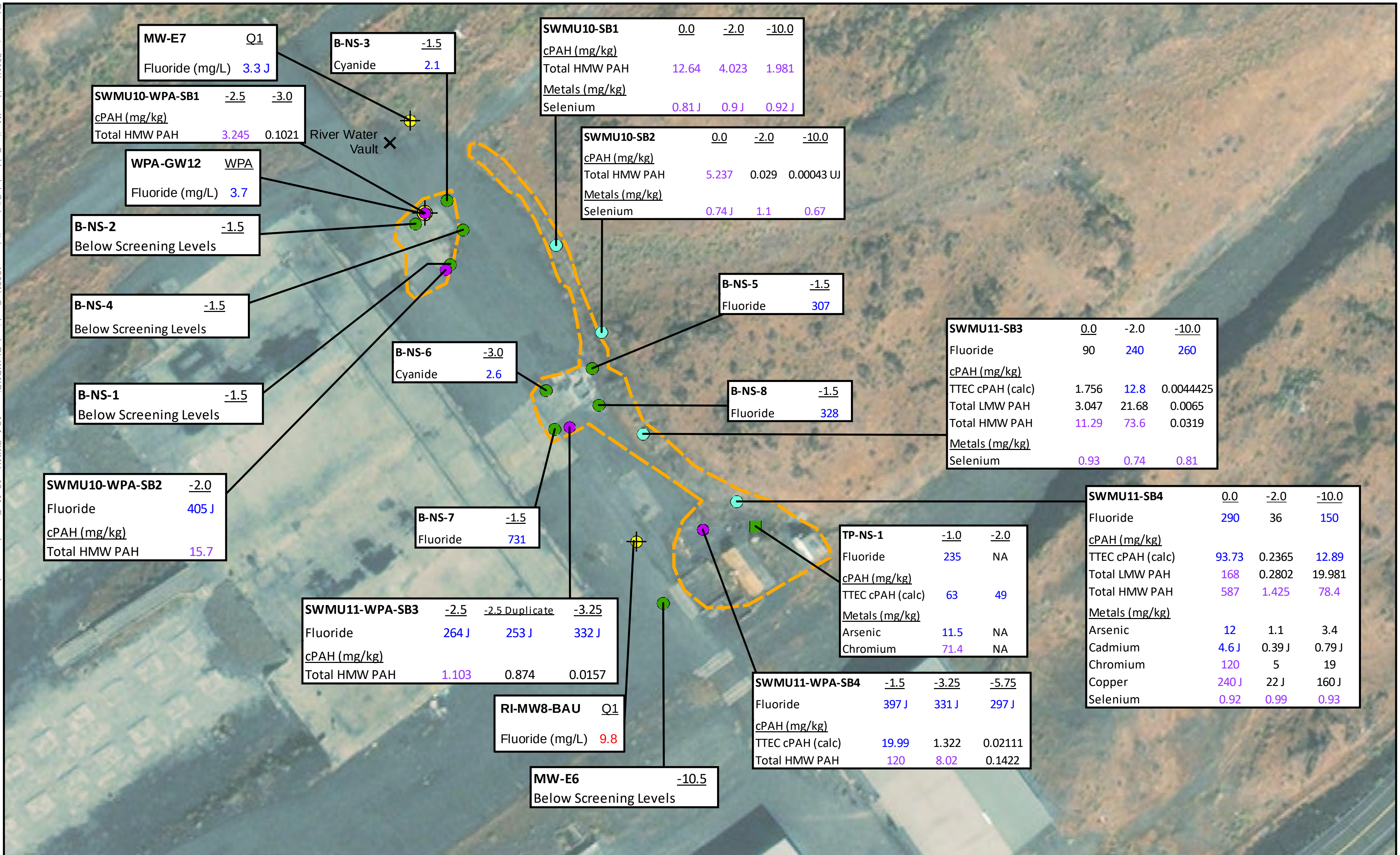
A new well was installed (RI-MW8-BAU) on the south (downgradient) side of SWMUs 10 and 11 to characterize water quality and groundwater flow in this area (refer to Figure 10-1). Groundwater in the vicinity of these SWMUs was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC of this report.

The initial RI field effort included drilling four soil borings (SB1 though SB4) using sonic drilling techniques (Figure 10-1) that produces a continuous core. The borings were drilled to the basalt bedrock contact or a maximum depth of 10 ft bgs, whichever was shallowest. Three soil samples were collected for chemical analyses from each boring (0 to 0.5 ft bgs, 2 ft bgs, and the base of the boring). The soil samples were analyzed for PAHs, total cyanide, fluoride, sulfate, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

10.1.2 WPA Field Investigation

The objective of the WPA field investigation included the following:

- Better characterize the vertical and horizontal extent of soil contamination, particularly with consideration of the revised soil screening levels for protection of groundwater for fluoride and cPAHs.
- Confirmation of the absence of shallow groundwater in this area.



Legend

- RI Soil Boring
- WPA Soil Boring
- Monitoring Well

2008 URS Sampling

- Soil Boring
- Test Pit

Approximated Lateral Extent of Soil Screening Level Exceedances

N / E / S / W

0 25 50 100
Feet

Imagery Souce: NAIP 2017

red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

Figure 10-1
SWMUs 10 and 11
North and South Potliner Soaking Stations
Sampling Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

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Four borings were advanced to 25 ft bgs using air-rotary drilling months during December 2020 to meet these objectives. The depth of the borings was determined based on the depth of nearby well MW-E7 and the completion of borings to this depth was performed regardless of the depth of the basalt contact and to better characterize the presence or absence of shallow groundwater in this area. Soil samples collected from each boring were analyzed for fluoride, sulfate, total cyanide, PAHs, and Total Petroleum Hydrocarbons – Diesel-extended range (TPH-Dx).

One shallow well was installed in this area (WPA-GW12) (Figure 10-1) during the WPA field investigation based on the occurrence of shallow groundwater within the basalts during drilling.

10.2 INVESTIGATION RESULTS

This section summarizes the results for the initial RI and WPA followed by the results for the 2008 investigation (URS 2008e). Results for the 2008 investigation (URS 2008e) are included because they were used to develop the initial RI sampling program, which supplement the results of the 2008 investigation. Also, the 2008 investigation results were not previously compared to soil screening levels protective of groundwater.

10.2.1 RI and WPA Results

The basalt bedrock contact was observed to be shallow (about 2-3 ft bgs) in the soil boring closest to the soaking stations. The depth to bedrock was observed to be deeper in the borings located to the south of South Pot Liner Soaking Station. Groundwater was encountered at a depth of about 20 ft bgs in the two northerly WPA borings but was not encountered to a depth of 25 ft bgs in the southerly borings.

The RI and WPA soil boring samples collected during June 2016 and December 2020 were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Completed soil boring lithologic logs are provided in Volume 5, Appendix B-10. The laboratory data reports and data validation reports for the initial RI soil samples are provided in Volume 4, Appendix H-1 and I-1, respectively. The laboratory and data validation reports for the WPA SWMU 10 and 11 data are provided in Appendix H-3 and I-3, respectively. The RI and WPA soil sample analytical results for SWMUs 10 and 11 are summarized in Tables 10-1 and 10-2, respectively. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA Method A Industrial (for petroleum hydrocarbons only), MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecological screening levels for wildlife protection. Site soil background concentrations are also provided in Table 10-1 for comparative review. Figure 10-1 shows the sampling locations and summarizes the exceedances of soil screening levels for the initial RI investigation, WPA investigation and 2008 URS investigation.

The distribution of COPCs are summarized as follows:

- Fluoride was detected above the MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in the majority (11 of 21) of samples collected in this area.
- The RI and WPA results show that concentrations of cPAHs in soil exceed the MTCA-derived screening levels as terrestrial ecological screening levels for wildlife protection in 14 of 21 samples collected (refer to Tables 10-1 and 10-2, and Figure 10-1). Four samples also exceed MTCA-derived soil screening levels for protection of groundwater.
- Metals (As, Cd, Cr and Cu) exceed MTCA-derived soil screening level for protection of groundwater and/or terrestrial ecological screening levels for wildlife protection in one surface soil sample (SWMU 11-SB4-0.0). Selenium (maximum of 1.1 mg/kg) was detected at low concentrations above terrestrial ecological screening levels for wildlife protection and background concentrations in all the 12 soil samples collected during the initial RI investigation.

The thickness of unconsolidated material is greater in the area south of the South Pot Liner Soaking Station near SWMU11-SB4 and SWMU11-WPA-SB4 as is the vertical extent of contamination with PAHs, fluoride, and metals contamination extending down of 5 to 10 ft bgs. It is unclear that the soil contamination in this area is directly related to operations in the North and South Pot Liner Soaking Stations but could be related to former operations, handling, storage associated with the former building structures in this area.

10.2.2 2008 Investigation Results

Figure 10-1 includes the 2008 site characterization (URS 2008e) sampling locations and summarizes the exceedances of the current soil screening levels used in the RI. Each pot liner soaking station was surrounded by four borings and additional borings and test pits were installed north and south of the soaking stations. The 2008 investigation report did not include evaluation of soil screening,

Table 10-1
SWMU 10 and SWMU 11 - North and South Pot Liner Soaking Station Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU10-SB1-0.0 6/27/2016	SWMU10-SB1-2.0 6/27/2016	SWMU10-SB1-10 6/27/2016	SWMU10-SB2-0.0 6/27/2016	SWMU10-SB2-2.0 6/27/2016	SWMU10-SB2-10.0 6/27/2016	SWMU11-SB3-0.0 6/27/2016	SWMU11-SB3-2.0 6/27/2016	SWMU11-SB3-10.0 6/27/2016	SWMU11-SB4-0.0 6/27/2016	SWMU11-SB4-2.0 6/27/2016	SWMU11-SB4-5.0 6/27/2016
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	1.9 UJ	2 UJ	2 UJ	2.3 UJ	2.1 UJ	2.4 UJ	1.8 U	2 U	2.1 U	1.9 U	2 U	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	44	26	24	83	16	3	90	**240**	**260**	**290**	36	**150**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	50	34	17	31	22	34	20	23	13	120	40	65
Polycyclic Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0062 U	0.0064 U	0.00061 U	0.0051 J	0.00071 U	0.00068 U	0.0062 U	0.08	0.0006 U	**0.83**	0.00056 U	0.074
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.011 J	0.0046 U	0.0019 J	0.006	0.00051 U	0.00048 U	0.0044 U	0.11	0.00043 U	1.1	0.0016 J	0.11
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.06	0.012 J	0.004 J	0.025	0.00067 U	0.00064 U	0.058	0.83	0.00058 U	5.6	0.0044 J	0.58
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0049 U	0.0051 U	0.00048 U	0.00058 U	0.00056 U	0.00054 U	0.0049 U	0.0052 U	0.00048 U	0.14	0.00045 U	0.027
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.09	0.016 J	0.012	0.062	0.00067 U	0.00064 U	0.096	1.1	0.00058 U	6.9	0.01	0.9
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1	0.27	0.17	0.53	0.0018 J	0.00082 U	0.98	7.8	0.0025 J	58	0.14	8.2
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1.3 J	0.39 J	0.21 J	0.48 J	0.0018 J	0.00043 UJ	1.2 J	9.2 J	0.0027 J	64 J	0.16 J	9 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	2.6 J	0.86 J	0.4 J	0.92 J	0.0076 J	0.00063 UJ	2.1 J	13 J	0.007 J	110 J	0.29 J	13 J
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	1.3 J	0.42 J	0.21 J	0.48 J	0.0032 J	0.00054 UJ	1 J	7.4 J	0.0045 J	48 J	0.15 J	8.6 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.75 J	0.28 J	0.16 J	0.39 J	0.0022 J	0.00064 UJ	0.84 J	5.3 J	0.0025 J	41 J	0.11 J	5.5 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	1.9 J	0.68 J	0.3 J	0.83 J	0.0048 J	0.0016 UJ	1.7 J	10 J	0.0038 J	93 J	0.2 J	11 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.19 J	0.073 J	0.031 J	0.077 J	0.00081 UJ	0.00077 UJ	0.17 J	1.2 J	0.00069 UJ	10 J	0.025 J	1.6 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	2.4 J	0.62 J	0.3 J	1.1 J	0.0036 J	0.0015 UJ	2.2 J	14 J	0.0046 J	110 J	0.2 J	13 J
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.021 J	0.0051 UJ	0.00048 UJ	0.017 J	0.00056 UJ	0.00054 UJ	0.027 J	0.38 J	0.00048 UJ	3 J	0.0037 J	0.37 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	1.5 J	0.48 J	0.23 J	0.53 J	0.0037 J	0.00064 UJ	1.3 J	7.7 J	0.0047 J	69 J	0.18 J	9.5 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.017 J	0.0082 U	0.0024 J	0.011	0.0009 U	0.00086 U	0.016 J	0.18	0.00077 U	1.6	0.0015 J	0.12
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.7 J	0.18 J	0.079 J	0.43 J	0.0017 J	0.00074 UJ	0.65 J	5 J	0.0019 J	39 J	0.059 J	4.8 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	2.1 J	0.57 J	0.27 J	1 J	0.0039 J	0.001 UJ	2 J	12 J	0.0042 J	94 J	0.17 J	12 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	1.923	0.5931	0.3121	0.733	0.0034185	0.000398	1.756	**12.8**	0.0044425	**93.73**	0.2365	**12.89**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	3.299	0.828	0.3993	1.6561	0.0053	0.00048 U	3.047	21.68	0.0065	**168**	0.2802	19.981
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**12.64**	**4.023**	**1.981**	**5.237**	0.029	0.00043 UJ	**11.29**	**73.6**	0.0319	**587**	**1.425**	**78.4**
Metals																			
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	7,700	7,400	7,700	14,000	11,000	18,000	5,400	17,000	11,000	31,000	9,000	14,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	0.83 J	0.68 J	0.6 J	0.74 J	0.77	0.57	1.7	2.1	0.84	**12**	1.1	3.4
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.35 J	0.3 J	0.25 J	0.45 J	0.62	0.54	0.43 J	0.59 J	0.45 J	**4.6 J**	0.39 J	0.79 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	9.9	11	8.4	4.4	3.4	6.3	9.6	20	7.9	**120**	5	19
Copper	mg/Kg	NA	140,000	217	280	217	28.4	20 J	20 J	23 J	20 J	24	24	22 J	23 J	24 J	**240 J**	22 J	160 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	4.3 J	13 J	3.1 J	3.6 J	4.4	3.7	4.8 J	9.5 J	1.9 J	90 J	1.9 J	14 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.012 J	0.0047 U	0.0045 U	0.0065 U	0.0057 U	0.0072 U	0.0092 J	0.011 J	0.0063 U	0.069	0.0062 U	0.01 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	5.7 J	5.3 J	3.7 J	6.8 J	5.6	6.5	9.2 J	23 J	7.8 J	120 J	4.6 J	16 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.81 J**	**0.9 J**	**0.92 J**	**0.74 J**	**1.1**	**0.67**	**0.93**	**0.74**	**0.81**	**0.92**	**0.99**	**0.93**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	62 J	50 J	44 J	57 J	70	57	67 J	52 J	58 J	350 J	51 J	88 J

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Table 10-2
SWMU 10 and SWMU 11 - North and South Pot Liner Soaking Station WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU10-WPA-SB1-2.5 11/30/2020	SWMU10-WPA-SB1-3.0 11/30/2020	SWMU10-WPA-SB2-2.0 12/1/2020	SWMU11-WPA-SB3-2.5 12/1/2020	SWMU11-WPA-SB50-2.5 (Duplicate of SWMU11-WPA-SB3-2.5) 12/1/2020	SWMU11-WPA-SB3-3.25 12/1/2020	SWMU11-WPA-SB4-1.5 12/1/2020	SWMU11-WPA-SB4-3.25 12/1/2020	SWMU11-WPA-SB4-5.75 12/1/2020
Aluminum Smelter																
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.07 U	0.08 U	0.87	0.15 J	0.19	0.32	0.18 J	0.07 U	0.08 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	98.3	143	**405 J**	**264 J**	**253 J**	**332 J**	**397 J**	**331 J**	**297 J**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	11.8	13.5	21.7	16.3 J	9.8 J	10.5	36.5	19.4	17.6
Polycyclic Aromatic Hydrocarbons (PAHs)																
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0036 J	0.00064 B	0.02	0.0013 B	0.00097 B	0.00063 B	0.27	0.059	0.00098 B
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.015	0.00045 B	0.16	0.0097	0.0074	0.00044 B	1.3	0.14	0.0015 B
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00081 J	0.00034 U	0.004 J	0.0003 U	0.0003 U	0.00036 U	0.011 J	0.017	0.00037 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.023	0.00054 J	0.24	0.022	0.016	0.00037 U	1.2	0.22	0.0021 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.27	0.0072	1.7	0.11	0.085	0.002 B	15	0.94	0.014
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.42	0.011	2	0.15	0.12	0.0017 J	14	0.93	0.014
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.61	0.02	2.9	0.19	0.15	0.0027 J	22	1.4	0.026
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.45	0.016	1.5	0.13	0.1	0.0017 J	9.4	0.68	0.016
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.22	0.007	0.99	0.074	0.059	0.0011 J	7.3	0.51	0.0093
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.36	0.012	2.1	0.12	0.096	0.0019 J	18	1.1	0.019
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.095	0.0029 J	0.41	0.029	0.024	0.0004 J	2.8	0.2	0.0039 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.38	0.011	2.7	0.18	0.14	0.0028 B	22	1.7	0.026
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0079	0.00068 U	0.084	0.0061	0.0048 J	0.00072 U	0.92	0.14	0.0013 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.43	0.015	1.7	0.14	0.11	0.0018 J	11	0.76	0.016
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0021 B	0.0014 B	0.023	0.0037 B	0.0018 B	0.0012 B	0.28	0.12	0.0021 B
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.13	0.0045 B	1.3	0.095	0.07	0.002 B	9	1.2	0.013
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.39	0.011	2.4	0.16	0.13	0.0024 B	20	1.5	0.024
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.0044 J	0.00072 U	0.053	0.0041 J	0.0029 J	0.00076 U	0.5	0.15	0.0014 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.5861	0.01633	2.791	0.2055	0.16376	0.002519	**19.99**	1.322	0.02111
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.56241	0.01853	4.531	0.3178	0.24097	0.00707	34.981	3.596	0.04698
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**3.245**	0.1021	**15.7**	**1.103**	0.874	0.0157	**120**	**8.02**	0.1422
Total Petroleum Hydrocarbons (TPHs)																
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	35	6.8 B	90 J	12 J	10 J	2.7 J	530	45	3.6 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	320	12 J	710 J	120	100 J	5 U	2,000	100 J	7.3 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

levels for protection of groundwater or terrestrial ecological screening levels. The current RI screening levels have been used in comparison with 2008 soil data with associated exceedances of COPCs. In general, the data show a similar distribution as the RI and WPA data sets with PAHs and fluoride exceeding screening levels for protection of groundwater. Total cyanide (maximum of 3.7 mg/kg) was detected at concentrations above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg in two locations (one sample associated with each soaking station). Note that this is a conservative comparison because this soil screening level is based on the toxicity of free cyanide and not total cyanide. Arsenic (11.5 mg/kg) was detected above MTCA-derived soil screening levels protective of groundwater in one sample (NS-1, 1.0 ft).

10.3 CONCLUSIONS AND RECOMMENDATIONS

The results for the RI confirm the findings from the 2008 investigation and show there is an area with particularly elevated PAH concentrations at the edge of the pavement southeast of SWMU 11. Concentrations of PAHs in soil exceeding MTCA Method A Industrial or MTCA Method C soil screening levels were observed from soil borings associated with SWMU 11, including RI borings SB3 and SB4. Cadmium and arsenic were also detected in SB4 surface soils at a concentration exceeded the MTCA Method A Industrial soil screening level and MTCA-derived soil screening levels for protection of groundwater, respectively.

Comparison of the RI soil screening levels that are protective of groundwater with the 2008 investigation results shows exceedances of RI soil screening levels in the vicinity of the soaking stations for PAHs, total cyanide, and fluoride.

Groundwater in the vicinity of these SWMUs was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC. Well RI-MW8-BAU was installed as part of the RI in the BAU zone on the south (downgradient) side of the soaking stations. Fluoride (maximum of 15 J mg/L) was consistently detected above the MCL of 4.0 mg/L during all four RI groundwater sampling rounds; total cyanide (maximum of 0.17 mg/L) was consistently detected above the MTCA Method B groundwater screening level for free cyanide of 0.0096 mg/L. Temporary well WPA-GW12 was installed, developed and sampled during the RI and fluoride was detected (3.7 mg/L) above the MTCA Method B groundwater screening levels.

Flowing water was found in a leaking river water vault in the vicinity of WPA-GW12 and MW-E7 (Figure 10-1). The water in this manhole appears associated with leakage from the plant intake river-water supply line. The vault is unlined. Water drains into the vault from a line originating to the west. Based on field observations, the line appears to be drain into the vault at a rate of a few gallons per minute.

The presence of leaking water in the vault is related to changes in the configuration of the potable water system that was modified during 2009-2010 plant demolition activities. When the plant was operating, production wells #1, and #3 on west were used to fill the potable water tank by the Rectifier Building. At that time, potable water was conveyed eastward by water lines inside the plant buildings mounted on ceilings. When the buildings were demolished, water could no longer be conveyed from the tank. To solve this problem, an underground pipe was installed to convey water from the water tank to the Administration Building. In order to supply water to the eastern side of the plant for demolition activities, site tenants, and the Smelter Sign lawn area, this line was then connected to a pre-existing fire hydrant line located along the south side fence-line and extending to the far eastern end of the former plant footprint. The hydrant line was hooked up to the pre-existing river water line that extends along the eastern end of the former plant. Due to these modifications, the river-water line now contains potable water originated from the well. The leaking vault is in the river-water line connection.

It appears that shallow groundwater in the vicinity of the North SPL Soaking Station is recharged by the leaking river-water vault that may affect groundwater contaminant transport. Water within the vault was sampled and sample results were below screening levels for fluoride. Results for the line sampling and the interaction of shallow groundwater and underground water and waste conveyance lines are summarized in Volume 3, Section 2.5 and Volume 4, Section 2.4, respectively.

SWMUs 10 and 11 are recommended for further evaluation in the FS based primarily on PAHs and fluoride-impacted soils detected during the WPA and RI, as well as PAHs and fluoride exceedances as previously reported during the 2008 site investigation (URS 2008e). Groundwater in this area of the site will be further evaluated in the FS as part of the Groundwater in the Uppermost Aquifer AOC.

Section 11
South Pot Liner Soaking Station (SWMU 11)

The South Pot Liner Soaking Station (SWMU 11) was combined and discussed together with the North Pot Liner Soaking Station (SWMU 10) previously in Section 10.

Section 12
East SPL Storage Area (SWMU 12)

The East SPL Storage Area (SWMU 12), also known as the Bath Storage Building, is located to the southeast of the former Production Buildings and received SPL generated at the smelter from 1971 to 1984 (refer to Figure P-1). SPL was stored on a 100-ft wide by 160-ft long concrete pad; however, the concrete pad capacity was exceeded, and SPL storage expanded onto adjacent unpaved areas, primarily the rocky area to the northeast of the pad.

In 1984, storage of SPL was discontinued at the East SPL Storage Area, and approximately 105,000 tons of SPL was removed and transferred to the West SPL Storage Area (SWMU 13). Between 1987 and 1994, the Bath Storage Building was constructed within the footprint of the former East SPL Storage Area (SWMU 12) and was formerly used for the storage of reclaimed bath material that contains elevated concentration of fluoride. Used cryolite/bath material from plant demolition activities remain stored in this building.

A soil investigation of SWMU 12 was conducted in 2008 and included 17 shallow soil test pits, one shallow soil boring, and three deeper soil borings (URS 2008c). Most soil samples were collected at depths of about 1 ft bgs. Soil samples were analyzed for PAHs, total cyanide, fluoride, sulfate metals, and PCBs. VOCs were eliminated through preliminary field screening. No PCBs were detected. Soils were characterized and determined to contain PAHs above industrial screening levels and remediation was recommended. Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for further details regarding the operational history, past investigation, and RI data needs for the East SPL Storage Area.

12.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The East SPL Storage Area (SWMU 12) field investigation was conducted in June 2016 in accordance with the Ecology-approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) as part of the initial RI field investigation. The primary RI objectives for SWMU 12 was to further delineate the horizontal and vertical extent of soil contamination (particularly PAHs-impacted soil) previously documented at this site.

The RI field investigation included drilling of three soil borings (SB01 through SB03), completed on the north, southwest, and southeast sides of the Bath Storage Building where soil was expected to be deepest. The boring locations were altered slightly from the location specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) for the following reasons: 1) the presence of bedrock at the ground surface at some of the proposed locations on the hillside east of the storage building, and 2) reduction in the amount of duplication/physical overlap between the 2008 sample stations and the RI stations. Soil borings were completed using a sonic drill rig to depths of up to 10 ft bgs or refusal. Discrete soil samples were collected at depths of 0.5 ft bgs, 2 ft bgs, and the base of the boring.

A total of eight shallow test pits (TP1 through TP7A) were excavated northeast of the Bath Storage Building where the soil was expected to be shallowest, and within the 2008 investigation area (URS 2008c). Some of the test pits were located where the previous 2008 investigation detected elevated concentrations of metals and PAHs in soil. Discrete soil samples were collected within the test pits at depths of 0.5 ft bgs and 2 ft bgs due to the thin soil on the hill. In addition to the planned test pits, three shallow observation (no sampling) test pits were excavated in the eastern portion of the site to better delineate the depth of the bedrock contact.

The boring and test pit soil samples were analyzed for PAHs, total cyanide, fluoride, sulfate, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), with results summarized in the following section.

12.2 INVESTIGATION RESULTS

This section summarizes the results for the RI, followed by the results for the 2008 investigation (URS 2008e). Results for 2008 investigation (URS 2008e) are included because they were used to develop the RI sampling program that supplemented the results of the 2008 investigation. Also, the 2008 investigation results were not previously compared to soil screening levels protective of groundwater or ecological screening levels protective of wildlife.

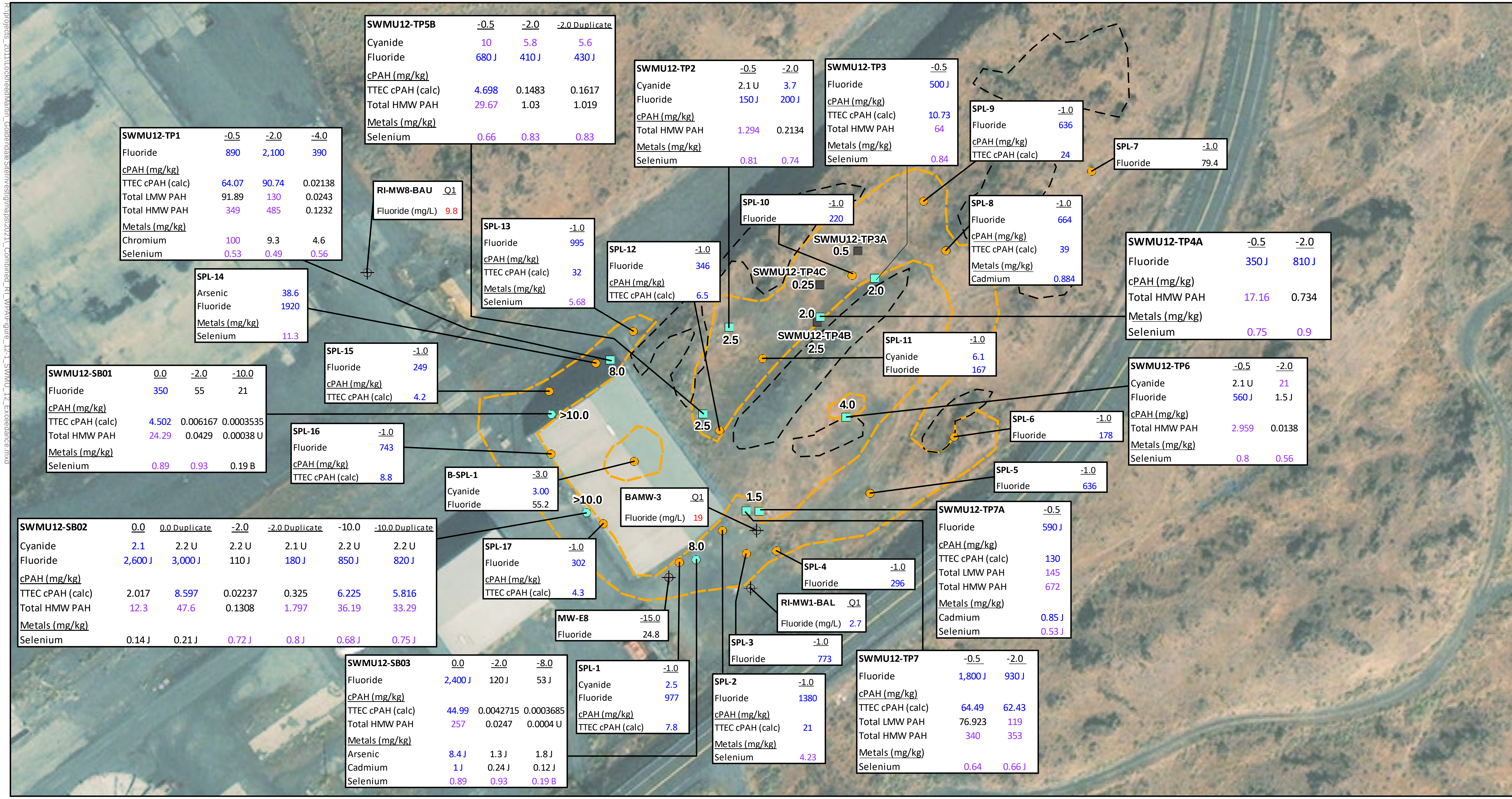
12.2.1 RI Soil Results

The RI boring and test pit soil samples collected during June 2016 were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Completed soil boring and test pit lithologic logs are provided in Volume 5, Appendix B-12. The laboratory data report and data validation report for the project soil samples are provided in Volume 4, Appendix H-1 and I-1, respectively.

During test pit excavation there were no waste materials encountered. Unconsolidated soils consisted primarily of silty gravel (GM) and gravely silt (ML) with some clayey gravel (GC) and clayey sand (SC). The thickness of unconsolidated soils varies significantly between the area of the Bath Storage Building and the hillside to the east (refer to Volume 5, Appendix B-12). Near the building the basalt bedrock contact was found at a depth of about 8 to 13 ft bgs, while on the hillside the basalt bedrock contact was typically about 2 ft bgs. On the hillside, there are some areas where basalt bedrock outcrops at the ground surface and no surficial soils are present. Figure 12-1 shows the soil boring and test pit sample locations, as well as location(s) were the basalt bedrock surface outcrops.

The RI soil sample analytical results for SWMU 12 are summarized in Table 12-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA Method A Industrial, and Ecology MTCA-derived soil screening levels for protection of groundwater. Site soil background concentrations are also provided in Table 12-1 for comparative review. Figure 12-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

The RI results show that concentrations of cPAHs exceed screening levels for protection of groundwater and terrestrial ecological screening levels at all three soil boring locations and in six of eight test pit locations (refer to Table 12-1 and Figure 12-1). MTCA Method C soil screening levels were not exceeded. In general, PAH concentrations decrease with depth, although in several cases, soils were contaminated down to the shallow bedrock contact.



Legend

- Monitoring Well
- Soil Boring
- Test Pit
- Test Pit (Logging Only)
- 2008 URS Sample Location
- Estimated Area of Basalt Outcrops
- 2.0 Depth to Basalt Bedrock (feet bgs)
- Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 25 50 100
Feet

Figure 12-1
SWMU 12
East SPL Storage Area
Sampling Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 12-1
SWMU 12 - East Spent Pot Liner Storage Area Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 1 of 2)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU12-SB01-0.0 6/27/2016	SWMU12-SB01-2.0 6/27/2016	SWMU12-SB01-10.0 6/27/2016	SWMU12-SB02-0.0 6/28/2016	SWMU12-SB40-0.0 (Duplicate of SWMU12-SB02-0.0) 6/28/2016	SWMU12-SB02-2.0 6/28/2016	SWMU12-SB40-2.0 (Duplicate of SWMU12-SB02-2.0) 6/28/2016	SWMU12-SB02-10 6/28/2016	SWMU12-SB40-10.0 (Duplicate of SWMU12-SB02-10) 6/28/2016	SWMU12-SB03-0.0 6/28/2016	SWMU12-SB03-2.0 6/28/2016	SWMU12-SB03-8.0 6/28/2016	SWMU12-TP1-0.5 6/30/2016	SWMU12-TP1-2.0 6/30/2016
Aluminum Smelter																					
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2 U	2.4 U	2 U	**2.1**	2.2 U	2.2 U	2.1 U	2.2 U	2.2 U	2.2 U	2.1 U	2 U	2.1 U	2.3 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	**350**	55	21	**2,600 J**	**3,000 J**	110 J	**180 J**	**850 J**	**820 J**	**2,400 J**	120 J	53 J	**890**	**2,100**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	9.5 J	6.7 J	4.6 J	45	43	12	12	35 J	53 J	73	11	4.7 J	6.6 J	16
Polycyclic Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.018 J	0.00074 U	0.0006 U	0.0099 J	0.052 J	0.00066 U	0.0011 J	0.017 J	0.017	**0.27**	0.0006 U	0.00062 U	**0.34**	**0.57**
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.023 J	0.00053 U	0.00043 U	0.014 J	0.063 J	0.00047 U	0.0015 J	0.024 J	0.023	0.37	0.00043 U	0.00045 U	0.48	0.76
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.21	0.0007 U	0.00057 U	0.12 J	0.73 J	0.00063 UJ	0.016 J	0.21	0.25	3.5	0.00057 U	0.00059 U	4.2	7.2
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0049 U	0.00059 U	0.00048 U	0.0015 J	0.0036 J	0.00053 U	0.0013 J	0.005 U	0.0025 J	0.038	0.00048 U	0.0005 U	0.023 U	0.026 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.22	0.0007 U	0.00057 U	0.095 J	0.47 J	0.0026 J	0.046 J	0.34	0.35	2.7	0.00057 U	0.00059 U	4.4	5.9
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	2.5	0.0036 J	0.00073 U	1.1 J	3.6 J	0.014 J	0.22 J	3.4	4.1	22	0.0024 J	0.00075 U	33	46
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	3.3 J	0.0038 J	0.00038 U	1.4 J	6.2 J	0.016 J	0.24 J	4.4	4.1	32	0.003 J	0.0004 U	47	67
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	4.4 J	0.0095 J	0.00057 U	2.3 J	10 J	0.023 J	0.26 J	6.5	5.9	50	0.0048	0.00058 U	62	84
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	2.2 J	0.0052 J	0.00048 U	1.6 J	5.5 J	0.013 J	0.18 J	4.9	4	30	0.0034 J	0.0005 U	41	55
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.8 J	0.0035 J	0.00057 U	0.77 J	2.9 J	0.0078 J	0.11 J	2.1	1.9	16	0.0016 J	0.00059 U	25	38
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	3.3 J	0.0055 J	0.0014 U	1.7 J	6.7 J	0.019 J	0.23 J	4.6	4.7	39	0.0027 J	0.0015 U	44	63
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.39 J	0.00084 UJ	0.00069 U	0.23 J	1 J	0.002 J	0.027 J	0.69	0.79	6	0.00069 U	0.00071 U	5.3	7.1
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	4 J	0.0064 J	0.0013 U	1.9 J	6.4 J	0.023 J	0.37 J	4.9	4	32	0.0035 J	0.0014 U	57	78
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.09 J	0.00059 UJ	0.00048 UJ	0.044 J	0.25 J	0.00053 UJ	0.013 J	0.098	0.12	1.2	0.00048 U	0.0005 U	1.6	2.7
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	2.6 J	0.0061 J	0.00057 U	1.6 J	5.8 J	0.015 J	0.21 J	5.1	4	32	0.0033 J	0.00059 U	41	56
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.042 J	0.00094 U	0.00077 U	0.027 J	0.12 J	0.00084 U	0.004 J	0.043 J	0.048	0.66	0.00076 U	0.00079 U	0.87	1.7
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	1.3 J	0.0026 J	0.00066 U	0.69 J	3.7 J	0.011 J	0.17 J	1.8	2.3	22	0.0015 J	0.00068 U	23	33
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	3.8 J	0.0057 J	0.00093 U	1.6 J	5.9 J	0.021 J	0.32 J	4.5	3.8	30	0.0035 J	0.00096 U	51	69
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**4.502**	0.006167	0.0003535	2.017	**8.597**	0.02237	0.325	**6.225**	**5.816**	**44.99**	0.0042715	0.0003685	**64.07**	**90.74**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	5.903	0.009	0.00043 U	2.9014	11.7886	0.0366	0.6229	7.432	7.1105	62.738	0.005	0.00045 U	91.89	**130**
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**24.29**	0.0429	0.00038 U	**12.3**	**47.6**	0.1308	**1.797**	**36.19**	**33.29**	**257**	0.0247	0.0004 U	**349**	**485**
Metals																					
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	11,000	10,000	4,800	68,000 J	92,000 J	8,000	9,300	22,000	24,000	96,000	4,000	3,800	75,000	64,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	1.7	0.86	0.36	2.6 J	3 J	2.3 J	2.5 J	3 J	3.3 J	**8.4 J**	1.3 J	1.8 J	2.9	5.9
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.34	0.32	0.11	0.47 J	0.77 J	0.23 J	0.3 J	0.46 J	0.48 J	**1 J**	0.24 J	0.12 J	0.39	0.77
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	8.1	6.8	2.3	1.8 J	3.1 J	6.2 J	7.6 J	13 J	16 J	9.6 J	3.2 J	2.3 J	**100**	9.3
Copper	mg/Kg	NA	140,000	217	280	217	28.4	21	15	9.7	4.2 J	5 J	16 J	18 J	18 J	22 J	23 J	11 J	11 J	30 J	24 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	4.5	3.4	0.66	6.4 J	6.2 J	4.4 J	5.5 J	6.3 J	7.7 J	20 J	2.7 J	2.4 J	11	13
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0076 J	0.0084 J	0.0062 U	0.0062 U	0.0064 U	0.0063 J	0.0089 J	0.008 J	0.0088 J	0.0064 U	0.0077 J	0.0061 U	0.0063 U	0.0063 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	9.7	6	1.2	56 J	44 J	6.3 J	8.2 J	16 J	15 J	69 J	3.7 J	3.1 J	20	33
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.89**	**0.93**	0.19 B	0.14 J	0.21 J	**0.72 J**	**0.8 J**	**0.68 J**	**0.75 J**	**0.62 J**	**0.5 J**	**0.57 J**	**0.53**	**0.49**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	58	52	10	5.5 J	9.2 J	51 J	57 J	57 J	66 J	60 J	31 J	32 J	61	65

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 12-1
SWMU 12 - East Spent Pot Liner Storage Area Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 2 of 2)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU12-TP1-4.0 6/30/2016	SWMU12-TP2-0.5 6/30/2016	SWMU12-TP2-2.0 6/30/2016	SWMU12-TP3-0.5 6/30/2016	SWMU12-TP4A-0.5 6/30/2016	SWMU12-TP4A-2.0 6/30/2016	SWMU12-TP5B-0.5 6/30/2016	SWMU12-TP5B-2.0 6/30/2016	SWMU12-TP52-2.0 (Duplicate of SWMU12-TB5B-2.0) 6/30/2016	SWMU12-TP6-0.5 6/30/2016	SWMU12-TP6-2.0 6/30/2016	SWMU12-TP7-0.5 6/30/2016	SWMU12-TP51-0.5 (Duplicate of SWMU12-TP7-0.5) 6/30/2016	SWMU12-TP7A-0.5 6/30/2016
Aluminum Smelter																					
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.1 U	2.1 U	**3.7**	2.1 U	2.2 U	2.2 U	**10**	**5.8**	**5.6**	2.1 U	**21**	1.9 U	2.1 U	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	**390**	**150 J**	**200 J**	**500 J**	**350 J**	**810 J**	**680 J**	**410 J**	**430 J**	**560 J**	1.5 J	**1,800 J**	**930 J**	**590 J**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	6.3 J	63 J	120 J	71 J	17 J	47 J	47 J	39 J	27 J	12 J	180 J	14 J	9.4 J	13 J
Polycyclic Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00063 U	0.00066 U	0.00068 U	0.049	0.024	0.00063 U	0.033	0.0012 J	0.00068 U	0.0015 J	0.00066 U	**0.19**	**0.62 J**	**0.33 J**
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00045 U	0.00047 U	0.00049 U	0.07	0.028	0.00045 U	0.05	0.0013 J	0.0014 J	0.0023 J	0.00047 U	0.24	0.9 J	0.37 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0006 U	0.0058	0.00065 U	0.52	0.28	0.0061	0.29	0.0043 J	0.0061	0.021	0.00063 U	2.2	4.2	4
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0005 U	0.00052 U	0.00054 U	0.0074 J	0.0011 U	0.0005 U	0.001 U	0.00054 U	0.00054 U	0.0005 U	0.00053 U	0.023 J	0.046	0.055
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0013 J	0.0091	0.0013 J	0.62	0.19	0.0062	0.27	0.006	0.007	0.02	0.00063 U	2.8	4.1	5.1
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.011	0.12	0.018	6.3	1.6	0.063	2.8 J	0.049	0.071	0.29	0.0014 J	32	31 J	53 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.015	0.18	0.027	7.5	2.3	0.092	3.2	0.09	0.11	0.37	0.0019 J	48	46 J	97 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.024	0.25	0.042	12	3.2	0.15	5.6	0.23	0.21	0.58	0.0032 J	57	60 J	120 J
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.016	0.15	0.028	6.7	1.9	0.08	3 J	0.17	0.12	0.32	0.0021 J	39	31 J	71 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0097	0.095	0.016	5.1	1.3	0.06	2.5 J	0.1	0.091	0.22	0.0012 J	20	22 J	45 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.016	0.17	0.028	9	2.2	0.11	5.1	0.13	0.18	0.43	0.0016 U	41	53 J	86 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0025 J	0.019	0.0034 J	1	0.26	0.013	0.47 J	0.041 J	0.017 J	0.049	0.00076 U	5.8	6 J	13 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.015	0.18	0.026	10	2.7	0.095	4.6	0.08	0.12	0.39	0.0017 J	54	74	100
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0005 U	0.00052 U	0.00054 U	0.21	0.094	0.0005 U	0.14	0.00054 U	0.00054 U	0.008	0.00053 U	1.1	2.5 J	1.6 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.015	0.15	0.027	7	2	0.08	3.1 J	0.15	0.11	0.35	0.0025 J	46	40 J	90 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0008 U	0.00084 U	0.00086 U	0.12	0.052	0.0015 J	0.087	0.0016 J	0.0039 J	0.0038 J	0.00084 U	0.37	1.1 J	0.58 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.008	0.064	0.01	3.4	1.2	0.037	1.8 J	0.031 J	0.05 J	0.13	0.00073 U	16	32	33
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.014	0.16	0.024	9.4	2.4	0.086	3.9 J	0.07 J	0.11 J	0.35	0.0015 J	51	64 J	97 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.02138	0.2451	0.03792	**10.73**	3.158	0.1297	**4.698**	0.1483	0.1617	0.5232	0.002776	**64.49**	**62.43**	**130**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.0243	0.2589	0.0373	14.9964	4.568	0.1458	7.27	0.1254	0.1884	0.5766	0.0017	76.923	**119**	**145**
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.1232	**1.294**	0.2134	**64**	**17.16**	0.734	**29.67**	1.03	1.019	**2.959**	0.0138	**340**	**353**	**672**
Metals																					
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	4,200	15,000	13,000	38,000	18,000	11,000	36,000	17,000	20,000	16,000	10,000	39,000	33,000 J	92,000 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	1.9	2.7	3.1	4.2	3.5	3.8	4.6	4	4.6	2.5	2.8	2.9	3.4	3.8
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.17	0.37	0.27	0.57	0.35	0.38	0.49	0.27	0.33	0.34	0.22	0.54	0.52 J	**0.85 J**
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	4.6	16	16	20	18	10	17	18	19	16	14	11	7.1 J	12 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	12 J	15 J	19 J	24 J	17 J	18 J	17 J	12 J	13 J	19 J	18 J	22 J	20 J	19 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	3	5.9	5.5	13	6.5	5	11	6	6.9	5.7	4.8	15	10	12
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.01 J	0.0059 J	0.013 J	0.015 J	0.0067 J	0.0087 J	0.013 J	0.0065 U	0.0066 U	0.0094 J	0.0089 J	0.0069 J	0.0072 J	0.0073 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	5.6	10	12	34	15	10	16	11	12	12	12	26	19 J	31 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.56**	**0.81**	**0.74**	**0.84**	**0.75**	**0.9**	**0.66**	**0.83**	**0.83**	**0.8**	**0.56**	**0.64**	**0.66 J**	**0.53 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	34	62	52	60	55	50	60	54	54	62	42	83	66 J	100 J

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Total cyanide was only detected in one soil boring (SB02) and two test pit locations (TP5 and TP6) at concentrations above the calculated MTCA soil screening level for protection of groundwater of 1.9 mg/kg (maximum detected concentration of 21 mg/kg) (6 of 28 samples). Note that this is a conservative comparison because this soil screening level is based on the toxicity of free cyanide and not total cyanide. Also, the maximum detected concentration of 21 mg/kg is below the MCL-based soil screening level for protection of groundwater of 40.4 mg/kg.

Fluoride was the most widespread of COPCs at SWMU 12 and was detected at concentrations above the Ecology MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in 22 of 28 samples (maximum detected concentration of 2,600 mg/kg). Sulfate was not detected above associated screening levels in soil (refer to Table 12-1 and Figure 12-1)

For metals, arsenic and cadmium were detected at concentrations above MTCA-derived screening levels for protection of groundwater and background concentrations. Cadmium was detected in two samples (SB03-0.0 and TP7A-0.5, maximum of 1 J mg/kg), and arsenic was detected (8.6 J mg/kg) in one sample (SB03-0.0). Arsenic and cadmium were found at concentrations above the MTCA-derived soil screening level for protection of groundwater of 0.69 mg/kg and 2.92 mg/kg, respectively (refer to Table 12-1 and Figure 12-1). Selenium (maximum of 0.93 mg/kg) exceeded in the terrestrial ecologic soil screening levels for wildlife protection in 26 of 28 samples.

12.2.2 2008 Soil Results

Figure 12-1 also includes the 2008 site characterization (URS 2008c) and summarizes the exceedances of the current soil screening levels used in the RI. The historical data generally shows similar contaminants and chemical distribution as the RI results. The 2008 soil results are summarized as follows:

- Concentrations of cPAHs exceed MTCA screening levels for protection of groundwater in 6 of 13 samples in the 2008 data set.
- Fluoride (maximum of 1,920 mg/kg) exceeded the MTCA-derived soil screening level of 147.6 mg/kg in 12 of 13 samples.
- Total cyanide (maximum of 6.1 mg/kg) exceeded the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg in 3 of 19 samples. Note that this is a conservative comparison because this soil screening level is based on the toxicity of free cyanide and not total cyanide.

- For metals, arsenic (maximum of 38.6 mg/kg) exceeded the MTCA-derived screening level for protection of groundwater screening level of 20 mg/kg in one of 13 samples. Selenium (maximum of 11.3 mg/kg) exceeded MTCA-derived soil screening level for protection of groundwater of 5.2 mg/kg in two samples. Cadmium (0.884 mg/kg) exceeded the MTCA-derived soil screening level for protection of groundwater of 0.69 mg/kg in one sample. The arsenic and selenium exceedances were found in soil samples collected from the north side of the Bath Storage building.

12.3 CONCLUSIONS AND RECOMMENDATIONS

Concentrations of PAHs in soil exceed soil screening levels for protection of groundwater and terrestrial ecologic screening level at several sample locations (refer to Figure 12-1). Fluoride and total cyanide exceed MTCA-derived soil screening levels for protection of groundwater. Concentrations of arsenic and cadmium also exceeded the MTCA-derived soil screening levels for protection of groundwater at a couple of locations and selenium exceeded terrestrial ecologic screening levels for wildlife protection in several locations.

Groundwater in the vicinity of SWMU 12 was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC. Well RI-MW1-BAL was installed on the south (downgradient) side of the Bath Storage Building during the RI. This well was screened within the Basalt Aquifer – Lower Zone (BAL). Well BAMW-3 is also present in this same area and is screened in the BAU zone. Results for these wells are summarized as follows:

- Fluoride was persistently detected (maximum of 23 J mg/L) above the MCL of 4.0 mg/L in well BAMW-3, which is screened in the BAU zone. Fluoride was also detected (maximum of 2.7 mg/L) above the MTCA Method B screening level of 0.010 mg/L during the first sampling round at deep well RI-MW1-BAL.

- Total cyanide (maximum of 0.49 mg/L) was detected above the MCL of 0.2 mg/L during two of four sampling rounds in well BAMW-3. Total cyanide (maximum of 0.083 mg/L) was also detected above the MTCA Method B groundwater screening level of 0.010 mg/L in deep well RI-MW1-BAL during the first sampling round only. Free cyanide concentrations were below screening levels.

SWMU 12 is recommended for further evaluation in the FS primarily based on PAH- and fluoride-impacted soils found during completion of this RI, and as previously reported during the 2008 site investigation (URS 2008c). Groundwater in this area of the site will be further evaluated in the FS as part of Groundwater in the Uppermost Aquifer AOC.

Section 13
West SPL Storage Area (SWMU 13)

The West SPL Storage Area (SWMU 13) was not included in the RI field program because this unit was formerly investigated, closed, and capped (refer to Figure P-1). The West SPL Storage Area was closed in 1988 under solid waste regulations, at which time a closure plan was prepared, and an engineered cap was constructed (CH2MHill 1988a,b).

For a summary of previous investigations and remediation work completed at SWMU 13 please refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

13.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No RI field investigation was performed at this SWMU as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

13.2 INVESTIGATION RESULTS

No additional RI data was collected at SWMU 13. Site-wide groundwater monitoring and characterization results for the SWMU 13 vicinity are presented in Volume 3 as part of the Groundwater in the Uppermost Aquifer AOC.

13.3 CONCLUSIONS AND RECOMMENDATIONS

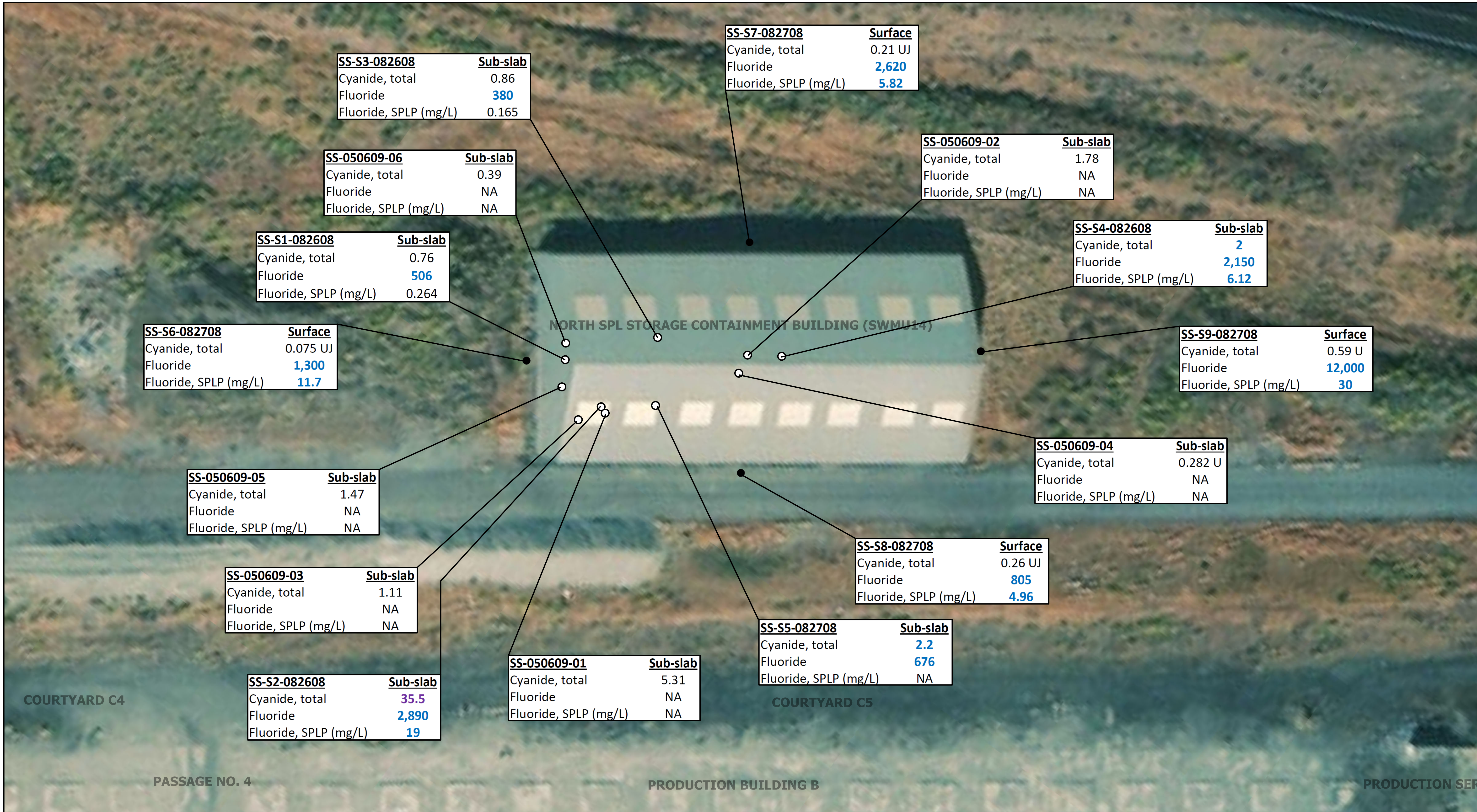
The West SPL Storage Area remains closed under solid waste regulations in effect at that time. Site-wide groundwater monitoring results, including the SWMU 13 vicinity will be summarized and addressed as part of the Groundwater in the Upper Most Aquifer AOC (refer to Volume 4, Section 2 of this report).

Section 14
North SPL Storage Containment Building (SWMU 14)

The North SPL Storage Containment Building (SWMU 14) is located at the northeastern end of the former production area (refer to Figure P-1). The building was placed in service in 1987 and was used for the storage and handling of SPL. The building's floor was originally constructed to include a compacted gravel base material, 30 mil PVC liner, sand layer, and 6-inch, reinforced concrete slab (Golder 1995, ENSR 1991). The walls included 4-foot concrete perimeter walls with aluminum sheeting forming the upper part of the wall. The building is covered with a pitched aluminum roof. The floor area for the North SPL Containment Building is about 20,000 ft^2.

The building was full of SPL by 1988 and sealed shut (Ecology 2014, ENSR 1991). SPL was removed from the North SPL Storage Building in mid-1995 for off-site disposal The North SPL Storage Building was upgraded in 1996 to meet the requirements of 40 CFR 24.1101 and became certified as a Containment Building (Golder 1996c, Ecology 1997). The North SPL Storage Building was cleaned and inspected prior to upgrade and modification of the building and operational procedures (Golder 1996b,c). The upgraded North SPL Containment Building was operated from 1996 until the plant ceased operations in 2003. Closure of SWMU 14 was completed under RCRA during 2008 and 2009 and approved by Ecology (Ecology 2009, CH2MHill 2009).

During closure, 11 confirmation samples were collected from the sand layer beneath the building floor in 2008 and 2009, and four confirmation samples were collected from surface soil outside the building at each of the four walls (Figure 14-1). All 15 samples were analyzed for total cyanide and one sample detected a concentration of 35.5 mg/kg which was above the closure criteria of 32 mg/kg (shown bolded on Figure 14-1). Five sand and the four soil samples were analyzed for fluoride with Synthetic Precipitation Leaching Procedure (SPLP) testing conducted for water soluble fluoride. Resulting concentrations of water-soluble fluoride from the nine samples did not exceed



- ● 2008 Closure Surface Soil Samples adjacent to building exterior
- ○ 2008/2009 Closure Sand Samples Collected from beneath the floor slab

2008/9 Closure Criteria for Soil and Sand: 32 mg/kg total cyanide, 240 mg/L water soluble fluoride derived by SPLP, RI/WPA soil samples were analyzed only for total fluoride.

Sample locations are approximate based on orthogonal measurements.

Sample results are measured in **mg/kg** unless otherwise noted.

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife

U: Analyte included in the analysis but not detected
J: Estimated value
NA: Not analyzed

N W E S

0 30 60 90
Feet

Figure 14-1

SWMU 14 North SPL Storage Containment Building

Closure Sand and Soil Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

the closure criteria of 240 mg/L for soluble fluoride. Detected concentrations of water-soluble fluoride that exceed the 4 mg/L MCL groundwater screening level are shown on Figure 14-1.

14.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

SWMU 14 was investigated in June 2016 with eight soil borings (Figure 14-2). Investigation objectives included characterizing chemical concentrations of COPC in soil at the exterior of the building and in soil beneath the liner under the building floor, and confirmation of the liner depth. Four soil borings were advanced inside the building through the concrete floor and underlying sand layer and PVC liner, and four soil borings were advanced around the perimeter of the building consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The four soil borings around the perimeter of the building were completed to depths of up to 10 ft or refusal with samples collected at 0.5 ft bgs, 5 ft bgs, and total depth. A total of 22 soil samples were collected from the borings with the shallowest sample in borings completed beneath the floor slab targeted at below the anticipated depth of the PVC liner. The targeted vertical interval for sampling was immediately below the anticipated depth of the PVC liner, with additional samples collected 2 ft below the initial sample and above the planned 10-ft total depth of borings. Figure 14-2 shows the sampling locations and summarizes the chemicals that exceed soil screening levels. The soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

14.2 INVESTIGATION RESULTS

Borings completed around the perimeter of the building were moved about 10 ft away from the edge of the building to provide needed working space. The borings were advanced and sampled using hollow-stem auger drilling techniques and all sampling procedures were performed according to the approved work plan. Soil encountered in the borings was characterized, logged, and sampled. Boring logs are included in Volume 5, Appendix B-14.

Soil beneath the building floor slab consists of gravelly sand (SP), stiff silt (ML), and medium sand (SP) identified as fill and ranging in thickness from 1.5 to 4.5 ft. Silt (ML) to silty clay (CL) was encountered beneath the sand layer to the total depths of borings at 10 ft. The clay ranges from yellowish-brown to black with medium to high plasticity. The soil profile is generally consistent with the description provided in the Final RI Phase 2 Work Plan Section 5.1.13.2 (Tetra Tech et al. 2015b) but differs in boring SWMU14-SB01. Closure documents indicated a liner was present

RI Borings

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife
NE: No exceedance

Sample depths in feet bgs.

N W E S

0 40 80 120
Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 14-2

SWMU 14 North SPL Containment Building

RI Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

beneath the floor slab. However, no evidence of a PVC liner was observed in soil borings or samples from beneath the building floor slab. Bedrock was not encountered in any of the borings during drilling.

Soil analytical results are summarized in Table 14-1. SWMU 14 data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Laboratory analytical reports are included in Volume 5, Appendix H-2 and data validation reports are included in Volume 5, Appendix I-2. The data quality objectives for the project were met and data qualifiers have been assigned as appropriate in Table 14-1. All samples have been collected and analyses completed as proposed in the final RI Work plan. In this investigation phase, reporting limits for cadmium and selenium exceed soil screening levels in most samples analyzed.

The RI results show that detected concentrations of total cyanide and sulfate do not exceed MTCA Method A Industrial, protection of groundwater soil screening levels in 21 of the 22 samples. Fluoride was detected at 580 mg/kg in boring SB08 at a 3-ft depth and exceeds the site-specific protection of groundwater screening level of 147.6 mg/kg. An additional sampled taken from soil boring SB08 at 9.5 ft bgs did not exceed the protection of groundwater for fluoride. Total high molecular weight (HMW) PAH concentrations exceed the ecological wildlife screening level of 1.1 mg/kg in three borings, SB02 at a 3-ft depth, SB05 at a 0.5-ft depth, and SB08 at a 3-ft depth. SB02 is located beneath the building floor slab, and SB05 and SB08 are located at the east and north exterior of the building. Detected concentrations of HMW PAH concentrations at deeper depths in all the borings do not exceed ecological wildlife screening levels.

Detected concentrations of metals, except for arsenic, do not exceed MTCA Method A Industrial, MTCA Method C, or protection of groundwater soil screening levels in 21 of the 22 samples. Arsenic was detected in one sample at 3.3 mg/kg which exceeds the protection of groundwater screening level of 2.92 mg/kg but does not exceed its natural background concentration of 7.61 mg/kg. For cadmium and selenium, the reporting limits slightly exceed their protection of groundwater and ecological wildlife screening levels, but for cadmium the reporting limits are below the natural background concentration. Cadmium reporting limits range from 0.55 to 0.8 mg/kg versus a protection of groundwater screening level of 0.69 mg/kg and natural background of

Table 14-1
SWMU 14 North SPL Storage Containment Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results										
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	SWMU14-SB01-2.0	SWMU14-SB01-3.0	SWMU14-SB01-5.0	SWMU14-SB01-9.5	SWMU14-SB02-3.0	SWMU14-SB02-5.0	SWMU14-SB02-9.5	SWMU14-SB03-1.5	SWMU14-SB03-3.5	SWMU14-SB03-9.5	SWMU14-SB04-1.3
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.086 U	0.086 U	0.089 U	0.086 U	0.37	0.089 U	0.086 U	0.06 UJ	0.058 UJ	0.058 UJ	0.058 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	28 J	10 J	11 J	4.4 J	33 J	15 J	4.5 J	21	4	3.6	27
Sulfate	mg/kg	NA	NE	2,150	NE	NE	65	28	100	28	120	82	46	24	18	10 U	110
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.021	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.0084 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.029	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.0084 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.1	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.0084 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.0077 U	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.0084 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.13	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.018
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0087 U	0.022	0.01 U	0.0097 U	0.2	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.051
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0087 U	0.027	0.01 U	0.0097 U	0.21	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.063
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0087 U	0.045	0.01 U	0.0097 U	0.28	0.0094 U	0.013	0.011	0.0097 U	0.0095 U	0.1
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0087 U	0.026	0.01 U	0.0097 U	0.16	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.053
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0087 U	0.012	0.01 U	0.0097 U	0.085	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.028
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0087 U	0.031	0.01 U	0.0097 U	0.16	0.0094 U	0.0099 U	0.0089 U	0.0097 U	0.0095 U	0.057
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.043	0.0094 U	0.0100 U	0.0089 U	0.0097 U	0.0095 U	0.0085
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0087 U	0.028	0.01 U	0.0097 U	0.37	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.076
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.046	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.0084 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0087 U	0.02	0.01 U	0.0097 U	0.13	0.0094 U	0.0101 U	0.0089 U	0.0097 U	0.0095 U	0.04
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0087 U	0.0077 U	0.01 U	0.0097 U	0.067	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.0084 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0087 U	0.012	0.01 U	0.0097 U	0.37	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.037
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0087 U	0.025	0.01 U	0.0097 U	0.31	0.0094 U	0.0098 U	0.0089 U	0.0097 U	0.0095 U	0.066
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0087	0.04	0.01	0.0097	0.27	0.0094	0.0013	0.001	0.0097	0.0095	0.08
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0087	0.04	0.01	0.0097	1.08	0.0094	0.0098	0.0089	0.0097	0.0095	0.13
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0087	0.21	0.01	0.0097	**1.58**	0.0094	0.01	0.01	0.0097	0.0095	0.47
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	12,000	11,000	29,000	14,000	11,000	17,000	16,000	15,000	29,000	20,000	14,000
Arsenic	mg/kg	20	88	2.9	7.61	132	1.2	2.3	0.59	2.1	1.3	1.1	2.8	1.3	1.5	0.88	1.3
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.65 U	0.58 U	0.76 U	0.72 U	0.58 U	0.7 U	0.74 U	0.67 U	0.73 U	0.71 U	0.63 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	6.2	8.3	5.7	12	9.2	8.6	15	9.6	12	15	9.9
Copper	mg/kg	NA	140,000	280	28.4	217	18	15	9.2	18	18	27	12	21	28	16	22
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.5 U	7.2	7.6 U	8.1	9.3	7.0 U	7.8	6.9	9.3	7.2	6.3 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.33 U	0.29 U	0.38 U	0.36 U	0.29 U	0.35 U	0.37 U	0.33 U	0.36 U	0.36 U	0.32 U
Nickel	mg/kg	NA	70,000	130	24.54	980	6.2	7.5	5.3	6.6	7.3	8.6	9.5	7.9	11	7.5	7.9
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	6.5 U	5.8 U	7.6 U	7.2 U	5.8 U	7.0 U	7.4 U	6.7 U	7.3 U	7.1 U	6.3 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	63	47	30	52	68	62	46	64	72	38	82

Notes:

B Chemical was detected in the blank and the sample.
J Estimated concentration.
NA Not applicable or not analyzed.
NE Not established.
NL Not listed or not shown for this chemical but detected concentrations accounted for in the summation process.
U Chemical was not detected. The associated value represents the method detection limit.
UJ Chemical was not detected. The associated limit is estimated.

TTEC Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH Low molecular weight PAH.
HMW PAH High molecular weight PAH.
Detected concentrations shown in **bold** exceed one or more site soil screening level.

Table 14-1
SWMU 14 North SPL Storage Containment Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results										
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**SWMU14-SB04-3.3**	**SWMU14-SB04-9.5**	**SWMU14-SB05-0.5**	**SWMU14-SB05-3.0**	**SWMU14-SB05-9.5**	**SWMU14-SB06-3.5**	**SWMU14-SB06-6.0**	**SWMU14-SB06-9.5**	**SWMU14-SB07-5.0**	**SWMU14-SB08-3.0**	**SWMU14-SB08-9.5**
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.057 J	0.058 UJ	0.058 UJ	0.06 UJ	0.056 UJ	0.057 UJ	0.06 UJ	0.059 UJ	0.06 UJ	0.057 UJ	0.056 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	30	3.7	57	86	13	9.7	7.1	2.9	31	**580**	20
Sulfate	mg/kg	NA	NE	2,150	NE	NE	40	10 U	10 U	10 U	10 U	10 U	27	10 U	10 U	10 U	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.012	0.0093 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.012	0.0093 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.008 U	0.01 U	0.0094	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.096	0.0093 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.0079 U	0.0093 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.008 U	0.01 U	0.031	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.21	0.0093 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.033	0.01 U	0.2	0.017	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1	0.0093 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.047	0.01 U	0.27	0.025	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.2	0.0093 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.072	0.01 U	0.46	0.043	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.9	0.011
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.041	0.01 U	0.25	0.025	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.1	0.0093 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.021	0.01 U	0.18	0.013	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.55	0.0093 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.041	0.01 U	0.24	0.024	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.96	0.0093 U
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.01	0.01 U	0.042	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.27	0.0093 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.049	0.01 U	0.28	0.023	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.3	0.0097
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.056	0.0093 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.03	0.01 U	0.19	0.017	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.82	0.0093 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.008 U	0.01 U	0.0074 U	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.016	0.0093 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.024	0.01 U	0.089	0.0097 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	0.58	0.0093 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.044	0.01 U	0.25	0.022	0.011 U	0.01 U	0.01 U	0.01 U	0.0094 U	1.2	0.0094
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.06	0.01	0.36	0.03	0.0011	0.01	0.01	0.01	0.0094	1.58	0.0011
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.07	0.01	0.41	0.02	0.0011	0.01	0.01	0.01	0.0094	2.26	0.01
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.34	0.01	**2.08**	0.19	0.0011	0.01	0.01	0.01	0.0094	**9**	0.02
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	14,000	17,000	16,000	30,000	13,000	20,000	32,000	13,000	19,000	16,000	14,000
Arsenic	mg/kg	20	88	2.9	7.61	132	1.7	3.3	2.3	1.4	0.71	1.6	0.9	0.66	1	2	1.4
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.60 U	0.79 U	0.55 U	0.72 U	0.80 U	0.76 U	0.78 U	0.76 U	0.70 U	0.59 U	0.70 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	11	11	11	12	23	11	12	21	11	12	14
Copper	mg/kg	NA	140,000	280	28.4	217	25	13	22	26	9.7	30	20	10	20	23	9.8
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.2	7.9 U	7.8	7.8	8.0 U	7.6 U	7.8 U	7.6 U	7.0 U	7.1	7.0 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.30 U	0.39 U	0.28 U	0.36 U	0.40 U	0.38 U	0.39 U	0.38 U	0.35 U	0.30 U	0.35 U
Nickel	mg/kg	NA	70,000	130	24.54	980	8.3	7.7	9.9	8.3	5.9	9	6.7	4.5	6.1	10	5.9
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	6.0 U	7.9 U	5.5 U	7.2 U	8.0 U	7.6 U	7.8 U	7.6 U	7.0 U	5.9 U	7.0 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	68	47	76	61	31	72	41	28	53	73	38

Notes:

B	Chemical was detected in the blank and the sample.
J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentrations accounted for in the summation process.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more soil screening levels.

0.81 mg/kg. Selenium reporting limits range from 5.5 to 7.9 mg/kg versus a protection of groundwater screening level of 5.2 mg/kg and an ecological wildlife screening level of 0.3 mg/kg.

14.3 CONCLUSIONS AND RECOMMENDATIONS

Concentrations of fluoride exceeds the protection of groundwater screen level in boring SB08 at 3 ft bgs but not at 9.5 ft bgs. Concentrations of PAHs as total HMW PAH detected in three borings exceed the ecological wildlife soil screening levels at shallow depths but not at deeper depths. Arsenic slightly exceeds its soil screening level for protection of groundwater but is below the natural background concentration.

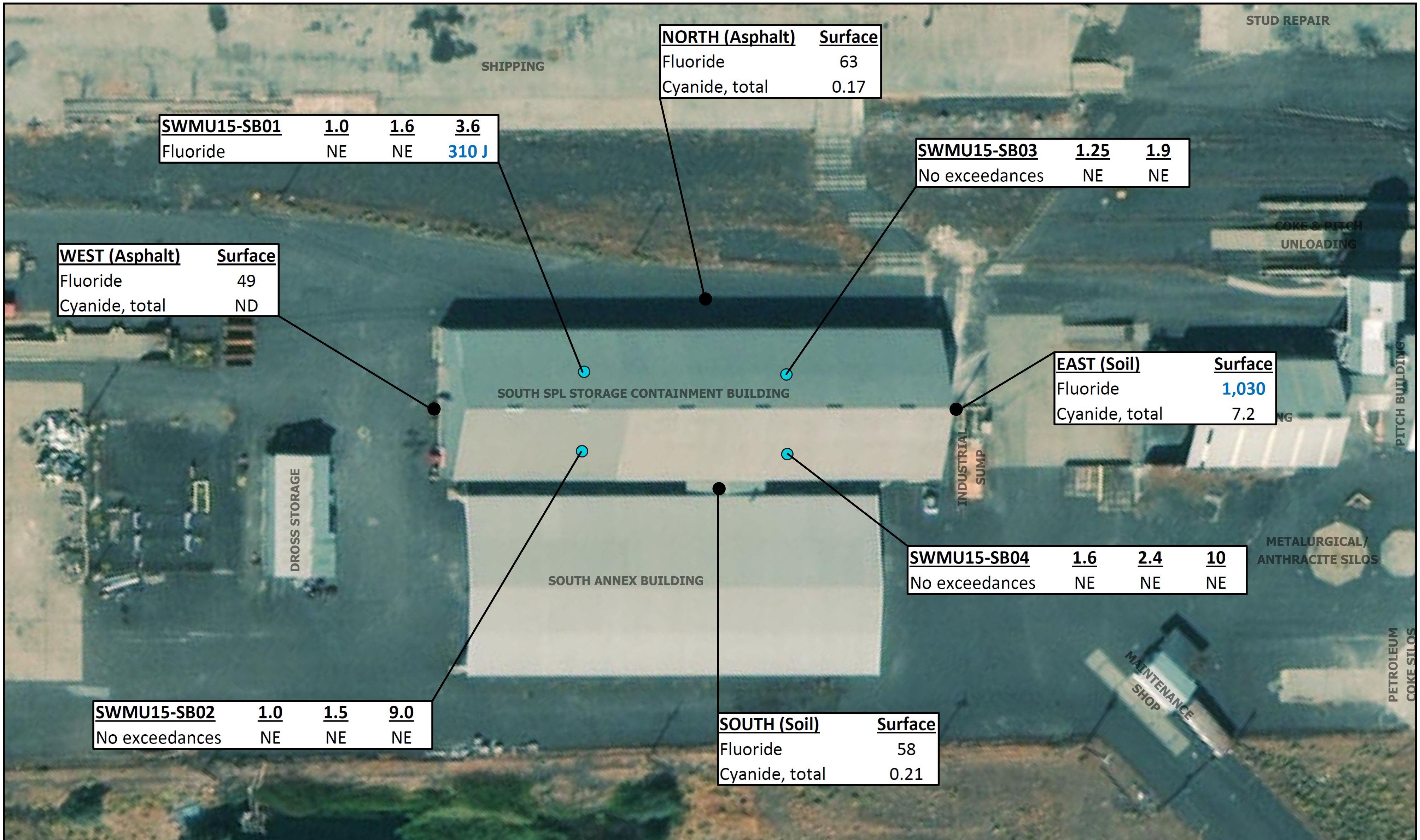
Based on the results of the RCRA Closure investigation and the RI investigation, this Ecology-approved closed RCRA facility does not require remediation and will not be evaluated in the FS. Groundwater in the vicinity of this SWMU was characterized during the RI and WPA, and soil in the vicinity of SWMU 14 was investigated during the WPA and the results are summarized in Volume 3, SE18 Investigation Area and Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

Section 15
South SPL Storage Building (SWMU 15)

The South SPL Storage Building (SWMU 15) was constructed in 1988 and is located south of the Cast House (Figure P-1). The walls included 4-ft concrete perimeter walls with aluminum sheeting forming the upper part of the wall, and a pitched aluminum roof. The building's floor was reportedly originally constructed with a reinforced 6-inch concrete slab, sand layer, 60-mil PVC liner, and compacted gravel base material (Golder 1995, Goldendale Aluminum Company 1997). SWMU 15 was enlarged in 1991 and 1992 by extending the foundation walls of the original building through construction of the South Annex Building (Golder 1995, 1996a).

SPL waste was removed from SWMU 15 and shipped to Chemical Waste Management's hazardous waste landfill in Arlington, Oregon in 1994 and 1995 and the South SPL Storage Building and South SPL Building Annex were clean closed under RCRA in 1996 (Golder 1996a). Closure of SWMU 15 (including the South Annex extension) was approved under the same Ecology-approved closure plan as for SWMU 14 and SWMU 16 (Golder 1995; Ecology 1995c,d).

Sampling under the closure plan was conducted in late 1995 and included sampling of dust, concrete, the sand layer beneath the concrete slab, and surface soil adjacent to the four sides of the SWMU 15 building. Five samples of sub-floor sand were collected and detected concentrations of total cyanide up to 1.94 mg/kg and fluoride up to 17 mg/kg did not exceed closure criteria of 32 mg/kg total cyanide and 4,800 mg/kg fluoride (Golder 1996a). Four samples were collected from the exterior of the building including soil at the south and east sides, and asphalt at the north and west sides. Detected concentrations of total cyanide ranged up to 7.2 mg/kg. Detected concentrations of fluoride in soil samples from the south and east sides of the building were 58 and 1,030 mg/kg respectively and detected concentrations in the asphalt samples from the north and west sides of the building were 63 and 49 mg/kg respectively (Figure 15-1). None of the samples collected during the closure of SWMU 15 exceeded the closure criteria of 4,800 mg/kg fluoride. Fluoride exceeds the RI site specific screening level for protection of groundwater in only one surface soil sample from the east side of the building.



RI Borings

Closure Surface Sample Locations

1996 Closure Criteria: 32 mg/kg total cyanide, 4,800 mg/kg total fluoride.

Soil Screening Levels
blue: Exceeds Protection of Groundwater
J: Estimated concentration
NE: No exceedance
ND: Not detected; detection limit unknown

Sample results are measured in **mg/kg**.
Sample depths in feet bgs.

W N S E

0 40 80 160
Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 15-1

SWMU 15 South SPL Storage Building

Closure and RI Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

15.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

SWMU 15 was investigated in June 2016 with four soil borings (Figure 15-1). Investigation objectives included verifying the presence of a liner beneath the building floor and characterizing site COPC in soil beneath the liner. The soil borings were located inside the structure and drilled through the concrete floor and underlying sand layer and PVC liner consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The borings were completed to depths of up to 10 ft or refusal. Eleven soil samples were collected from the borings with shallowest samples targeted at below the anticipated depth of the PVC liner. The borings were drilled and sampled using hollow-stem auger drilling techniques and all sampling procedures were performed according to the approved work plan.

The soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

15.2 INVESTIGATION RESULTS

Soil borings were completed in accessible locations in each of four sectors inside the building. Soil encountered in the borings was characterized, logged, and sampled. Boring logs are included in Volume 5, Appendix B-15. Samples were collected where feasible from immediately beneath the liner, 2 ft below the liner, and at the base of the boring. Figure 15-1 shows the locations of the borings and the sample collection depths.

Soil beneath the building's concrete floor slab consists of sand with varying percentage of gravel (SP to SW) from beneath the floor slab at 0.7 ft bgs to depths of 2.5 to 4 ft bgs. In soil boring SB03, clayey silt was encountered beneath the floor slab to 2.5 ft bgs. Very dense gravel with varying percentages of fine particles (GP to GW) was encountered from 2.5 to 4 ft bgs, except in boring SB02 where sandy silt was encountered at 9 ft bgs. Drilling in the four soil borings met with refusal at about 2.5 ft bgs using Hollow Stem Auger equipment. Air rotary equipment was used to complete soil borings SB02 and SB04 to the targeted depth of 10 ft bgs. Apparent liner fragments were observed in soil samples collected between 1.5 and 2.5 ft bgs in the four soil borings.

Soil analytical results are summarized in Table 15-1. The SWMU 15 analytical results were compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater and ecological wildlife soil screening levels. Laboratory analytical reports are included in Volume 5, Appendix H-2 and data validation reports are included in Volume 5, Appendix I-2. The data quality

Table 15-1
SWMU 15 South SPL Storage Building RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

	Screening Levels					Ecological Screening Levels	RI Analytical Results										
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	SWMU15-SB01-1.0	SWMU15-SB01-1.6	SWMU15-SB01-3.6	SWMU15-SB02-1.0	SWMU15-SB02-1.5	SWMU15-SB02-9.0	SWMU15-SB03-1.25	SWMU15-SB03-1.9	SWMU15-SB04-1.6	SWMU15-SB04-2.4	SWMU15-SB04-10
Aluminum Smelting																	
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.09 U	0.086 U	0.77	0.09 U	0.095	0.056 UJ	0.19	0.087 U	0.082 U	0.089 U	0.057 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	1.4 J	13 J	**310 J**	1.1 J	110 J	12	17 J	15 J	6.2 J	9.9 J	1.3 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	15	58	57	35	280	11	74	88	49	69	13
Polynuclear Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0071 U	0.0072 U	0.0073 U	0.0069 U	0.0081 U	0.0074 U	0.0078 U	0.0076 U	0.0078 U	0.0078 U	0.0073 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0071 U	0.0072 U	0.0073 U	0.0069 U	0.0081 U	0.0074 U	0.0078 U	0.0076 U	0.0078 U	0.0078 U	0.0073 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.0071 U	0.0072 U	0.0073 U	0.0069 U	0.01	0.0074 U	0.0078 U	0.0086	0.0078 U	0.0078 U	0.0073 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.0072 U	0.0073 U	0.0069 U	0.0081 U	0.0074 U	0.0078 U	0.0076 U	0.0078 U	0.0078 U	0.0073 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.0071 U	0.0072 U	0.011	0.0069 U	0.018	0.0074 U	0.01	0.0076 U	0.0078 U	0.0078 U	0.0073 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0071 U	0.014	0.079	0.0069 U	0.072	0.0074 U	0.057	0.063	0.0078 U	0.0078 U	0.0073 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.0071 U	0.016	0.093	0.0069 U	0.079	0.0074 U	0.072	0.073	0.0078 U	0.0078 U	0.0073 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0071 U	0.025	0.15	0.0069 U	0.13	0.0074 U	0.1	0.1	0.0078 U	0.0078 U	0.0073 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.015	0.11	0.0069 U	0.077	0.0074 U	0.063	0.066	0.0078 U	0.0078 U	0.0073 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.0071 U	0.0072 U	0.046	0.0069 U	0.053	0.0074 U	0.033	0.033	0.0078 U	0.0078 U	0.0073 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.0071 U	0.014	0.094	0.0069 U	0.072	0.0074 U	0.058	0.062	0.0078 U	0.0078 U	0.0073 U
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.0071 U	0.0072 U	0.018	0.0069 U	0.04 U	0.0074 U	0.01	0.011	0.0078 U	0.0078 U	0.0073 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.0071 U	0.016	0.094	0.0069 U	0.1	0.0074 U	0.068	0.078	0.0078 U	0.0078 U	0.0073 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0071 U	0.0072 U	0.0073 U	0.0069 U	0.0081 U	0.0074 U	0.0078 U	0.0076 U	0.0078 U	0.0078 U	0.0073 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.0071 U	0.012	0.084	0.0069 U	0.057	0.0074 U	0.049	0.053	0.0078 U	0.0078 U	0.0073 U
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0071 U	0.0072 U	0.0073 U	0.0069 U	0.055	0.0074 U	0.0078 U	0.0076 U	0.0078 U	0.0078 U	0.0073 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.0072 U	0.037	0.0069 U	0.058	0.0074 U	0.03	0.038	0.0078 U	0.0078 U	0.0073 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.0071 U	0.014	0.082	0.0069 U	0.091	0.0074 U	0.061	0.068	0.0078 U	0.0078 U	0.0073 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.0071	0.02	0.12	0.0069	0.17	0.0074	0.09	0.09	0.0078	0.0078	0.0073
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.0071	0.02	0.14	0.0069	0.24	0.0074	0.11	0.12	0.0078	0.0078	0.0073
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.0071	0.12	0.76	0.0069	0.63	0.0074	0.51	0.53	0.0078	0.0078	0.0073
Metals																	
Aluminum	mg/kg	NA	3,500,000	480,000.00	28,299	NE	6,700	7,500	86,000	5,600	22,000	13,000	12,000	8,700	6,900	8,700	7,800
Arsenic	mg/kg	20	88	2.9	7.61	132	1.5	1.7	1.8	2	4.2	2.4	2.4	3.4	2.9	3.8	2.5
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.54 U	0.54 U	0.54 U	0.52 U	0.61 U	0.56 U	0.58 U	0.57 U	0.59 U	0.59 U	0.55 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	4.7	5.6	150	6.3	38	12	8.8	8.6	7.5	8.9	6.7
Copper	mg/kg	NA	140,000	280	28.4	217	15	17	170	15	23	17	14	15	14	15	15
Lead	mg/kg	1,000	NE	3,000	13.1	118	5.4 U	5.4 U	5.4 U	5.2 U	6.1 U	5.6 U	8.6	6.1	6.3	6.2	5.5 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.27 U	0.27 U	0.26 U	0.3 U	0.28 U	0.29 U	0.29 U	0.29 U	0.29 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	6.7	6.3	12	7.7	5.9	11	7.3	8.6	8	9.4	7.3
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.4 U	5.4 U	5.4 U	5.2 U	6.1 U	5.6 U	5.8 U	5.7 U	5.9 U	5.9 U	5.5 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	39	42	61	36	37	47	50	46	41	47	45

Notes:

B Chemical was detected in the blank and the sample.
J Estimated concentration.
NA Not applicable or not analyzed.
NE Not established.
NL Not listed or not shown for this chemical but detected concentrations accounted for in the summation process.
TTEC Total Toxicity Equivalent Concentration for carcinogenic PAHs.
U Chemical was not detected. The associated value represents the method detection limit.
UJ Chemical was not detected. The associated limit is estimated.

TTEC Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH Low molecular weight PAH.
HMW PAH High molecular weight PAH.
Detected concentrations shown in **bold** exceed one or more site soil screening levels.

objectives for the project were met and data qualifiers have been assigned as appropriate in Table 15-1. All investigation objectives were met, samples collected, and analyses completed as proposed in the final RI Work Plan. In this investigation phase reporting limits for selenium exceed soil screening levels in all samples analyzed.

The RI results indicate that concentrations of total cyanide, sulfate, PAHs, and metals do not exceed MTCA Method C, protection of groundwater or ecological wildlife soil screening levels in any of the 11 samples. Fluoride exceeds the site-specific protection of groundwater screening level of 147.6 mg/kg in one sample collected during the RI (SB01-3.6 at a detected concentration of 310 J mg/kg). One historical surface soil sample collected during site closure in 1995 from the east side of the building also exceeded the RI soil screening level for protection of groundwater with a detected fluoride concentration of 1,030 mg/kg (Figure 15-1).

Arsenic was detected at concentrations that exceed its protection of groundwater screening level 2.92 mg/kg in three soil samples, but these concentrations do not exceed the natural background concentration of 7.61 mg/kg. Mercury and selenium reporting limits exceeded the protection of groundwater and ecological wildlife soil screening levels. Mercury reporting limits ranged from 0.26 to 0.29 mg/kg versus a protection of groundwater screening level of 2.1 mg/kg. Selenium reporting limits ranged from 5.2 to 6.1 mg/kg versus a protection of groundwater screening level of 5.2 mg/kg and an ecological wildlife screening level of 0.3 mg/kg.

15.3 CONCLUSIONS AND RECOMMENDATIONS

Concentrations of total cyanide, sulfate, PAHs, and metals detected in the 11 soil samples do not exceed the MTCA Method A Industrial, MTCA Method C, protection of groundwater, or ecological wildlife soil screening levels. The exception is fluoride which exceeds its site-specific protection of groundwater soil screening level in two samples. Mercury and selenium reporting limits are slightly higher than the protection of groundwater soil screening level, and for selenium also higher than the ecological wildlife screening level.

Based on the results of the RI investigation and past-closure 1995 results, two sample stations with fluoride contamination in soil above the protection of groundwater screening level were identified for SWMU 15. Based on the results and Ecology (2022) comments on the Revised RI Report, SWMU 15 will be carried forward into the FS for further evaluation. Groundwater near this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

Section 16
SPL Handling Containment Building (SWMU 16)

The SPL Handling Containment Building (SWMU 16) was not included in the RI field program because this unit was formerly investigated and cleaned up concurrent with plant demolition activities (refer to Figure P-1). SWMU 16 was closed under RCRA in 2011 (PGG 2011).

For a summary of previous investigations and remediation work completed at SWMU 16, please refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

16.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No RI field investigation was performed at this SWMU as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

16.2 INVESTIGATION RESULTS

No additional RI data was collected at SWMU 16.

16.3 CONCLUSIONS AND RECOMMENDATIONS

No SWMU-specific recommendations are provided as this site was previously cleaned up to MTCA soil standards and closed under RCRA.

Section 17
East End Landfill (SWMU 17)

The East End Landfill (EELF) SWMU 17, is an unlined landfill located southeast of the Paste Plant that was operated from 1971 to 1982. According to the Agreed Order, material disposed of in the EELF reportedly included wood, demolition waste, carbon waste, contaminated alumina, and general trash. An engineering drawing of paving and roads (Harvey Aluminum 1971, Drawing A01099 Revision 3) shows that SPL storage may have occurred at the EELF, although SPL has not been found during past environmental investigations.

The EELF was investigated in 1991 as a test pit investigation (Technico Environmental Services 1991a) and in 2008 (URS 2008a) as a draft Remedial Investigation/Feasibility Study (RI/FS). The URS (2008a) investigation included excavation of 19 test pits, installation of 5 soil borings, and installation of 4 monitoring wells. Landfill wastes ranged in thickness from 2 to 19 ft and were encountered in most of the test pits at the site. The volume of landfill waste was estimated to be 35,380 cubic yards. Waste material encountered during the 2008 investigation consisted of construction debris (metal pipes, fiberglass siding, brick, plastic sheeting, asphalt, and concrete), smelter wastes (reportedly carbon briquettes), potential asbestos-containing material (siding, insulation), crushed metal drums, tires, and both gray and black fine-grained material that comprised about 60 to 70 percent of the waste encountered. The 2008 RI/FS report states that the gray waste material may be cryolite bath material and the black waste material may be carbon waste material (URS 2008a). Excavation and disposal was identified as the preferred remedial alternative in the draft RI/FS.

The Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) identified additional soil and landfill waste characterization and refinement of contaminated material volumes as data needs. The objectives of the RI field investigation are to determine: 1) the amount of listed K088 SPL waste at the EELF Area as well as other state and federal hazardous waste, and 2) the extent of COPC in site soils that underlie the wastes. These objectives were accomplished through implementation of a test pit sampling program and associated waste and soil sampling.

17.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The EELF is one of two SWMUs (i.e., SWMU 17 and SWMU 31) with RI data needs where there was a reasonable likelihood of encountering SPL, a listed hazardous waste, as well as other aluminum process wastes that include anode or other carbon waste, cryolite and alumina waste, and potential scrubber sludges. For this reason, a waste recognition, categorization, and sampling approach were developed for these two SWMUs that was included in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b; Tetra Tech 2011a).

Test pit excavations were used to qualitatively determine the type of wastes present in specific areas and to determine the lateral extent of wastes. The physical characteristics of encountered waste materials were described and used to categorize the wastes.

The team identified suspected SPL in the field based on the waste recognition, categorization, and logging procedures specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b); and the SPL waste recognition technical memorandum that was included as Appendix D of the Work Plan.

17.1.1 Initial RI Field Program

The fieldwork for SWMU 17 was conducted during late June 2016. The location of the test pits was based on historical investigation results and review of historical aerial photographs and drawings. A total of eight test pits were included in the EELF Area as shown in Figure 17-1. At one location, a boring was drilled using sonic drilling techniques in lieu of excavation due to the thickness of the concrete pad (which required coring).

The Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) had provision for excavation of up to four additional test pits based on the results of the initial locations. Field observation of the eight test pits indicated that the thickness and distribution of the landfill material was similar to the 2008 investigation, so the supplemental test pits were not excavated.

All excavations were backfilled with the excavated materials and compacted and graded using the excavator.

Legend

- RI Soil Boring Location
- RI Test Pit Location
- Well - WPA Soil Boring Location (SB-SE17 Area)
- East End Landfill

Imagery Source: NAIP 2017

Figure 17-1
SWMU 17
East End Landfill Area
RI and WPA Sampling Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

17.1.1.1 Waste Analytical Program

A sampling program was implemented consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) to characterize the wastes. The highest priority of sample collection was to identify probable SPL waste. Other types of aluminum process wastes were also sampled if they were found in significant quantities including anode wastes or other carbon wastes including anodes, briquettes, bag house dust, and unidentified carbon (particularly if they were mixed in with suspected pot liners), cryolite and alumina waste, and potential scrubber sludges.

A total of eight discrete waste samples were collected from the subsurface at the EELF. Chemical analyses of the wastes included: total cyanide, fluoride, SPLP fluoride and SPLP cyanide (one sample), sulfate, PAHs, PCBs, selected metals (Al, As, Cd, Cr, Cu, Fe Pb, Hg, Ni, Se, and Zn), TPH-Dx, Total Petroleum Hydrocarbons – Gasoline-extended range (TPH-Gx), and VOCs. Some suspected SPL samples were also analyzed for a geochemical suite (Na, Ca, Mg, Li, P, Si, Mn, Si, and total organic carbon). Consistent with the Work Plan, and depending on the suspected waste type, some samples were analyzed for a subset of the analyses listed above.

17.1.1.2 Soil Analytical Program

Soil samples were collected from beneath the encountered wastes at intervals approximately 1-ft and 3-ft below the wastes unless bedrock was encountered. In cases where no wastes were encountered, soil samples were collected from the excavation base. Soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Fe Pb, Hg, Ni, Se, and Zn), and petroleum hydrocarbon (TPH-Dx and TPH-Gx). A few samples were also analyzed for PCBs and VOCs.

17.1.2 WPA Field Investigation of SE17 Area

The SE17 Area was investigated as part of the WPA field investigation of the Plant Area AOC. The SE17 Area is located within the footprint of the EELF (SWMU 17), and the soil results are relevant to cleanup of the EELF as well as to the nearby scrubber effluent line. Results are summarized in this section as they are relevant to the EELF cleanup.

Boring SB-SE17 is located within the footprint of the EELF (SWMU 17) and near the scrubber effluent line that discharges at the head of NPDES Pond A. During the RI, black silty gravel and gravelly silt (likely smelter wastes) was found between 2.5 and 4.0 ft bgs as well as between 6 and 8 ft bgs. The boring was also found to be damp to wet from 15 to 24 ft bgs with basalt (likely bedrock contact) encountered a 24.0 to 25.0 ft bgs. This indicates that the base of the boring above the bedrock contact is potentially saturated. The scrubber effluent line may leak downstream of manhole MH18L4 where the redwood line joins the reinforced concrete pipe (RCP) and may contribute to water at the bedrock contact within the footprint of the EELF.

Soil analytical data for the SB-SE17 boring showed significantly elevated concentrations of PAHs, fluoride, and TPH-Dx for samples collected at 3.0 ft bgs and 6.0 ft bgs. Trichloroethene was also detected at elevated concentrations (maximum of 0.74 mg/kg) above the MTCA Method A Industrial Soil Cleanup Level of 0.03 mg/kg, as well as the MTCA Cleanup Level and Risk Calculation (CLARC) soil screening level for protection of groundwater of 0.025 mg/kg.

WPA Investigation objectives included the following:

- Characterization of soil chemical concentrations below the waste and above the bedrock contact (unless the waste directly overlies the bedrock).
- Verification of the presence of a saturated interval above the basalt bedrock contact (UA zone) at this location.
- Characterization of the occurrence of the BAU zone in this area.
- Characterization of the groundwater flow pattern in this area with comparison to the approximate scrubber effluent and other line elevations.
- Characterization of groundwater chemical concentrations.

The investigation scope included installation of two monitoring wells in this area: one completed in the UA zone and one completed in the BAU zone.

Soil samples were collected from beneath the wastes at 2 or 3 depth intervals depending on the soil thickness and analyzed for fluoride, sulfate, total cyanide, PAHs, petroleum hydrocarbons, and selected metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn). VOC soil samples were not collected as planned due to lack of positive soil headspace PID field screening results in the borings and sample volume limitations.

The UA zone well was installed immediately above the weathered basalt bedrock contact. Based on the SB-SE17 boring log the shallow zone UA zone (if present) should be found between 15 and about 24 ft bgs; damp to wet soils were found in this interval during drilling of SB SE17.

The BAU zone well was completed in the shallowest encountered water-bearing zone that is within the basalts. Based on nearby BAU zone wells, this zone was anticipated to occur at approximately 32 to 52 ft bgs based on well RI-MW10-BAU to as deep as 111 to 131 ft bgs based on well BAMW-3).

17.2 INITIAL RI AND WPA INVESTIGATION RESULTS

This section summarizes the results, including the waste distribution and field observations, waste analytical results, soil analytical results, and waste estimates. Soil samples and waste samples were collected in June 2016 and were received by the laboratory in good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. The initial RI analytical results for SWMU 17 are provided in Volume 5, Appendix H-1 and data validation reports are provided in Volume 5, Appendix I-1, respectively. WPA analytical results and data validation reports for SWMU 17 are provided in Volume 5, Appendix H-3 and I-3, respectively. Refer to Volume 1, Section 6 for a summary of the data quality assessment performed for the RI and WPA. Test pit and boring logs for the RI and WPA are included in Volume 5, Appendix B-17.

Waste and soil analytical results have been screened against MTCA Method A Industrial screening levels (petroleum hydrocarbons only), MTCA Method C screening levels, MTCA-derived soil screening levels protective of groundwater, and terrestrial ecological screening levels for wildlife protection. Background concentrations are also included in the data summary tables for comparison.

17.2.1 Waste Description and Occurrence

Figure 17-2 shows the occurrence of aluminum smelter-related wastes encountered during the RI excavation program. Carbon wastes were found at five of the eight station locations. The team identified suspected SPL and other aluminum smelter-related wastes in the field based on the waste recognition, categorization, and logging procedures specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b); and including the SPL waste recognition technical memorandum. Test pit logs summarizing the encountered wastes and soil types are included in Volume 5, Appendix B-17(A).

Legend

- RI Soil Boring Location
- RI Test Pit Location
- Well
- East End Landfill

Carbon waste interval including intermixed suspected spent pot liner (SPL) 1.5-7.0 feet bgs

N W E S

0 50 100 200

Feet

Imagery Source: NAIP 2017

Figure 17-2
SWMU 17
East End Landfill Area
Waste Distribution

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

R:\projects_2011\LockheedMartin_GoldendaleSiteInvestig\maps\2021_Combined_RI_WPA\Figure_17-2_SWMU_17_Waste_Distribution.mxd

The carbon wastes present at the site include a variety of types (the carbon wastes appeared to be mixed in with solid wastes and not segregated) including suspected SPL, anode blocks, and other types of carbon wastes that could not be conclusively identified. Tar and pitch were observed in test pits as well as in the John Day Dam Road embankment. Some suspected alumina and cryolite wastes were also found, but these did not appear to represent a significant amount of the overall waste volume in this area.

The aluminum reduction wastes were mixed in with solid wastes including: bricks, concrete blocks, metal strapping, metal pipes, small metal sheets, cables, rugs, hoses, plastic sheeting, rebar, fiberglass, and wood debris.

Based on the RI test pit program, aluminum smelter wastes appeared to make up the majority of the landfill material (about 60 to 75 percent). This estimate is like the 2008 investigation findings.

One of the objectives of the RI field program was to verify the extent of the landfill material that was originally characterized during the 2008 investigation. Confirmation of the northern landfill boundary was a specific objective of the RI field investigation. The northern extent of the landfill wastes was confirmed based on SWMU17-SB2, SWMU17-TP3, and SWMU17-TP4.

17.2.2 Waste Analytical Results Summary

- Carbon wastes were found at 5 of the 8 station locations. A description of each waste sample is included in Table 17-1 along with a summary of the analytical results. Figure 17-3 shows exceedances of screening levels for the sampled wastes. Photographs of the collected waste samples are provided in Volume 5, Appendix B-17(B). The carbon wastes present at the site include a variety of types (the carbon wastes appeared to be mixed in with solid wastes and not segregated) including suspected SPL, anode blocks, and other types of carbon wastes that could not be conclusively identified. Some suspected alumina and cryolite wastes were also found, but these did not appear to represent a significant amount of the overall waste volume in this area.

- Total cyanide was not detected in any of the collected samples. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.

- cPAH concentrations exceed MTCA Method C screening levels in all of the waste samples that were analyzed for PAHs (four of the eight samples). Two of the waste samples also exceeded the Washington State Dangerous Waste Persistence criteria of 10,000 mg/kg (1 percent) for PAHs.

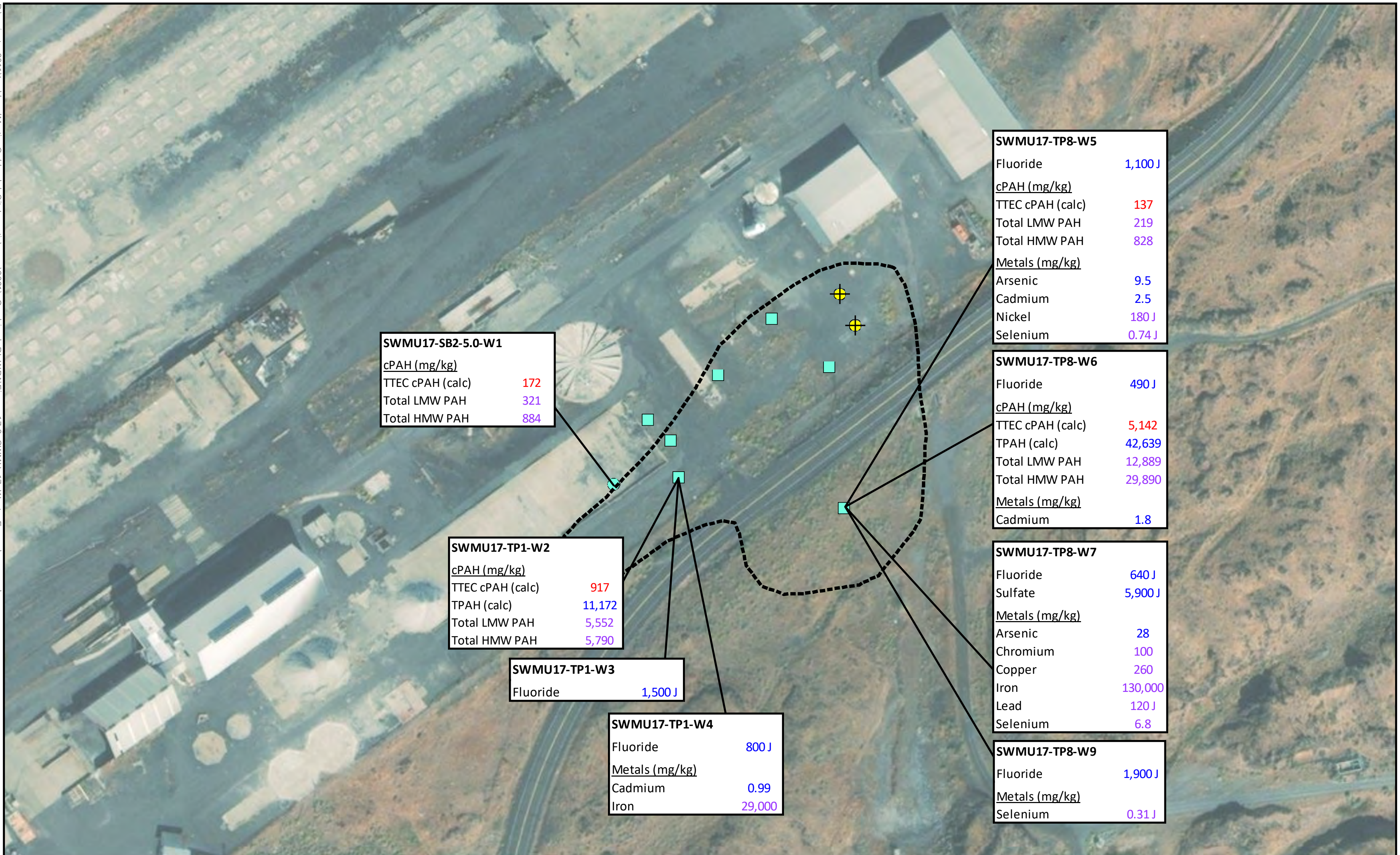
Table 17-1
SWMU 17 - East End Landfill Waste Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Washington Dangerous Waste Persistence Criteria	Analytical Results: SWMU17-SB2-5.0-W1 6/28/2016	SWMU17-TP1-W2 6/29/2016	SWMU17-TP1-W3 6/29/2016	SWMU17-TP1-W4 6/29/2016	SWMU17-TP8-W5 6/29/2016	SWMU17-TP8-W6 6/29/2016	SWMU17-TP8-W7 6/29/2016	SWMU17-TP8-W9 6/29/2016
Waste Description									Suspected Non-SPL Carbon Waste, Black, Fine (Silty Sand)	Suspected Non-SPL Carbon Waste, Dark Brown to Black, Blocky, Friable, Non-dense, with Orange Secondary Minerals and Yellow-Green Hue in Some Areas	Suspected Alumina/Cryolite Waste, Dense, White, Cemented to Carbon, Suspected "Tap Out"	Suspected SPL, medium dense, steel gray, with brown, rust-red, orange-yellow, and white secondary minerals	Suspected non-SPL Carbon Waste, Dark Gray to Black, Fine-Grained (Silty Sand)	Suspected SPL, Steel Gray, Formed into Brick Shape with Wavy Surface Texture, may be "Second Cut" (Refractory Carbon) SPL	Suspected SPL, Dark Brown to Black, Blocky, Friable, Non-dense, with Orange Secondary Minerals (Similar in appearance to NESI-W8 and NESI-W12)	Suspected SPL, Steel Gray to Black, Dense, with White Secondary Mineralization
Aluminum Smelter																
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	--	2.1 UJ	2.1 U	NA	2 U	2.4 U	1.7 U	2 U	1.9 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	--	35 J	46 J	**1,500 J**	**800 J**	**1,100 J**	**490 J**	**640 J**	**1,900 J**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	--	NA	NA	NA	910 J	NA	NA	**5,900 J**	550 J
SPLP Flouride	mg/L	NA	NE	NE	NE	NE	NE	--	4.2	4	410	20	170	95	190	340
Polycyclic Aromatic Hydrocarbons (PAHs)																
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	--	**1.2**	**170**	NA	NA	**1.6**	**140**	NA	NA
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	--	1.6	**240**	NA	NA	**2.2**	**210**	NA	NA
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	--	12	**610**	NA	NA	8.1	**650**	NA	NA
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	--	3.8	12	NA	NA	0.23	8.7	NA	NA
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	--	27	410	NA	NA	13	630	NA	NA
Benz[a]anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	--	87	680	NA	NA	79	3,300	NA	NA
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	--	130	650	NA	NA	97	3,800	NA	NA
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	--	140	850	NA	NA	140	4,300	NA	NA
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	--	97	510	NA	NA	92	2,700	NA	NA
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	--	69	350	NA	NA	54	2,100	NA	NA
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	--	100	730	NA	NA	130	4,300	NA	NA
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	--	12	120	NA	NA	17	390	NA	NA
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	--	170	**1,600**	NA	NA	130	**7,200**	NA	NA
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	--	9.6	**360**	NA	NA	4.2	**320**	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	--	99	600	NA	NA	99	2,900	NA	NA
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	--	**14**	**150**	NA	NA	3.3	**230**	NA	NA
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	--	96	2,000	NA	NA	56	3,500	NA	NA
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	--	150	**1,300**	NA	NA	120	**6,100**	NA	NA
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	--	**172**	**917**	NA	NA	**137**	**5,142**	NA	NA
Total PAHs (calc)	mg/Kg	NE	130	NE	NE	10,000	NE	10,000	1,204	**11,172**	NA	NA	1,045	**42,639**	NA	NA
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	--	**321**	**5,552**	NA	NA	**219**	**12,889**	NA	NA
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	--	**884**	**5,790**	NA	NA	**828**	**29,890**	NA	NA
Metals																
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	--	380 J	78 J	NA	1,700 J	50,000 J	1,200 J	36,000 J	20,000 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	--	0.2 J	0.62	NA	1.4	**9.5**	0.24	**28**	1.4
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	--	0.089 J	0.78	NA	**0.99**	**2.5**	**1.8**	0.64	0.1
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	--	1.1	1.8	NA	15	24	0.86	**100**	6.8
Copper	mg/Kg	NA	140,000	217	280	217	28.4	--	1.3 B	4.4	NA	27	47	0.36 B	**260**	21
Iron	mg/Kg	NE	2,500,000	NE	5,600	5,600	NE	--	NA	NA	NA	**29,000**			**130,000**	4,800
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	--	2.4 J	4.1 J	NA	6.9 J	58 J	3.8 J	**120 J**	7.9 J
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	--	0.006 U	0.005 U	NA	0.0079 J	0.048	0.0058 U	0.029	0.0061 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	--	3.9 J	0.62 J	NA	14 J	**180 J**	2.3 J	75 J	25 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	--	0.099 U	0.23 J	NA	0.17 J	**0.74 J**	0.093 U	**6.8**	**0.31 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	--	5.8	6.1	NA	8.8	38	6.5	70	14

Table 17-1
SWMU 17 - East End Landfill Waste Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 2 of 2)

				Ecological Indicator					Analytical Results							
									SWMU17-SB2-5.0-W1 6/28/2016	SWMU17-TP1-W2 6/29/2016	SWMU17-TP1-W3 6/29/2016	SWMU17-TP1-W4 6/29/2016	SWMU17-TP8-W5 6/29/2016	SWMU17-TP8-W6 6/29/2016	SWMU17-TP8-W7 6/29/2016	SWMU17-TP8-W9 6/29/2016
									Waste Description							
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Washington Dangerous Waste Persistence Criteria	Suspected Non-SPL Carbon Waste, Black, Fine (Silty Sand)	Suspected Non-SPL Carbon Waste, Dark Brown to Black, Blocky, Friable, Non-dense, with Orange Secondary Minerals and Yellow-Green Hue in Some Areas	Suspected Alumina/Cryolite Waste, Dense, White, Cemented to Carbon, Suspected "Tap Out"	Suspected SPL, medium dense, steel gray, with brown, rust-red, orange-yellow, and white secondary minerals	Suspected non-SPL Carbon Waste, Dark Gray to Black, Fine-Grained (Silty Sand)	Suspected SPL, Steel Gray, Formed into Brick Shape with Wavy Surface Texture, may be "Second Cut" (Refractory Carbon) SPL	Suspected SPL, Dark Brown to Black, Blocky, Friable, Non-dense, with Orange Secondary Minerals (Similar in appearance to NESI-W8 and NESI-W12)	Suspected SPL, Steel Gray to Black, Dense, with White Secondary Mineralization
Geo Chemistry																
Sodium	mg/Kg	NE	NE	NE	NE	NE	NE	--	43 U	49 J	NA	790	24,000	840	3,200	32,000
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	430	NA	NA	5,300	870
Magnesium	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	100 U	NA	NA	660	260
Lithium	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	1 U	NA	NA	13	11
Phosphorus	mg/Kg	NE	70	NE	NE	70	NE	--	NA	NA	NA	13	NA	NA	31	4.1
Silicon	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	15	NA	NA	44	29
Manganese	mg/Kg	NE	160,000	NE	970	970	NE	--	NA	NA	NA	99	NA	NA	440	49
Total Organic Carbon	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	720,000	NA	NA	480,000	610,000
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	3,300	NA	NA	12,000	920
Quartz	mg/Kg	NE	NE	NE	NE	NE	NE	--	NA	NA	NA	33	NA	NA	93	61

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration



Legend

- RI Soil Boring Location
- RI Test Pit Location
- Well
- East End Landfill

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)
Waste samples were not collected at un-labelled test pits and borings.

N W E S

0 50 100 200
Feet

Figure 17-3
SWMU 17
East End Landfill Area
Waste Sampling Locations and
Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Fluoride was detected at concentrations above the soil screening level for protection of groundwater of 147.6 mg/kg in 5 of 8 waste samples (maximum of 1,900 J mg/kg).
- The SPLP fluoride leachate concentrations for the waste samples ranged from 4 mg/L to 410 mg/L, which are all above the groundwater MCL for fluoride.
- Sulfate was detected (550 J to 5,900 J mg/kg) in the three analyzed waste samples. The maximum detected concentration exceeded the MTCA-derived soil screening level of 2,150 mg/kg for protection of groundwater.
- For metals, arsenic, cadmium, chromium, copper, iron, lead, nickel, and selenium were detected in the wastes above MTCA-derived soil screening levels for protection of groundwater and/or terrestrial ecological screening levels for protection of wildlife, as well as soil background concentrations.

A hypothesis during Work Plan development was that the SPL waste would likely contain elevated concentrations of cyanide, fluoride, aluminum and sodium relative to non-SPL carbon waste. It was also hypothesized that the suspected SPL might be characterized by lower PAH concentrations than the anode wastes due to the lower percentages of pitch and coke used in the SPL. However, these trends could not be completely demonstrated in the EELF waste data set. In general, the suspected SPL samples were characterized by higher fluoride, aluminum, and sodium concentrations than the suspected non-SPL carbon waste concentrations. There was no clear PAH distribution between the carbon waste types. In some cases, it was challenging to reliably distinguish suspected SPL from other carbon wastes based on field observations given the large variety in appearance of the carbon wastes.

A range of SPL composition percentages was included in the pot liner waste definition and recognition memorandum included in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). However, the cited ranges for the wastes in the memorandum were broad, and in some cases the reported percentages for the SPL (e.g., fluoride, aluminum, and sodium) were significantly greater than the maximum results for the sampled waste. The following additional factors also complicated comparison between the reported percentages for SPL and the site data: 1) total cyanide was not detected in any of the waste samples from the EELF, 2) composition percentages of anodes and other aluminum smelter wastes types (e.g., anodes, bag house dust, briquettes) are not documented, and 3) not all of the samples were analyzed for the same chemicals [this sampling approach was consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) sampling program]. These factors also apply to the waste samples collected at SWMU 31, Smelter Sign Area (SSA).

17.2.3 Soil Analytical Results Summary

Soil samples were collected from below the wastes consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). In one case (SWMU17-TP8), the wastes were underlain by basalt bedrock, and accordingly soil samples were not collected. Soil sample chemical results are summarized in Table 17-2. Figure 17-4 shows exceedances of soil screening levels. In general, soil concentrations were significantly lower than the waste concentrations.

Soil chemical results are summarized as follows:

- Total cyanide was not detected in any of the collected samples. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.
- Fluoride was detected at low concentrations (2 J to 77 J mg/kg) below the MTCA-derived soil for protection of groundwater screening level of 147.6 mg/kg.
- The MTCA Method A and C Industrial screening level for PAHs was not exceeded in any of the collected soil samples. PAH concentrations were above soil screening levels for protection of wildlife of 1.1 mg/kg as HMW PAH in 5 of 12 samples.
- Sulfate was detected at concentrations ranging from (7.5 J to 1,500 J mg/kg), but below the MTCA-derived soil screening level for protection of groundwater of 2,150 mg/kg.
- PCBs were not detected.
- For metals, concentrations of arsenic (maximum of 9.8 J mg/kg) exceeded the MTCA-derived soil screening level for protection of groundwater and background concentration of 7.61 mg/kg in 2 of 12 soil samples.
- Low concentrations of gasoline (maximum of 2.4 J mg/kg), diesel (maximum of 260 mg/kg), and motor oil (maximum of 1,300 mg/kg) were detected in soils below MTCA Method A Industrial TPH-screening levels.
- VOCs [benzene, toluene, ethylbenzene, and total xylenes (BTEX) and common chlorinated solvent constituents] were not detected.

The results show that the contaminants in the wastes have not migrated significantly into soils below the wastes in most areas. These results are similar to findings of the URS (2008a) investigation. In the 2008 investigation, PAH concentrations for one of 13 soil samples collected beneath the wastes exceeded MTCA Method C screening levels. Oil-range petroleum hydrocarbons exceeded the MTCA Method A Industrial soil screening level in one of 13 soil samples collected below the wastes.

Table 17-2
SWMU 17 - East End Landfill Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 1 of 2)

				Ecological Indicator				Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU17-SB2-8.5 6/28/2016	SWMU17-SB2-11.5 6/28/2016	SWMU17-TP1-8.0 6/29/2016	SWMU17-TP3-3.0 6/29/2016	SWMU17-TP50-3.0 (Duplicate of SWM17-TP3-3.0) 6/29/2016	SWMU17-TP3-5.5 6/29/2016	SWMU17-TP4-5.0 6/29/2016	SWMU17-TP5-2.5 6/29/2016	SWMU17-TP5-6.0 6/29/2016	SWMU17-TP6-2.0 6/30/2016	SWMU17-TP6-8.0 6/30/2016	SWMU17-TP7-18.0 6/29/2016
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.3 U	2.3 U	2.3 UJ	2.1 UJ	2.1 UJ	2.3 UJ	2.3 UJ	2.2 UJ	2.3 UJ	2.2 U	2.2 U	2.3 UJ
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	80	63	40 J	24 J	24 J	52 J	77 J	11 J	2.1 J	33	21	2 J
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	9.1 J	7.5 J	190	13	10 J	160	160	42	13	6.8 J	6.6 J	1,500 J
Polycyclic Aromatic Hydrocarbons (PAHs)																			
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	**0.44**	0.0013 J	0.00076 U	0.00059 UJ	0.023 J	0.0018 J	0.00061 U	0.00058 U	0.00062 U	0.011	0.0017 J	0.0057
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.84	0.0025 J	0.00054 U	0.00042 UJ	0.034 J	0.0025 J	0.00043 U	0.0013 J	0.00044 U	0.012	0.0023 J	0.0075
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	1.3	0.011	0.00073 U	0.0034 J	0.092 J	0.021	0.014	0.0084	0.00059 U	0.068	0.013	0.019
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.015	0.00052 U	0.0006 U	0.00047 U	0.0005 U	0.0005 U	0.0029 J	0.00046 U	0.00049 U	0.0022 J	0.00053 U	0.002 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.43	0.0081	0.00073 U	0.0052 J	0.072 J	0.03	0.046	0.009	0.00059 U	0.11	0.011	0.016
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.43	0.01	0.00092 U	0.028 J	0.2 J	0.12	0.15	0.084	0.0046 J	0.65	0.093	0.067
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.3	0.0073	0.00048 U	0.041 J	0.25 J	0.17	0.67	0.12	0.0044 J	0.8	0.12	0.075
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.38	0.01	0.00071 U	0.048 J	0.3 J	0.18	1.1	0.17	0.0078	1	0.17	0.097
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.19	0.0051 J	0.0006 U	0.033 J	0.19 J	0.12	0.58	0.094	0.0044 J	0.67	0.11	0.058
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.12	0.0036 J	0.00073 U	0.023 J	0.13 J	0.08	0.25	0.065	0.0023 J	0.42	0.071	0.042
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.38	0.0097	0.0018 U	0.037 J	0.23 J	0.15	0.34	0.12	0.0063	0.78	0.12	0.084
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.031	0.00074 U	0.00087 U	0.004 J	0.023 J	0.015	0.058	0.013	0.0007 U	0.099	0.015	0.0081
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	1.4	0.028	0.0017 U	0.048 J	0.43 J	0.21	0.28	0.13	0.0086	1.2	0.15	0.13
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.67 J	0.011 J	0.0006 U	0.00047 UJ	0.039 J	0.013	0.01	0.0035 J	0.00049 U	0.024	0.0039 J	0.0099
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.24	0.0058	0.00073 U	0.033 J	0.21 J	0.13	0.52	0.1	0.0045 J	0.74	0.12	0.063
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	1.4 J	0.002 UJ	0.002 UJ	0.0021 U	0.0017 U	0.0019 U	0.0017 U	0.0019 U	0.0017 U	0.00097 UJ	0.0018 UJ	0.0016 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	2.4	0.043	0.0019 J	0.023 J	0.36 J	0.12	0.14	0.053	0.0045 J	0.43	0.061	0.083
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	1	0.022	0.0012 U	0.043 J	0.35 J	0.18	0.36	0.12	0.007	1.1	0.14	0.11
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.4239	0.010374	0.000447	0.05497	0.3386	0.224	0.8812	0.1644	0.006418	1.0987	0.1681	0.10355
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	1.4	0.1071	0.0019	0.0809	1.17	0.4039	0.4944	0.207	0.016	1.8722	0.2474	0.2891
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**3.071**	0.0735	0.00048 U	0.29	**1.883**	**1.145**	**4.028**	0.886	0.0413	**6.259**	0.959	0.6041
Polychlorinated Biphenyls (PCBs)																			
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0079 U	0.0077 U	0.008 U	0.0082 U	0.0083 U	0.0079 U	0.0081 U	0.008 U	0.0074 U	0.0068 U	0.0088 U	0.0084 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0045 U	0.0044 U	0.0045 U	0.0046 U	0.0047 U	0.0045 U	0.0046 U	0.0045 U	0.0042 U	0.0039 U	0.005 U	0.0047 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0052 U	0.0051 U	0.0053 U	0.0054 U	0.0055 U	0.0053 U	0.0054 U	0.0053 U	0.0049 U	0.0045 U	0.0058 U	0.0055 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0017 U	0.0017 U	0.0017 U	0.0018 U	0.0018 U	0.0017 U	0.0018 U	0.0017 U	0.0016 U	0.0015 U	0.0019 U	0.0018 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0031 UJ	0.003 UJ	0.0031 U	0.0032 U	0.0032 U	0.0031 U	0.0032 U	0.0031 U	0.0029 U	0.0027 U	0.0034 U	0.0033 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	0.0016 U	0.0016 U	0.0016 U	0.0017 U	0.0017 U	0.0016 U	0.0016 U	0.0016 U	0.0015 U	0.0014 U	0.0018 U	0.0017 U
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.002 U	0.002 U	0.0021 U	0.0021 U	0.0021 U	0.002 U	0.0021 U	0.002 U	0.0019 U	0.0018 U	0.0025 J	0.0021 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00053 U	0.00052 U	0.00054 UJ	0.00055 UJ	0.00056 UJ	0.00054 UJ	0.00055 UJ	0.00054 UJ	0.0005 UJ	0.00046 U	0.00059 U	0.00057 UJ
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00096 U	0.00093 U	0.00097 U	0.00099 U	0.001 U	0.00097 U	0.00099 U	0.00097 U	0.0009 U	0.00083 U	0.0011 U	0.001 U
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.00053 U	0.00052 U	0.00054 UJ	0.00055 UJ	0.00056 UJ	0.00054 UJ	0.00055 UJ	0.00054 UJ	0.0005 UJ	0.00046 U	0.0025	0.00057 UJ
Metals																			
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	7,100 J	7,800 J	11,000	6,600 J	8,400 J	9,100	7,900	8,200	11,000	9,400	7,400	13,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4 J	**9.8 J**	**8.6**	2.9	2.7	2.8	5	1.2	3.8	2.3	1.5	3.5
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.19 J	0.23 J	0.19	0.17 J	0.29 J	0.2	0.24	0.26	0.24	0.27	0.2	0.25
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	8.5 J	10 J	15	7.4	6.2	11	8.8	2.7	15	5.1	5	18
Copper	mg/Kg	NA	140,000	217	280	217	28.4	21 J	15 J	19 J	13 J	19 J	13 J	15 J	16 J	17 J	17	17	18 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	6 J	8.8 J	6	6.7 J	5.3 J	5.2	6.6	3.7	6.1	4.6	3.5	6.1
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.011 J	0.012 J	0.0077 J	0.013 J	0.0062 U	0.0076 J	0.0065 U	0.0065 U	0.017 J	0.0061 U	0.0064 U	0.0081 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	9.5 J	11 J	14	7.8	8.6	9.8	9.9	4.2	11	6.5	6.5	13
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.64 J**	**0.57 J**	**0.68**	**0.72 J**	**0.91 J**	**0.66**	**0.88**	**0.95**	**0.85**	**0.86**	**0.88**	**0.81**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	45 J	46 J	45	46	53	45	50	47	51	46	46	53

Table 17-2
SWMU 17 - East End Landfill Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU17-SB2-8.5 6/28/2016	SWMU17-SB2-11.5 6/28/2016	SWMU17-TP1-8.0 6/29/2016	SWMU17-TP3-3.0 6/29/2016	SWMU17-TP50-3.0 (Duplicate of SWM17-TP3-3.0) 6/29/2016	SWMU17-TP3-5.5 6/29/2016	SWMU17-TP4-5.0 6/29/2016	SWMU17-TP5-2.5 6/29/2016	SWMU17-TP5-6.0 6/29/2016	SWMU17-TP6-2.0 6/30/2016	SWMU17-TP6-8.0 6/30/2016	SWMU17-TP7-18.0 6/29/2016
Total Petroleum Hydrocarbons (TPHs)																			
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	2.4 J	0.59 U	0.56 U	0.98 U	0.6 U	0.64 U	0.59 U	0.62 U	0.48 U	1.8 J	0.68 J	0.56 U
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	40	12 U	13 U	10 U	12 U	12 U	12 U	12 U	11 U	15 J	260	12 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	37 J	9.9 U	15 J	43 J	14 J	24 J	52 J	10 J	16 J	63	1,300	27 J
Volatile Organic Compounds (VOCs)																			
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	0.00028 UJ	0.0003 U	0.00033 UJ	0.00035 U	0.00029 U	0.00031 U	0.00029 U	0.00032 U	0.00029 U	0.00016 UJ	0.0003 UJ	0.00026 U
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	0.00028 UJ	0.0003 U	0.00033 UJ	0.00035 U	0.00029 U	0.00031 U	0.00029 U	0.00032 U	0.00029 U	0.00016 UJ	0.0003 UJ	0.00026 U
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	0.00038 UJ	0.0004 U	0.00043 UJ	0.00047 U	0.00038 U	0.00042 U	0.00038 U	0.00043 U	0.00038 U	0.00022 UJ	0.00039 UJ	0.00035 U
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	0.00019 UJ	0.0002 U	0.00022 UJ	0.00024 U	0.00019 U	0.00021 U	0.00019 U	0.00022 U	0.00019 U	0.00011 UJ	0.0002 UJ	0.00017 U
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	0.00024 UJ	0.00026 U	0.00028 UJ	0.00031 U	0.00025 U	0.00027 U	0.00025 U	0.00028 U	0.00025 U	0.00014 UJ	0.00026 UJ	0.00023 U
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	0.00028 UJ	0.0003 U	0.00033 UJ	0.00035 UJ	0.00029 UJ	0.00031 UJ	0.00029 UJ	0.00032 UJ	0.00029 UJ	0.00016 UJ	0.0003 UJ	0.00026 UJ
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	0.00014 UJ	0.00015 U	0.00016 UJ	0.00018 U	0.00014 U	0.00016 U	0.00014 U	0.00016 U	0.00014 U	0.000081 UJ	0.00015 UJ	0.00013 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	0.00028 UJ	0.0003 U	0.00033 UJ	0.00035 U	0.00029 U	0.00031 U	0.00029 U	0.00032 U	0.00029 U	0.00016 UJ	0.0003 UJ	0.00026 U
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	0.00038 UJ	0.0004 U	0.00043 UJ	0.00047 U	0.00038 U	0.00042 U	0.00038 U	0.00043 U	0.00038 U	0.00022 UJ	0.00039 UJ	0.00035 U
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	0.00028 UJ	0.0003 U	0.00033 UJ	0.00035 U	0.00029 U	0.0005 J	0.00029 U	0.00032 U	0.00029 U	0.00016 UJ	0.00031 J	0.00026 U
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	0.00028 UJ	0.0003 U	0.00033 UJ	0.00035 UJ	0.00029 UJ	0.00031 UJ	0.00029 UJ	0.00032 UJ	0.00029 UJ	0.00016 UJ	0.0003 UJ	0.00026 UJ

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

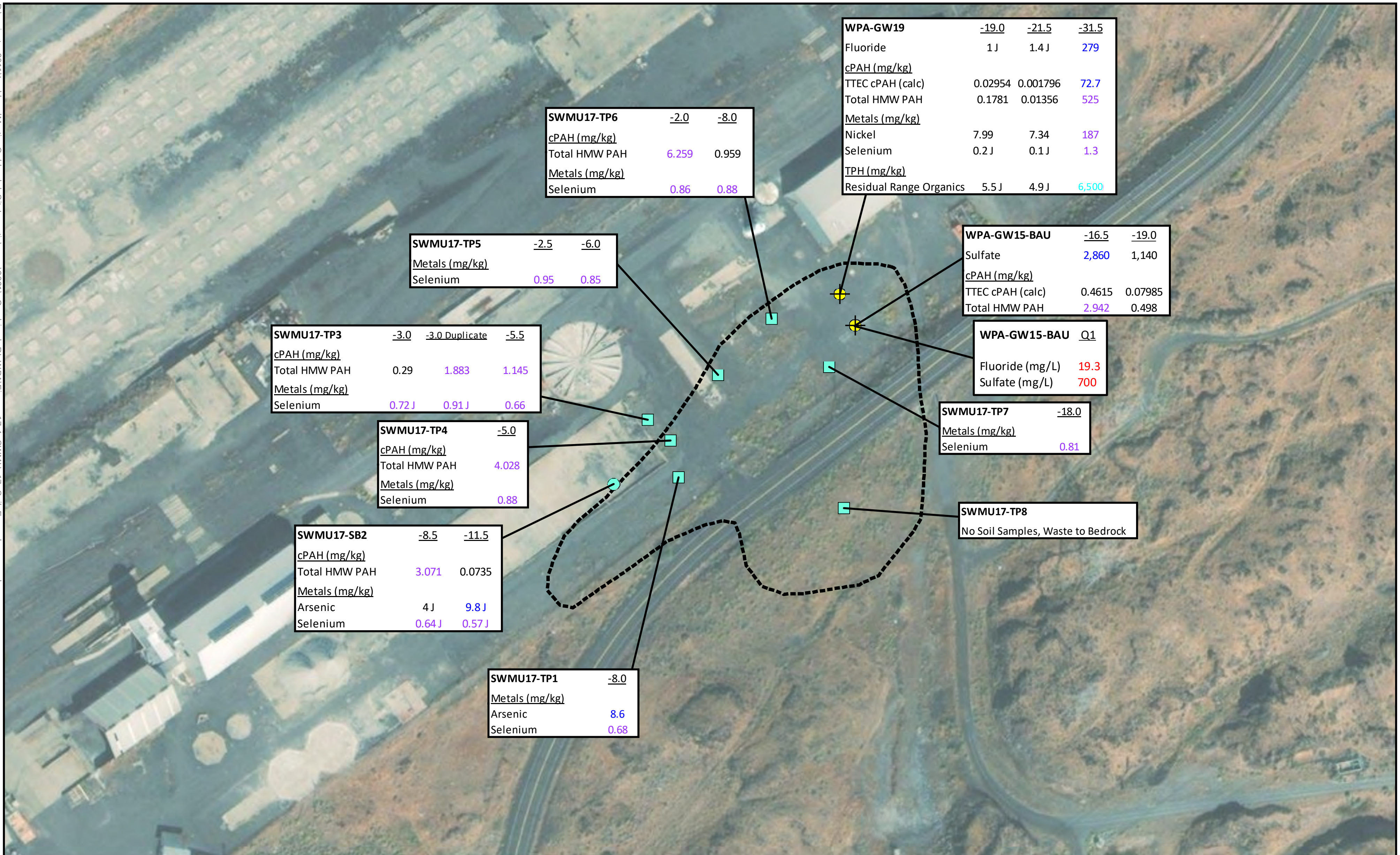
J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds



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Legend

RI Soil Boring Location

RI Test Pit Location

Well

East End Landfill

red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N
W E
S

0 50 100 200
Feet

Imagery Source: NAIP 2017

Figure 17-4
SWMU 17
East End Landfill Area
Soil Sampling Locations and
Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

17.2.4 SE17 Area Results

During the WPA field mobilization, 5 soil samples were collected during drilling of the two wells [WPA-GW15-BAU and WPA-GW19 (which was dry)] in the SB-SE17/EELF. There was about 11.5 ft of mixed smelter waste extending from the ground surface at WPA-GW15-BAU and about 4 ft of mixed smelter waste at the WPA-GW19. Bedrock was found at about 32-33 ft bgs at both locations.

Two soil samples were collected below the waste at WPA-GW15-BAU and at three samples were collected below the waste at WPA-GW19. These results are summarized in Table 17-3 and shown on Figure 17-4. In this area, the results show that the soil contamination extends below the waste at both locations:

- At WPA-GW15-BAU, elevated sulfate concentrations (2,860 mg/kg) above sulfate screening levels for protection of groundwater were found at WP-GW15 at a depth of 16.5 ft bgs (about 4.5 ft below the waste) at this location. The underlying sample from 19.0 ft bgs did not have chemical concentrations above screening levels.
- At WPA-GW19, at a depth of 31.5 ft bgs, PAHs, fluoride, TPH-residual range (heavy oil) nickel, and arsenic exceeded soil screening levels for protection of groundwater or MTCA Method A Industrial Levels in the case of petroleum hydrocarbons. This sample was collected from immediately above bedrock and the soils were moist to wet, black, and greasy; however, there was no odor or elevated PID soil headspace.

The base of the scrubber effluent line in this area was about 23.5 ft bgs (refer to Volume 3, Section 2). Leakage from the line or the surrounding fill material could be a source of shallow water (damp to wet soil conditions above the bedrock contact) in this location.

WPA-GW19 was completed with the screen interval immediately above the basalt bedrock contact and no water accumulated in the well. WPA-GW15-BAU was completed in a permeable, discrete fracture zone within the top of basalt (screen interval of 37.9 to 47.9 ft bgs). Analytical results for this well show fluoride (19.3 mg/L) above the 4.0 mg/L MCL and 0.96 mg/L MTCA Method B screening level, sulfate (700 mg/L) was detected above the Secondary MCL of 250 mg/L, and total cyanide (0.06 mg/L) was detected above the MTCA Method B screening level of 0.0096 mg/L for free cyanide. Free cyanide concentrations were below this screening level.

Table 17-3
SWMU 17 - East End Landfill WPA Soil Results Summary
SB-SE17 Area
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2020

				Ecological Indicator				Analytical Results				
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	WPA-GW15-BAU-16.5 12/1/2020	WPA-GW15-BAU-19.0 12/1/2020	WPA-GW19-19.0 12/2/2020	WPA-GW19-21.5 12/2/2020	WPA-GW19-31.5 12/2/2020
Aluminum Smelter												
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.07 U	0.07 U	0.69
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	99.4 J	11.2 J	1 J	1.4 J	**279**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	**2,860**	1,140	2.9	3.7	16.8
Polycyclic Aromatic Hydrocarbons (PAHs)												
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0044 J	0.0026 B	0.001 J	0.0004 U	0.021 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.017	0.0049 J	0.0041 J	0.00032 U	0.02 J
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00065 J	0.00042 J	0.0003 U	0.0003 U	0.045 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.034	0.0071	0.0061	0.00031 U	1.4
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.31	0.052	0.021	0.0016 B	24
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.31	0.055	0.021	0.0011 J	40
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.57	0.094	0.03	0.0025 J	190
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.29	0.046	0.015	0.0014 J	58
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.2	0.032	0.012	0.00087 J	30
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.43	0.075	0.023	0.002 J	100
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.072	0.012	0.0031 J	0.00029 J	13
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.45	0.081	0.042	0.0025 J	15
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0094	0.0047 J	0.0025 J	0.00061 U	0.079 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.32	0.051	0.017	0.0015 J	60
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0054	0.0021 B	0.0015 B	0.00062 B	0.029 B
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.19	0.034	0.031	0.0013 J	1.8
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.44	0.081	0.036	0.0023 B	9.5
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.0093	0.0034 J	0.0026 J	0.00064 U	0.11 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.4615	0.07985	0.02954	0.001796	**72.7**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.71085	0.13682	0.0882	0.00442	18.394
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**2.942**	0.498	0.1781	0.01356	**525**
Metals												
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	7,840	5,030	5,990	5,820	5,210
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.07	1.5	2.56	2.87	5.11
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.113	0.089	0.111	0.113	0.409
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	6.72	5	6.29	6.89	7.62
Copper	mg/Kg	NA	140,000	217	280	217	28.4	17.8	13.2	16.3	15.5	24.7
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	3.92	3.45	4.98	4.44	72.6
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.002 U	0.002 U	0.002 U	0.002 U	0.007 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	11.7	4.7	7.99	7.34	**187**
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	0.2 J	0.2 J	0.2 J	0.1 J	**1.3**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	53.2	41.4	58	48.2	46.1
Total Petroleum Hydrocarbons (TPHs)												
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	21 J	6.8 J	3.3 J	2.5 J	540
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	64 J	13 J	5.5 J	4.9 J	**6,500**

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

These results suggest that some waste constituents may leaching out of the waste and accumulating at the bedrock contact at this location. This finding contrasts with most of the RI results, which have shown that at several locations the soils underlying the waste generally become less impacted a short vertical distance below the waste.

An evaluation of the interactions of the underground lines (including the scrubber effluent lines) and shallow groundwater is summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

17.2.5 Estimated Waste Volumes

Figure 17-5 is a map that shows the thickness and lateral extent of landfilled aluminum smelter-related wastes at the EELF. The map shows that maximum waste thicknesses of about 15 ft occurring on both sides of John Day Dam Road. Field observations of the road embankment suggests that the wastes underlie John Day Dam Road. The volumes have been adjusted to account for field observations in the SE17 investigation area as well as the EELF slopes above NPDES Pond A.

Volume 5, Appendix B-17(C) presents the calculations for the waste volumes. The calculated bulk volume of landfill waste is estimated at 37,723 cubic yards and approximately 67,901 tons.

17.3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions regarding the EELF (SWMU 17) are summarized as follows:

- Carbon wastes, including suspected SPL, were found at all of test pit and boring locations where wastes were encountered. Suspected SPL was mixed in with carbon block anode wastes, other aluminum smelter-related wastes, and solid wastes. It appears that the suspected SPL may represent the minority of the carbon wastes encountered. However, it does not appear that the aluminum smelter-related waste types can be readily segregated.

- A significant thickness of landfill materials (about 15 ft) appears to extend beneath John Day Dam Road, and overlies the scrubber effluent system RCP extension from MH18L4 to Pond A. Remedial alternatives will need to address this finding.

- The waste geochemistry sample results were not completely reliable in distinguishing suspected SPL from other carbon wastes.

Legend

- Test Pit Location
- Soil Boring Location
- Historic Test Pit (URS 2008a)
- Monitoring Well
- Drainage Line From Plant Plans
- Slope Break From Plant Plans
- 7.5-foot Waste Thickness Contour Interval
- Extent of Waste
- East End Landfill

Carbon waste interval including intermixed suspected spent pot liner (SPL) 1.5-7.0 feet bgs

N W E S

0 50 100 200

Feet

Imagery Source: NAIP 2017

Figure 17-5
SWMU 17
East End Landfill Area
Test Pit Locations and Waste Thickness

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- A minority of the sampled carbon wastes exceeded the Washington State Dangerous Waste Persistence Criteria for PAHs of one percent. It doesn't appear that wastes exceeding these criteria can be reliably determined based on field observations.

- Soils collected from beneath the waste generally did not exceed screening levels which was consistent with URS (2008a) previous results with the exception of the SE17 area boring. The contact between the wastes and underlying soils could be readily identified in the field.

- In the SE17 area based on data collected during drilling of wells WPA-GW19 and WPA-GW15-BAU, a contaminated soil zone was found immediately above the bedrock contact, which is significantly below the waste. The soil interval beneath the waste was below screening levels. These results suggest that some waste constituents may leaching out of the waste and accumulating at the bedrock contact at this location.

- Leaching of COPC from wastes into groundwater in the UA or BAU zones is a transport pathway of potential concern for this SWMU that will be addressed in the FS. Refer to the Volume 4, Section 2 for a summary of groundwater contaminant distributions.

SWMU 17 is recommended for further evaluation in the FS due to suspected presence of SPL and other smelter related wastes, as well as elevated PAH, fluoride, metals, and petroleum hydrocarbon waste and soil chemical concentrations. Groundwater is also contaminated in this area as summarized in Volume 4.0, Section 2.4

Section 18
West End Landfill (SWMU 18)

The West End Landfill (WELF) was not included in the RI field program because it was previously investigated, and no RI field investigation data needs were identified during the RI planning process. Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for a complete summary of past results. The WELF is located southwest of the former Plant Area (refer to Figure P-1).

Lockheed Martin previously performed an independent RI/FS of the WELF during 2008 and 2009 (URS 2008f, 2010). This work was conducted as an independent action with informal Ecology review and concurrence regarding the project Work Plan. The scope of the investigation work included test pit excavations and chemical sampling, a geophysical survey, and monitoring well installation and groundwater sampling. Elevated concentrations of oil-range petroleum hydrocarbons, cPAHs, arsenic, cadmium, and fluoride were found primarily in landfill materials.

In December 2010, Lockheed Martin prepared a draft Cleanup Action Plan (CAP) for the WELF site (Tetra Tech 2010). The main objectives of the CAP were to document and summarize the selected cleanup alternative and to present the conceptual design for the selected alternative. The conceptual design defined the design criteria and established the overall scope and components of the landfill cover system design. Environmental protection and post-closure maintenance and monitoring planning components were also incorporated in the 2010 CAP (Tetra Tech 2010). Both a 60 percent design package and a 100 percent design package (Tetra Tech 2012) were prepared in support of the WELF Capping Project. The CAP and associated design packages were not reviewed by Ecology because the site-wide RI/FS Agreed Order was still pending and had not been negotiated and signed at that time.

18.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

A field investigation was not performed at this SWMU as part of the RI consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

18.2 INVESTIGATION RESULTS

No additional RI data was collected at the WELF (SWMU 18). Groundwater monitoring and groundwater characterization results for this SWMU are evaluated and discussed in Volume 4, Section 2, Groundwater in the Upper Most Aquifer AOC.

18.3 CONCLUSIONS AND RECOMMENDATIONS

The impermeable cap remedial alternative as well as other remedial alternatives will be re-evaluated in the FS.

Section 19
Plant Construction Landfill (SWMU 19)

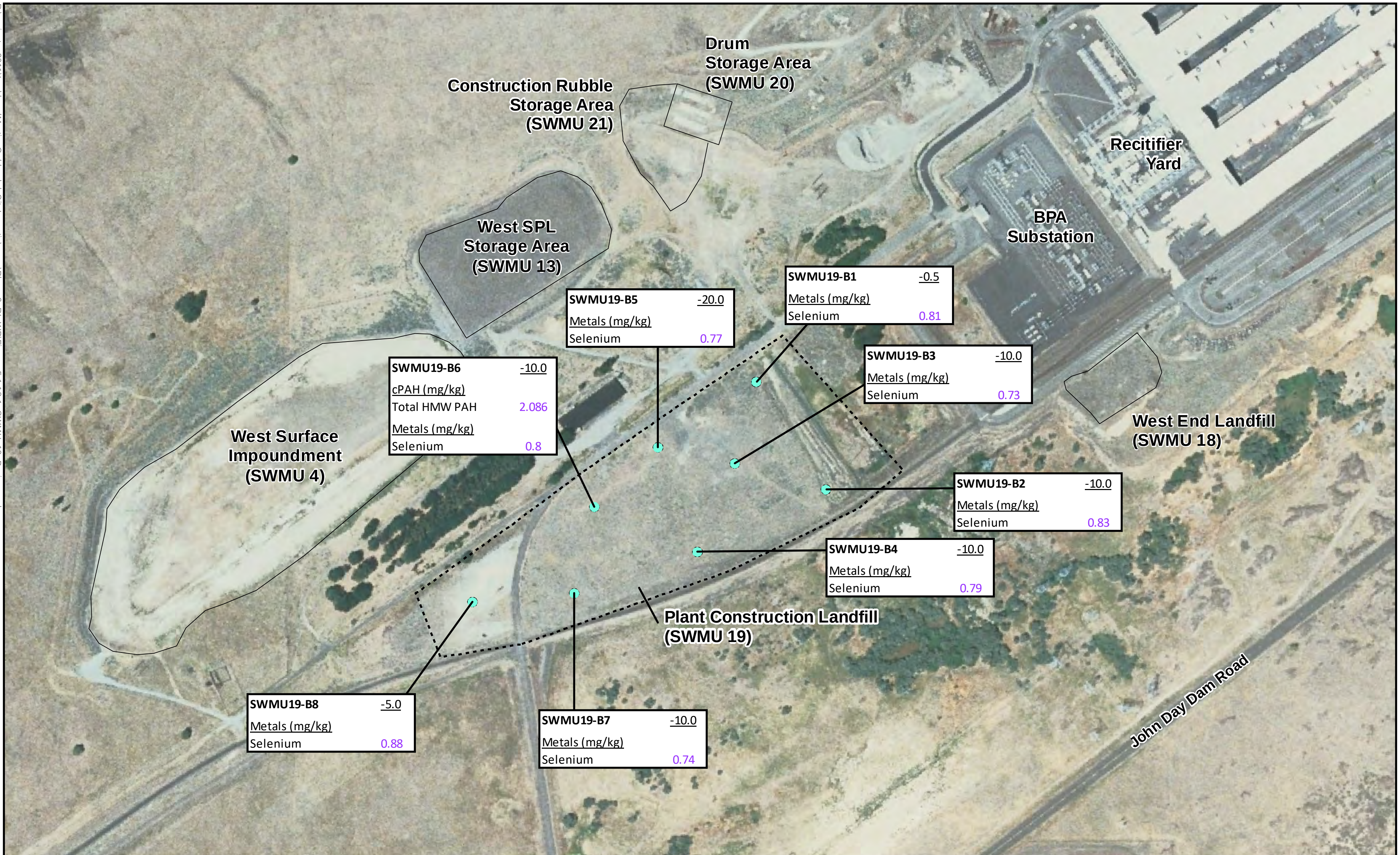
The Plant Construction Landfill (SWMU 19) was reportedly created during construction of the smelter in 1969-1970 where rock and general debris was disposed of in the flat and open area west of the Rectifier Yard and east of the WSI (Ecology 2014, Parametrix 2004a).

A geotechnical investigation was performed in 2001 and included 19 borings [one completed as a piezometer (B11)], four backhoe test pits, geotechnical testing of soils, and a geophysical survey (Fujitani Hilts & Associates 2001). No environmental samples were collected during the 2001 geotechnical investigation. The geotechnical investigation identified a fill unit consisting of fine to coarse gravel rock fragments with silty sand that ranges in thickness from 3 to 22 ft bgs. The presence of man-made debris/landfill materials was not noted in the logs for the borings and test pits. The fill unit is underlain by flood deposits consisting of stratified sand and silty sand, and basalt bedrock. Groundwater was typically encountered at a depth of about 20 ft bgs.

The Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) identified collection of surface and subsurface soil chemical data as a data need given the size, lack of documentation, and likely future development of this area. The RI investigation objective was to characterize current soil chemical concentrations.

19.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

Consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) sampling program, eight borings were proposed and installed for SWMU 21 to characterize chemical concentrations in the fill material present in this area (Figure 19-1). Each boring was drilled during the initial RI field mobilization using sonic drilling methods with a planned maximum depth of the shallowest of: 1) the base of the fill, 2) shallow groundwater, 3) refusal, or 4) 25 ft bgs. Soil samples were collected at 5-ft intervals with a split-spoon sampler and examined for visual or olfactory evidence of contamination and field screened using a PID.



Legend

- - - - - Approximate Location Boundary

● Boring Location

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

N W E S

0 125 250 500
Feet

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

Figure 19-1
SWMU 19
Plant Construction Landfill
Sample Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The analytical program for surface and subsurface soil samples included: PAHs, total cyanide, fluoride, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and sulfate. Because no contamination was suspected, a representative grab sample of fill material was collected from each boring consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The soil samples were collected at depths ranging from 5 to 20 ft bgs with five of the eight samples collected at 10 ft bgs. VOCs and TPH-Gx were added to the analytical program at three locations (SWMU19-B6-10, SWMU19-B7-10, and SWMU19-B8-10).

19.2 INVESTIGATION RESULTS

This section summarizes result for SWMU 19. Soil samples collected in June 2016, were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Lithologic logs are provided in Volume 5, Appendix B-19. The laboratory data report and data validation report for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively.

The RI soil sample analytical results for SWMU 19 are summarized in Table 19-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA Method A Industrial (petroleum hydrocarbons only), MTCA-derived soil screening levels for protection of groundwater, and MTCA terrestrial ecologic screening levels for protection of wildlife. Site soil background concentrations are also provided in Table 19-1 for comparative review. Figure 19-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

All borings were drilled to the maximum depth of 25 ft bgs and shallow groundwater was not encountered. Solid waste/debris and aluminum smelter-related wastes were not found at SWMU 19. Fill material at the site consisted primarily of silty gravel (GM) and clayey gravel (GC). At three boring locations (-B2, -B7, and -B8), gravels were encountered for the entire drilled interval of 25 ft. Gravelly, silty, sand (SM) was encountered below the silty and clayey gravels at the remaining five borings. Basalt bedrock was encountered in the base of boring SWMU19-SB02 at a depth of 23 ft bgs.

Table 19-1
SWMU 19 - Plant Construction Landfill Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU19-B1-5 6/29/2016	SWMU19-B2-10 6/29/2016	SWMU19-B3-10 6/29/2016	SWMU19-B4-10 6/29/2016	SWMU19-B5-20 6/28/2016	SWMU19-B6-10 6/28/2016	SWMU19-B7-10 6/28/2016	SWMU19-B8-5.0 6/28/2016
Aluminum Smelter															
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.3 U	2.4 U	2.3 U	2.3 U	2.2 U	2.3 U	2.3 U	2.3 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	17	21	10	79	0.88 J	21	6	6
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	7.9 J	6 J	6.8 J	11 J	7.5 J	7.3 J	22	13
Polycyclic Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0007 U	0.00069 U	0.0034 U	0.00066 U	0.00068 U	0.00061 U	0.00061 U	0.00072 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0005 U	0.00049 U	0.0024 U	0.00047 U	0.00049 U	0.0012 J	0.00044 U	0.00052 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.00066 U	0.004 J	0.0033 U	0.00063 U	0.00065 U	0.012	0.0071	0.00069 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00055 U	0.00055 U	0.0027 U	0.00053 U	0.00054 U	0.0015 J	0.00049 U	0.00057 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0021 J	0.0054 J	0.0033 U	0.0017 J	0.00065 U	0.014	0.011	0.0014 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0053 J	0.053	0.029	0.012	0.00082 U	0.19	0.026	0.0036 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.0044 J	0.084	0.029	0.011	0.00043 U	0.26	0.024	0.0032 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0081	0.15	0.065	0.02	0.00064 U	0.4	0.031	0.0052 J
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0038 J	0.11	0.037	0.012	0.00054 U	0.26	0.022	0.0026 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0036 J	0.063	0.023 J	0.0092	0.00065 U	0.12	0.012	0.0019 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0074	0.11	0.054	0.018	0.0016 U	0.26	0.028	0.0038 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0008 U	0.014	0.0061 J	0.0017 J	0.00078 U	0.036	0.0031 J	0.00083 U
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.013	0.068	0.04	0.021	0.0015 U	0.29	0.047	0.0083
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.00055 U	0.00055 U	0.0027 U	0.00053 U	0.00054 U	0.0054	0.005 J	0.00057 UJ
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0042 J	0.097	0.036	0.012	0.00065 U	0.28	0.023	0.0029 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0018 UJ	0.0018 J	0.0043 U	0.00084 U	0.00087 U	0.0022 U	0.0028 B	0.0049 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.012	0.027	0.016 J	0.0097	0.00075 U	0.095	0.044	0.0066
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.01	0.065	0.041	0.02	0.001 U	0.28	0.044	0.0064
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.006634	0.1228	0.04545	0.01667	0.0004	0.3652	0.03379	0.0046395
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.0271	0.1062	0.056	0.0324	0.00049 U	0.421	0.0028	0.0049
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.0468	0.746	0.3201	0.1159	0.00043 U	**2.086**	0.2131	0.0296
Metals															
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	11,000	13,000	12,000	13,000	7,400	9,200	9,700	10,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2	1.4	2.8	2.3	2.1	2	2.5	3.5
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.26	0.26	0.23	0.21	0.31	0.26	0.25	0.23
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	7.2	6.4	13	13	8.8	7	9.1	9.7
Copper	mg/Kg	NA	140,000	217	280	217	28.4	21	19	19	19	15	22	19	24
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	3.5	4.4	7.3	4.8	5.2	4.1	5.2	4.3
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.006 U	0.0066 U	0.013 J	0.0099 J	0.0065 J	0.0081 J	0.0086 J	0.012 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	8.5	8.7	11	9.1	10	9.1	8.6	8.5
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.81**	**0.83**	**0.73**	**0.79**	**0.77**	**0.8**	**0.74**	**0.88**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	48	55	54	58	60	53	60	51
Total Petroleum Hydrocarbons (TPHs)															
Gasoline Range Organics	mg/Kg	100	NE	1,000	NE	1000	NE	0.55 U	NA	NA	NA	NA	0.67 U	0.6 U	0.63 U
Volatile Organic Compounds (VOCs)															
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	0.0003 UJ	NA	NA	NA	NA	0.00037 UJ	0.00031 UJ	0.0003 U
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	0.0003 UJ	NA	NA	NA	NA	0.00037 UJ	0.00031 UJ	0.0003 U
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	0.0004 UJ	NA	NA	NA	NA	0.00049 UJ	0.00041 UJ	0.0004 U
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	0.0002 UJ	NA	NA	NA	NA	0.00025 UJ	0.00021 UJ	0.0002 U
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	0.00026 UJ	NA	NA	NA	NA	0.00032 UJ	0.00027 UJ	0.00026 U
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	0.0003 UJ	NA	NA	NA	NA	0.00037 UJ	0.00031 UJ	0.0003 U
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	0.00015 UJ	NA	NA	NA	NA	0.00018 UJ	0.00016 UJ	0.00015 U
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	0.0003 UJ	NA	NA	NA	NA	0.00037 UJ	0.00031 UJ	0.0003 U
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	0.0004 UJ	NA	NA	NA	NA	0.00049 UJ	0.00041 UJ	0.0004 U
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	0.0003 UJ	NA	NA	NA	NA	0.00037 UJ	0.00031 UJ	0.0003 U
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	0.0003 UJ	NA	NA	NA	NA	0.00037 UJ	0.00031 UJ	0.0003 U

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPHs = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds

Chemical results are summarized as follows:

- Total cyanide was not detected. Note that the reporting limits for these samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.

- Fluoride and sulfate were detected at low concentrations below screening levels.

- PAHs were detected above soil screening levels in only one sample (SWMU19-B6-10). Total HMW PAH (2.086 mg/kg) exceed the terrestrial ecologic soil screening level for wildlife protection of (1.1 mg/kg).

- For metals, selenium was detected in all the samples at low concentrations (maximum of 0.88 mg/kg) slightly above the MTCA Terrestrial Ecological screening level of 0.3 mg/kg, and selenium background concentrations (0.29 mg/kg). Given the ubiquitous low-level occurrence of selenium in soil at this SWMU, it is unclear that selenium represents a site-related contaminant for SWMU 19.

- Gasoline-range petroleum hydrocarbons and VOCs were not detected in the two collected soil samples.

19.3 CONCLUSIONS AND RECOMMENDATIONS

SWMU 19 will not be further evaluated in the FS based on the analytical results and the lack of solid waste or aluminum-smelter related wastes found at this SWMU. Based on the RI results, no further action is recommended.

Section 20
Drum Storage Area (SWMU 20)

The Drum Storage Area (SWMU 20) was not included in the RI field program because this unit (refer to Figure P-1) was formerly characterized as part of an independent site investigation in 2008 (URS 2008d). The results of previous investigation show the presence of PAHs in soil above MTCA Method B, but below MTCA Method C soil screening levels as summarized in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

20.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No RI field investigation was performed at SWMU 20 as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b). However, the SWMU 20 data from the 2008 investigation was compared to protection of groundwater and ecological wildlife soil screening levels. PAHs as TTEC detected in two of three samples analyzed for PAHs exceed the protection of groundwater screening level of 3.9 mg/kg, and as HMW PAH in three samples analyzed for PAH exceed the ecological wildlife screening level of 1.1 mg/kg.

20.2 INVESTIGATION RESULTS

No additional RI data was collected at SWMU 20.

20.3 CONCLUSIONS AND RECOMMENDATIONS

Based on results from the 2008 investigation, and comparison of those results to the RI soil screening levels, SWMU 20 will be carried over to the FS for further evaluation of potential remedial measures to include institutional controls.

Section 21

Construction Rubble Storage Area (SWMU 21)

The Construction Rubble Storage Area (SWMU 21) is located west of the Bonneville Power Administration (BPA) Substation (refer to Figure P-1). Construction rubble was disposed in this approximate location following closure of the WELF (SWMU 18) in 1987 and was active until the smelter closed in 2003. Figure 21-1 shows the approximate location of the Construction Rubble Storage Area. A borrow pit is located southeast of SWMU 21; however, SWMU 21 does not extend into the area of the borrow pit (PGG 2014a,c) and per the approved work plan, the borrow pit was not investigated. The Agreed Order states that because of the inert nature of the construction rubble, the possibility of soil or groundwater contamination is considered unlikely. No previous environmental investigations have been performed associated with this area as summarized in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

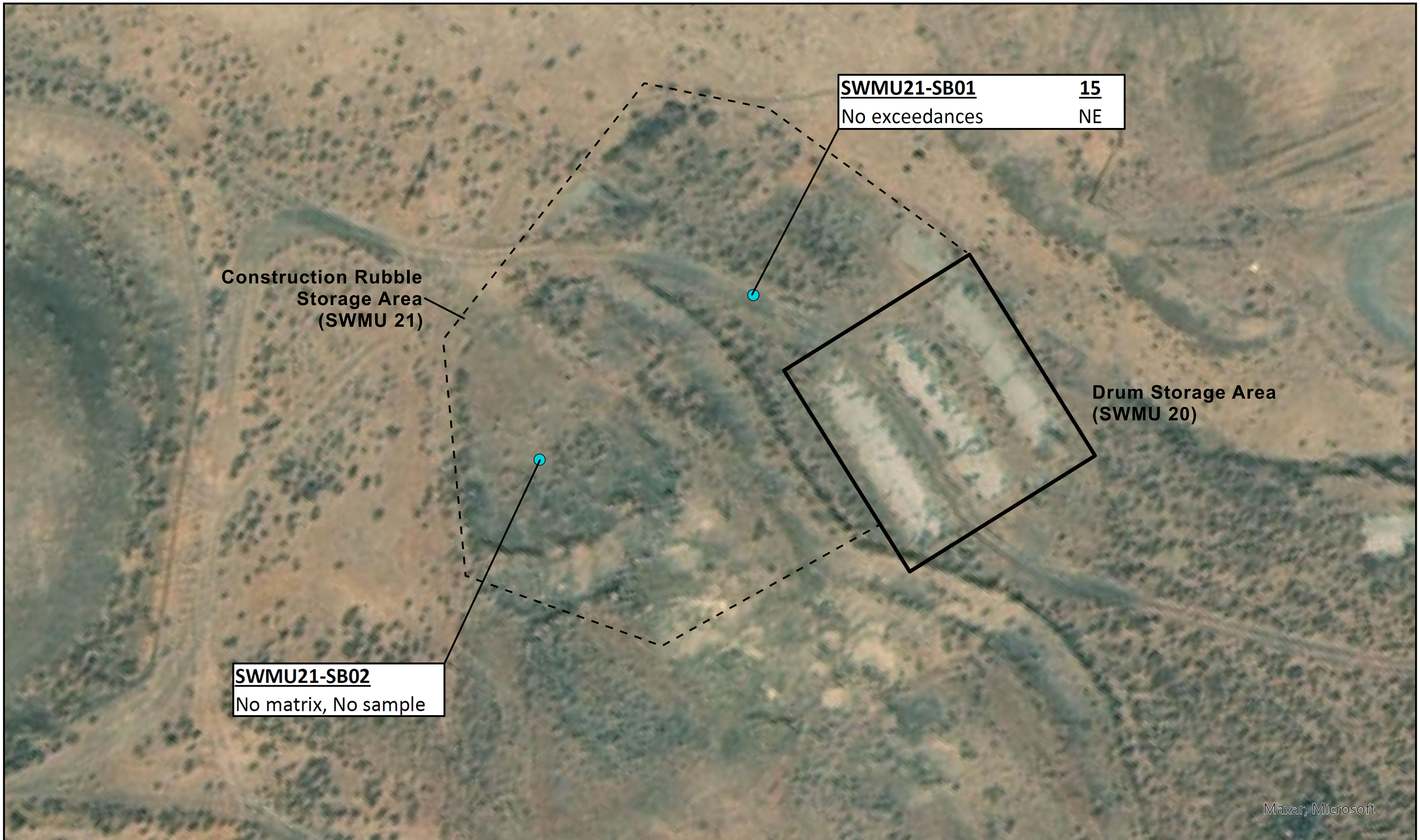
21.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

SWMU 21 was investigated in June 2016 with two soil borings located within the approximate boundary of the rubble storage area (Figure 21-1). The investigation objective was to characterize concentrations of COPCs in the subsurface in the SWMU 21 fill. Soil borings were completed to depths of 20 ft bgs. The borings were drilled and sampled using hollow-stem auger drilling techniques and all sampling procedures were performed according to the approved work plan.

The collected soil sample was analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zinc), and TPHs.

21.2 INVESTIGATION RESULTS

Soil borings were completed in the northern and southern portions of the rubble storage area (Figure 21-1). Soil encountered in the borings was characterized, logged, and sampled. Boring logs are included in Volume 5, Appendix B-21. The objective was to collect soil samples at 5-ft intervals



RI Borings

Sample depth in feet bgs.

W N E S

0 25 50 100

Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 21-1

SWMU 21 Construction Rubble Storage Area

RI Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

and submit one sample from the most contaminated interval from each boring based on PID field screening and field observations.

Soil encountered in the borings consisted of very dense gravel with little or no fine-grained matrix, and occasional boulders, which resulted in collection of only one sample in boring SWMU21-SB01. A very dense gravelly sand was encountered from approximately 10 to 15 ft bgs in boring SWMU21-SB01. An apparent cavity between boulders was encountered from approximately 19 to 20 ft bgs in boring SWMU21-SB02. The overall lack of fine-grained matrix in the two borings resulted in collection of only one soil sample in boring SWMU21-SB01 at 15 ft bgs. Logs of borings for SWMU 21 are included in Volume 5, Appendix B-21.

Soil analytical results are summarized in Table 21-1. SWMU 21 data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife screening levels. Laboratory analytical reports are included in Volume 5, Appendix H-2 and data validation reports are included in Volume 5, Appendix I-2. The data quality objectives for the project were met and data qualifiers have been assigned as appropriate in Table 21-1. All samples were collected where possible, and analyses completed, as proposed in the final RI Work Plan. In this investigation phase reporting limits for selenium exceed soil screening levels.

The RI results indicate that concentrations of total cyanide, fluoride, sulfate, PAHs, and metals do not exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels.

Diesel and residual range organics were not detected at concentrations that exceed their reporting limits. The reporting limit for selenium is slightly higher at 5.3 mg/kg than the protection of groundwater screening level of 5.2 mg/kg, and higher than the ecological wildlife screening level of 0.3 mg/kg.

21.3 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the RI investigation, soil analytical data did not exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, or ecological wildlife soil screening levels. SWMU 21 will not be carried forward into the FS. Groundwater near this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

Table 21-1
SWMU 21 Construction Rubble Storage Area RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

Parameter Name	Units	Screening Levels: MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Ecological Screening Levels: Wildlife	RI Analytical Results: SWMU21-SB01-15
Aluminum Smelting							
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.058 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	3.6
Sulfate	mg/kg	NA	NE	2,150	NE	NE	41
Polynuclear Aromatic Hydrocarbons (PAHs)							
1-Methylnaphthalene	mg/kg	NA	4,500	0.1	NE	NL	0.007 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.007 U
Acenaphthene	mg/kg	NA	210,000	98.0	NE	NL	0.007 U
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.007 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.007 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.007 U
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.007 U
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.007 U
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.007 U
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.007 U
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.007 U
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.007 U
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.007 U
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.007 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.007 U
Naphthalene	mg/kg	5	70	4.50	NE	NL	0.007 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.007 U
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.007 U
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.007
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.007
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	0.007
Metals							
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,500
Arsenic	mg/kg	20	87.5	2.9	7.61	132	1.6
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.53 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	11
Copper	mg/kg	NA	140,000	280	28.4	217	15
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.5
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U
Nickel	mg/kg	NA	70,000	130	24.54	980	9
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.3 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	36 J
Total Petroleum Hydrocarbons (TPHs)							
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	26 U
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	53 U

Notes:

B	Chemical was detected in the blank and the sample.
J	Estimated concentration.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentrations accounted for in summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening level.

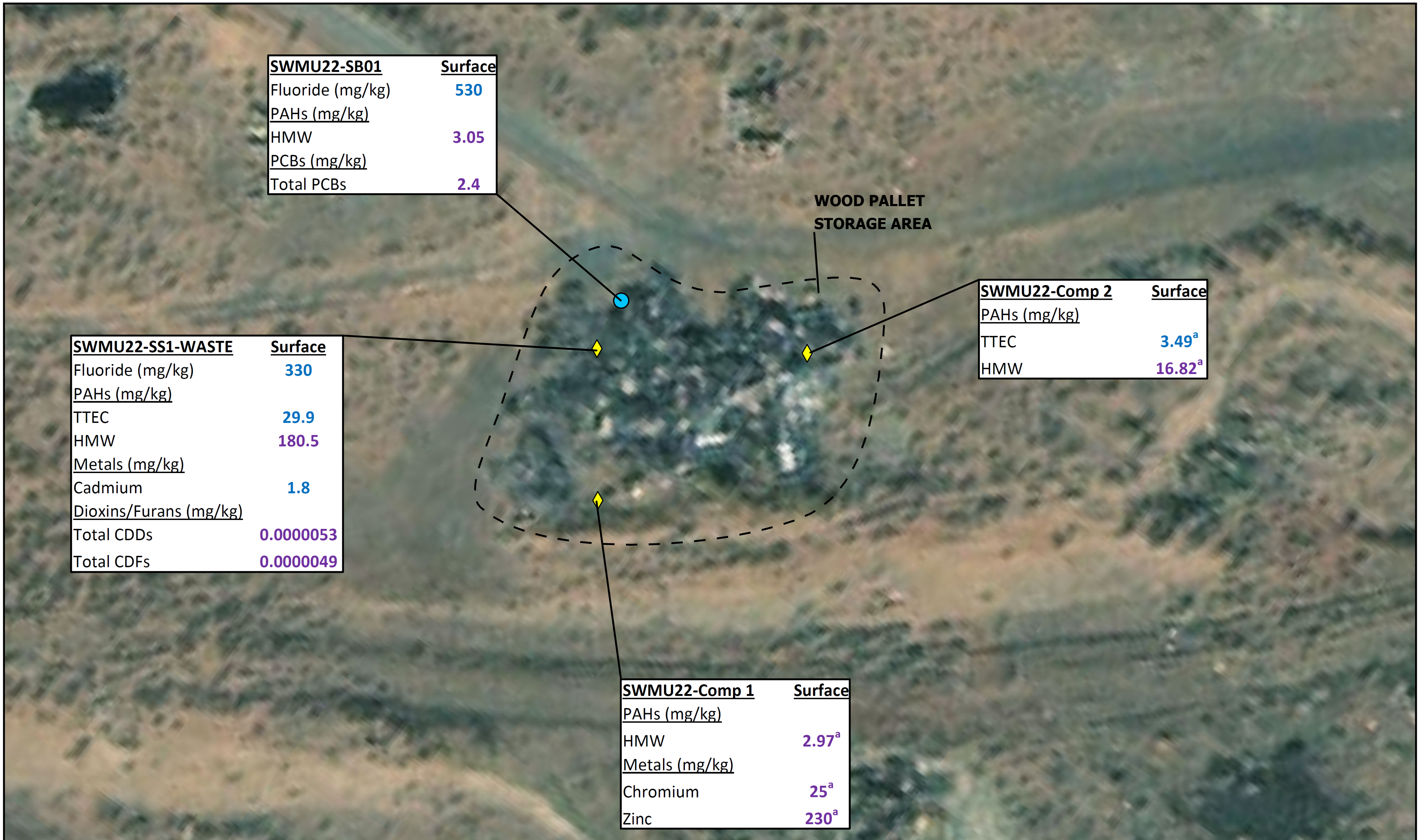
Section 22
Wood Pallet Storage Area (SWMU 22)

As documented in the approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), following closure of the WELF in 1987, wood waste was transported to a storage and burning area northeast of the smelter and north of the Rectifier Yard (Ecology 2014) (refer to Figure P-1). Excess wood at the site was burned periodically at this location under a permit from the county fire department (Ecology 2014, Parametrix 2004a). Employees were reportedly invited to use the wood for home construction projects or firewood. The 2004 Part B Permit Application (Parametrix 2004a) states that because of the inert nature of this material, the possibility of soil or groundwater contamination from this activity is remote.

Due to the presence of materials other than wood in the pile, including plastic, metal, and coated/uncoated wires (PGG 2012a), soil beneath the wood pallet storage pile was investigated.

22.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

SWMU 22 was investigated in June 2016 with one soil boring, and three surface soil samples collected from within the identified boundary of the wood pallet storage/burn area (Figure 22-1). The investigation objectives were to characterize site COPCs in soil beneath the burn pile and to collect data for waste profiling for disposal and was conducted consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). One soil boring was completed to a depth of 10 ft bgs and the first soil sample was collected as a surface soil sample prior to start of drilling because there was evidence of burned material at ground surface at the boring location. The three surface soil samples were collected in other areas of the burn pile and included two composite samples and one discrete soil sample where past burning was evident (Figure 22-1). The boring was drilled and sampled using hollow-stem auger drilling techniques and all sampling procedures were performed according to the approved work plan.



RI Borings

Grab and Composite Samples

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife
a: Indicates concentration exceeds an adjusted screening level calculated by
dividing screening level by 5 (number of subsamples in composite)

0 15 30 60
Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 22-1

SWMU 22 Wood Pallet Storage Area

RI Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The collected soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs,metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn), and TPHs. Two soil samples were collected at locations where visible evidence of burned materials were identified and were also analyzed for dioxins and furans using EPA Method 1613B.

22.2 INVESTIGATION RESULTS

The soil boring was completed on the western edge of the wood pallet storage pile where access was feasible and burn waste was visually identified at ground surface. Soil encountered in the borings and other surface soil samples was characterized and logged. The boring log is included in Volume 5, Appendix B-22. The objective for soil sampling in the boring was to collect one sample at ground surface and one sample above the total depth of the boring. Soil encountered in the boring consisted of fine to coarse sand (SW) with some gravel and a trace of silt and clay to a depth of 1.5 ft bgs. Gravel with a trace of silt and clay (GP) was encountered from 1.5 ft bgs to the total depth of the boring at 10 ft bgs. The overall lack of fine-grained matrix in subsurface materials resulted in collection of only the surface soil sample in boring SWMU22-SB01. Fine to coarse sand was encountered during collection of the three surface soil samples.

Soil analytical results are summarized in Table 22-1. SWMU 22 data was compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. In addition, for the two surface soil samples of burn waste analyzed for dioxins and furans, resulting data was compared to MTCA Method C industrial and ecological wildlife screening levels. The laboratory reports are provided in Volume 5, Appendix H-2 and data validation reports are included in Volume 5, Appendix I-2, respectively. The data quality objectives for the project were met and data qualifiers have been assigned as appropriate in Table 22-1. All investigation objectives were met, samples collected, and analyses completed as proposed in the Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b). In this phase of investigation, reporting limits for selenium exceed soil screening levels in most samples analyzed.

The RI results for soil samples SWMU22-SS1-WASTE and SWMU22-SB01-0 indicate that detected concentrations of total cyanide, sulfate, most metals, and TPH-Dx do not exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels.

Table 22-1
SWMU 22 Wood Pallet Storage Area RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site,
Goldendale, Washington

		Screening Levels				Ecological Screening Levels	RI Analytical Results			
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**SWMU22-Comp 1**	**SWMU22-Comp 2**	**SWMU22-SS1-WASTE**	**SWMU22-SB01-0**
Aluminum Smelting										
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.086 U	0.09 U	0.059 U	0.059 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	20	15	**330**	**530**
Sulfate	mg/kg	NA	NE	2,150	NE	NE	170	44	100	10 U
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0067 U	0.007	0.076	0.0071 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0067 U	0.0078	0.088	0.0071 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.016	0.1	0.51	0.012
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0067 U	0.0068 U	0.18	0.0071 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.034	0.3	2.1	0.027
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.3	1.8	17	0.27
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.39	2.4	21	0.37
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.61	3.6	34	0.61
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.42	1.8	23	0.46
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.15	1.3	11	0.18
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.32	1.9	25	0.36
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.1	0.42	5.5	0.11
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.38	2.5	28	0.38
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.0085	0.043	0.48	0.0071 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.32	1.3	19	0.34
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0079	0.01	0.25	0.0071 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.12	0.89	9.8	0.13
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.36	2.3	25	0.35
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.54	**3.49 [a]**	**29.9**	0.5
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.57	3.84	41.32	0.55
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**2.97 [a]**	**16.82 [a]**	**180.5**	**3.05**
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	mg/kg	NA	250	NE	NE	NA	0.051 U	0.051 U	0.051 U	0.53 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NA	0.051 U	0.051 U	0.051 U	0.53 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NA	0.051 U	0.051 U	0.051 U	0.53 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NA	0.051 U	0.051 U	0.051 U	0.53 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NA	0.051 U	0.051 U	0.051 U	0.53 U
Aroclor 1254	mg/kg	NA	66	0.71	NE	NA	0.051 U	0.051 U	0.062	2.4
Aroclor 1260	mg/kg	NA	66	NE	NE	NA	0.051 U	0.051 U	0.051 U	0.53 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.051 U	0.051 U	0.062	**2.4**
Metals										
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	15,000	9,700	16,000	12,000
Arsenic	mg/kg	20	88	2.9	7.61	132	6.1	1.9	4.7	2.5
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.51 U	0.51 U	**1.8**	0.53 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	**25 [a]**	10	23	13
Copper	mg/kg	NA	140,000	280	28.4	217	31	18	200 J	36 J
Lead	mg/kg	1,000	NE	3,000	13.1	118	9.3	7.4	16	13
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.25 U	0.25 U	0.25 U	0.26 U
Nickel	mg/kg	NA	70,000	130	24.54	980	18	12	27	13
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.1 U	5.1 U	5.1 U	5.3 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	**230 [a]**	67	240 J	77 J
Dioxins/Furans (Estimated Maximum Possible Concentrations)										
2,3,7,8-TCDD	pg/g	NE	0.0041	NE	NE	NA	NA	NA	0.318 U	0.0412 U
1,2,3,7,8-PeCDD	pg/g	NE	NE	NE	NE	NA	NA	NA	1.17	0.126 U
1,2,3,4,7,8-HxCDD	pg/g	NE	NE	NE	NE	NA	NA	NA	2.31	0.216
1,2,3,6,7,8-HxCDD	pg/g	NE	NE	NE	NE	NA	NA	NA	7.7	0.487
1,2,3,7,8,9-HxCDD	pg/g	NE	NE	NE	NE	NA	NA	NA	4.31	0.419
1,2,3,4,6,7,8-HpCDD	pg/g	NE	NE	NE	NE	NA	NA	NA	214	12.3
OCDD	pg/g	NE	NE	NE	NE	NA	NA	NA	1930	92.4
2,3,7,8-TCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	6.53	3.09
1,2,3,7,8-PeCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	6.21	0.685
2,3,4,7,8-PeCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	4.52	1.64
1,2,3,4,7,8-HxCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	10.9	1.19
1,2,3,6,7,8-HxCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	4.11	0.493
2,3,4,6,7,8-HxCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	3.18	0.384
1,2,3,7,8,9-HxCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	2.37	0.314
1,2,3,4,6,7,8-HpCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	56.3	1.97
1,2,3,4,7,8,9-HpCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	7.04	0.272
OCDF	pg/g	NE	NE	NE	NE	NA	NA	NA	243	6.12
Total CDDs	mg/kg	NE	0.000005	NE	NE	0.000002	NA	NA	**0.0000053**	0.0000003
Total CDFs	mg/kg	NE	0.000003	NE	NE	0.000002	NA	NA	**0.0000049**	0.0000011
Total Petroleum Hydrocarbons (TPHs)										
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	25 U	32 U	NA	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	64	250	NA	NA

Notes:

a	Concentration exceeds an adjusted screening level calculated by dividing screening level by 5 (number of subsamples in composite).
J, U	J: Estimated concentration. U: Chemical was not detected. The associated value represents the method detection limit.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentration accounted for by the summation process.
TTEC	Total Toxicity Equivalent Concentraton for carcinogenic PAHs.
LMW PAH/HMW PAH	Low molecular weight PAH/high molecular weight PAH.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Fluoride was detected at concentrations that exceed the site-specific protection of groundwater screening level in SWMU22-SS1-WASTE at 330 mg/kg and in SWMU22-SB01-0 at 530 mg/kg. PAHs as TTEC was calculated for sample SWMU22-WASTE at a concentration of 29.9 mg/kg that exceeds the protection of groundwater screening level of 3.9 mg/kg. PAHs as total HMW PAH exceed the ecological wildlife soil screening level of 1.1 mg/kg in both soil samples. Several individual PAHs exceed their ecological wildlife screening level in sample SWMU22-SS1-WASTE. Total PCBs were detected in SWMU22-SB01-0 at 2.4 mg/kg that exceeds the ecological wildlife screening level of 0.65 mg/kg. Cadmium was detected in sample SWMU22-SS1-WASTE at a concentration of 1.8 mg/kg that exceeds protection of groundwater screening level.

Samples SWMU22-Comp1 and SWMU22-Comp2 are composite samples consisting of five subsamples each and collected according to the RI work plan (Tetra Tech et al. 2015b). Per Ecology guidance (Ecology 1995a) screening level concentrations would be adjusted by dividing the screening value by the number of subsamples before comparison to detected concentrations in a composite sample. Following this guidance, detected concentrations of total cyanide, fluoride and sulfate did not exceed their MTCA Method C, protection of groundwater, and ecological wildlife adjusted screening levels. PAHs as TTEC in SWMU22-Comp2 were detected at 3.49 mg/kg and exceeds the adjusted MTCA Method A Industrial screening level. Total HMW PAH in both SWMU22-Comp1 and SWMU22-Comp2 were detected at 2.97 mg/kg and 16.82 mg/kg, respectively, and exceed the adjusted ecological wildlife screening level. Chromium and zinc both exceed the adjusted ecological wildlife screening levels.

Total equivalent concentrations for dioxins (CDDs) and furans (CDFs) were calculated from concentrations detected in samples SWMU22-WASTE and SWMU22-SB01-0 per Ecology guidance (Ecology 2007). These calculated concentrations were then compared to MTCA Method C industrial screening levels for CDD of 0.000005 mg/kg and for CDF of 0.000003 mg/kg (Table 749-2) and ecological wildlife for CDD and CDF of 0.000002 mg/kg (Table 749-3). Calculated equivalent total concentrations in sample SWMU22-WASTE for CDD of 0.0000053 and CDF of 0.0000049 mg/kg exceed both the MTCA Method C and ecological wildlife screening levels. Calculated equivalent total concentrations of CDD and CDF in sample SWMU22-SB01-0 did not exceed screening levels.

Selenium reporting limits exceed the protection of groundwater screening level in one sample, and the ecological wildlife screening level in all samples.

22.3 CONCLUSIONS AND RECOMMENDATIONS

For composite samples SWMU22-Comp1 and SWMU22-Comp2 PAH as TTEC and total HMW PAH exceed the adjusted MTCA Method A Industrial, protection of groundwater, and/or ecological wildlife screening levels. For samples SWMU22-SS1-WASTE and SWMU22-SB01-0 fluoride, TTEC, total HMW PAH, total PCBs, and cadmium exceed either protection of groundwater or ecological wildlife screening levels. Calculated equivalent CDD and CDF exceeds both MTCA Method C and ecological wildlife screening levels.

The RI results indicate that wood pallet storage/burn pile has impacted the underlying surface soil. Based on the results of the RI investigation, SWMU22 will be carried over to the FS for further evaluation of potential remedial alternatives. Groundwater near this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

Section 23
Reduction Cell Skirt Storage Area (SWMU 23)

The Reduction Cell Skirt Storage Area (SWMU 23) is located west of the west end of Production Building D (Figure P-1). The Reduction Cell Skirt Storage Area was used for the storage of failed skirts from the reduction cells from 1988 to 1995. The steel skirts reportedly had residual bath (cryolite salts) adhered to the steel skirts and the skirts were stored in the area until the steel was recycled off-site (Ecology 2014). According to Ecology (2014), the skirts and residual bath material in soil were removed in 1995. After 1995, the skirts were stored on a concrete pad next to the Paste Plant before recycling. The 2004 RCRA Part B Permit Application states that the unit was "clean closed" (Parametrix 2004a); however, no closure approval documentation has been found by Ecology or other agencies.

23.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

SWMU 23 was investigated in June 2016 with three soil borings located within the storage area (Figure 23-1) consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The investigation objective was to characterize COPCs in soil. The borings were drilled and sampled using hollow-stem auger drilling techniques and drilled to a depth of 10 to 11.5 ft bgs. Six soil samples were collected from the borings where sufficient fine-grained matrix was present.

The collected soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn), and TPHs.

23.2 INVESTIGATION RESULTS

The soil borings were completed in the western and eastern portions of the storage area. Soil encountered in the borings was characterized, logged, and sampled. Boring logs for SWMU 23 are included in Volume 5, Appendix B-23. The objective for soil sampling was to collect samples at depths of 0.5 ft bgs, 5 ft bgs, and above the base of the borings. Because of insufficient percentage

RI Borings

Soil Screening Levels
blue: Exceeds Protection of Groundwater
purple: Exceeds Ecological Wildlife
NE: No exceedance

Sample depths in feet bgs.

W N S E

0 37.5 75 150
Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 23-1

SWMU 23 Reduction Cell Skirt Storage Area

Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

of fine-grained matrix present in subsurface soil, only six soil samples were collected. Soil encountered in the borings consisted of fine sand from ground surface to a depth of 1 and 1.5 ft bgs, and gravel with some to no fine-grained matrix from a depth of 1 to 1.5 ft bgs to the bottom of the borings.

Soil analytical results are summarized in Table 23-1. SWMU 23 data were compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Laboratory analytical reports are included in Volume 5, Appendix H-2 and data validation reports are included in Volume 5, Appendix I-2. The data quality objectives for the project were met and data qualifiers have been assigned as appropriate in Table 23-1. All samples have been collected and analyses completed as proposed in the final RI Work Plan. In this investigation phase reporting limits for selenium exceed soil screening levels in all samples analyzed.

The RI results indicate that detected concentrations of total cyanide, sulfate, PCBs, and diesel and residual range organics do not exceed MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels (Table 23-1). Fluoride exceeds the site-specific protection of groundwater screening level in borings SWMU23-SB01 at a depth of 0.5 ft bgs and 5 ft bgs, and in SWMU23-SB02 at a depth of 0.5 ft bgs. PAHs as TTEC exceeds the protection of groundwater screening level of 3.9 mg/kg at a depth of 0.5 ft bgs but not at deeper sample depths. HMW PAH exceeds the ecological wildlife screening level of 1.1 mg/kg in all three borings at a depth of 0.5 ft bgs but not in deeper sample depths.

Metals exceed protection of groundwater and ecological wildlife screening levels in borings SWMU23-SB01 and SWMU23-SB02. Arsenic, cadmium, and nickel exceed the protection of groundwater screening level in SWMU23-SB02 at a depth of 0.5 ft bgs, and arsenic exceeds in SWMU23-SB01 at 0.5 ft bgs. Chromium exceeds the ecological wildlife screening level in SWMU23-SB02 at 0.5 ft bgs. Selenium is reported as not detected but reporting limits range from 5.2 to 6.1 mg/kg, which is slightly higher than the protection of groundwater screening level of 5.2 mg/kg and higher than the ecological wildlife screening level of 0.3 mg/kg.

Table 23-1
SWMU 23 Reduction Cell Skirt Storage Area RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

Parameter Name	Units	Screening Levels				Ecological Screening Levels	RI Analytical Results					
		MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	SWMU23-SB01-0.5	SWMU23-SB01-5	SWMU23-SB02-0.5	SWMU23-SB02-4.0	SWMU23-SB02-8.5	SWMU23-SB03-0.5
Aluminum Smelting												
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.06 UJ	0.057 UJ	0.058 UJ	0.059 UJ	0.059 UJ	0.057 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	**590**	**260**	**1900**	69	3.6	62
Sulfate	mg/kg	NA	NE	2,150	NE	NE	850	130	260	97	10 U	26
Polynuclear Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0076	0.0081 U	0.018	0.0079 U	0.0081 U	0.0069 U
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.01	0.0081 U	0.029	0.0079 U	0.0081 U	0.0069 U
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.11	0.0081 U	0.24	0.0079 U	0.0081 U	0.0099
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.007 U	0.0081 U	0.0069 U	0.0079 U	0.0081 U	0.0069 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.17	0.0081 U	0.33	0.0079 U	0.0081 U	0.014
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	1.1	0.0081 U	3	0.0079 U	0.0081 U	0.15
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	1.6	0.0081 U	3.8	0.0079 U	0.0081 U	0.2
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	2.5	0.0081 U	7.3	0.012	0.0081 U	0.34
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	1.7	0.0081 U	4.4	0.0098	0.0081 U	0.21
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	1.1	0.0081 U	2.3	0.0079 U	0.0081 U	0.099
Chrysene	mg/kg	NA	NL	NL	NE	NL	1.6	0.0081 U	4.2	0.0079 U	0.0081 U	0.21
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.38	0.0081 U	1	0.0079 U	0.0081 U	0.05
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	1.8	0.0081 U	4	0.0079 U	0.0081 U	0.23
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.054	0.0081 U	0.12	0.0079 U	0.0081 U	0.0069 U
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	1.4	0.0081 U	3.5	0.0079 U	0.0081 U	0.16
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.02	0.0081 U	0.049	0.0079 U	0.0081 U	0.0069 U
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.72	0.0081 U	1.8	0.0079 U	0.0081 U	0.08
Pyrene	mg/kg	NA	110,000	650	NE	NL	1.5	0.0081 U	3.3	0.0079 U	0.0081 U	0.2
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	2.12	0.0081	**5.55**	0.0012	0.0081	0.27
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	2.87	0.0081	6.54	0.008	0.0081	0.33
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**12.88**	0.0081	**32.8**	0.0079	0.0081	**1.17**
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	mg/kg	NA	250	NE	NE	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Aroclor 1221	mg/kg	NA	NE	NE	NE	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Aroclor 1232	mg/kg	NA	NE	NE	NE	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Aroclor 1242	mg/kg	NA	NE	NE	NE	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Aroclor 1248	mg/kg	NA	NE	NE	NE	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Aroclor 1254	mg/kg	NA	66	0.71	NL	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Aroclor 1260	mg/kg	NA	66	NE	NE	NA	0.052 U	0.061 U	0.052 U	0.12 U	0.061 U	0.052 U
Total PCBs (calc)	mg/kg	10	66	NE	NE	0.65	0.05	0.06	0.05	0.12	0.06	0.05
Metals												
Aluminum	mg/kg	NA	3,500,000	480,000.00	28,299	NE	13,000	6,400	53,000	4,800	8,200	7,000
Arsenic	mg/kg	20	88	2.9	7.61	132	2.9	0.67	**12**	0.65	1.8	1.2
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**3.8**	0.61 U	**12**	0.59 U	0.61 U	0.52 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	31	2.9	**410**	3.3	7.7	9
Copper	mg/kg	NA	140,000	280	28.4	217	24	9.8	100	6.5	13	11
Lead	mg/kg	1,000	NE	3,000	13.1	118	17	6.1 U	110	5.9 U	6.1 U	5.2 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.26 U	0.3 U	0.26 U	0.3 U	0.3 U	0.26 U
Nickel	mg/kg	NA	70,000	130	24.54	980	56	4	**340**	3.2	7.1	12
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.2 U	6.1 U	5.2 U	5.9 U	6.1 U	5.2 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	45	25	36	30	47	41
Total Petroleum Hydrocarbons (TPHs)												
Diesel Range Organics	mg/kg	2,000	NE	NA	NA	2,000	26 U	30 U	40	30 U	30 U	NA
Residual Range Organics	mg/kg	2,000	NE	NA	NA	2,000	150	61 U	400	60 U	61 U	NA

Notes:

J	Estimated concentration.
NA	Not analyzed or not applicable.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentrations accounted for in the summation process.
TTEC	Total Toxicity Equivalent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

23.3 CONCLUSIONS AND RECOMMENDATIONS

Concentrations of fluoride, PAHs as TTEC and HMW PAH, and arsenic, cadmium, chromium, and nickel exceed one or both of protection of groundwater and/or ecological wildlife soil screening levels. These chemicals exceeded screening levels in the three borings at a depth of 0.5 ft bgs but not in deeper sample depths. Only fluoride exceeded the protection of groundwater screening level at a deeper depth, at a concentration of 260 mg/kg in SWMU23-SB01 at 5 ft bgs.

The RI results indicate that shallow soil in localized portions of the SWMU 23 area have been impacted by site activities. Based on the results of the RI investigation, SWMU 23 will be carried over to the FS for further evaluation. Groundwater near this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

Section 24

Carbon Waste Roll-Off Area (SWMU 24)

The Carbon Waste Roll-Off Area (SWMU 24) refers to roll-off bins that were in more than one location, and therefore have been investigated as part of the PAAOC. A discussion of the scope of investigation for SWMU 24 is presented in Volume 3, Section 5 of the PAAOC. A brief description of this SWMU is provided for context and convenience.

According to the Agreed Order, in 1987, a 20-cubic yard roll-off bin was located between the pot rooms and was used to collect, store, and transport various solid wastes prior to offsite disposal. Wastes managed in this area included: fume system carbon, waste briquettes, production room floor sweepings, silo top paste, and stud hole paste. Carbon waste was collected and stored onsite, prior to offsite disposal, in 20-yard roll-off bins. Roll-off bins were in several areas throughout the site inside the Production Buildings and in the courtyards between buildings, notably south of Production Building A at its eastern end. The Carbon Waste Roll-Off Bin was shown on historical SWMU maps as located on the south side of Production Building A. Characterization data for soil was previously collected from the Courtyards (PGG 2010) and show PAH concentrations above MTCA Method C screening levels in some areas.

Section 25

Solid Waste Collection Bin and Dumpsters (SWMU 25)

The Solid Waste Collection Bin and Dumpsters (SWMU 25) were in more than one location in the plant area and therefore have been investigated as part of the PAAOC. A discussion of the scope of investigation for SWMU 25 is presented in Volume 3, Section 5 of the PAAOC. A brief description of this SWMU is provided for context and convenience.

Miscellaneous, nonhazardous solid waste was placed in small dumpsters or roll-off bins at various collection points throughout the production area. Wastes reportedly included: transite, empty cans, floor sweepings, PVC/glass pipe, and secondary treatment plant screen wastes. The specific locations of the collection points are unclear and appear to have changed during the history of operations. One location at the east end of Production Building A was noted in a 1990 inspection conducted by Ecology (Ecology 1990a).

Section 26
HEAF Filter Roll-Off Bin (SWMU 26)

No environmental investigations have been performed at the High Efficiency Air Filtration (HEAF) Filter Roll-Off Bin (SWMU 26). The likelihood of release is low based on the period and nature of this storage operation. Because SWMU 26 does not have a clearly defined ground footprint, it was investigated as part the PAAOC and is discussed in Volume 3, Section 5 of the PAAOC. A brief description of this SWMU is provided for context and convenience.

The HEAF system air emission control system for the Paste Plant used fabric filters in its process. Particulates containing high concentrations of PAHs were removed from the off gases into fabric filters during HEAF system operations. Spent filters were collected in a 20-yard roll-off bin prior to offsite disposal. The Paste Plant emission control system was converted from a wet scrubber to a dry HEAF system in 1990. The HEAF filter roll-off bin was located east and north of the Paste Plant near the northern end of the briquette storage slab.

Section 27
Tire and Wheel Storage Area (SWMU 27)

No RI data needs were identified for the Tire and Wheel Storage Area (SWMU 27), and it was not included in the RI field investigation (Figure P-1). SWMU 27 overlaps physically with the Drum Storage Area (SWMU 20), which was previously investigated as part of an independent site investigation in 2008 (URS 2008d). The results of previous investigation show the presence of PAHs in soil above MTCA Method B but below MTCA Method C soil screening levels as summarized in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a).

27.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No RI field investigation was performed at SWMU 27 as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

27.2 2007 INVESTIGATION RESULTS

No additional RI data was collected at SWMU 27.

27.3 CONCLUSIONS AND RECOMMENDATIONS

Based on results from the 2008 investigation, and comparison of those results to the RI soil screening levels, SWMU 27 will be carried over to the FS for further evaluation of potential remedial measures to include institutional controls.

Section 28
90-Day Drum Storage Area (SWMU 28)

The 90-Day Drum Storage Area (SWMU 28) was not included in the RI field investigation because there was no data need identified. The 90-Day Drum Storage area was geographically situated at the Rectifier Yard (refer to Figure P-1) which is being addressed as an AOC in Volume 3, Section 4 of this report. Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for a summary of this SWMU.

28.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

No RI field investigation was performed at SWMU 28 as consistent with the Ecology-approved Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

28.2 INVESTIGATION RESULTS

No additional RI data was collected at SWMU 28.

28.3 CONCLUSIONS AND RECOMMENDATIONS

No further action is recommended for the 90-Day Drum Storage Area (SWMU 28). This SWMU is not recommended for evaluation in the FS.

Section 29
Caustic Spill (SWMU 29)

A caustic spill associated with operations of the Line A Secondary Scrubber Recycle System (SWMU 5) occurred in late 1990 (Ecology 1990b,c). The spill occurred in an area north of the railway lines and south of the two fixed above-ground sodium hydroxide storage tanks (capacities of 30,000 and 60,000 gallons) that were located near the southern wall of SWMU 29. SWMU 29 is in the east-central portion of the main plant area (Figure P-1).

Approximately 5,000 gallons of 20 percent sodium hydroxide, originating from a transfer of liquid between the tanks, was spilled on the ground. Reportedly, other smaller spills had occurred previously in this area. Spill response included flushing liquid to the nearest storm drain while the NPDES system was monitored. NPDES limits were not exceeded. Some soil with elevated pH was removed and the area was repaved.

Investigation objectives included characterizing COPC in soil and determining whether a release from SWMU 29 has occurred.

29.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The Caustic Spill was investigated with three soil borings located within the Caustic Spill Area. The borings were planned to be completed to a maximum depth of 10 ft or refusal. Discrete soil samples were planned to be collected at depths of 0.5 ft bgs, 2 ft bgs, and the base of each boring. Soil samples were analyzed for metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn) and pH.

One shallow temporary well (specified in the Work Plan as RI-GW3) was initially planned in the area of the Caustic Spill as part of the GWAOC investigation.

29.2 INVESTIGATION RESULTS

Soil samples collected in December 2015 as part of the initial RI mobilization, were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Lithologic logs are provided in Volume 5, Appendix B-29. The laboratory data report and data validation report for the project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively.

The RI soil sample analytical results for SWMU 29 are summarized in Table 29-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecologic screening levels for wildlife protection. Site soil background concentrations are also provided in Table 29-1 for comparative review. Figure 29-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

All three borings were drilled using hollow-stem auger drilling techniques. Soil samples were collected and logged at selected intervals ranging from 1.0 to 5.0 ft bgs using a heavy-duty, Dames & Moore style, stainless-steel, split-spoon sampler. Boring SWMU29-SB01 and SWMU29-SB03 were drilled to a depth of 14.5 and 16 ft bgs, respectively, which are both deeper than the specified maximum depth of 10 ft bgs. Both borings were terminated at refusal. The added depth was drilled to characterize the top of the shallow water-bearing zone at SWMU 29, so that a temporary well could be installed; however, shallow groundwater was not encountered, and a temporary well was not installed at this location.

Boring SWMU29-SB02 was terminated at a depth of 5 ft when an active waterline was struck during drilling activities.

Lithology at this site consisted predominately of dense silty gravel (GM), clayey gravel (GC) and gravelly silt (ML) that likely represent fill material.

Consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), the eight soil samples were analyzed for a limited chemical suite (pH and metals only). The results show that:

- pH ranges from 8.07 to 10.4 pH units indicating that the soils are alkaline. Levels of pH are significantly below the hazardous waste characteristic designation criteria of 12.5 pH units.

Table 29-1
SWMU 29 - Caustic Spill Area Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2015

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU29-SB01-0.5 12/3/2015	SWMU29-SB01-3.0 12/3/2015	SWMU29-SB01-14.5 12/4/2015	SWMU29-SB02-0.75 12/3/2015	SWMU29-SB02-4.0 12/3/2015	SWMU29-SB03-0.75 12/3/2015	SWMU29-SB03-4.0 12/3/2015	SWMU29-SB03-10.5 12/3/2015
Metals															
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	15,000 J	4,600 J	5,800	31,000 J	8,800 J	19,000 J	4,900 J	4,600 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.5 J	0.93 J	1	1.9 J	1.3 J	1.9 J	0.79 J	0.96 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.33 J	0.035 J	0.18	0.17 J	0.085 J	0.13 J	0.039 J	0.038 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	9.5 J	3 J	5.6 J	26 J	8.7 J	**100 J**	4.1 J	4.9 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	18 J	6.6 J	21 J	20 J	19 J	28 J	13 J	14 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	9.9 J	2.1 J	2.1	6.7 J	3 J	4.2 J	1.7 J	1.8 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	15 J	3 J	13 J	46 J	8.2 J	39 J	4.1 J	4.6 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.4 J**	**1.1 J**	**1.7**	**1.4 J**	**2.3 J**	**2 J**	**1.4 J**	**1.6 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	69 J	28 J	45	49 J	60 J	62 J	32 J	29 J
Geo Chemistry															
pH	SU	NE	NE	NE	NE	NE	NE	9.74	10.4	10	8.39	9.98	8.07	9.98	10.1

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
SSL = Soil Screening Level
SU = Standard Units

R:\projects_2011\LockheedMartin_GoldendaleSiteInvestig\maps\2021_Combined_RI_WPA\Figure_29-1_SWMU_29_Exceedance.mxd

Legend

Soil Boring Location

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

N W E S

0 50 100 200
Feet

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

Figure 29-1
SWMU 29
Caustic Spill
Sampling Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Of metals, chromium (100 J mg/kg) was detected above terrestrial ecological screening levels for wildlife protection and background concentrations in one sample. Selenium was detected at low concentrations (maximum of 2.3 J mg/kg) above terrestrial ecologic screening levels for wildlife protection in all of the collected samples.

- These results suggest that the historical caustic spill does not appear to represent an ongoing source.

Discolored (dark-brown to gray-black) soils were noted in about the uppermost 3 ft of soils during excavation activities conducted in the vicinity of boring SWMU29-SB02 (excavation work was needed to repair the broken water line caused by drilling operations). This soil discoloration is likely indicative of the presence of PAHs in the shallow subsurface.

29.3 CONCLUSIONS AND RECOMMENDATIONS

Chemical concentrations in surface and subsurface soils generally did not exceed soil screening levels. Based on the collected RI data, the historical spill does not appear to represent an ongoing source and as such SWMU 29 is not recommended for further evaluation in the FS.

Section 30
Paste Plant Spill (SWMU 30)

The Paste Plant Spill (SWMU 30) is in the southern portion of the plant area (Figure P-1). Spills associated with the Paste Plant Recycle Water System (SWMU 9) and adjacent Briquette Slab Storage Area comprise the area of SWMU 30. The Paste Plant Recycle Water System (SWMU 9), nearby and associated facilities, and Ecology inspections and administrative actions related to the Paste Plant Recycle Water System are discussed in this RI Report above in Section 9.

As previously described in the approved Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), during a May 1990 inspection (Ecology 1990a), an overflow event was observed at the cooling tower on the east side of the Paste Plant. The cooling tower and associated sump are part of the Paste Plant Recycle Water System. The overflow event reportedly reached the fence on the south side of the Paste Plant. The inspection report (Ecology 1990a) noted other overflow events had occurred previously and resulted in at least one previous soil cleanup during 1989 where approximately 150 tons of state designated EHW had been removed from the same area as the spill (interpreted as a grassy area south of the fence line).

In 1990, Columbia Aluminum was ordered by Ecology (Order No. 90-1054) to remove all PAH contaminated soil associated with the Paste Plant spills south of the Paste Plant facility chain link fence to John Dam Road to the south (Ecology 1990c). During the May 1990 inspection, Ecology collected four soil/sediment samples from the spill area and determined that the soil would designate as either a state designated DW or EHW based on the detected concentrations of cPAHs.

Surface soil was sampled, excavated, and removed from the area south of the Paste Plant (Technico Environmental Services 1991c). Approximately 2,830 cubic yards of PAH-contaminated soil were excavated and disposed at the WSI, because they contained less than one percent PAHs, and were not designated as an EHW under the Washington State Dangerous Waste Regulations (Chapter 173-303 WAC) (Technico Environmental Services 1991c). During the 1991 soil removal screening was conducted on total PAH concentrations rather than TTEC concentrations since the current specified TEC approach [WAC 173-340-708(8)] was not yet adopted (Technico Environmental Services 1991c).

During the soil removal, a previously unknown landfill containing plant waste was discovered (the EELF, SWMU 17) to the east along the fence line; therefore, the soil removal was not completed. In addition, a former discharge line for the Paste Plant was identified along the fence line and noted as a likely historical source of contaminants (Technico Environmental Services 1991c).

30.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The Paste Plant Spill was investigated during June 2016 with 12 soil borings and one surface soil sample (Figure 30-1) consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The investigation objectives included characterizing COPCs in soil in the spill area to supplement previous data from removals and confirmation sampling, and to determine an approximate area and volume of PAH-contaminated soil that exceeds site soil screening levels.

Ten of twelve borings were drilled and sampled using hollow-stem auger drilling techniques, and two borings were drilled using a stainless-steel hand auger. All drilling and sampling procedures were performed according to the approved work plan. Five of the soil borings were located between the Paste Plant and the fence line to the south, and seven borings were completed in the grassy area south of the fence line focusing on the lowest-lying areas that represent a flow path from the historic discharge pipe outlet to the lowest elevation in the grassy area. The surface soil sample (SWMU30-SS01) was collected at the outlet of the identified historical discharge pipe, daylighting at the south side of the paste plant boiler room foundation at the fence line, and which was also an apparent area of potential flow from the paved area north of the fence line to the grassy area south of the fence line. Seventeen soil samples were collected from the borings where sufficient fine-grained matrix was present.

The soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, and metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn).

RI Borings

Soil Screening Levels
blue: Exceeds Protection of Groundwater Screening Level
purple: Exceeds Ecological Wildlife Screening Level
NE: No exceedance

Sample depths in feet bgs.

0 20 40 80
Feet

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 30-1

SWMU 30 Paste Plant Spill

RI Sampling Locations and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

30.2 RI INVESTIGATION RESULTS

Five soil borings were completed in the plant area along the north side of the fence line, and seven soil borings and one surface soil sample were completed to the south of the plant area boundary between the fence line and John Day Dam Road. Soil encountered in the borings was characterized, logged, and sampled. Boring logs for SWMU 30 are included in Volume 5, Appendix B-30. Samples were planned to be collected at depths of 0.5 ft bgs and 2 ft bgs, and above the bottom of the boring at about 10 ft bgs. Insufficient fine-grained matrix was present in boring SWMU30-SB05, and no samples were collected.

The area investigated inside the plant area fence line is presently paved. Soil encountered in borings SWMU30-SB01 through SWMU30-SB05 consisted of layered gravel containing concrete fragments (GW to GP) and sand (SW to SP) fill to depths of 7 to 10 ft bgs. Black silt and micaceous fine to medium sand were encountered from 7 to 10 ft bgs and overlying the upper surface of bedrock vesicular basalt flow top at about 11 ft bgs in borings SWMU30-SB01 and SWMU30-SB04.

The grassy area between the south plant fence line and John Day Dam Road is undeveloped with uneven terrain formed by exposed bedrock surrounded by lower lying areas where sandy soil has accumulated resulting from historic glacial flooding. Also contributing to the uneven terrain is past soil removal activity conducted in the grassy area to remove sandy soil between areas of exposed bedrock (Technico Environmental Services 1991c). Sandy micaceous soil was encountered in the seven soil borings drilled in the area outside the fence line and ranged in thickness from 0.5 ft bgs to 7 ft bgs overlying the upper surface of basalt bedrock and in boring SWMU30-SB06 vesicular basalt flow top at about 6 ft bgs. Wet soil was encountered in borings SWMU30-SB09 at 9.5 ft bgs and in SWMU30-SB10 at 8 ft bgs.

Soil analytical results are summarized in Table 30-1. SWMU 30 data are compared to MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife soil screening levels. Laboratory analytical reports are included in Volume 5, Appendix H-2 and data validation reports are included in Volume 5, Appendix I-2. The data quality objectives for the project were met and data qualifiers have been assigned as appropriate in Table 30-1. All samples have been collected where feasible and analyses completed as proposed in the Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b). In this investigation phase reporting limits for selenium exceed soil screening levels in most samples analyzed.

Table 30-1
SWMU 30 Paste Plant Spill RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	RI Analytical Results								
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Protection of Groundwater	Natural Background	Wildlife	SWMU30-SS01	SWMU30-SB01-3.0	SWMU30-SB01-10.0	SWMU30-SB02-7.0	SWMU30-SB02-9.8	SWMU30-SB03-3.0	SWMU30-SB03-5.0	SWMU30-SB04-4.0	SWMU30-SB04-9.5
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.085 U	0.056 UJ	0.06 UJ	0.057 U	0.057 UJ	0.075 J	0.057 UJ	0.055 UJ	0.056 UJ
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	59 J	9.9	6.6	3.9	6	40	**240**	37	8.9
Sulfate	mg/kg	NA	NE	2,150	NE	NE	NA	16	10 U	10 U	16	25	10 U	10 UJ	33
Polynuclear Aromatic Hydrocarbons(PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	2.7 U	0.014	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.27
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	2.7 U	0.017	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.4
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	14	0.12	0.0093 U	0.045 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.016
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	2.7 U	0.04	0.0093 U	0.046 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.0084
Anthracene	mg/kg	NA	NE	2,300	NE	NL	40	0.38	0.0093 U	0.17 UJ	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.008 U
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	260	2.2	0.0093 U	1.2	0.58	0.0077 U	0.0076 U	0.0077 U	0.052
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	300	2.3	0.0093 U	0.41	0.25	0.0077 U	0.0076 U	0.009	0.065
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	380	3.8	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0094	0.081
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	250	2.2	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.009	0.057
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	130	1.5	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.026
Chrysene	mg/kg	NA	NL	NL	NE	NL	230	2.7	0.0093 U	0.33	0.16	0.0077 U	0.0076 U	0.0077 U	0.044
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	59	0.52	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.014
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	320	3.3	0.0093 U	14	4.9	0.0077 U	0.0076 U	0.0077 U	0.055
Fluorene	mg/kg	NL	140,000	100	NE	NL	8.2	0.068	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.016
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	180	1.7	0.0093 U	0.039 U, UJ	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.042
Naphthalene	mg/kg	5	70	4.5	NE	NL	2.7 U	0.022	0.0093 U	0.039 U	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.13
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	120	0.87	0.0093 U	0.065 UJ	0.16 U	0.0077 U	0.0076 U	0.0077 U	0.028
Pyrene	mg/kg	NA	110,000	650	NE	NL	290	3.4	0.0093 U	8.3 UJ	2.8	0.0077 U	0.0076 U	0.0094	0.068
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	**385.2**	3.13	0.0093	0.53	0.59	0.0077	0.0076	0.011	0.87
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	**502.2**	4.8	0.0093	14	4.9	0.0077	0.0076	0.01	0.25
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**2,079**	**20.32**	0.0093	**4.74**	**3.79**	0.0077	0.0076	0.04	0.45
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	44,000	8,400	23,000	7,800	17,000	8,600	8,600	9,900	7,500
Arsenic	mg/kg	20	88	2.9	7.61	132	4.5	3.9	6.1	2.2	3.5	0.94	1.1	2.4	**8.9**
Cadmium	mg/kg	2	3,500	0.69	0.81	14	**1.5**	0.56 U	0.70 U	0.58 U	0.61 U	0.57 U	0.57 U	0.58 U	0.60 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	34	11	9.9	8.4	12	4.2	3.3	6.8	8.6
Copper	mg/kg	NA	140,000	280	28.4	217	80	15	33	13	25	11	12	14	14
Lead	mg/kg	1,000	NE	3,000	13.1	118	37	5.6 U	7.0 U	6.8	6.3	5.7 U	7.2	5.8 U	6.0 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	**2.2**	0.28 U	0.35 U	0.29 U	0.31 U	0.29 U	0.29 U	0.29 U	0.30 U
Nickel	mg/kg	NA	70,000	130	24.54	980	43	11	14	11	10	4.5	3.6	6.6	9.2
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.1 U	5.6 U	7.0 U	5.8 U	6.1 U	5.7 U	5.7 U	5.8 U	6.0 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	**730**	42	48	39	56	47	43	55	41

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed or not shown for this chemical but detected concentrations accounted for in the summation process.
TTEC	Total Toxicity Equivanlent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

Table 30-1
SWMU 30 Paste Plant Spill RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

		Screening Levels				Ecological Screening Levels	RI Analytical Results								
Parameter Name	**Units**	**MTCA Method A Industrial**	**MTCA Method C**	**Protection of Groundwater**	**Natural Background**	**Wildlife**	**SWMU30-SB06-0.5**	**SWMU30-SB06-5.0**	**SWMU30-SB07-0.5**	**SWMU30-SB07-3.0**	**SWMU30-SB08-0.5**	**SWMU30-SB09-0.5**	**SWMU30-SB10-0.5**	**SWMU30-SB11-0.5**	**SWMU30-SB12-0.5**
Aluminum Smelting															
Cyanide, total	mg/kg	NA	2,200	1.9	NE	5	0.056 UJ	0.057 UJ	0.057 UJ	0.057 UJ	0.058 UJ	0.058 UJ	0.059 UJ	0.089 U	0.084 U
Fluoride	mg/kg	NA	210,000	147.6	14.11	NE	35	21	33	7.5	35	82	21	25 J	37 J
Sulfate	mg/kg	NA	NE	2,150	NE	NE	46	32	35	16	NA	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons(PAHs)															
1-Methylnaphthalene	mg/kg	NA	4,500	0.082	NE	NL	0.0071 U	0.0071 U	0.0073 U	0.0076 U	0.0071 U	0.0072 U	0.0069 U	0.011	0.019
2-Methylnaphthalene	mg/kg	NA	14,000	1.7	NE	NL	0.0071 U	0.0071 U	0.0073 U	0.0076 U	0.0071 U	0.0072 U	0.0069 U	0.015	0.025
Acenaphthene	mg/kg	NA	210,000	98	NE	NL	0.025	0.0071 U	0.078	0.0076 U	0.024	0.035	0.0089	0.14	0.19
Acenaphthylene	mg/kg	NA	NE	NE	NE	NL	0.0071 U	0.0071 U	0.0073 U	0.0076 U	0.0071 U	0.0072 U	0.0069 U	0.0073 U	0.0072 U
Anthracene	mg/kg	NA	NE	2,300	NE	NL	0.061	0.0071 U	0.17	0.0076 U	0.049	0.052	0.026	0.41	0.59
Benzo(a)anthracene	mg/kg	NA	NL	NL	NE	NL	0.49	0.0071 U	1.3	0.018	0.51	0.69	0.21	2.9	3.7
Benzo(a)pyrene	mg/kg	2	NL	NL	NE	NL	0.7	0.0071 U	1.6	0.027	0.67	0.71	0.27	3.7	4.5
Benzo(b)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.93	0.0071 U	2.6	0.032	0.92	1.1	0.35	5.1	5.9
Benzo(g,h,i)perylene	mg/kg	NA	NE	NE	NE	NL	0.58	0.0071 U	1.7	0.02	0.6	0.87	0.26	2.7	3.3
Benzo(k)fluoranthene	mg/kg	NA	NL	NL	NE	NL	0.39	0.0071 U	1	0.013	0.39	0.36	0.11	1.6	1.7
Chrysene	mg/kg	NA	NL	NL	NE	NL	0.46	0.0071 U	1.9	0.019	0.45	0.33	0.18	2.7	3.4
Dibenz(a,h)anthracene	mg/kg	NA	NL	NL	NE	NL	0.11	0.0071 U	0.4	0.0076 U	0.14	0.16	0.062	0.48	0.65
Fluoranthene	mg/kg	NA	140,000	630	NE	NL	0.57	0.0071 U	1.9	0.024	0.6	0.13	0.24	3.8	4.7
Fluorene	mg/kg	NL	140,000	100	NE	NL	0.014	0.0071 U	0.044	0.0076 U	0.012	0.013	0.0069 U	0.08	0.11
Indeno(1,2,3-cd)pyrene	mg/kg	NL	NL	NL	NE	NL	0.42	0.0071 U	1.4	0.014	0.43	0.54	0.18	2	2.6
Naphthalene	mg/kg	5	70	4.5	NE	NL	0.0071 U	0.0071 U	0.013	0.0076 U	0.0071 U	0.0072 U	0.0069 U	0.023	0.037
Phenanthrene	mg/kg	NA	NE	NE	NE	NL	0.21	0.0071 U	0.66	0.0076 U	0.2	0.29	0.079	1.3	1.7
Pyrene	mg/kg	NA	110,000	650	NE	NL	0.54	0.0071 U	1.8	0.022	0.55	0.6	0.22	3.4	4.2
TTEC cPAH (calc)	mg/kg	2	130	3.9	NE	NE	0.9	0.0071	2.15	0.03	0.87	0.94	0.35	**4.74**	**5.73**
Total LMW PAH (calc)	mg/kg	NA	NE	NE	NE	100	0.88	0.0071	2.87	0.024	0.89	0.52	0.35	5.75	7.33
Total HMW PAH (calc)	mg/kg	NA	NE	NE	NE	1.1	**4.62**	0.0071	**10.5**	**3.72**	**4.66**	**5.36**	**1.84**	**24.58**	**39.95**
Metals															
Aluminum	mg/kg	NA	3,500,000	480,000	28,299	NE	9,400	10,000	10,000	9,900	10,000	10,000	8,600	11,000	12,000
Arsenic	mg/kg	20	88	2.9	7.61	132	4.5	3.6	3.5	4.2	3.2	4.4	4.4	1.6	2.5
Cadmium	mg/kg	2	3,500	0.69	0.81	14	0.53 U	0.53 U	0.54 U	0.57 U	0.54 U	0.54 U	0.52 U	0.55 U	0.54 U
Chromium	mg/kg	2,000	5,300,000	490,000	31.88	67	10	12	12	13	11	9.7	10	5.8	11
Copper	mg/kg	NA	140,000	280	28.4	217	12	14	15	18	16	17	14	19	17
Lead	mg/kg	1,000	NE	3,000	13.1	118	6.2	8.1	5.4 U	5.7 U	5.4 U	5.4 U	7.3	5.8	5.4 U
Mercury	mg/kg	2	NE	2.1	0.04	5.5	0.27 U	0.27 U	0.27 U	0.29 U	0.27 U	0.27 U	0.26 U	0.27 U	0.27 U
Nickel	mg/kg	NA	70,000	130	24.54	980	9.8	9.4	9.7	12	10	9.5	11	6.9	11
Selenium	mg/kg	NA	18,000	5.2	0.29	0.3	5.3 U	5.3 U	5.4 U	5.7 U	5.4 U	5.4 U	5.2 U	5.5 U	5.4 U
Zinc	mg/kg	NA	1,100,000	6,000	80.91	360	43	49	43	40	42	39	45	47	56

Notes:

J	Estimated concentration.
NA	Not applicable or not analyzed.
NE	Not established.
NL	Not listed for this chemical but accounted for in the summation process.
TTEC	Total Toxicity Equivanlent Concentration for carcinogenic PAHs.
LMW PAH	Low molecular weight PAH.
HMW PAH	High molecular weight PAH.
U	Chemical was not detected. The associated value represents the method detection limit.
UJ	Chemical was not detected. The associated limit is estimated.

Detected concentrations shown in **bold** exceed one or more site soil screening levels.

The laboratory analytical results for the soil boring samples indicate total cyanide, sulfate, and most metals do not exceed site soil screening levels. PAH detected in the surface soil sample SWMU30-SS01 collected at the paste plant boiler room discharge pipe (Figure 30-1) included calculated TTEC at 385.2 mg/kg, LMW PAH at 502.2 mg/kg, and HMW PAH at 2,019 mg/kg. PAH as TTEC exceeds the protection of groundwater screening level at depths of 0.5 ft bgs in SWMU30-SB11 and SWMU30-SB12. PAH as HMW PAH exceeds the ecological wildlife screening level in 11 of 17 soil samples, with highest concentrations of 20.32 mg/kg in boring SWMU30-SB01, 10.5 mg/kg in SWMU30-SB07, 24.58 mg/kg in SWMU30-SB11, and 39.95 mg/kg in SWMU30-SB12. Concentrations of PAHs calculated as TTEC and HMW PAH that exceed protection of groundwater and ecological wildlife screening levels, respectively, were detected at multiple depths throughout the soil column overlying bedrock.

Fluoride exceeded the site-specific protection of groundwater screening level of 147.6 mg/kg in one sample at 5.0 ft bgs in boring SWMU30-SB03. All other detected concentrations of fluoride were below about 59 mg/kg. Metals that exceeded either protection of groundwater or ecological wildlife screening levels included arsenic, cadmium, mercury, and zinc. In surface soil sample SWMU30-SS01 cadmium and mercury exceeded their protection of groundwater screening levels, and zinc exceeded the ecological wildlife screening level. Arsenic exceeded the protection of groundwater screening level in boring SWMU30-SB04 at 9.5 ft bgs. reporting limits for selenium ranging from 5.1 to 7.0 mg/kg exceeded the protection of groundwater screening level of 5.2 mg/kg in 16 out of 18 samples and exceeded the ecological wildlife screening level in all samples.

An estimate of the volume of impacted soil was calculated for the grassy area located between the plant area fence line and John Day Dam Road to the south. Figure 30-2 indicates the approximate area for the 1991 soil removal shown as a solid line, and an area representing the lowest-lying ground surface that may have received liquid flowing from the exposed pipe at the south edge of the paste plant foundation near the fence line shown as a dashed line (Figure 30-2). The approximate area inside the dashed line (lowest-lying area) was calculated as approximately 12,145 ft^2. An average depth of soil overlying bedrock in this area was calculated by taking the average of soil depth in borings SWMU30-SB06 through SWMU30-SB12, or about 2 ft. The approximate volume of soil overlying bedrock in this area is an estimated 28,300 cubic feet or 900 cubic yards.

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

Figure 30-2

SWMU 30 Paste Plant Spill

Outlines of RI Sampling Area and 1991 Soil Removal

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

30.3 CONCLUSIONS AND RECOMMENDATIONS

Detected concentrations of total cyanide, sulfate, and most metals in samples collected from 12 soil borings at depths of up to 9.8 ft bgs, do not exceed site soil screening levels. PAHs as TTEC and HMW PAH exceeded protection of groundwater and/or ecological wildlife screening levels in most soil samples. Surface soil sample SWMU30-SB01-0.5 collected at the paste plant foundation outfall exceeded MTCA Method C and ecological wildlife screening levels for TTEC, LMW and HMW PAH. Fluoride and arsenic exceeded the protection of groundwater screening level in one sample each. Cadmium, mercury, and zinc exceeded protection of groundwater and ecological wildlife screening levels in the surface soil sample.

Based on the results of the RI investigation of SWMU 30, remedial alternatives for contaminated soil will be evaluated in the FS. Groundwater near this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.

Section 31
Smelter Sign Area (SWMU 31)

The Smelter Sign Area (SSA) consists of two primary areas, including the actual area where the smelter sign is located, between the eastern edge of the Production Area and John Day Dam Road and an area located North of the East Surface Impoundment (NESI) (refer to Figure 31-1).

Prior to the RI, no environmental investigation was completed in the areas associated with the SSA (SWMU 31). However, site inspections were performed in 2011 to better understand the site conditions and to help develop the scope for the RI (Tetra Tech 2011b,c). Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for a detailed summary of available information regarding the SSA.

31.1 SMELTER SIGN AREA DESCRIPTION

The SSA consists of: 1) the plant sign area with associated irrigated lawn and gravel access road along the northern lawn boundary, 2) a built-up bench-area with a rough gravel roadway and two small concrete pads that are present south of the lawn, and 3) a knoll area with basalt outcrops and backfill material with some evidence of historical disposal that is located southwest of the lawn and northwest of the bench area. From the top of the bench area the topography slopes downward to the north, west, south, and east (refer to Figure 31-1).

During the 2011 inspection, two concrete pads were observed present on top of the bench area along with a line of small, low-lying metal supports. These supports may potentially be related to historical piping for the ESI area that was closed during the late 1980s. Scattered chunks of suspected pot liner wastes, and a few small piles of miscellaneous plant wastes were observed in the bench area and the knoll area southwest of the lawn. Also observed were plant-related waste that included bricks in the northeastern area adjacent to the irrigated lawn. No wastes were observed on the grassy southeast facing slope of the bench area above the railway spur (Tetra Tech 2011c).

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Legend

Smelter Sign and NESI Area Boundaries

NESI Wetland Spring

Note: NESI Area (Area North of East Surface Impoundment)

Imagery Data Sources: USDA NAIP 1-m Imagery, 2006.

N W E S

0 125 250 500

Feet

Figure 31-1
SWMU 31
Smelter Sign and NESI Area
Site Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

31.2 NESI AREA DESCRIPTION

The NESI Area consists of an open area that currently appears to be used as pastureland. The site is characterized by hummocky topography with some outcrops of basalt bedrock. A gravel road enters the site from the west and north. A spur of the gravel road serves as an entrance to the closed ESI Area. A series of rock walls composed of basalt cobbles and boulders are present at the site. Some low-lying areas of the site were observed to have seasonal standing water and represent delineated wetland areas (Tetra Tech 2011c).

Carbon wastes, suspected SPL, and cryolite wastes were observed in several areas of the site. The wastes are distributed along the sides of the gravel road, particularly in areas of low elevations. In some areas, it appears that the wastes had been graded and pushed up to the sides of depression areas. A series of historical aerial photographs were summarized and included in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a). A 1972 aerial photograph shows evidence of extensive waste disposal in the area and was used to help define the investigation area(s). The largest accumulation of waste appeared to be present immediately west of the road, in the central part of the investigation area and can be readily seen in Figure 31-1.

During the 2011 site inspection (Tetra Tech 2011c), a wetlands assessment was performed to ensure that the field investigation of this area can be appropriately conducted, and that necessary permits can be obtained prior to conducting previously planned investigation activities. Evidence of waste disposal was found within the wetlands in the central and eastern portion of the planned NESI Area investigation.

31.3 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

This section summarizes the field investigation analytical program for SWMU 31. The overall purpose of the sampling program was to determine the vertical and lateral extent of aluminum smelter wastes and impacted soils at these sites. More specifically, the areas and depths containing listed K088 SPL waste, as well as other state and federal hazardous waste was a primary goal. Another primary objective was to characterize, the extent of COPC in site soils that underlie the wastes. These objectives were addressed through implementation of a trenching and test pit sampling program and associated waste and soil sampling.

Rough order-of-magnitude estimates of the volume of wastes in various categories (e.g., RCRA–listed wastes, Washington State Dangerous and Extremely Dangerous Wastes, and non-hazardous wastes) have been made to facilitate future evaluation of remedial alternatives and associated costs.

SWMU 31 is one of two SWMUs (SWMU 31 and SWMU 17) at the site undergoing RI characterization where suspected SPL is present, a listed hazardous waste, as well as other aluminum process wastes that include anode or other carbon wastes, cryolite, and alumina waste, and potential scrubber sludges. For this reason, a waste recognition, categorization, and sampling approach were developed for these two SWMUs that was included in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

Test pit excavations were used to qualitatively determine the type of wastes present in specific areas and to determine the lateral extent of wastes. The physical characteristics of encountered waste materials were described and used to categorize the wastes.

The team identified suspected SPL in the field based on the waste recognition, categorization, and logging procedures specified in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), including the SPL waste recognition technical memorandum.

31.3.1 Field Investigation and Analytical Program Summary

The fieldwork for SWMU 31 was conducted during late June 2016. Based on the results of the initial RI fieldwork, Ecology and Yakama Nation Comments on the Draft RI, further investigation of SWMU 31 was conducted as part of the WPA as summarized in the following sections.

31.3.1.1 Initial RI Field Investigation

The initial RI investigation at the NESI included excavation work in a wetland area and the fieldwork required permitting through the USACE Nationwide 6 Permit, as well as the completion of a Joint Aquatic Resources Permit Application (JARPA). The JARPA and associated project plans were approved by USACE and Ecology. Tribal entities, including the Yakama Nation, were also notified of this project as part of the JARPA approval process. Klickitat County was also notified to ensure that the project complies with the Klickitat County Critical Areas Ordinance. As part of the JARPA, a cultural resources survey was performed by a qualified archaeologist, who was also onsite during excavation activities. The cultural resources work was performed consistent with the procedures of the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). No cultural resource artifacts were found.

The physical characteristics of encountered waste materials were described, and these observations have been used to categorize the wastes. Field logs of the test pit excavation and trenching program are provided in Volume 5, Appendix B-31(A).

For SWMU 31, sample names associated with the trenches include a trench segment designation [e.g., TR11A (meaning trench 11, segment A)] that is additional to the sample numbering procedure described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Several of the trenches in this area were significantly greater than 100 ft in length. In order to accurately log the locations of observations within a given trench, the trenches were logged in approximate 40- to 60-ft segments with the first 40- to 60-ft horizontal segment of the excavation being designated as segment “A”, and subsequent trench segments being assigned sequential letter designations (B, C, etc.). The soil and waste sample numbers include the trench segment designation for clarity and tracking purposes.

In one case at the SSA, an additional test pit (TP3A) was excavated near the edge of the lawn at the base of the roughly constructed, rip-rap ramp located northwest of TR10. This was to verify that no wastes were under the lawn and no samples were collected at this location. Based on the results of the four test pits excavated in the lawn area, which documented that no wastes were present beneath the lawn, it was determined that excavation of trenches in the lawn area (as proposed in the Work Plan) was unnecessary. This decision-making rationale was specified in the Work Plan.

All excavations were backfilled with the excavated materials and compacted and graded using the excavator.

31.3.1.2 Waste Analytical Program

The highest priority was to identify, and sample probable SPL waste using the protocols in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Other types of aluminum process wastes were also sampled if they were found in significant quantities including anode wastes or other carbon wastes (particularly if they are mixed in with suspected SPL), cryolite and alumina waste, and potential scrubber sludges.

Consistent with the work plan the wastes in each trench or test pit segment were collected from various subsurface depths as encountered. Discrete waste samples were categorized by suspected type and placed directly in jars or double-sealed zip-lock bags for analysis. A total of 7 waste samples were collected and analyzed for the SSA and 14 waste samples were collected and analyzed for the NESI.

Chemical analyses of the wastes included: total cyanide, fluoride, SPLP for fluoride, sulfate, PAHs, and selected metals (Al, As, Cd, Cr, Cu, Fe Pb, Hg, Ni, Se, and Zn). At the NESI area, a subset of waste samples was analyzed for SPLP cyanide (one sample), PCBs, TPH-Dx, TPH-Gx, and VOCs. At both sites, suspected SPL samples were also analyzed for a geochemical suite (Na, Ca, Mg, Li, P, Si, Mn, Si, and total organic carbon). Consistent with the Work Plan, and depending on the suspected waste type, some samples were analyzed for a subset of the analyses listed above.

31.3.1.3 Soil Analytical Program

Soil samples were collected from beneath the encountered wastes at intervals of about 0.5 ft and 2 ft below the wastes unless bedrock was encountered. In cases where no wastes were encountered, soil samples were collected from the excavation base. All the collected soil samples represent discrete grab samples that were collected either directly from the excavation side walls using a clean stainless-steel spoon, or from the excavator bucket if the depth of the excavation precluded field personnel entry. A total of 40 discrete soil samples were collected and analyzed from the SSA and 43 discrete soil samples were collected analyzed at the NESI, including field duplicates.

Like the EELF (SWMU 17), soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Se, and Zn), and total petroleum hydrocarbons (TPH-Dx and TPH-Gx). A few samples were also analyzed for PCBs and VOCs.

31.3.2 WPA Field Investigation

The WPA sampling program is summarized in the Final Work Plan Addendum, Revision 1 (Tetra Tech et al. 2020b). Both the SSA and the NESI Area were further investigated as part of the WPA.

The SSA consists of two subareas that were investigated as part of the RI, including the Smelter Sign subarea and the NESI subarea (Figure 31-1). Suspected SPL and other smelter-related wastes were found in both subareas. For both subareas, the RI sampling program emphasized subsurface waste and subsurface soil sampling and the Draft RI Report (Tetra Tech et al. 2019a) identified additional characterization of surface soil concentrations as a data need for the FS or design phase of the project. Based on Ecology and Yakama Nation comments on the Draft RI Report further characterization was included as part of the WPA.

31.3.2.1 Smelter Sign Subarea

Sampling Stations within the Smelter Sign Subarea are shown in Figure 31-2. The objective of the WPA field investigation is to characterize the extent of surface soil contamination in the Smelter Sign subarea to better estimate the extent and volume of contaminated surface soil. The WPA investigation scope for the Smelter Sign subarea included collection of 29 surface soil samples at an approximate 75-foot spacing.

The soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and diesel/oil-range petroleum hydrocarbons.

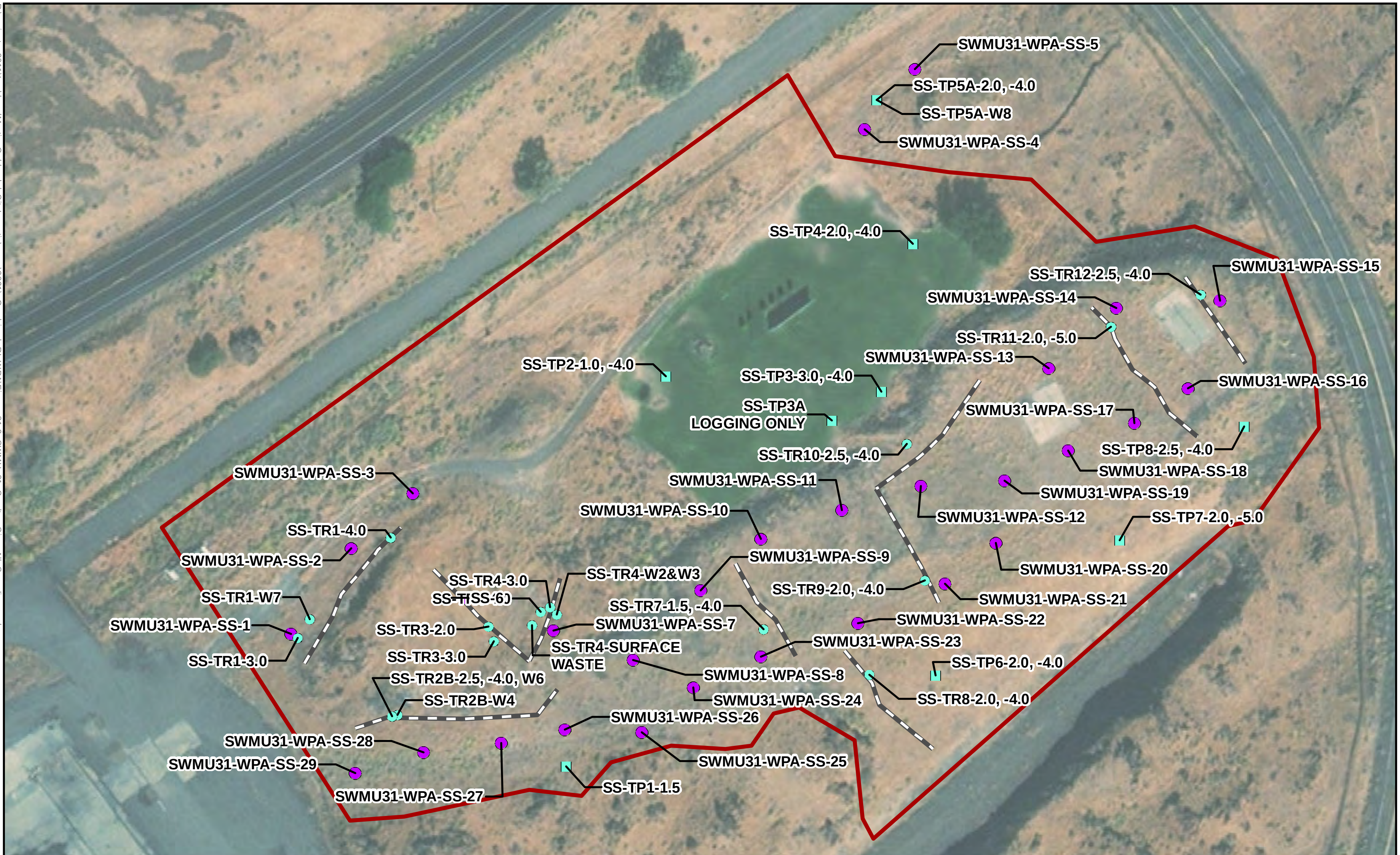
31.3.2.2 NESI Subarea

Figures 31-3 shows the RI and WPA sampling locations for the NESI Subarea. The objective of the NESI WPA field investigation is to characterize the extent of surface soil contamination in the NESI subarea to better estimate the extent and volume of contaminated surface soil for both RI and FS purposes.

Site reconnaissance activities for the larger area east of the NESI were performed as part of assessment of an additional investigation area – the Eastern Reconnaissance Area. Refer to Section 35 of this volume.

The WPA investigation scope for the NESI subarea is includes the following:

- **NESI Wetland**. Seven surface soil samples were collected from the NESI wetland that was not previously investigated during the RI.
- **Areas Adjacent to Waste Footprint.** Eleven surface soil samples were collected from areas adjacent to Waste Footprint areas. In the NESI area, most wastes were found at or near the ground surface, and it is assumed that surface soils in all waste areas are contaminated and will need to be addressed during remediation. For this reason, the proposed surface soil sample stations in the NESI area will be collected from outside the Waste Footprint.



Legend

Smelter Sign Area

Trench Location

RI Test Pit Location

RI Trench Sampling Location

WPA Sample Location

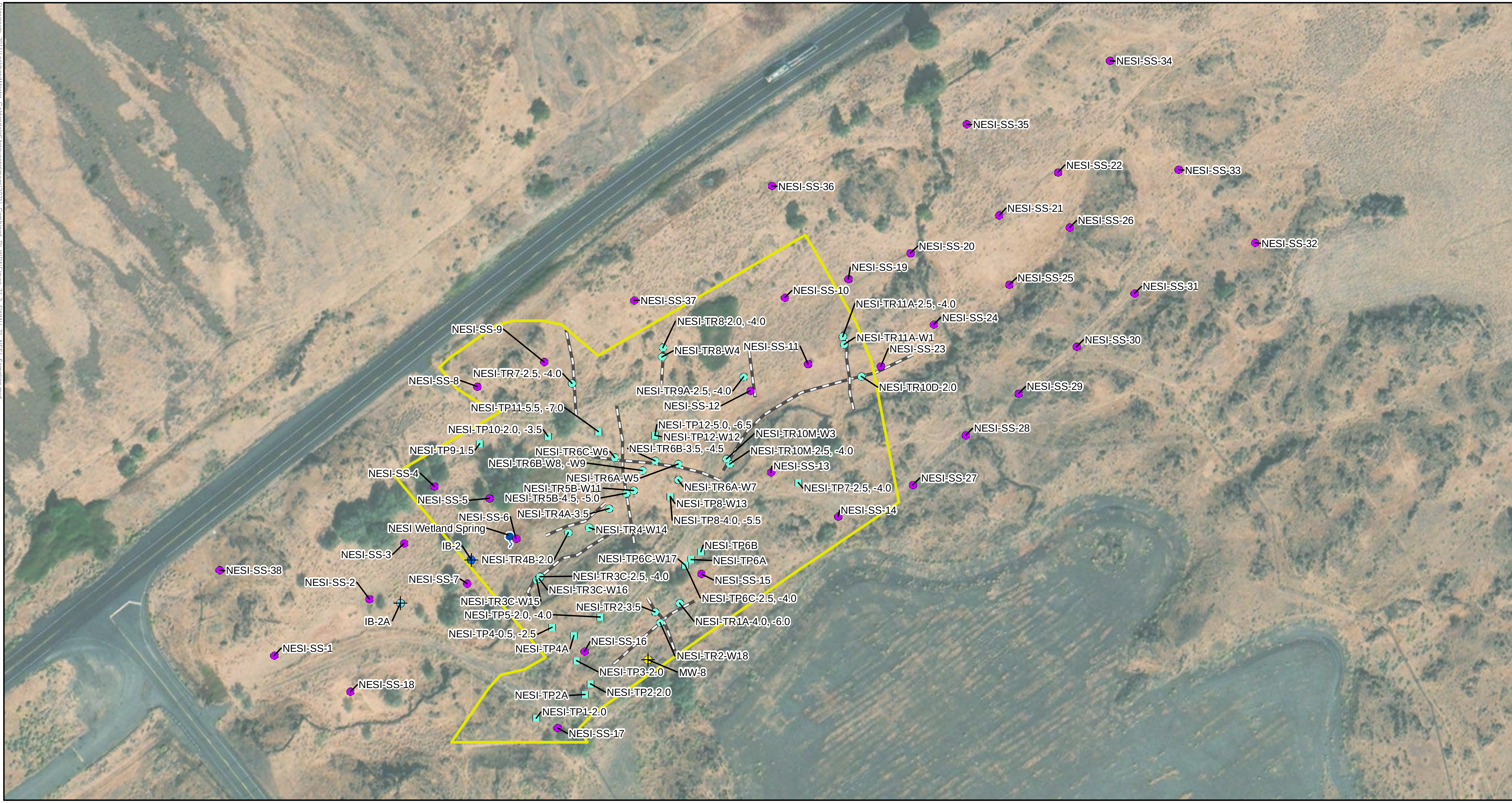
N
W E
S

0 50 100 200

Feet

Figure 31-2
SWMU 31
Smelter Sign Area
Sampling Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Legend

- NESI Area
- RI Test Pit Location
- RI Trench Sampling Location
- WPA Sample Location
- Trench Location
- NESI Wetland Spring
- Unconsolidated Aquifer Well (UA)

Uppermost Basalt Aquifer Well (BAU)

- BAU_1 - Shallower Water-bearing Zone
- BAU_2 - Deeper Water-bearing Zone

N
W E
S

0 50 100 200
Feet

Figure 31-3
SWMU 31
NESI Area
Sampling Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The WPA investigation scope for the NESI subarea is includes the following:

- **NESI Wetland**. Seven surface soil samples were collected from the NESI wetland that was not previously investigated during the RI.

- **Areas Adjacent to Waste Footprint.** Eleven surface soil samples were collected from areas adjacent to Waste Footprint areas. In the NESI area, most wastes were found at or near the ground surface, and it is assumed that surface soils in all waste areas are contaminated and will need to be addressed during remediation. For this reason, the proposed surface soil sample stations in the NESI area will be collected from outside the Waste Footprint.

- **Eastern Area**. Surface soils were collected along three transects at an approximate 100-foot spacing to characterize surface soil concentrations immediately east of the NESI area. The transects were placed in low lying areas, areas of former dirt roads, and cattle paths and in the general dominant downwind direction from the NESI Area (i.e., up valley, dominant wind direction is from the southwest to the northeast). A total of 13 surface soil samples were collected from this area.

The soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and diesel/oil-range petroleum hydrocarbons.

This portion of the WPA field program was implemented during fall and winter of 2020. Based on these results, an additional 7 samples were collected from outlying areas of NESI to the east and north of the past sample locations. These samples were collected during May 2021.

31.4 INVESTIGATION RESULTS

This section summarizes the waste and soil results for the SSA and the NESI.

Complete analytical results for the initial RI investigation phase of SWMU 31 are provided in Volume 5, Appendix H-1 and data validation reports are provided in Volume 5, Appendix I-1. Complete analytical results and data validation for the WPA samples are provided in Volume 5, H-3 and I-3, respectively. Soil and waste samples were collected during June 2016, December 2020, and May 2021, and received by the laboratory in good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Refer to Volume 1, Section 6 for summary of the data quality assessment performed for the RI. Sample logs are included in Volume 5, Appendix B-31.

The Smelter Sign subarea is located on NSC-owned land that is currently zoned as an Industrial Park. For this reason, waste and soil results have been screened against MTCA Method A industrial screening levels (petroleum hydrocarbons only), MTCA Method C screening levels, MTCA-derived soil screening levels for groundwater protection, and terrestrial ecological screening levels for protection of wildlife. Background soil concentration are also provided in the data summary tables.

The NESI subarea is located on NSC-owned land that is currently zoned for Extensive Agriculture. For this reason, waste and soil results have been screened against MTCA Method A unrestricted land use screening levels (petroleum hydrocarbons only), MTCA Method B screening levels, MTCA-derived soil screening levels for groundwater protection, and MTCA Terrestrial Ecological screening levels protective of plants, soil biota, and protection of wildlife. Background soil concentrations are also provided in the data summary tables.

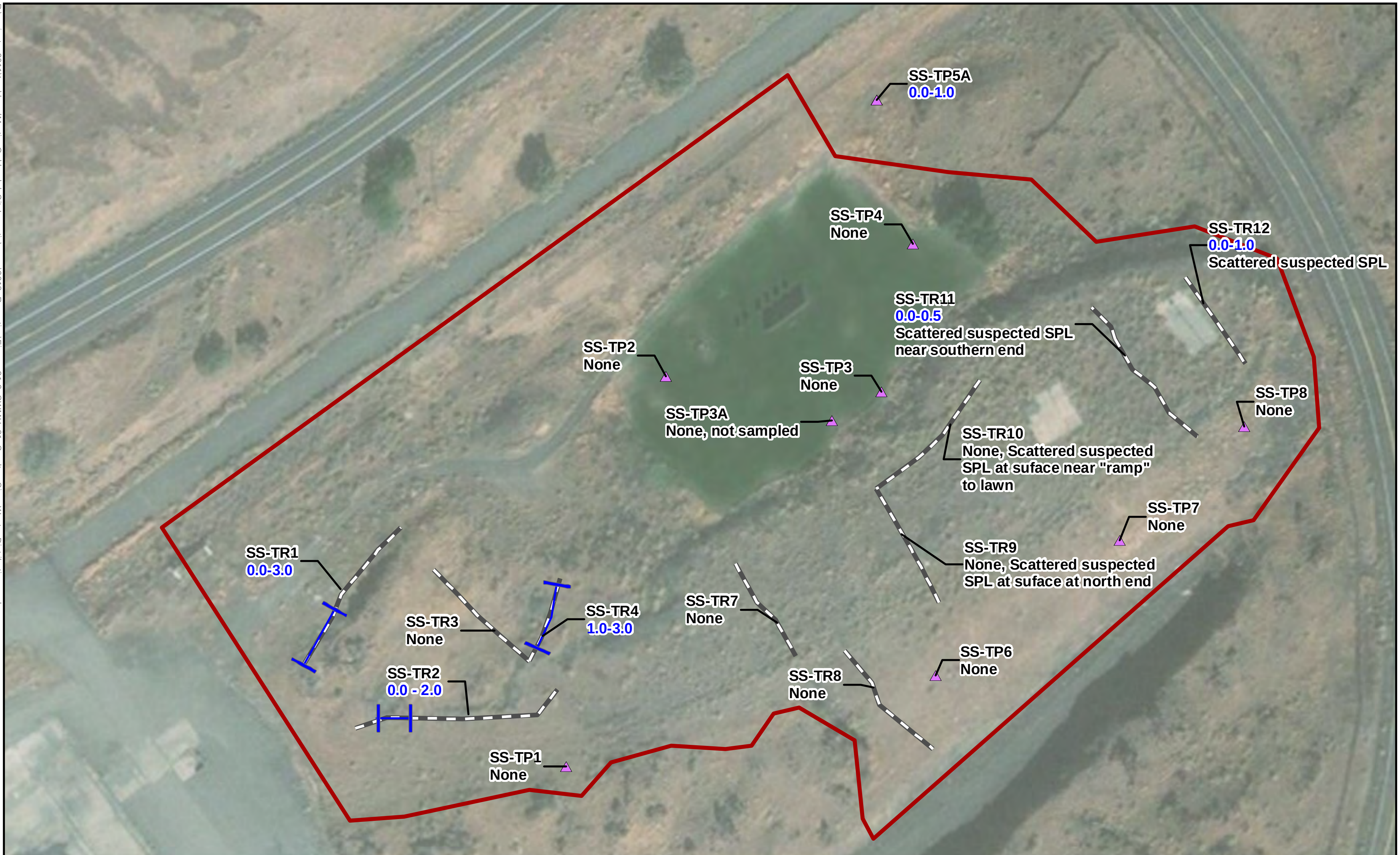
31.4.1 Smelter Sign Subarea Results

Test pit, trench locations, and sample locations at the SSA are shown in Figure 31-2. A total of 10 trenches and 9 test pits were excavated and sampled during the initial RI field mobilization consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b).

31.4.1.1 Smelter Sign Waste Description and Occurrence

Figure 31-4 shows the occurrence of aluminum smelter-related wastes found at the SSA. The carbon wastes present in the SSA appear to represent suspected SPL, and other types of carbon wastes that could not be conclusively identified. The amount of carbon waste present at the site is relatively small and is found in localized low areas (SS-TR1, SS-TR2B, SS-TR4), piles (TP-5A), or scattered in the top 6-inches to 1-ft of the excavation (TR-11 and TR-12). In general, where carbon waste was encountered, the thickness of the waste zone was a maximum of 2-3 ft thick. Very little suspected alumina or cryolite wastes were found in this area of the site. Photographs of all collected waste samples are presented in Volume 5, Appendix B-31(B).

Note that one of the SPL samples previously used as a “type” example in the SPL identification training was selected for chemical analyses (labeled as -SPL1) to facilitate data comparisons between the various types of sampled carbon waste.



Legend

- Smelter Sign Area
- Trench Location
- Test Pit Location
- Lateral Extent of Carbon Waste in Trench

Carbon waste interval including intermixed
suspected spent pot liner (SPL) 2.0-4.0 feet bgs

N
W E
S

0 25 50 100
Feet

Figure 31-4
SWMU 31
Smelter Sign Area
Trench and Test Pit Locations
Distribution of Carbon Waste

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

31.4.1.2 Smelter Sign Area Waste Chemical Results

Table 31-1 summarizes the analytical results for the collected SSA waste samples collected during the initial RI field investigation. Photographs of the sampled wastes are shown in Volume 5, Appendix B-31(B). Figure 31-5 shows the locations of waste samples that exceed soil screening levels.

Analytical results for the SSA wastes are summarized as follows:

- Total cyanide was not detected [not even in the sample collected from the identification training SPL sample (SPL-1)]. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.

- cPAH concentrations exceed MTCA Method C screening level of 130 mg/kg (TEC) in one of two analyzed carbon waste samples (maximum of 262.3 mg/kg, TEC); the other sample exceeded the MTCA-derived screening level for protection of groundwater and terrestrial ecological screening levels for protection of wildlife. Neither of the two analyzed carbon waste samples exceeded the Washington State Dangerous Waste criteria of 10,000 mg/kg (1 percent).

- Fluoride was detected at concentrations above the MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in 5 of 7 of the analyzed waste samples (maximum of 2,800 J mg/kg). Elevated fluoride concentrations were found in both the suspected SPL and non-SPL wastes and the suspected SPL-type sample was characterized by low fluoride concentrations (68 mg/kg). The SPLP fluoride leachate concentrations for these waste samples ranged from 6.6 mg/L to 450 mg/L, which are all above the groundwater MCL for fluoride (4.0 mg/L).

- Sulfate was detected at concentration ranging from 39 J to 66 J mg/kg in three analyzed waste samples. These concentrations are below the MTCA-derived soil screening level for protection of groundwater of 2,150 mg/kg.

- For metals, arsenic (maximum of 30 mg/kg) exceeded the MTCA-derived soil screening level for protection of groundwater. Cadmium (maximum of 1.6 mg/kg), nickel (maximum of 560 mg/kg), and selenium (maximum of 11 mg/kg) were detected in the wastes above MTCA-derived screening levels for protection of groundwater, as well as background concentrations. Lead (maximum of 430 mg/kg) and selenium (maximum of 11 mg/kg) also exceeded MTCA soil terrestrial ecological screening levels and background concentrations.

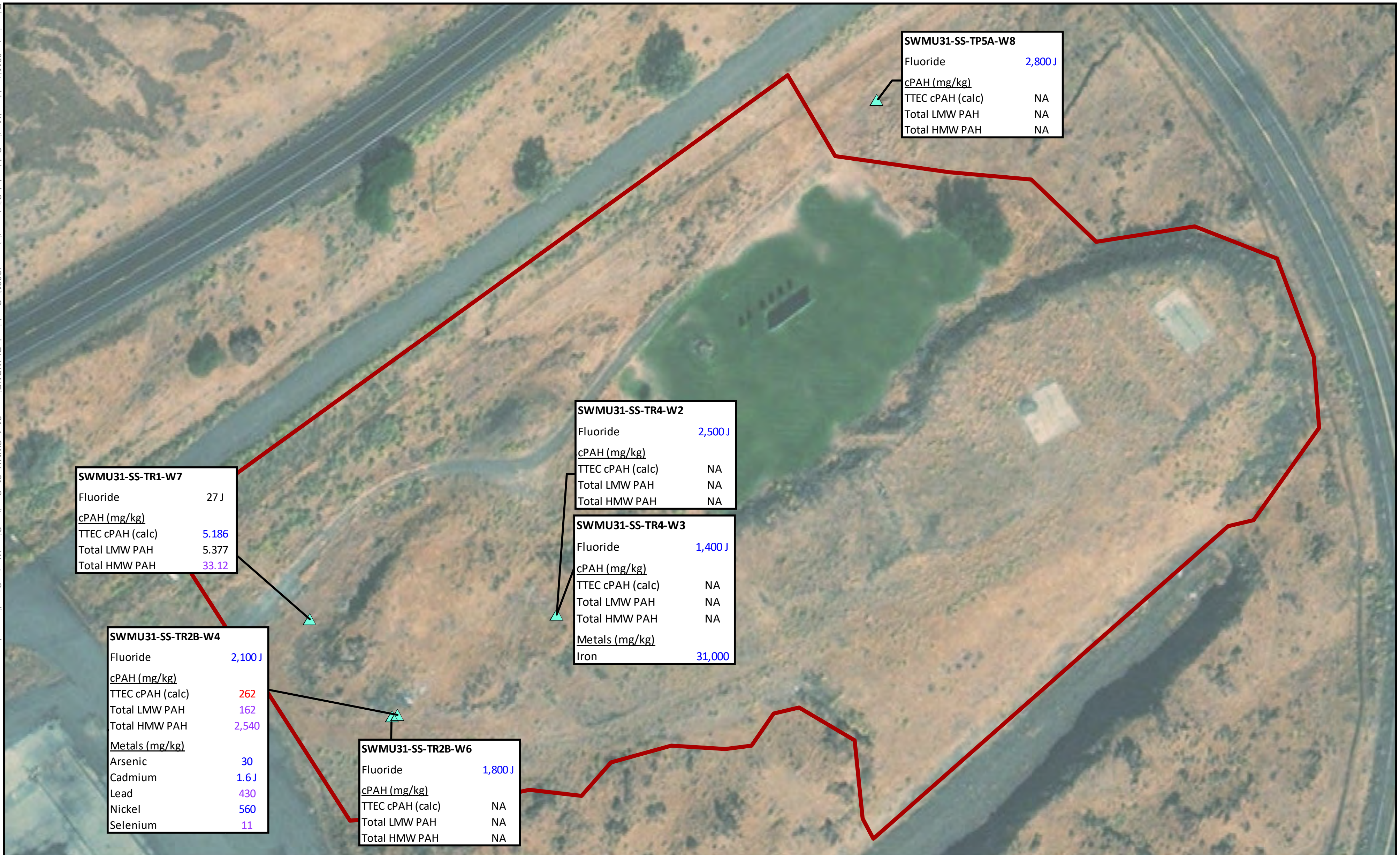
Table 31-1
SWMU 31 - Smelter Sign Area Waste Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 1 of 2)

				Ecological Indicator					Analytical Results						
									SWMU31-SS-SPL1 6/30/2016	SWMU31-SS-TR4-W2 6/27/2016	SWMU31-SS-TR4-W3 6/27/2016	SWMU31-SS-TR2B-W4 6/28/2016	SWMU31-SS-TR2B-W6 6/28/2016	SWMU31-SS-TR1-W7 6/28/2016	SWMU31-SS-TP5A-W8 6/28/2016
									Waste Description						
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Washington Dangerous Waste Persistence Criteria	Suspected SPL, dense, hard, black to blue-gray, one of the type examples from identification training	Suspected cryolite/alumina waste, white, hard, and dense. Cemented to carbon waste	Suspected SPL, gray, hard, vesicular, with rust-red to orange secondary minerals	Suspected non-SPL carbon waste, dark gray to black powder	Suspected SPL, dense, gray-blue with white secondary minerals	Suspected non-SPL carbon waste, dark brown to black, blocky, friable, non-dense	Suspected SPL, gray-blue, fine-grained with some supected white cryolite/alumina
Aluminum Smelter															
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	--	1.8 U	NA	1.9 U	1.9 U	1.7 U	1.8 U	2.3 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	--	68	**2,500 J**	**1,400 J**	**2,100 J**	**1,800 J**	27 J	**2,800 J**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	--	43	NA	39 J	NA	66 J	NA	NA
SPLP Flouride	mg/L	NA	NE	NE	NE	NE	NE	--	340	380	360	450	390	6.6	7.1
Polycyclic Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	--	NA	NA	NA	0.043 J	NA	0.056 U	NA
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	--	NA	NA	NA	0.056	NA	0.04 U	NA
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	--	NA	NA	NA	0.45	NA	0.097 J	NA
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	--	NA	NA	NA	0.098	NA	0.045 U	NA
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	--	NA	NA	NA	2.4	NA	0.18 J	NA
Benz[a]anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	--	NA	NA	NA	190	NA	3.4	NA
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	--	NA	NA	NA	100	NA	3.4	NA
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	--	NA	NA	NA	870	NA	7.2	NA
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	--	NA	NA	NA	180	NA	3.2	NA
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	--	NA	NA	NA	200	NA	2.2	NA
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	--	NA	NA	NA	530	NA	5.4	NA
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	--	NA	NA	NA	60	NA	0.62	NA
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	--	NA	NA	NA	150	NA	4	NA
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	--	NA	NA	NA	0.23	NA	0.045 U	NA
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	--	NA	NA	NA	250	NA	3.9	NA
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	--	NA	NA	NA	0.14	NA	0.071 U	NA
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	--	NA	NA	NA	9	NA	1.1	NA
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	--	NA	NA	NA	160	NA	3.8	NA
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	--	NA	NA	NA	**262**	NA	**5.186**	NA
Total PAHs (calc)	mg/Kg	NE	130	NE	NE	10,000	NE	10,000	NA	NA	NA	2,702	NA	38.497	NA
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	--	NA	NA	NA	**162**	NA	5.377	NA
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	--	NA	NA	NA	**2,540**	NA	**33.12**	NA
Metals															
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	--	22,000 J	NA	2,000 J	73,000 J	28,000 J	1,200 J	NA
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	--	0.82	NA	0.42	**30**	3.4	0.47	NA
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	--	**3.2 J**	NA	0.49 J	**1.6 J**	0.087 J	0.093 J	NA
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	--	4.1 J	NA	0.28 J	66 J	3.1 J	1.4 J	NA
Copper	mg/Kg	NA	140,000	217	280	217	28.4	--	5.1 J	NA	1.2 B	31 J	4.7 J	7.5 J	NA
Iron	mg/Kg	NE	2,500,000	NE	5,600	5,600	NE	--	640	NA	**31,000**	NA	460	NA	NA
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	--	2.9	NA	1.1	**430**	3	1	NA
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	--	0.0054 U	NA	0.37	0.045	0.0059 U	0.0072 J	NA
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	--	6	NA	3.7	**560**	4.4	5.9	NA
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	--	0.26 J	NA	0.13 J	**11**	0.23 J	0.3 J	NA
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	--	2.2 J	NA	2.5 J	68 J	2 J	13 J	NA

Table 31-1
SWMU 31 - Smelter Sign Area Waste Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Washington Dangerous Waste Persistence Criteria	Analytical Results: SWMU31-SS-SPL1 6/30/2016	SWMU31-SS-TR4-W2 6/27/2016	SWMU31-SS-TR4-W3 6/27/2016	SWMU31-SS-TR2B-W4 6/28/2016	SWMU31-SS-TR2B-W6 6/28/2016	SWMU31-SS-TR1-W7 6/28/2016	SWMU31-SS-TP5A-W8 6/28/2016
Waste Description									Suspected SPL, dense, hard, black to blue-gray, one of the type examples from identification training	Suspected cryolite/alumina waste, white, hard, and dense. Cemented to carbon waste	Suspected SPL, gray, hard, vesicular, with rust-red to orange secondary minerals	Suspected non-SPL carbon waste, dark gray to black powder	Suspected SPL, dense, gray-blue with white secondary minerals	Suspected non-SPL carbon waste, dark brown to black, blocky, friable, non-dense	Suspected SPL, gray-blue, fine-grained with some supected white cryolite/alumina
Geo Chemistry															
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	--	4,700	NA	6000	NA	3,800	NA	NA
Magnesium	mg/Kg	NE	NE	NE	NE	NE	NE	--	210	NA	820	NA	180 J	NA	NA
Sodium	mg/Kg	NE	NE	NE	NE	NE	NE	--	49,000 J	NA	4,500 J	95,000 J	62,000 J	110 J	NA
Lithium	mg/Kg	NE	NE	NE	NE	NE	NE	--	4.8 J	NA	3.8 J	NA	12	NA	NA
Phosphorus	mg/Kg	NE	70	NE	NE	70	NE	--	32	NA	25	NA	19	NA	NA
Silicon	mg/Kg	NE	NE	NE	NE	NE	NE	--	31	NA	24	NA	83	NA	NA
Manganese	mg/Kg	NE	160,000	NE	970	970	NE	--	16	NA	140	NA	4.7	NA	NA
Total Organic Carbon	mg/Kg	NE	NE	NE	NE	NE	NE	--	650,000	NA	740,000	NA	510,000	NA	NA
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	--	460	NA	4,300	NA	530	NA	NA
Quartz	mg/Kg	NE	NE	NE	NE	NE	NE	--	66	NA	51	NA	180	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration



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Legend

Smelter Sign Area

Waste Sampling Location

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 31-5
SWMU 31
Smelter Sign Area
Waste Sampling Locations
and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

A hypothesis during Work Plan development was that the SPL waste would likely contain elevated concentrations of cyanide, fluoride, aluminum and sodium relative to non-SPL carbon waste. It was also hypothesized that the suspected SPL might be characterized by lower PAH concentrations than the anode wastes due to the lower percentages of pitch and coke used in the SPL. However, these trends could not be completely demonstrated in the SSA waste data set. In general, the suspected SPL samples were characterized by generally higher fluoride, aluminum, and sodium concentrations than the suspected non-SPL carbon waste concentrations. No PAH distribution trend could be identified between the waste types in part because of limitations in the data set for the SSA. Also, in some cases, it was challenging to reliably distinguish suspected SPL from other carbon wastes based on field observations, given the large variety in appearance of the carbon wastes.

31.4.1.3 Smelter Sign Area Soil Chemical Results

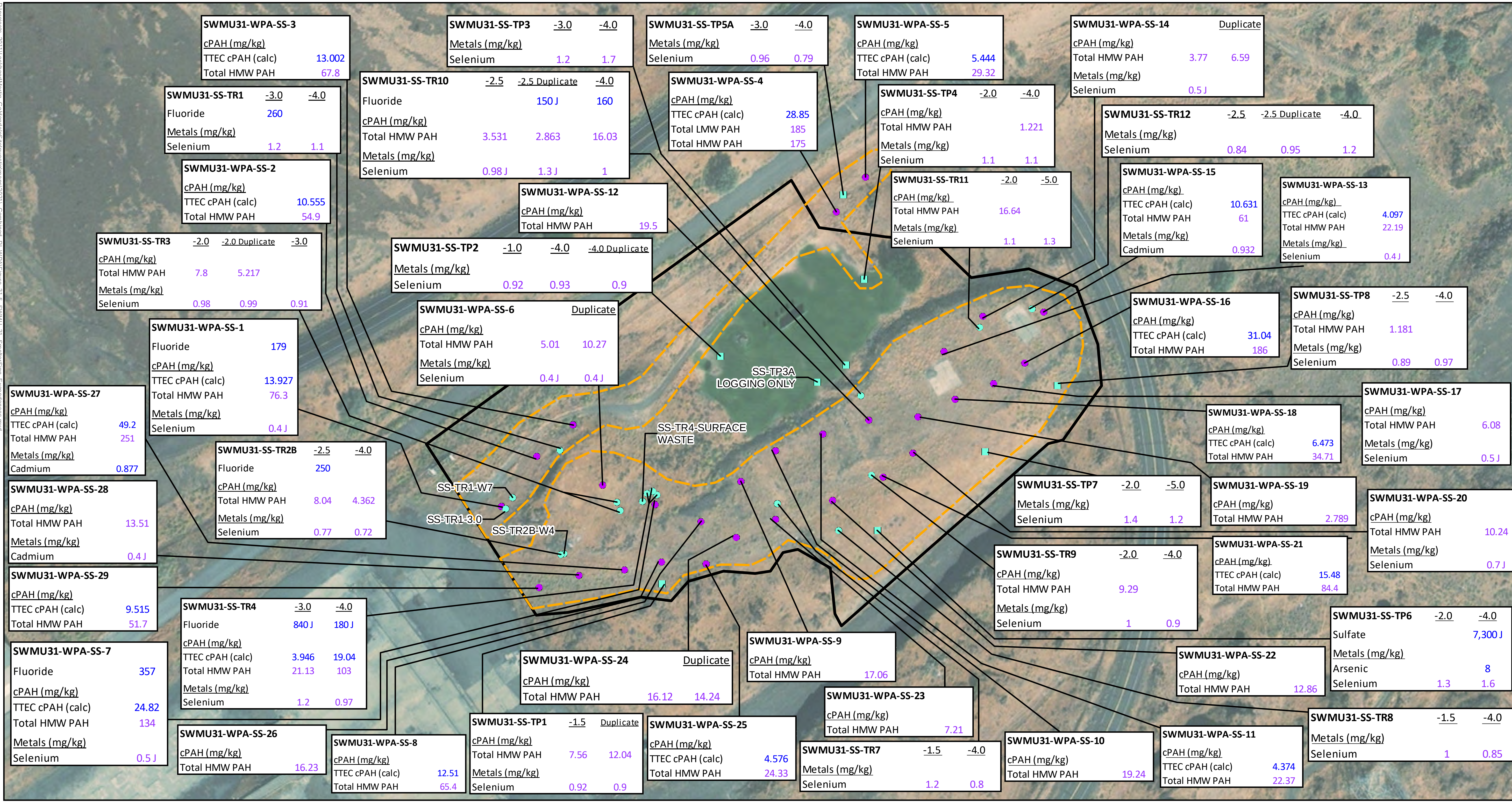
Table 31-1 summarizes the analytical results for the collected SSA waste samples. Figure 31-6 shows the locations of soil samples above screening levels for the SSA both the initial RI and WPA field investigations.

Initial RI Shallow Subsurface Soil Sample Results

During the initial RI investigation, soil samples were collected from below the wastes or at the base of the excavation (Table 31-2), if wastes weren't present [consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)]. The initial RI soil sampling program focused on subsurface soil sample collection below wastes. Note that consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b), surface soil samples were not initially collected.

The subsurface soil samples collected below the wastes ranged in depth from 1.0 to 4.0 ft bgs. Shallow subsurface soil chemical results collected during initial RI sampling are summarized as follows:

- Total cyanide was not detected in any of the collected samples sent for laboratory analysis. Note that the reporting limits for some samples were elevated slightly above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. The soil screening level is based specifically on free cyanide and the total cyanide analytical method conservatively includes all species of cyanide.
- Fluoride was detected at low to moderate concentrations (below MTCA screening levels). Only one sample (840 J mg/kg) exceeded the MTCA-derived screening level for protection of groundwater.



Legend
- RI Test Pit Location
- RI Trench Sampling Location
- WPA Sample Location
- Smelter Sign Area
- Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 31-6
SWMU 31
Smelter Sign Area
Soil Sampling Locations and
Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-SS-TP1-1.5 6/27/2016	SWMU31-SS-TP45-1.5 (Duplicate of SWMU31-SS-TP1-1.5) 6/27/2016	SWMU31-SS-TP2-1.0 6/28/2016	SWMU31-SS-TP2-4.0 6/28/2016	SWMU31-SS-TP47-4.0 (Duplicate of SWMU31-SS-TP2-4.0) 6/28/2016	SWMU31-SS-TP3-3.0 6/27/2016	SWMU31-SS-TP3-4.0 6/27/2016	SWMU31-SS-TP4-2.0 6/28/2016	SWMU31-SS-TP4-4.0 6/28/2016	SWMU31-SS-TP5A-2.0 6/28/2016
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	1.9 UJ	1.9 UJ	2.2 UJ	2.3 UJ	2.4 UJ	2.1 U	2.6 U	2.2 UJ	2.3 UJ	2.5 UJ
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	71	78	27 J	16 J	17 J	1	6.3	27 J	7.2 J	42
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	6.8 J	9.3 J	22 J	71 J	99 J	130	540	53 J	130 J	6 J
Polycyclic Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0035 J	0.0063	0.00072 U	0.00077 U	0.00065 U	0.0006 U	0.00078 U	0.00069 U	0.0011 J	0.00075 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0043 J	0.0077	0.00051 U	0.00055 U	0.00046 U	0.00043 U	0.0045 J	0.0005 U	0.0017 J	0.00053 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.058 J	0.098 J	0.0028 J	0.00073 U	0.00062 U	0.00057 U	0.00074 U	0.00066 U	0.012	0.00071 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0012 J	0.0017 J	0.00057 U	0.00061 U	0.00051 U	0.00048 U	0.00062 U	0.00055 U	0.00047 U	0.00059 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.088 J	0.15 J	0.0027 J	0.00073 U	0.00062 U	0.00057 U	0.00074 U	0.00066 U	0.014	0.0012 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.78 J	1.3 J	0.028	0.00093 U	0.00078 U	0.00073 U	0.00094 U	0.0019 J	0.14	0.0084
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1 J	1.6 J	0.034	0.0014 J	0.0011 J	0.00038 U	0.00049 U	0.0023 J	0.17	0.01
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.4	2	0.044	0.0029 J	0.003 J	0.00056 U	0.00073 U	0.0037 J	0.21	0.014
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.83 J	1.3 J	0.028	0.0013 J	0.0011 J	0.00048 U	0.0016 J	0.0023 J	0.14	0.0086
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.43 J	0.74 J	0.014	0.00073 U	0.00062 U	0.00057 U	0.00074 U	0.0017 J	0.073	0.0057 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.97	1.4	0.037	0.0027 J	0.0031 J	0.0014 U	0.0019 U	0.0031 J	0.16	0.013
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.13 J	0.2 J	0.0038 J	0.00088 U	0.00074 U	0.00069 U	0.00089 U	0.00079 U	0.018	0.0014 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	1.2 J	2.1 J	0.041	0.0032 J	0.0028 J	0.0013 U	0.0033 J	0.0041 J	0.19	0.013
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.027 J	0.051 J	0.0016 J	0.00061 U	0.00051 U	0.00048 UJ	0.00062 UJ	0.00055 U	0.0061	0.00059 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.92 J	1.6 J	0.03	0.0014 J	0.0011 J	0.00057 U	0.00074 U	0.0026 J	0.14	0.0097
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0084 J	0.015 J	0.00091 U	0.00098 U	0.00082 U	0.00076 U	0.0018 J	0.00088 U	0.0031 J	0.00095 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.48 J	0.81 J	0.018	0.0016 J	0.0016 J	0.00066 U	0.0079	0.0024 J	0.08	0.0058 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	1.1 J	1.9 J	0.037	0.0028 J	0.0024 J	0.00093 U	0.0028 J	0.0038 J	0.17	0.012
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	1.3757	2.198	0.04635	0.001984	0.001648	0.000353	0.0004565	0.0033605	0.2297	0.01405
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	1.8704	3.2397	0.0661	0.0048	0.0044	0.00043 U	0.0175	0.0065	0.308	0.02
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**7.56**	**12.04**	0.2558	0.0125	0.0118	0.00038 U	0.0044	0.0214	**1.221**	0.0828
Polychlorinated Biphenyls (PCBs)																	
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	14,000 J	14,000 J	10,000	14,000	15,000	7,100	14,000	11,000	11,000	14,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4.1	3.5	6.1	2	1.9	4.7	3.3	6.1	6.4	3
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.31	0.29	0.23	0.22	0.2	0.29	0.6	0.2	0.28	0.2
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	12 J	12 J	13	16 J	13 J	11	14	12	15	11
Copper	mg/Kg	NA	140,000	217	280	217	28.4	20 J	19 J	18	19	19	16	32	17	17	25
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	8.2 J	6.7 J	8.2	5.1	4.5	6.6	8.5	8.3	8.1	4.9
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.014 J	0.013 J	0.014 J	0.019 J	0.012 J	0.0096 J	0.014 J	0.0086 J	0.0068 U	0.012 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	12 J	11 J	12	8.6	8.8	8.7	19	11	12	9.6
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.92**	**0.9**	**0.92**	**0.93**	**0.9**	**1.2**	**1.7**	**1.1**	**1.1**	**0.96**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	61	59	60	66	68	52	98	56	58	54

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 2 of 8)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-SS-TP1-1.5 6/27/2016	SWMU31-SS-TP45-1.5 (Duplicate of SWMU31-SS-TP1-1.5) 6/27/2016	SWMU31-SS-TP2-1.0 6/28/2016	SWMU31-SS-TP2-4.0 6/28/2016	SWMU31-SS-TP47-4.0 (Duplicate of SWMU31-SS-TP2-4.0) 6/28/2016	SWMU31-SS-TP3-3.0 6/27/2016	SWMU31-SS-TP3-4.0 6/27/2016	SWMU31-SS-TP4-2.0 6/28/2016	SWMU31-SS-TP4-4.0 6/28/2016	SWMU31-SS-TP5A-2.0 6/28/2016
Total Petroleum Hydrocarbons (TPHs)																	
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	0.55 U	0.56 U	0.59 U	0.71 U	0.76 U	0.66 U	0.92 U	0.6 U	0.71 U	0.83 U
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	27	10 U	12 U	13 U	14 U	11 U	14 U	12 U	12 U	13 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	160 J	62 J	22 J	27 J	32 J	9.6 U	82	22 J	45 J	22 J
Volatile Organic Compounds																	
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 3 of 8)

				Ecological Indicator				Analytical Results										
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-SS-TP5A-4.0 6/28/2016	SWMU31-SS-TP6-2.0 6/27/2016	SWMU31-SS-TP6-4.0 6/27/2016	SWMU31-SS-TP7-2.0 6/24/2016	SWMU31-SS-TP7-5.0 6/24/2016	SWMU31-SS-TP8-2.5 6/24/2016	SWMU31-SS-TP8-4.0 6/24/2016	SWMU31-SS-TR1-3.0 6/28/2016	SWMU31-SS-TR1-4.0 6/28/2016	SWMU31-SS-TR2B-2.5 6/28/2016	SWMU31-SS-TR2B-4.0 6/28/2016
Aluminum Smelter																		
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.2 UJ	2.1 UJ	2 UJ	2 U	2.1 U	2 U	2 U	2.4 UJ	2.7 UJ	2.2 U	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	22	65	5.2	60	28	54	56	**260**	7.4	**250**	140
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	15	4.9 J	**7,300 J**	13	150	6.7 J	5.7 J	4.9 J	560	9.7 J	6 J
Polycyclic Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.00063 U	0.00064 U	0.00061 U	0.00071 U	0.00064 U	0.00057 U	0.00063 U	0.00066 U	0.0071	0.0063	0.0024 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00045 U	0.0012 J	0.00043 U	0.0005 U	0.00046 U	0.0004 U	0.00045 U	0.0012 J	0.015	0.0094	0.0036 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0006 U	0.0045 J	0.00058 U	0.00067 U	0.00061 U	0.008	0.0006 U	0.0087	0.00082 U	0.061	0.036
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0005 U	0.00051 U	0.00048 U	0.00056 U	0.00051 U	0.00045 U	0.0005 U	0.00052 U	0.0037 J	0.0027 J	0.0005 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0006 U	0.0025 J	0.00058 U	0.0021 J	0.00061 U	0.0097	0.0006 U	0.011	0.0081	0.088	0.045
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00075 U	0.028	0.00073 U	0.025	0.005 J	0.11	0.0071	0.11	0.0029 J	0.8	0.45
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.0004 U	0.037	0.00038 U	0.04 J	0.0068 J	0.15	0.01	0.12	0.00055 U	0.96	0.56
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00059 U	0.047	0.00057 U	0.049 J	0.011 J	0.22	0.015	0.16	0.0008 U	1.4	0.81
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.001 J	0.031	0.00048 U	0.029 J	0.0068 J	0.14	0.0086	0.1	0.00068 U	0.91	0.5
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0006 U	0.022	0.00058 U	0.023 J	0.0049 J	0.07	0.0049 J	0.059	0.00082 U	0.61	0.25
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0015 U	0.039	0.0014 U	0.04 J	0.0077 J	0.16	0.011	0.13	0.0031 J	1	0.56
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.00072 U	0.0051	0.00069 U	0.0046 J	0.0011 J	0.021	0.0014 J	0.017	0.00098 U	0.16	0.082
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.0018 J	0.036	0.0013 U	0.042 J	0.0087 J	0.17	0.01	0.16	0.021	1.2	0.65
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0005 U	0.0025 J	0.00048 UJ	0.00056 UJ	0.00051 UJ	0.0034 J	0.0005 UJ	0.0041 J	0.0039 J	0.028	0.016
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0006 U	0.035	0.00058 U	0.031 J	0.0072 J	0.16	0.0092	0.12	0.00082 U	1.1	0.56
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00079 U	0.0029 J	0.00077 U	0.0009 U	0.00081 U	0.0013 J	0.0008 U	0.0025 UJ	0.02	0.0011 U	0.0072
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0011 J	0.017	0.00066 U	0.014 J	0.0037 J	0.059	0.0035 J	0.063	0.036	0.48	0.26
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.002 J	0.034	0.00093 U	0.048 J	0.0082 J	0.15	0.01	0.14	0.02	1.1	0.59
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.0003705	0.0511	0.0003545	0.05366	0.009797	0.2097	0.01387	0.1679	0.000767	1.377	0.7808
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.0029	0.0666	0.00043 U	0.0581	0.0124	0.2514	0.0135	0.2507	0.1148	1.8924	1.0202
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.003	0.2781	0.00038 U	0.2896	0.0587	**1.181**	0.0772	0.956	0.026	**8.04**	**4.362**
Polychlorinated Biphenyls (PCBs)																		
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	NA	NA	NA	NA	NA	NA	NA	0.0086 U	NA	0.0079 U	NA
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0049 U	NA	0.0045 U	NA
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0057 U	NA	0.0053 U	NA
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0019 U	NA	0.0017 U	NA
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.0034 U	NA	0.0031 U	NA
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	NA	NA	NA	NA	NA	NA	NA	0.0017 U	NA	0.0016 U	NA
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	NA	NA	NA	NA	NA	NA	NA	0.0022 U	NA	0.002 U	NA
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.00058 UJ	NA	0.00054 UJ	NA
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	0.001 U	NA	0.00097 U	NA
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	NA	NA	NA	NA	NA	NA	NA	0.00058 U	NA	0.00054 U	NA
Metals																		
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	8,300	11,000 J	7,700 J	11,000	8,900	10,000	11,000	16,000	20,000	13,000	12,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.2	6.9	**8**	6.4	6	3	3.2	4.6	2.3	3.2	4.2
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.21	0.23	0.18	0.31	0.21	0.25	0.29	0.25	0.25	0.37	0.2
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	30	14 J	12 J	14	11	11	13	12	10	14	17
Copper	mg/Kg	NA	140,000	217	280	217	28.4	8.9	18 J	13 J	18	17	16	17	25	15	23	19
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	4.3	9.2 J	7.7 J	7.8	7.8	7	5.8	5.3	6.2	85	6.2
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0067 U	0.011 J	0.01 J	0.012 J	0.01 J	0.0097 J	0.0087 J	0.0088 J	0.0078 U	0.018 J	0.013 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	5.8	11 J	7.2 J	11	10	9.9	12	10	7.4	17	13
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.79**	**1.3**	**1.6**	**1.4**	**1.2**	**0.89**	**0.97**	**1.2**	**1.1**	**0.77**	**0.72**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	46	59	40	60	55	51	54	54	55	92	50

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

				Ecological Indicator				Analytical Results										
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-SS-TP5A-4.0 6/28/2016	SWMU31-SS-TP6-2.0 6/27/2016	SWMU31-SS-TP6-4.0 6/27/2016	SWMU31-SS-TP7-2.0 6/24/2016	SWMU31-SS-TP7-5.0 6/24/2016	SWMU31-SS-TP8-2.5 6/24/2016	SWMU31-SS-TP8-4.0 6/24/2016	SWMU31-SS-TR1-3.0 6/28/2016	SWMU31-SS-TR1-4.0 6/28/2016	SWMU31-SS-TR2B-2.5 6/28/2016	SWMU31-SS-TR2B-4.0 6/28/2016
Total Petroleum Hydrocarbons (TPHs)																		
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	0.54 U	0.56 U	0.62 U	0.63 U	0.61 U	0.67 U	0.51 U	0.89 U	1.1 U	0.63 U	0.55 U
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	11 U	12 U	12 U	12 U	11 U	12 U	11 U	13 U	14 U	19 J	11 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	9.4 U	16 J	54 J	16 J	19 J	9.7 U	15 J	32 J	21 J	130	25 J
Volatile Organic Compounds																		
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	0.00042 UJ	NA	0.00019 U	NA
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	0.00042 UJ	NA	0.00019 U	NA
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	0.00056 UJ	NA	0.00025 U	NA
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	0.00028 UJ	NA	0.00013 U	NA
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	0.00037 UJ	NA	0.00016 U	NA
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	0.00042 UJ	NA	0.00019 U	NA
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	0.00021 UJ	NA	0.000095 U	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	0.00042 UJ	NA	0.00019 U	NA
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	0.0022 J	NA	0.00025 U	NA
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	0.00042 UJ	NA	0.00019 U	NA
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	0.00042 UJ	NA	0.00019 UJ	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU31-SS-TR3-2.0 6/28/2016	SWMU31-SS-TR46-2.0 (Duplicate of SWM31-SS-TR3-2.0) 6/28/2016	SWMU31-SS-TR3-3.0 6/28/2016	SWMU31-SS-TR4-3.0 6/27/2016	SWMU31-SS-TR4-4.0 6/27/2016	SWMU31-SS-TR7-1.5 6/27/2016	SWMU31-SS-TR7-4.0 6/27/2016	SWMU31-SS-TR8-2.0 6/27/2016	SWMU31-SS-TR8-4.0 6/27/2016	SWMU31-SS-TR9-2.0 6/27/2016	SWMU31-SS-TR9-4.0 6/27/2016
Aluminum Smelter																		
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.2 U	2.1 U	2.1 UJ	2.2 UJ	2 UJ	2.1 UJ	2.1 UJ	2 UJ	2.1 UJ	2.2 U	2.3 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	140	120	42	**840 J**	**180 J**	35	38	73	4	48	17
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	13 J	17 J	13	100	120	41	12	6.3 J	29	140	330
Polycyclic Aromatic Hydrocarbons (PAHs)																		
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0026 J	0.0015 J	0.00065 U	0.016	**0.14**	0.00066 U	0.00062 U	0.00066 U	0.00065 U	0.0039 J	0.0007 U
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.003 J	0.0017 J	0.00046 U	0.016	0.18	0.00047 U	0.00044 U	0.00047 U	0.00046 U	0.0042 J	0.0005 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.052 J	0.029 J	0.00062 U	0.17	1.1	0.00063 U	0.0024 J	0.0041 J	0.00062 U	0.058	0.00066 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00054 U	0.00048 U	0.00052 U	0.0022 J	0.025 J	0.00053 U	0.00049 U	0.00052 U	0.00051 U	0.0014 J	0.00055 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.069 J	0.041 J	0.009	0.25	1.4	0.00063 U	0.0027 J	0.0049 J	0.00062 U	0.052	0.0007 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.78 J	0.51 J	0.019	1.9 J	10	0.003 J	0.036	0.078	0.00078 U	0.95	0.0071
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1	0.71	0.026	2.9 J	14	0.004 J	0.047	0.099	0.0013 J	1.3	0.0092
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.4 J	0.88 J	0.049	3.6 J	16	0.0066	0.059	0.13	0.00061 U	1.7	0.014
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.93	0.64	0.022	2.8 J	13	0.0029 J	0.038	0.058	0.00051 U	0.95	0.0071
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.44	0.37	0.044	1.1 J	7.2	0.0022 J	0.027	0.047	0.00062 U	0.65	0.0045 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	1 J	0.62 J	0.025	2.3 J	12	0.0045 J	0.049	0.091	0.0015 U	1.2	0.011
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.15 J	0.097 J	0.00074 U	0.43 J	2	0.00076 U	0.0057	0.0098	0.00074 U	0.14	0.0013 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	1.2 J	0.73 J	0.027	3.3 J	17	0.0046 J	0.05	0.1	0.0016 J	1.5	0.01
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.022 J	0.012 J	0.00052 U	0.083 J	0.52 J	0.00053 UJ	0.001 J	0.0017 J	0.00051 UJ	0.025 J	0.00055 UJ
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	1	0.71	0.026	3.2 J	14	0.0033 J	0.043	0.074	0.001 J	1	0.0088
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.006	0.0037 J	0.00083 U	0.022	0.33	0.00084 U	0.00078 U	0.0014 J	0.00082 U	0.0096	0.00088 U
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.37 J	0.23 J	0.0088	1.4 J	8.3	0.0019 J	0.018	0.031	0.00071 U	0.41	0.0042 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	1.1 J	0.68 J	0.025	2.9 J	15	0.0046 J	0.047	0.093	0.0015 J	1.4	0.0092
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	1.387	0.9729	0.040087	**3.946**	**19.04**	0.005593	0.06456	0.13379	0.001545	1.756	0.01288
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	1.7246	1.0489	0.0448	5.2592	28.995	0.0065	0.0741	0.1431	0.0016	2.0641	0.0149
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**7.8**	**5.217**		**21.13**	**103**	0.0311	0.3517	0.6798	0.0038	**9.29**	0.0722
Polychlorinated Biphenyls (PCBs)																		
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																		
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	15,000	15,000	15,000	21,000 J	18,000 J	11,000 J	11,000 J	14,000 J	9,800 J	10,000	9,600
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4.9	4.5	5.2	4.6	4.8	3.6	5.1	4.5	5.2	4.2	3.8
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.29	0.24	0.25	0.46	0.39	0.31	0.26	0.26	0.24	0.36	0.32
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	19	17	17	16 J	16 J	5.5 J	13 J	14 J	11 J	11	12
Copper	mg/Kg	NA	140,000	217	280	217	28.4	23	21	19	20 J	22 J	27 J	18 J	21 J	18 J	20	22
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	7.8	7.4	7.1	8.9 J	7.4 J	4.6 J	8.8 J	8.5 J	7.7 J	9.3	13
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.013 J	0.015 J	0.011 J	0.018 J	0.022	0.0056 J	0.01 J	0.011 J	0.0075 J	0.011 J	0.011 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	14	14	14	31 J	18 J	7.8 J	12 J	12 J	12 J	14	14
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.98**	**0.99**	**0.91**	**1.2**	**0.97**	**1.2**	**0.8**	**1**	**0.85**	**1**	**0.9**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	62	58	54	64	58	60	56	58	59	61	64

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU31-SS-TR3-2.0 6/28/2016	SWMU31-SS-TR46-2.0 (Duplicate of SWM31-SS-TR3-2.0) 6/28/2016	SWMU31-SS-TR3-3.0 6/28/2016	SWMU31-SS-TR4-3.0 6/27/2016	SWMU31-SS-TR4-4.0 6/27/2016	SWMU31-SS-TR7-1.5 6/27/2016	SWMU31-SS-TR7-4.0 6/27/2016	SWMU31-SS-TR8-2.0 6/27/2016	SWMU31-SS-TR8-4.0 6/27/2016	SWMU31-SS-TR9-2.0 6/27/2016	SWMU31-SS-TR9-4.0 6/27/2016
Total Petroleum Hydrocarbons (TPHs)																		
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	0.56 U	0.62 U	0.54 U	0.58 U	0.57 U	0.75 U	0.57 U	0.65 U	0.63 U	0.62 U	0.61 U
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	15 J	11 U	11 U	230 J	47	13 U	12 U	12 U	11 U	12 U	13 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	95 J	66 J	16 J	1,500 J	320	13 J	27 J	11 J	9.3 U	78	11 U
Volatile Organic Compounds																		
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 7 of 8)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU31-SS-TR10-2.5 6/24/2016	SWMU31-SS-TR44-2.5 (Duplicate of SWMU31-SS-TR10-2.5) 6/24/2016	SWMU31-SS-TR10-4.0 6/24/2016	SWMU31-SS-TR11-2.0 6/24/2016	SWMU31-SS-TR11-5.0 6/24/2016	SWMU31-SS-TR12-2.5 6/24/2016	SWMU31-SS-TR43-2.5 (Duplicate of SWMU31-SS-TR12-2.5) 6/24/2016	SWMU31-SS-TR12-4.0 6/24/2016
Aluminum Smelter															
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	1.9 U	2.1 U	2.2 U	2.1 U	2 U	2.2 U	2.3 U	2.1 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	120 J	**150 J**	**160**	30	34	68	61	51
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	20 J	39 J	4.8 U	12	5.3 J	4.7 J	6.5 J	7.2 J
Polycyclic Aromatic Hydrocarbons (PAHs)															
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.0025 J	0.0018 J	0.013	0.0052 J	0.00066 U	0.00068 U	0.00069 U	0.0014 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0026 J	0.002 J	0.014	0.0046 J	0.00047 U	0.00048 U	0.00049 U	0.0025 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.024	0.02	0.14	0.075	0.00063 U	0.0036 J	0.003 J	0.0059
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.00047 U	0.00048 U	0.0023 J	0.00057 U	0.00052 U	0.00054 U	0.00054 U	0.00056 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.031	0.023	0.16	0.079	0.00063 U	0.0044 J	0.0045 J	0.0068
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.31	0.25	1.5	1.6	0.0047 J	0.059	0.041	0.026
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.46 J	0.36 J	2 J	2	0.0057	0.074 J	0.049 J	0.033
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.64 J	0.52 J	3.1 J	2.9	0.011	0.11	0.08	0.051
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.43 J	0.35 J	1.8 J	2	0.0062	0.069	0.049	0.031
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.27 J	0.22 J	0.93 J	1.1	0.0037 J	0.047 J	0.026 J	0.017
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.45 J	0.36 J	2.1 J	2	0.0081	0.088	0.062	0.044
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.061 J	0.053 J	0.3 J	0.34	0.00076 U	0.01	0.0073	0.0046 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.52 J	0.42 J	2.7 J	2.5	0.0067	0.076	0.06	0.043
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0086 J	0.0058 J	0.049 J	0.027 J	0.00052 UJ	0.00054 UJ	0.00054 UJ	0.0039 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.44 J	0.37 J	1.9 J	2.2	0.0066	0.079	0.054	0.034
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.004 J	0.0032 J	0.022	0.008	0.00084 U	0.00086 U	0.00087 U	0.006
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.18 J	0.14 J	0.98 J	0.65	0.0024 J	0.027	0.024	0.03
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.47 J	0.38 J	2.4 J	2.5	0.0067	0.072	0.056	0.038
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.6366	0.5049	2.794	2.834	0.008419	0.10538	0.07045	0.0467
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.7727	0.6158	4.0803	3.3488	0.0091	0.111	0.0915	0.0995
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**3.531**	**2.863**	**16.03**	**16.64**	0.0527	0.608	0.4243	0.2786
Polychlorinated Biphenyls (PCBs)															
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	NA	NA	NA	NA	NA	NA	NA	NA
Metals															
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	11,000	12,000	13,000	12,000	12,000	11,000	10,000	14,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.6	3.6	2.6	2.3	3.7	2.8	2.6	2.8
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.28 J	0.34 J	0.33 J	0.38	0.31	0.18 J	0.24 J	0.31
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	5.8	7	7.4	7.5	9.2	12	11	12
Copper	mg/Kg	NA	140,000	217	280	217	28.4	22	25	23	24	25	21 J	17 J	24
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	5.8	5.3	7.3	7.4	8.2	5.8	5.8	8.2
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.0068 J	0.0078 J	0.012 J	0.008 J	0.011 J	0.016 J	0.012 J	0.012 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	7.4	8.4	10	11	10	11	9.1	11
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.98 J**	**1.3 J**	**1**	**1.1**	**1.3**	**0.84**	**0.95**	**1.2**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	50	53	59	53	58	53	49	57

Table 31-2
SWMU 31 - Smelter Sign Area Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

				Ecological Indicator				Analytical Results							
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-SS-TR10-2.5 6/24/2016	SWMU31-SS-TR44-2.5 (Duplicate of SWMU31-SS-TR10-2.5) 6/24/2016	SWMU31-SS-TR10-4.0 6/24/2016	SWMU31-SS-TR11-2.0 6/24/2016	SWMU31-SS-TR11-5.0 6/24/2016	SWMU31-SS-TR12-2.5 6/24/2016	SWMU31-SS-TR43-2.5 (Duplicate of SWMU31-SS-TR12-2.5) 6/24/2016	SWMU31-SS-TR12-4.0 6/24/2016
Total Petroleum Hydrocarbons (TPHs)															
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	0.67 U	0.62 U	0.7 U	0.6 U	0.89 U	0.57 U	0.67 U	0.86 U
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	12 U	12 U	20 J	12 U	12 U	12 U	12 U	13 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	63	64	110	76	19 J	10 U	10 U	13 J
Volatile Organic Compounds															
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

- Sulfate was detected at concentrations ranging from (6 J to 7,300 J mg/kg). The MTCA-derived soil screening level for protection of groundwater of 2,150 mg/kg was exceeded in one of the 40 analyzed soil samples.

- The MTCA-derived screening level (3.9 mg/kg TEC) was exceeded in two of the 40 analyzed soil samples (maximum 19.04 mg/kg TEC). The terrestrial ecological screening level for wildlife protection (1.1 mg/kg total HMW PAH) was exceeded in 15 of 40 soil samples.

- PCBs were not detected in the two samples analyzed.

- For metals, concentrations of arsenic (maximum of 8 mg/kg) exceed MTCA-derived soil screening levels for protection of groundwater and background concentration in one sample. Selenium (maximum of 1.7 mg/kg) exceeded MTCA terrestrial ecological screening levels in all 40 of the collected samples.

- Low concentrations of diesel (maximum of 230 J mg/kg) and motor oil (maximum of 1,500 J mg/kg) were detected in soils below MTCA Method A TPH-screening levels. TPH-Gx was not detected.

- VOCs (BTEX and common chlorinated solvent constituents) were generally not detected in the two soil samples analyzed. One exception is that a low concentration of trichloroethene (0.0022 J mg/kg) was detected below screening levels in one sample.

WPA Smelter Sign Area Surface Soil Sample Results

Surface soil samples were sampled using an informal grid system to evaluate the extent of surface soil contamination in this area (Table 31-3), which had been assumed to be largely contaminated based on field observations during the initial RI field effort.

The results are summarized as follows:

- Total HMW PAHs exceeded soil terrestrial ecologic screening levels for wildlife protection (1.1. mg/kg) in all of the 32 collected samples. The soils screening level for TTEC cPAH of 3.9 mg/kg was exceeded in 16 of 32 samples. LMW PAH exceeded the terrestrial ecologic screening level for wildlife protection of 100 mg/kg in one sample.

- Fluoride exceeded soil screening levels for protection of groundwater of 147.6 mg/kg in 2 of 32 samples.

- Total cyanide and sulfate were detected at low concentrations below screening levels in all of the collected samples.

Table 31-3
SWMU 31 - Smelter Sign Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020
(Page 1 of 3)

				Ecological Indicator				Analytical Results												
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-WPA-SS-1 11/30/2020	SWMU31-WPA-SS-2 11/30/2020	SWMU31-WPA-SS-3 11/30/2020	SWMU31-WPA-SS-4 11/30/2020	SWMU31-WPA-SS-5 11/30/2020	SWMU31-WPA-SS-6 11/30/2020	SWMU31-WPA-SS-48 (Duplicate of SWMU31-WPA-SS-48) 11/30/2020	SWMU31-WPA-SS-7 11/30/2020	SWMU31-WPA-SS-8 11/30/2020	SWMU31-WPA-SSA-SS-9 12/1/2020	SWMU31-WPA-SSA-SS-10 12/1/2020	SWMU31-WPA-SSA-SS-11 12/1/2020	SWMU31-WPA-SSA-SS-12 12/1/2020
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.29	0.08 J	0.16 J	0.12 J	0.07 U	0.08 U	0.08 U	0.33	0.08 U	0.07 UJ	0.08 UJ	0.07 UJ	0.12 J
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	**179**	94.4	76.3	70.7	35.9	77.3	76.7	**357**	76.1	109	59	37	46
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	7.6	10.1	10.6	10.5	13.9	15.6	14.2	7.4	15.7	6.4	6.4	1.1 U	1.6 J
Polycyclic Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.063	0.017 B	0.032 J	**4.5**	0.16	0.0036 J	0.006	0.076	0.025 B	0.0072	0.0071	0.0067	0.038
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.53	0.2	0.43	20	1	0.029 J	0.059 J	0.98	0.34	0.085	0.11	0.12	0.29
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.013 J	0.0041 J	0.0068 J	0.094	0.012 J	0.00081 J	0.0012 J	0.012 J	0.0061 J	0.0014 J	0.0017 J	0.0018 J	0.0034 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.84	0.37	0.58	13	0.69	0.037 J	0.084 J	1.2	0.43	0.095	0.14	0.16	0.36
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	7.9	5.1	6.5	21	2.9	0.49 J	1.1 J	14	6	1.6	1.9	2	2.1
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	10	7.7	9.5	21	4	0.68 J	1.4 J	18	9.1	2.2	2.7	3.2	2.6
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	15	11	13	26	5.3	1 J	2 J	25	13	3.7	3.9	4.6	3.8
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	7.3	5.9	7	11	2.9	0.49 J	0.99 J	12	6.7	1.7	2	2.2	1.8
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	5	3.6	4.8	11	1.9	0.33 J	0.7 J	8.9	4.7	1.1	1.3	1.5	1.2
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	9.7	6.5	8.2	22	3.2	0.63 J	1.3 J	18	8	2.1	2.3	2.7	2.5
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.9	1.5	1.9	3.3	0.72	0.14 J	0.28 J	3.5	1.8	0.46	0.54	0.57	0.5
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	12	7.5	9.7	57	5.8	0.71 J	1.4 J	22	9.1	2.2	2.6	3.1	3.2
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.3	0.12	0.22	15	0.57	0.013 J	0.025 J	0.4	0.13	0.031	0.046	0.05	0.12
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	8.5	6.7	8	15	3.3	0.57 J	1.1 J	15	7.8	2	2.2	2.8	2.1
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.087	0.018 B	0.045 B	**8.7**	0.29	0.0052 J	0.0086	0.1	0.024 B	0.011	0.011	0.011	0.05
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	5.1	2.5	3.6	67	4.2	0.23 J	0.49 J	8.4	3	0.71	0.88	1	1.8
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	11	6.9	8.9	45	5.1	0.68 J	1.4 J	20	8.3	2.2	2.4	2.8	2.9
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.15	0.056	0.098	9	0.31	0.0069 J	0.012 J	0.23	0.067	0.018	0.021	0.025	0.092
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**13.927**	**10.555**	**13.002**	**28.85**	**5.444**	0.9393	1.931	**24.82**	**12.51**	3.107	3.707	**4.374**	3.595
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	18.933	10.7291	14.6138	**185**	12.722	1.02861	2.0738	33.168	13.0551	3.1406	3.7958	4.4495	5.8614
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**76.3**	**54.9**	**67.8**	**175**	**29.32**	**5.01**	**10.27**	**134**	**65.4**	**17.06**	**19.24**	**22.37**	**19.5**
Metals																				
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	21,400	14,500	16,300	7,950	5,430	11,900	11,900	30,200	14,900	11,200	12,300	9,610	10,600
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.48	3.04	4.04	2.01	1.43	4.23	4.38	4.6	2.85	3.18	2.22	2.39	3.62
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.694	0.477	0.619	0.311	0.142	0.174	0.207	0.479	0.369	0.149	0.209	0.161	0.202
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	16.7 J	11.6 J	11.6 J	6 J	4.66 J	15.2 J	15.6 J	17.2 J	8.64 J	7.3 J	6.61 J	6.07 J	6.93 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	21.1	16.9	20.3	16.1	21.6	16.5	17.3	28	24.3	25.6	26.6	17.8	19.6
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	14.8	10.5	18.3	17	6.23	6.79	7.63	14.6	9.66	5.02	5.61	5.06	6.16
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.012 J	0.002 J	0.01 J	0.003 J	0.002 U	0.004 J	0.003 J	0.007 J	0.002 U	0.005 J	0.007 J	0.006 J	0.006 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	20.4	16.6	18.7	10.4	7.47	10.4	11.4	38.5	18	10.6	11.8	8.93	9.5
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.4 J**	0.3 J	0.3 J	0.3 J	0.2 J	**0.4 J**	**0.4 J**	**0.5 J**	0.3 J	0.3 J	0.3 J	0.3 J	0.3 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	99.1	85.5	105	64.4	52.8	56.6	59.3	74.1	66.6	47.7 J	57 J	54.8 J	64.7 J
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	220 J	140 J	280 J	**4,000**	100	14 J	27 J	320	130 J	24 J	54	46	42
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	960 J	700 J	1,300	**6,700 J**	340	52 J	110 J	1,700	590 J	130	290	240	170

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 31-3
SWMU 31 - Smelter Sign Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020
(Page 2 of 3)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-WPA-SSA-SS-13 12/1/2020	SWMU31-WPA-SSA-SS-14 12/1/2020	SWMU31-WPA-SSA-SS-49 (Duplicate of SWMU31-WPA-SSA-14) 12/1/2020	SWMU31-WPA-SSA-SS-15 12/1/2020	SWMU31-WPA-SSA-SS-16 12/1/2020	SWMU31-WPA-SSA-SS-17 12/1/2020	SWMU31-WPA-SSA-SS-18 12/1/2020	SWMU31-WPA-SSA-SS-19 12/1/2020	SWMU31-WPA-SSA-SS-20 12/1/2020	SWMU31-WPA-SSA-SS-21 12/1/2020
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.58 J	0.07 UJ	0.07 UJ	0.19 J	0.2 J	0.08 U	0.37	0.07 U	0.08 U	0.18 J
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	108	32.8	41.6	44.7	52.4	31.5	63.1	33	34.9	40
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	14.5	1.9 J	2.5	6.4	6.2	1.2 U	1.1 U	1.1 U	1.3 J	4.1
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.06	0.002 J	0.0037 J	0.048	0.079	0.0031 J	0.031	0.0013 J	0.0061	0.057
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.42 J	0.024 J	0.043 J	0.5	1.3	0.033	0.3	0.013	0.069	0.84
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0068	0.00042 J	0.00092 J	0.061	0.13	0.00069 J	0.01 J	0.00043 J	0.0011 J	0.0083 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.61 J	0.028 J	0.056 J	0.86	4.6	0.037	0.57	0.014	0.093	0.77
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	2.3	0.34 J	0.64 J	6.8	23	0.55	3.5	0.25	0.99	9.3
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	3	0.51 J	0.87 J	7.8	23	0.82	4.7	0.37	1.4	11
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	4.3	0.77 J	1.3 J	9.6	28	1.2	6.6	0.56	2	16
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	1.9	0.41 J	0.66 J	4.6	10	0.65	3.3	0.3	1	8.7
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.4 J	0.25 J	0.44 J	4.1	9.1	0.4	2.3	0.2	0.67	5.9
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	2.8	0.45 J	0.81 J	8.1	24	0.74	4.2	0.33	1.3	11
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.49	0.11 J	0.18 J	1.3	2.9	0.17	0.91	0.079	0.28	2.5
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	4.3	0.49 J	0.95 J	13	53	0.79	5.7	0.37	1.5	11
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.2	0.01 J	0.019 J	0.41	1.5	0.011	0.16	0.0043 J	0.032	0.38
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	2.2	0.46 J	0.75 J	5.7	15	0.74	4	0.34	1.2	10
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.078	0.0034 B	0.0051 J	0.11	0.17	0.0051 J	0.042	0.0023 B	0.0087	0.081
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	3	0.18 J	0.35 J	6.8	32	0.27	3	0.11	0.58	5.3
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	3.8	0.47	0.94 J	13	51	0.81	5.2	0.36	1.4	10
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.16	0.0053 J	0.009	0.21	0.62	0.007	0.1	0.0027 J	0.018	0.16
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**4.097**	0.7075	1.2091	**10.631**	**31.04**	1.1334	**6.473**	0.5162	1.927	**15.48**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	8.6748	0.73782	1.42772	21.789	92.779	1.14989	9.813	0.51533	2.2899	18.4363
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**22.19**	**3.77**	**6.59**	**61**	**186**	**6.08**	**34.71**	**2.789**	**10.24**	**84.4**
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	13,300	9,730	8,350	10,200	10,400	10,900	11,600	8,470	10,900	13,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.73	2.76	2.39	4.81	3.6	2.93	3.02	2.72	5.1	4.38
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.249	0.142	0.138	**0.932**	0.46	0.141	0.179	0.122	0.139	0.346
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	10.2 J	8.73 J	6.48 J	7.34 J	6.23 J	6.21 J	8.55 J	4.16 J	9.44 J	11.4 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	22.3	21.9	18.2	20.1	19.1	23.2	14.5	19.2	25.3	20.9
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	17.2	5.17	4.55	16.9	8.69	4.93	8.9	4.45	5.9	12.6
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.006 J	0.006 J	0.006 J	0.01 J	0.008 J	0.005 J	0.005 J	0.004 J	0.005 J	0.016 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	12.1	9.92	8.36	10.2	8.99	9.97	11.4	6.73	11.2	16.5
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.4 J**	**0.5 J**	0.3 J	0.3 J	0.3 J	**0.5 J**	0.2 J	0.3 J	**0.7 J**	0.3 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	88.4 J	46.2 J	43.8 J	57.9 J	59 J	51.1 J	61.9 J	50.8 J	54.6 J	79.6 J
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	41	11 J	13 J	210	960	13 J	78	76	16 J	250 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	160	54 J	65 J	580	**2,200**	69 J	320	410	72 J	1,200 J

Notes:
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mg/Kg = milligrams per kilogram
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TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 31-3
SWMU 31 - Smelter Sign Area WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
Winter 2020
(Page 3 of 3)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-WPA-SSA-SS-22 12/1/2020	SWMU31-WPA-SSA-SS-23 12/1/2020	SWMU31-WPA-SSA-SS-24 12/1/2020	SWMU31-WPA-SSA-SS-51 (Duplicate of SWMU31-WPA-SSA-SS-24) 12/1/2020	SWMU31-WPA-SSA-SS-25 12/1/2020	SWMU31-WPA-SSA-SS-26 12/1/2020	SWMU31-WPA-SSA-SS-27 12/1/2020	SWMU31-WPA-SSA-SS-28 12/1/2020	SWMU31-WPA-SSA-SS-29 12/1/2020
Aluminum Smelter																
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.09 J	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.3	0.09 J	0.25
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	52.4	50.2	48.8	54.5	91.5	65.9	120 J	96 J	135 J
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	5.2	3.3	2.5	2.5	2.7	2.1 J	15 J	12.1 J	12.2 J
Polycyclic Aromatic Hydrocarbons (PAHs)																
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0053 J	0.003 J	0.0071	0.0041 J	0.015	0.005 J	0.17	0.01	0.044
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.082	0.038	0.1 J	0.06 J	0.16	0.078	2	0.092	0.48
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0013 J	0.00084 J	0.0018 J	0.0013 J	0.0022 J	0.0018 J	0.016 J	0.0015 J	0.0086 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.099	0.058	0.16 J	0.09 J	0.18	0.12	2.6	0.11	0.73
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.3	0.67	1.6	1.3	2.5	1.5	27	1.3 J	5.7
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1.7	0.97	2.2	1.9	3.3	2.2	36	1.8 J	6.9
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	2.5	1.4	3.1	2.9	4.9	3.5	50	2.7	9.5
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	1.3	0.77	1.6	1.4	2.1	1.6	23	1.4	4.7
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.82	0.49	1.1	0.95	1.5	1	18	0.93 J	3.4
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	1.6	0.87	2	1.8	3.3	2	32	1.7 J	6.5
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.34	0.19	0.42	0.39	0.63	0.43	5.8	0.38	1.3
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	1.7	0.98	2.4	1.9	3.5	2.1	43	1.8	8.9
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.031	0.018	0.049 J	0.026 J	0.064	0.035	0.97	0.043	0.26
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	1.5	0.87	1.9	1.7	2.9	1.9	28	1.5	5.6
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0063	0.004 B	0.011 J	0.0058 J	0.022	0.008	0.3	0.015	0.067
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.62	0.35	0.89 J	0.59 J	1.2	0.73	16	0.69	3.9
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	1.8	0.98	2.2	1.9	3.2	2.1	31	1.8 J	8.1
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.015	0.009	0.024 J	0.015 J	0.033	0.021	0.5	0.023	0.12
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	2.362	1.3407	3.032	2.642	**4.576**	3.053	**49.2**	2.498	**9.515**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	2.5449	1.45184	3.6189	2.6772	5.1432	3.0778	65.056	2.7615	14.3896
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**12.86**	**7.21**	**16.12**	**14.24**	**24.33**	**16.23**	**251**	**13.51**	**51.7**
Metals																
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	8,180	7,780	10,000	10,200	10,200	9,850	20,000	11,800	14,700
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.43	3.95	3.6	3.52	2.89	2.89	3.65	4.53	2.75
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.169	0.141	0.175	0.161	0.237	0.216	**0.877**	0.209	0.351
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	7.74 J	4.16 J	6.17 J	5.39 J	6.8 J	8.84 J	13.7	11	8.15
Copper	mg/Kg	NA	140,000	217	280	217	28.4	18.3	18.9	22.8	23.8	15.8	19.6	22.2	19.4	15.3
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	35.2	4.1	4.37	4.25	7.48	7.01	19.6	8.33	10.4
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.005 J	0.007 J	0.006 J	0.005 J	0.005 J	0.006 J	0.019 J	0.002 U	0.002 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	9.41	7.95	10.5	10	16.2	11	28	13.3	12.5
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	0.3 J	0.3 J	0.3 J	0.3 J	0.3 J	0.3 J	0.2 J	**0.4 J**	0.2 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	127 J	46.2 J	46.2 J	52.5 J	60.2 J	68.4 J	108	56.3	71.8
Total Petroleum Hydrocarbons (TPHs)																
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	31	15 J	24 J	17 J	78	37	800	28 J	120 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	150	69 J	120 J	80 J	350	190	**4,100**	130	510 J

Notes:
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a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
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mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

- Of metals, cadmium (maximum of 0.932 mg/kg) exceeded the MTCA-derived soil screening level for groundwater protection in two of 32 samples. Selenium (maximum of 0.5 mg/L) exceeded the MTCA-derived soil screening level in 9 of 32 samples.
- Diesel-range organics exceeded the MTCA Method A Industrial Screening Level of 2,000 mg/kg in one of 32 samples. Residual-range organics also exceeded the MTCA Method A Industrial Screening Level in 3 of 32 samples.

31.4.1.4 Smelter Sign Area Waste and Contaminated Soil Volume Estimate

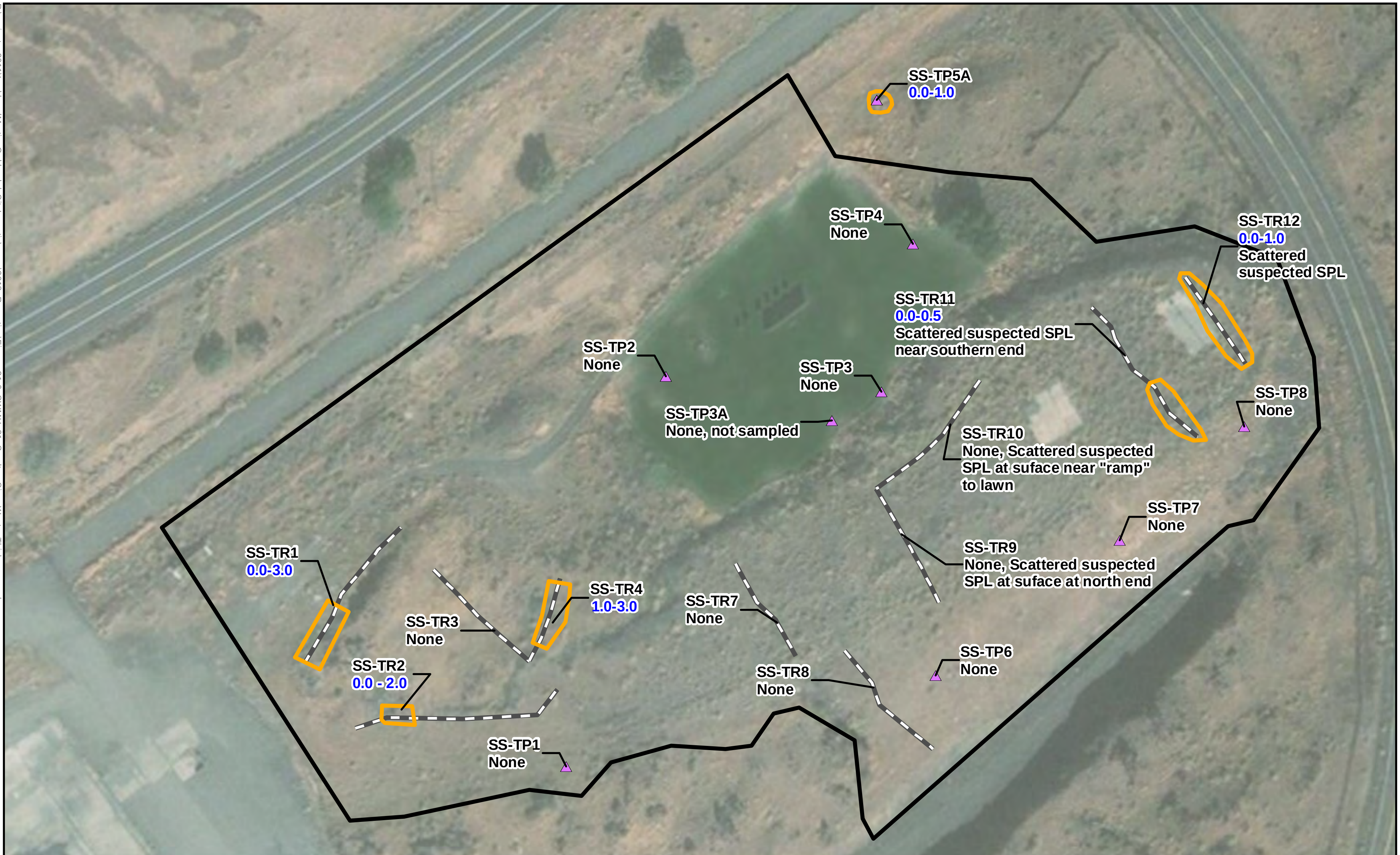
Figure 31-7 shows the extent and thickness of aluminum smelter wastes at the SSA. Volume 5, Appendix B-31(C) shows the calculations and supporting figure used for the waste volume calculations. An estimated bulk volume of 334 cubic yards (516 tons) of smelter wastes was estimated for the SSA.

31.4.2 NESI Results

Test pit, trench locations, and sample locations at the NESI are shown in Figure 31-3. A total of 11 trenches and 16 test pit locations were excavated and sampled consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b) as part of initial RI characterization activities.

31.4.2.1 NESI Waste Description and Occurrence

Figure 31-8 shows the occurrence of aluminum smelter-related wastes found at the NESI area. The carbon wastes present in the NESI area appear to represent anode blocks, suspected SPL, and other carbon wastes that could not be conclusively identified. The largest amount of carbon waste was found in the area of NESI-TR5 and NESI-TR6 (the trenches that form an X-shape, immediately east of the primary NESI wetland area). In this area, mixed carbon wastes were laterally continuous and typically were 3-8 ft thick. Wire, rebar, other metal debris, fiberglass, plastic, wood, and other miscellaneous solid waste was mixed in with the carbon wastes. Water was first encountered in the excavations this area at about 4-6 ft bgs. A tan to brown, sandy, lean clay layer was found in this area beneath the carbon wastes and may help distinguish native soils from fill material. A minor amount of suspected asbestos-containing material was encountered, but analytical results showed that the material did not contain asbestos.



R:\projects_2011\LockheedMartin_GoldendaleSiteInvestig\maps\2018_Reporting\Figure_31-6_SWMU_31_Smelter_Sign_Waste_Thickness.mxd

Legend

- Smelter Sign Area
- Trench Location
- Test Pit Location
- Carbon Waste Area

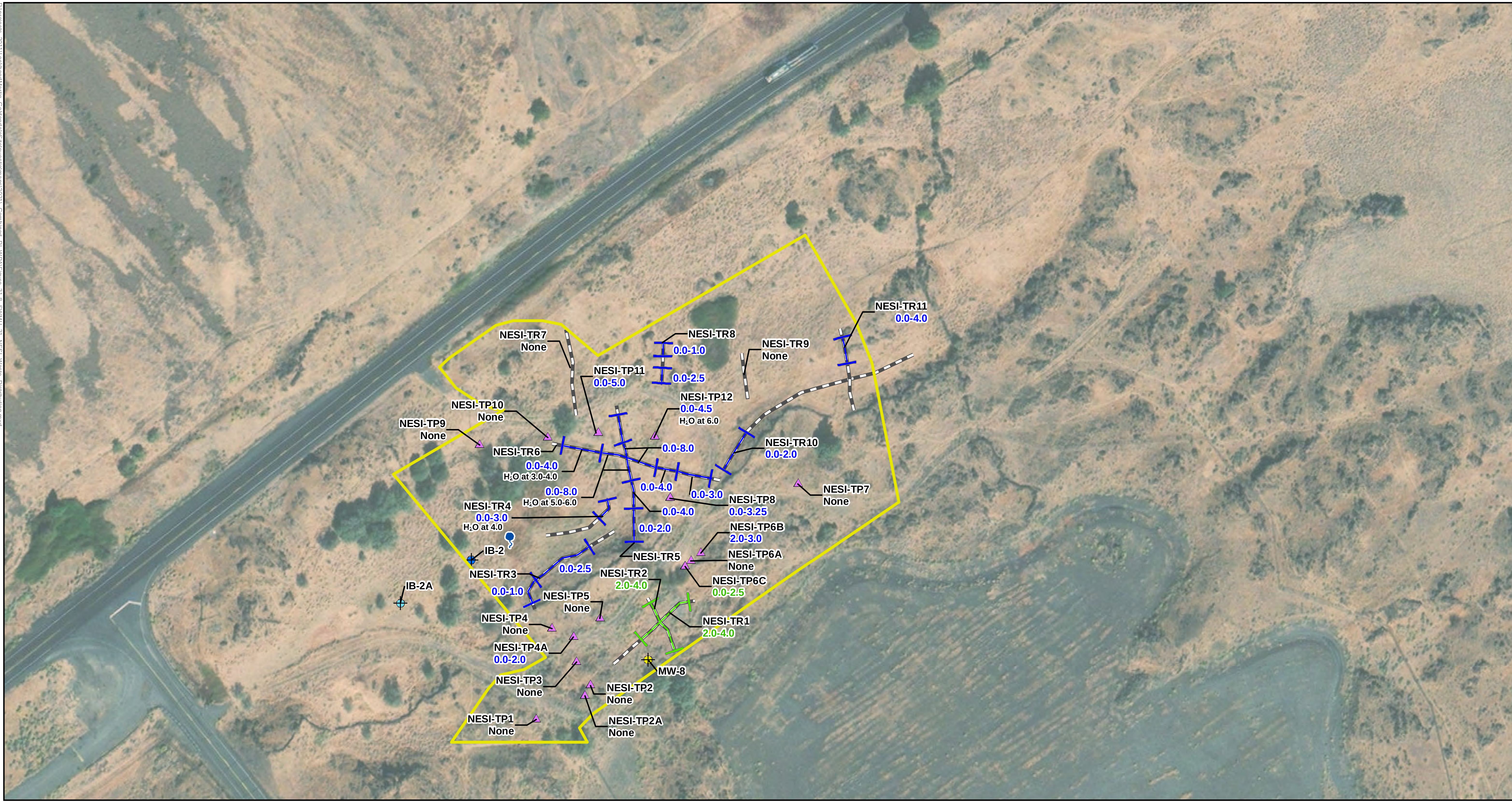
Carbon waste interval including intermixed
suspected spent pot liner (SPL) 2.0-4.0 feet bgs

N
W E
S

0 25 50 100
Feet

Figure 31-7
SWMU 31
Smelter Sign Area
Waste Thickness and Extent

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Legend

- NESI Area
- Trench Location
- Test Pit Location
- Lateral Extent of Carbon Waste in Trench

Carbon waste interval including intermixed suspected spent pot liner (SPL) 2.0-4.0 feet bgs

- Lateral Extent of Cryolite Waste (Some Carbon Waste Also Present)

Cryolite waste interval 2.0-4.0 feet bgs

0.0- Base of waste not characterized in excavation segment

- NESI Wetland Spring
- Unconsolidated Aquifer Well (UA)

Uppermost Basalt Aquifer Well (BAU)

- BAU_1 - Shallower Water-bearing Zone
- BAU_2 - Deeper Water-bearing Zone

N
W E
S

0 50 100 200
Feet

Figure 31-8
SWMU 31
NESI Area
Trench and Test Pit Locations
Distribution of Carbon Waste

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

An area of suspected used cryolite waste was found in the southern portion of the NESI area (in NESI-TR1, NESI-TR2, and NESI-TP6C). The suspected cryolite appears as an indurated and partly cemented layer in some locations. Carbon wastes were also found in this same area, but the suspected cryolite waste represents most of the waste found at this location.

Photographs of all collected waste samples are included in Volume 5, Appendix B-31(B). Photographs of excavation activities are available upon request.

31.4.2.2 NESI Waste Results

Table 31-4 summarizes the results for the NESI wastes. Exceedances of screening levels for NESI waste results are shown on Figure 31-9.

Analytical results for the wastes are summarized as follows:

- Total cyanide was detected in one sample (concentration of 3.1 J mg/kg) above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg. Note that this is a conservative comparison because this soil screening level is based on the toxicity of free cyanide and not total cyanide. Total cyanide was not detected in the SPLP cyanide results for this same sample.
- cPAH concentrations exceed the MTCA Method C Industrial screening level of 130 mg/kg (TEC) in two of six analyzed waste samples (maximum of 2,189 mg/kg, TEC). One of the analyzed carbon waste samples (Suspected Anode, 25,908 mg/kg, total PAHs) exceeded the Washington State Dangerous Waste criteria of 10,000 mg/kg (1 percent) for total PAHs.
- Fluoride was detected at concentrations above the MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in 10 of 11 analyzed waste samples. Elevated concentrations were found in both suspected SPL and non-SPL carbon wastes. Highest fluoride concentrations (3,000 J mg/kg) were detected in alumina/cryolite waste. The SPLP fluoride leachate concentrations for these waste samples ranged from 5 mg/L to 350 mg/L, which are all above the groundwater MCL for fluoride (4.0 mg/L).
- Sulfate was detected at a concentration (maximum of 8,500 J mg/kg) above the MTCA-derived soil screening level for protection of groundwater of 2,150 mg/kg in one of 10 waste samples analyzed.
- For metals, cadmium (maximum of 0.85 mg/kg) was detected above MTCA-derived soil screening levels for protection of groundwater and background concentrations in one of 11 waste samples. Chromium (maximum of 540 J mg/kg), copper (260 J mg/kg), and selenium (maximum of 2.2 mg/kg) were detected in the wastes above MTCA terrestrial ecologic screening levels. Chromium and copper were detected at elevated concentration in one of 11 waste samples analyzed, while selenium exceeded screening levels in 8 of 11 samples.

Table 31-4
SWMU 31 - North of the East Surface Impoundment Waste Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

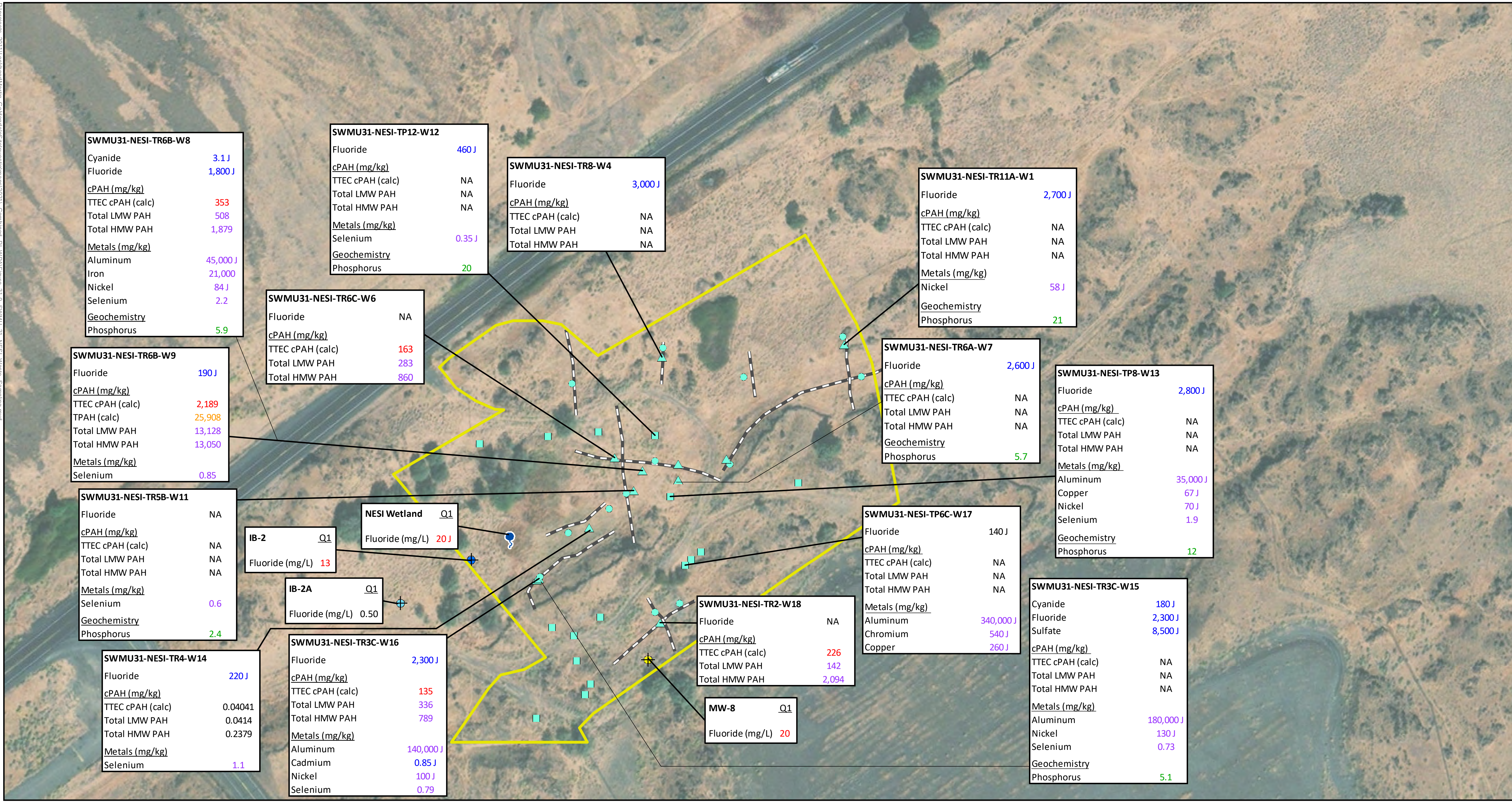
						Ecological Indicator						
Parameter Name	**Units**	**MTCA Method A Unrestricted Land Use**	**MTCA Method A Industrial**	**MTCA Method B**	**MTCA Method C**	**Eco-SSL Plants**	**Eco-SSL Soil Biota**	**Eco-SSL Wildlife**	**Protection of Groundwater Vadose Zone[a]**	**Selected Screening Level**	**Natural Background**	**Washington Dangerous Waste Persistence Criteria**
Aluminum Smelter												
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	--
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	--
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	--
Polycyclic Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	--
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	--
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	--
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	--
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	--
Benz[a]anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	--
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	--
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	--
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	--
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	--
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	--
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	--
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	--
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	--
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	--
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	--
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	--
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	--
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	--
Total PAHs (calc)	mg/Kg	10,000	NE	0.19	130	NE	NE	NE	NE	10,000	NE	10,000
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	--
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	--
Metals												
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	--
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	--
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	--
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	--
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	--
Iron	mg/Kg	NE	NE	56,000	2,500,000	NE	NE	NE	5,600	5,600	NE	--
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	--
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	--
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	--
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	--
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	--
Geo Chemistry												
Calcium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Sodium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Magnesium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Lithium	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Phosphorus	mg/Kg	NE	NE	1.6	70	NE	NE	NE	NE	1.6	NE	--
Silicon	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Manganese	mg/Kg	NE	NE	11,200	160,000	NE	NE	NE	970	970	NE	--
Total Organic Carbon	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Sulfur	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--
Quartz	mg/Kg	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	--

	Analytical Results													
Parameter Name	**SWMU31-NESI-TR11A-W1 6/20/2016**	**SWMU31-NESI-TR8-W4 6/21/2016**	**SWMU31-NESI-TR6C-W6 6/21/2016**	**SWMU31-NESI-TR6A-W7 6/21/2016**	**SWMU31-NESI-TR6B-W8 6/21/2016**	**SWMU31-NESI-TR6B-W9 6/21/2016**	**SWMU31-NESI-TR5B-W11 6/22/2016**	**SWMU31-NESI-TP12-W12 6/22/2016**	**SWMU31-NESI-TP8-W13 6/22/2016**	**SWMU31-NESI-TR4-W14 6/22/2016**	**SWMU31-NESI-TR3C-W15 6/23/2016**	**SWMU31-NESI-TR3C-W16 6/23/2016**	**SWMU31-NESI-TP6C-W17 6/23/2016**	**SWMU31-NESI-TR2-W18 6/23/2016**
	Waste Description													
	Suspected SPL with alumina (white)	**Suspected alumina or cryolite, fine-grained, white**	**Suspected SPL with orange to rust secondary minerals**	**Suspected SPL, gray-blue to black, white secondary minerals**	**Suspected SPL with orange to rust secondary minerals**	**Suspected Non-SPL carbon waste, suspected anode, dark brown to black**	**Suspected SPL, fine, blue-black**	**Suspected SPL with orange-tan secondary mineralization**	**Suspected SPL with alumina (white)**	**Non-carbon waste, chocolate-brown, silty backfill from mound in NESI Wetland**	**Suspected SPL with bright blue coloration**	**Suspected non-SPL carbon waste, dark gray-brown, fine-grained**	**Suspected used cryolite waste from road bed**	**Suspected non-SPL carbon waste, fine-grained, black**
Aluminum Smelter														
Cyanide[b]	2 UJ	NA	NA	2 UJ	**3.1 J**	2.1 UJ	2 UJ	1.9 UJ	2 UJ	2.5 UJ	**180 J**	2 UJ	2.2 UJ	NA
Fluoride	**2,700 J**	**3,000 J**	NA	**2,600 J**	**1,800 J**	**190 J**	NA	**460 J**	**2,800 J**	**220 J**	**2,300 J**	**2,300 J**	140 J	NA
Sulfate	15 J	NA	NA	20 J	49 J	22 J	NA	88 J	190 J	120 J	**8,500 J**	51 J	17 J	NA
Polycyclic Aromatic Hydrocarbons (PAHs)														
1-Methylnaphthalene	NA	NA	**2.6 J**	NA	**2.3 J**	**270 J**	NA	NA	NA	0.00073 UJ	NA	**1.9 J**	NA	**0.73 J**
2-Methylnaphthalene	NA	NA	**3.8 J**	NA	**3.1 J**	**390 J**	NA	NA	NA	0.00052 UJ	NA	**2.2 J**	NA	1.6 J
Acenaphthene	NA	NA	14 J	NA	17 J	**1,700 J**	NA	NA	NA	0.0012 J	NA	16 J	NA	2.3 J
Acenaphthylene	NA	NA	0.21 J	NA	0.78 J	28 J	NA	NA	NA	0.0013 J	NA	0.13 J	NA	0.55 J
Anthracene	NA	NA	19 J	NA	27 J	840 J	NA	NA	NA	0.0019 J	NA	32 J	NA	6.3 J
Benz[a]anthracene	NA	NA	82 J	NA	180 J	1,500 J	NA	NA	NA	0.023 J	NA	93 J	NA	200 J
Benzo(a)pyrene	NA	NA	120 J	NA	260 J	1,600 J	NA	NA	NA	0.028 J	NA	97 J	NA	110 J
Benzo(b)fluoranthene	NA	NA	150 J	NA	320 J	2,000 J	NA	NA	NA	0.041 J	NA	130 J	NA	520 J
Benzo(ghi)perylene	NA	NA	110 J	NA	250 J	1,200 J	NA	NA	NA	0.032 J	NA	83 J	NA	180 J
Benzo(k)fluoranthene	NA	NA	41 J	NA	120 J	740 J	NA	NA	NA	0.02 J	NA	38 J	NA	160 J
Chrysene	NA	NA	90 J	NA	200 J	1,400 J	NA	NA	NA	0.032 J	NA	95 J	NA	580 J
Dibenzo(a,h)anthracene	NA	NA	17 J	NA	29 J	210 J	NA	NA	NA	0.0039 J	NA	15 J	NA	34 J
Fluoranthene	NA	NA	140 J	NA	300 J	**4,000 J**	NA	NA	NA	0.025 J	NA	160 J	NA	98 J
Fluorene	NA	NA	7.5 J	NA	8.8 J	**660 J**	NA	NA	NA	0.00058 UJ	NA	10 J	NA	1.6 J
Indeno(1,2,3-cd)pyrene	NA	NA	130 J	NA	260 J	1,300 J	NA	NA	NA	0.033 J	NA	98 J	NA	190 J
Naphthalene	NA	NA	**11 J**	NA	**8.8 J**	**540 J**	NA	NA	NA	0.002 J	NA	4 J	NA	0.57 J
Phenanthrene	NA	NA	85 J	NA	140 J	4,700 J	NA	NA	NA	0.01 J	NA	110 J	NA	30 J
Pyrene	NA	NA	120 J	NA	260 J	**3,100 J**	NA	NA	NA	0.025 J	NA	140 J	NA	120 J
Total TEC cPAH (calc)	NA	NA	**163**	NA	**353**	**2,189**	NA	NA	NA	0.04041	NA	**135**	NA	**226**
Total PAHs (calc)	NA	NA	162.9	NA	2,384	**25,908**	NA	NA	NA	0.2793	NA	1,123	NA	2,235
LMW PAH	NA	NA	**283**	NA	**508**	**13,128**	NA	NA	NA	0.0414	NA	**336**	NA	**142**
HMW PAH	NA	NA	**860**	NA	**1,879**	**13,050**	NA	NA	NA	0.2379	NA	**789**		**2,094**
Metals														
Aluminum	19,000 J	NA	NA	23,000 J	**45,000 J**	470 J	5,700 J	1,100 J	**35,000 J**	18,000 J	**180,000 J**	**140,000 J**	**340,000 J**	NA
Arsenic	2	NA	NA	1.1	4.5	1.1	0.73	0.92	4	2	5.1	3.8	0.49 J	NA
Cadmium	0.043 B	NA	NA	0.041 B	0.3 B	0.27 B	0.1 B	0.081 B	0.39 J	0.21 B	0.39 J	**0.85 J**	0.53 J	NA
Chromium	1.1 J	NA	NA	0.32 J	6.7 J	4.8 J	2 J	0.86 J	16 J	13 J	6.7 J	5.8 J	**540 J**	NA
Copper	9.3 J	NA	NA	2.4 J	26 J	5.4 J	3.9 J	3.4 J	**67 J**	22 J	41 J	22 J	**260 J**	NA
Iron	300	NA	NA	320	**21,000**	NA	180	810	3,800		3,800			NA
Lead	3.8 J	NA	NA	2.9 J	16 J	5.2	4.1 J	5.3 J	27 J	4.3	13 J	20	15 J	NA
Mercury	0.0056 U	NA	NA	0.011 J	0.037	0.0063 U	0.0054 U	0.0058 U	0.0065 J	0.019 J	0.0064 U	0.006 U	0.01 J	NA
Nickel	**58 J**	NA	NA	25 J	**84 J**	5.3 J	8.6 J	1.6 J	**70 J**	9.9 J	**130 J**	**100 J**	29 J	NA
Selenium	0.14 J	NA	NA	0.22 J	**2.2**	**0.85**	**0.6**	**0.35 J**	**1.9**	**1.1**	**0.73**	**0.79**	0.17 B	NA
Zinc	21	NA	NA	11	32	11	6.8	6.9	53	49	35	43	38 J	NA
Geo Chemistry														
Calcium	790	NA	NA	3,600	2,100	NA	100 U	200	2,100	NA	6,400	NA	NA	NA
Sodium	48,000	NA	NA	56,000	6,800	NA	130 U	130 U	23,000	NA	37,000	NA	NA	NA
Magnesium	98 U	NA	NA	100 U	740	NA	100 U	100 U	120 J	NA	570	NA	NA	NA
Lithium	3 J	NA	NA	3.2 J	1.3 J	NA	1 U	1 U	1.1 U	NA	3.8 J	NA	NA	NA
Phosphorus	**21**	NA	NA	**5.7**	**5.9**	NA	**2.4**	**20**	**12**	NA	**5.1**	NA	NA	NA
Silicon	32	NA	NA	29	33	NA	60	3.8 J	47	NA	51	NA	NA	NA
Manganese	13	NA	NA	35	85	NA	1.6 J	60	58	NA	59	NA	NA	NA
Total Organic Carbon	140,000 J	NA	NA	360,000 J	580,000 J	NA	640,000 J	770,000 J	240,000 J	NA	87,000 J	NA	NA	NA
Sulfur	160	NA	NA	85	640	NA	37 J	200	150	NA	14,000	NA	NA	NA
Quartz	68	NA	NA	63	70	NA	130	8.1 J	100	NA	110	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act

NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration



Legend

- NESI Area
- Test Pit Location
- Soil Sampling Location
- Waste Sampling Location
- Trench Location
- NESI Wetland Spring
- Unconsolidated Aquifer Well (UA)

Uppermost Basalt Aquifer Well (BAU)

- BAU_1 - Shallower Water-bearing Zone
- BAU_2 - Deeper Water-bearing Zone

orange: Exceeds Washington State Dangerous Waste Regulation
red: Exceeds MTCA Method C Soil Screening Level or MCL for Groundwater
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater or MTCA Method B Groundwater Screening Level
purple: Exceeds Terrestrial Ecological Soil Screening Level
green: Exceeds MTCA Method B
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
NA = Not Analyzed
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 31-9
SWMU 31
NESI Area
Waste Sampling Locations
and Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

A hypothesis during Work Plan development was that the SPL waste would likely contain elevated concentrations of cyanide, fluoride, aluminum, and sodium relative to non-SPL carbon waste. It was also hypothesized that the suspected SPL might be characterized by lower PAH concentrations than the anode wastes due to the lower percentages of pitch and coke used in the SPL. However, these trends could not be completely demonstrated in the NESI waste data set. In general, the suspected SPL samples were characterized by higher fluoride, aluminum, and sodium concentrations than the suspected non-SPL carbon waste concentrations. Highest PAH concentrations were found in the one suspected anode waste that was collected, but the suspected SPL was also characterized by high PAH concentrations above the MTCA Method C screening level. The only detected cyanide concentration in the complete site waste data set was for a suspected SPL sample from the NESI area.

31.4.2.3 NESI Soil Results

Table 31-5 summarizes the RI soil sample results and Table 31-6 summarizes the WPA results for NESI soils. For ease of presentation, exceedances of soil screening levels are shown in Figure 31-10 that shows the western portion of the NESI subarea, and Figure 31-11 that shows the eastern portion of the NESI subarea, respectively.

Initial RI investigation Shallow Subsurface Samples

Soil samples were collected from below the wastes or at the base of the excavation if wastes were not present [consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b)] at depths ranging from 2 to 8 ft bgs. In three cases (NESI-TP4/TP4A, NESI-TP2/TP2A, and NESI-TP6A/6B/6C), additional test pits were excavated for logging purposes to better characterize the waste distribution in these areas. Additional samples were not collected. In general, soil concentrations were lower than the waste concentrations.

Initial RI soil chemical results are summarized as follows:

- Total cyanide was detected (21 mg/kg) above the MTCA-derived soil screening level for protection of groundwater of 1.9 mg/kg in one soil sample that was collected from beneath wastes in main area of solid and carbon waste material located immediately east of the main NESI wetland (SWMU31-NESI-TR5B-4.5). The deeper sample collected at this location SWMU31-NESI-TR5B-5.0) did not have a positive detection of total cyanide. Note that this is a conservative comparison because this soil screening level is based on the toxicity of free cyanide and not total cyanide.

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

						Ecological Indicator						Analytical Results									
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TP1-2.0 6/23/2016	SWMU31-NESI-TP2-2.0 6/23/2016	SWMU31-NESI-TP3-2.0 6/23/2016	SWMU31-NESI-TP4-0.5 6/23/2016	SWMU31-NESI-TP4-2.5 6/23/2016	SWMU31-NESI-TP5-2.0 6/23/2016	SWMU31-NESI-TP5-4.0 6/23/2016	SWMU31-NESI-TP6C-2.5 6/23/2016	SWMU31-NESI-TP6C-4.0 6/23/2016	SWMU31-NESI-TP7-2.5 6/22/2016
Aluminum Smelter																					
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	1.9 U	2.1 U	2.1 U	2 U	2.1 U	2.1 U	2.1 U	2.5 U	2.2 U	1.9 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	65	81	**440 J**	**480 J**	9.9 J	72 J	92 J	53 J	7.4 J	15 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	4.9 J	4.6 J	23	13	160	9.5 J	8.5 J	15	82	7.8 J
Polycyclic Aromatic Hydrocarbons (PAHs)																					
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	0.011 J	0.00064 UJ	0.053 J	**0.61 J**	0.0007 UJ	0.003 J	0.00065 UJ	0.00082 UJ	0.00072 UJ	0.0006 U
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.013 J	0.0016 J	0.075 J	0.45 J	0.0005 UJ	0.0032 J	0.00047 UJ	0.00059 UJ	0.00052 UJ	0.00043 U
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.12 J	0.0013 J	0.46 J	4.5 J	0.00066 UJ	0.042 J	0.00062 UJ	0.0017 J	0.00069 UJ	0.00057 U
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0024 J	0.00051 UJ	0.0077 J	0.098 J	0.00055 UJ	0.00052 UJ	0.00052 UJ	0.00065 UJ	0.00057 UJ	0.00048 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.15 J	0.0014 J	0.59 J	7.9 J	0.0016 J	0.06 J	0.00062 UJ	0.0025 J	0.00069 UJ	0.00057 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.1 J	0.013 J	3.4 J	24 J	0.012 J	0.42 J	0.0035 J	0.013 J	0.00087 UJ	0.0022 J
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	1.5 J	0.015 J	4.8 J	29 J	0.013 J	0.6 J	0.0054 J	0.014 J	0.00046 UJ	0.0026 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.9 J	0.02 J	5.6 J	38 J	0.02 J	0.66 J	0.0081 J	0.024 J	0.00068 UJ	0.0044 J
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	1.3 J	0.013 J	3.8 J	24 J	0.013 J	0.54 J	0.0056 J	0.012 J	0.00057 UJ	0.0031 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.75 J	0.0068 J	2.3 J	13 J	0.0075 J	0.32 J	0.0039 J	0.009 J	0.00069 UJ	0.0017 J
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.5 J	0.015 J	4.2 J	31 J	0.013 J	0.5 J	0.0059 J	0.025 J	0.0017 UJ	0.0025 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.2 J	0.0019 J	0.61 J	3.5 J	0.0022 J	0.074 J	0.00075 UJ	0.0026 J	0.00083 UJ	0.00069 U
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	2 J	0.018 J	7.3 J	64 J	0.017 J	0.67 J	0.0049 J	0.02 J	0.0016 UJ	0.0035 J
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.065 J	0.00051 UJ	0.18 J	1.8 J	0.00055 UJ	0.022 J	0.00052 UJ	0.0016 J	0.00057 UJ	0.00048 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.5 J	0.014 J	4.2 J	24 J	0.014 J	0.63 J	0.0061 J	0.014 J	0.00069 UJ	0.0031 J
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.024 J	0.016 J	0.17 J	0.7 J	0.00088 UJ	0.0059 J	0.00083 UJ	0.002 J	0.00092 UJ	0.00077 U
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.87 J	0.0073 J	3.6 J	33 J	0.0072 J	0.31 J	0.0023 J	0.0094 J	0.0013 J	0.0017 J
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	1.8 J	0.016 J	6.5 J	61 J	0.015 J	0.6 J	0.0045 J	0.018 J	0.0013 J	0.0031 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**2.06**	0.02072	**6.453**	**39.56**	0.0187	**0.8154**	0.0076565	0.02051	0.0004265	0.0037995
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	3.2554	0.0456	12.4357	**113**	0.0258	1.1161	0.0072	0.0372	0.0013	0.0052
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**11.55**	0.1147	**35.41**	**248**	0.1097	**4.344**	0.043	0.1316	0.0013	0.0227
Polychlorinated Biphenyls (PCBs)																					
PCB-aroclor 1016	mg/Kg	NA	NA	5.6	250	NE	NE	NE	NE	5.6	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	NA	0.5	66	40	NE	NE	0.71	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	NA	0.5	66	NE	NE	NE	NE	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	1.0	10	0.5	66	40	NE	0.65	NE	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																					
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	18,000	18,000	23,000	**31,000**	12,000	10,000	9,700	11,000	11,000	15,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.8	3.9	3.2	2.8	3.3	5.3	4.8	1.6	3	4.8
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.51	0.29 B	0.6 J	0.14 B	0.058 B	0.054 B	0.044 B	0.083 B	0.057 B	0.2 B
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	16	19	17 J	17 J	14 J	13 J	11 J	19 J	19 J	16 J
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	26	20	**59**	22	17	15	15	19	21	21 J
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	21	7.1	19	8.4	5.1	6	8.6	5.2	5.7	6.2
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.032	0.015 J	0.012 J	0.015 J	0.0099 J	0.01 J	0.008 J	0.01 J	0.012 J	0.028
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	14	13	12	28	11	9.8	9.7	8.3	12	11
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**0.88**	**1.1**	**0.95**	**1**	**0.95**	**0.85**	**0.94**	**0.88**	**0.85**	**1**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	75	58	**100**	71	46	45	48	48	49	54

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 2 of 10)

						Ecological Indicator						Analytical Results									
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TP1-2.0 6/23/2016	SWMU31-NESI-TP2-2.0 6/23/2016	SWMU31-NESI-TP3-2.0 6/23/2016	SWMU31-NESI-TP4-0.5 6/23/2016	SWMU31-NESI-TP4-2.5 6/23/2016	SWMU31-NESI-TP5-2.0 6/23/2016	SWMU31-NESI-TP5-4.0 6/23/2016	SWMU31-NESI-TP6C-2.5 6/23/2016	SWMU31-NESI-TP6C-4.0 6/23/2016	SWMU31-NESI-TP7-2.5 6/22/2016
Total Petroleum Hydrocarbons (TPHs)																					
Gasoline Range Organics	mg/Kg	100	100	NE	NE	120	120	1,000	NA	100	NA	0.6 UJ	0.62 UJ	1.1 J	1.3 J	0.76 UJ	0.64 UJ	1.3 UJ	0.76 UJ	0.78 UJ	16
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	14 J	10 UJ	140 J	**270 J**	12 UJ	12 UJ	10 UJ	64 J	13 UJ	10 U
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	82 J	17 J	**330 J**	**540 J**	37 J	9.7 UJ	8.7 UJ	12 UJ	12 J	18 J
Volatile Organic Compounds																					
Benzene	mg/kg	0.03	0.03	18	2,400	NE	NE	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	7.0	6,400	280,000	200	NE	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	6.0	8,000	350,000	NE	NE	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	2.0	160,000	7,000,000	NE	NE	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	mg/Kg	NE	NE	18	2,300	NE	NE	NL	0.017	0.017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	NE	11	1,400	NE	NE	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	NE	160	7,000	NE	NE	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	0.05	480	21,000	NE	NE	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	0.03	12	1,800	NE	NE	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	NE	0.67	88	NE	NE	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyls

SSL = Soil Screening Level

Total TEC = Total Toxicity Equivalent Concentration

VOCs = Volatile Organic Compounds

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

						Ecological Indicator						Analytical Results								
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TP7-4.0 6/22/2016	SWMU31-NESI-TP8-4.0 6/22/2016	SWMU31-NESI-TP8-5.5 6/22/2016	SWMU31-NESI-TP9-1.5 6/22/2016	SWMU31-NESI-TP41-1.5 (Duplicate of SWMU31-NESI-TP9-1.5) 6/22/2016	SWMU31-NESI-TP10-2.0 6/21/2016	SWMU31-NESI-TP10-3.5 6/21/2016	SWMU31-NESI-TP11-5.5 6/21/2016	SWMU31-NESI-TP11-7.0 6/21/2016
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.5 UJ	2.5 UJ	2.8 UJ	3.1 UJ
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	12 J	73	31 J	18 J	23 J	46	13	**3,800**	32
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	9.5 J	42	24 J	11 J	8.5 J	15	11 J	53	16 J
Polycyclic Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	0.0006 U	**0.093**	0.01	0.00064 U	0.0007 U	0.011	0.00071 U	**1.1**	0.049
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00043 U	0.11	0.012	0.00045 U	0.0005 U	0.018	0.0005 U	1.3	0.057
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0031 J	0.77	0.085	0.0014 J	0.00067 U	0.41	0.006	7.1	0.32
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00047 U	0.0099	0.00052 U	0.0005 U	0.00055 U	0.00064 U	0.00056 U	0.099	0.0065 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0031 J	1.1	0.11	0.0014 J	0.00067 U	1	0.017	11	0.33
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.031	2.3	0.18	0.014 J	0.0078 J	4.3	0.085	44	0.93
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.046	2.4	0.17	0.017 J	0.0089 J	5	0.093	50	1
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.069	2.8	0.2	0.029 J	0.014 J	6	0.11	61	1.1
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.05	2	0.13	0.018 J	0.0096 J	3.6	0.078	39	0.8
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.032	1.3	0.1	0.0096 J	0.0062 J	1.8	0.042	25	0.54
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.05	2.6	0.22	0.019 J	0.011 J	4.3	0.078	51	0.93
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0059	0.28	0.019	0.0021 J	0.0012 J	0.6	0.011	6.7	0.12
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.052	5.6	0.49	0.022 J	0.013 J	8.3	0.12	96	2
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00047 U	0.42	0.041	0.0005 U	0.00055 U	0.31	0.0043 J	4.5	0.16
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.047	2.1	0.14	0.018 J	0.0086 J	4.1	0.087	47	0.9
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.001 J	0.23	0.023	0.00081 U	0.00089 U	0.049	0.0009 U	2.8	0.1
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.018	4.4	0.48	0.0087 J	0.0057 J	4.2	0.058	60	1.8
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.047	4.9	0.45	0.019 J	0.011 J	7.2	0.11	82	1.7
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.06499	**3.304**	**0.2361**	0.02446	0.01279	**6.723**	0.12728	**68.88**	**1.3683**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.0772	12.7329	1.251	0.0335	0.0187	14.298	0.2053	**184**	4.8225
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.3779	**20.68**	**1.609**	0.1457	0.0783	**36.9**	0.694	**406**	**8.02**
Polychlorinated Biphenyls (PCBs)																				
PCB-aroclor 1016	mg/Kg	NA	NA	5.6	250	NE	NE	NE	NE	5.6	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	NA	0.5	66	40	NE	NE	0.71	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	NA	0.5	66	NE	NE	NE	NE	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	1.0	10	0.5	66	40	NE	0.65	NE	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	12,000	14,000	11,000	19,000	21,000	18,000	13,000	**66,000**	16,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	4	1	0.82	2.9	3	2.8	1.8	6.7	0.68
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.25 B	0.27 B	0.18 B	0.11 B	0.11 B	0.23	0.11 B	**3.3 J**	0.24 B
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	11 J	26 J	20 J	15	15	10	20	18	26
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	18 J	16 J	5.8 J	23	24	24	9.7	48	26
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.9	7.4	6.3	6.7	6.6	4.5	5.7	**62**	6.6
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.0084 J	0.012 J	0.0065 J	0.014 J	0.014 J	0.015 J	0.0073 J	0.017 J	0.013 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	8.3	12	5.3	12	13	9.9	6.7	**150**	7.3
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**0.93**	**0.91**	**0.72**	**1.3**	**1.2**	**1**	**0.66**	**1.1**	**0.78**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	53	40	32	64	67	49	32	**110**	20

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June 2016

						Ecological Indicator						Analytical Results								
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TP7-4.0 6/22/2016	SWMU31-NESI-TP8-4.0 6/22/2016	SWMU31-NESI-TP8-5.5 6/22/2016	SWMU31-NESI-TP9-1.5 6/22/2016	SWMU31-NESI-TP41-1.5 (Duplicate of SWMU31-NESI-TP9-1.5) 6/22/2016	SWMU31-NESI-TP10-2.0 6/21/2016	SWMU31-NESI-TP10-3.5 6/21/2016	SWMU31-NESI-TP11-5.5 6/21/2016	SWMU31-NESI-TP11-7.0 6/21/2016
Total Petroleum Hydrocarbons (TPHs)																				
Gasoline Range Organics	mg/Kg	100	100	NE	NE	120	120	1,000	NA	100	NA	1.2 U	1.4 U	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.8 U	2.1 U
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	12 U	14 U	31	13 U	13 U	14 U	12 U	**1,100**	16 U
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	11 J	15 J	44 J	14 J	20 J	12 U	10 U	**3,600**	13 U
Volatile Organic Compounds																				
Benzene	mg/kg	0.03	0.03	18	2,400	NE	NE	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	7.0	6,400	280,000	200	NE	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	6.0	8,000	350,000	NE	NE	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	2.0	160,000	7,000,000	NE	NE	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	mg/Kg	NE	NE	18	2,300	NE	NE	NL	0.017	0.017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	NE	11	1,400	NE	NE	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	NE	160	7,000	NE	NE	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	0.05	480	21,000	NE	NE	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	0.03	12	1,800	NE	NE	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	NE	0.67	88	NE	NE	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 5 of 10)

						Ecological Indicator						Analytical Results								
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TP12-5.0 6/22/2016	SWMU31-NESI-TP40-5.0 (Duplicate of SWMU31-NESI-TP12-5.0) 6/22/2016	SWMU31-NESI-TP12-6.5 6/22/2016	SWMU31-NESI-TR1A-4.0 6/23/2016	SWMU31-NESI-TR42-4.0 (Duplicate of SWMU31-NESI-TR1A-4.0) 6/23/2016	SWMU31-NESI-TR1A-6.0 6/23/2016	SWMU31-NESI-TR2-3.5 6/23/2016	SWMU31-NESI-TR3C-2.5 6/23/2016	SWMU31-NESI-TR3C-4.0 6/23/2016
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	2.9 U	2.6 U	2.6 U	2.6 U	2.7 U	2.1 U	2.2 U	2.4 U	2.3 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	**2,500**	**2,600**	40	**170 J**	**150 J**	7.5 J	**530 J**	78 J	29 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	110	120	14	18	18	46	230	17	17
Polycyclic Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	**1.2 J**	**28 J**	0.00076 U	0.00076 UJ	0.00084 UJ	0.0007 UJ	0.0017 J	0.019 J	0.00075 UJ
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	1.6 J	**43 J**	0.00054 U	0.00055 UJ	0.0006 UJ	0.0005 UJ	0.0028 J	0.017 J	0.00053 UJ
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	6.3 J	**130 J**	0.00072 U	0.00073 UJ	0.0008 UJ	0.00067 UJ	0.017 J	0.11 J	0.00071 UJ
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.075 J	1.7 J	0.0006 U	0.00061 UJ	0.00066 UJ	0.00056 UJ	0.0034 J	0.0016 J	0.00059 UJ
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	7.9 J	170 J	0.00072 U	0.00073 UJ	0.002 J	0.00067 UJ	0.054 J	0.15 J	0.00071 UJ
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	21 J	220 J	0.00092 U	0.002 J	0.055 J	0.00085 UJ	0.86 J	0.31 J	0.0044 J
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	26 J	220 J	0.00048 U	0.002 J	0.07 J	0.0012 J	2.5 J	0.34 J	0.00047 UJ
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	32 J	270 J	0.00071 U	0.0046 J	0.2 J	0.0039 J	8.9 J	0.38 J	0.061 J
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	24 J	170 J	0.0006 U	0.0025 J	0.091 J	0.0028 J	7.8 J	0.22 J	0.0098 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	14 J	100 J	0.00072 U	0.0019 J	0.079 J	0.0018 J	2.6 J	0.18 J	0.019 J
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	25 J	260 J	0.0018 U	0.0031 J	0.089 J	0.0025 J	3.1 J	0.39 J	0.018 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	3 J	22 J	0.00087 U	0.00087 UJ	0.018 J	0.0008 UJ	1.5 J	0.031 J	0.0033 J
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	46 J	**640 J**	0.0021 J	0.0029 J	0.047 J	0.0018 J	0.87 J	0.72 J	0.0042 J
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	3.4 J	73 J	0.0006 U	0.00061 UJ	0.00066 UJ	0.00056 UJ	0.016 J	0.047 J	0.00059 UJ
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	25 J	170 J	0.00072 U	0.0024 J	0.09 J	0.0028 J	8.2 J	0.25 J	0.01 J
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	3.8 J	**100 J**	0.00096 U	0.00097 UJ	0.0011 UJ	0.00089 UJ	0.0057 J	0.029 J	0.00095 UJ
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	31 J	610 J	0.0019 J	0.0021 J	0.01 J	0.0016 J	0.23 J	0.59 J	0.003 J
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	40 J	510 J	0.0019 J	0.0025 J	0.046 J	0.0011 UJ	0.82 J	0.65 J	0.0039 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**35.75**	**301**	0.000446	0.0031645	0.11509	0.0021575	**4.737**	**0.459**	0.010185
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	**101**	**1,796**	0.004	0.005	0.059	0.0034	1.2006	1.6836	0.0072
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**210**	**1,942**	0.0019	0.021	0.738	0.015	**36.28**	**2.751**	0.1294
Polychlorinated Biphenyls (PCBs)																				
PCB-aroclor 1016	mg/Kg	NA	NA	5.6	250	NE	NE	NE	NE	5.6	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	NA	0.5	66	40	NE	NE	0.71	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	NA	0.5	66	NE	NE	NE	NE	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	1.0	10	0.5	66	40	NE	0.65	NE	0.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	**41,000 J**	**66,000 J**	13,000	6,200 J	10,000 J	9,600	16,000	9,600	11,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.5 J	**10 J**	1.1	3 J	2.4 J	2.1	4.4	2.9	2.2
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	**0.97 J**	**2 J**	0.12 B	0.058 B	0.063 B	0.26 B	**1 J**	0.069 B	0.049 B
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	30 J	27 J	17 J	7.4 J	13 J	15 J	20 J	15 J	17 J
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	45 J	**82 J**	6.5 J	9.5 J	17 J	15	24	9.7	8.7
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	16 J	**55 J**	7.2	2.5 J	3.9 J	6.3	30	5.3	7.3
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.034	0.021 J	0.0073 U	0.0085 J	0.012 J	0.016 J	0.016 J	0.007 U	0.01 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	17 J	**36 J**	5.5	6.1 J	8.7 J	12	**67**	11	7.8
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**1.6**	**1.4**	**0.74**	**0.52 J**	**0.92**	**0.78**	**1.7**	**0.65**	**0.81**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	70 J	**240 J**	26	25 J	44 J	44	62	43	53

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June 2016

						Ecological Indicator						Analytical Results								
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TP12-5.0 6/22/2016	SWMU31-NESI-TP40-5.0 (Duplicate of SWMU31-NESI-TP12-5.0) 6/22/2016	SWMU31-NESI-TP12-6.5 6/22/2016	SWMU31-NESI-TR1A-4.0 6/23/2016	SWMU31-NESI-TR42-4.0 (Duplicate of SWMU31-NESI-TR1A-4.0) 6/23/2016	SWMU31-NESI-TR1A-6.0 6/23/2016	SWMU31-NESI-TR2-3.5 6/23/2016	SWMU31-NESI-TR3C-2.5 6/23/2016	SWMU31-NESI-TR3C-4.0 6/23/2016
Total Petroleum Hydrocarbons (TPHs)																				
Gasoline Range Organics	mg/Kg	100	100	NE	NE	120	120	1,000	NA	100	NA	11 J	17	1.4 U	0.78 UJ	1 UJ	0.59 UJ	0.63 UJ	0.56 UJ	0.6 UJ
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	**5,100**	**5,500 J**	13 U	13 UJ	15 UJ	12 UJ	31 J	12 UJ	14 UJ
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	**8,100**	**8,500 J**	11 U	42 J	12 J	9.8 UJ	110 J	9.9 UJ	11 UJ
Volatile Organic Compounds																				
Benzene	mg/kg	0.03	0.03	18	2,400	NE	NE	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	7.0	6,400	280,000	200	NE	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	6.0	8,000	350,000	NE	NE	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	2.0	160,000	7,000,000	NE	NE	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	mg/Kg	NE	NE	18	2,300	NE	NE	NL	0.017	0.017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	NE	11	1,400	NE	NE	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	NE	160	7,000	NE	NE	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	0.05	480	21,000	NE	NE	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	0.03	12	1,800	NE	NE	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	NE	0.67	88	NE	NE	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
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cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
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PAHs = Polycyclic Aromatic Hydrocarbon
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Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-NESI-TR10D-2.0 6/20/2016	SWMU31-NESI-TR10M-2.5 6/20/2016	SWMU31-NESI-TR10M-4.0 6/20/2016	SWMU31-NESI-TR4A-3.5 6/22/2016	SWMU31-NESI-TR4B-2.0 6/22/2016	SWMU31-NESI-TR5B-4.5 6/22/2016	SWMU31-NESI-TR5B-5.0 6/22/2016	SWMU31-NESI-TR6B-3.5 6/21/2016	SWMU31-NESI-TR6B-4.5 6/21/2016
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	NA	2.1 UJ	2.2 UJ	2.1 U	2 U	**21**	2.6 U	2.6 UJ	2.3 UJ
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	NA	**1,800**	**230**	94 J	25 J	**790**	59	**1,100**	27
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	NA	15	40	37 J	14 J	52	22	40	12
Polycyclic Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	0.00073 U	0.006	0.00068 U	0.016	0.00067 U	**6.5**	0.0042 J	**0.14**	0.00075 U
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00052 U	0.0068	0.00049 U	0.024	0.00048 U	**11**	0.005 J	0.19	0.00054 U
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0007 U	0.05	0.00065 U	0.094	0.00064 U	43	0.039	1.4	0.00071 U
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00058 U	0.002 J	0.00054 U	0.0015 J	0.00053 U	0.034 U	0.00068 U	0.014	0.0006 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0007 U	0.14	0.0012 J	0.1	0.00064 U	72	0.053	3	0.0015 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00088 U	2.1	0.012	0.35	0.0013 J	86	0.15	5.4	0.0048 J
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.00046 U	1.8	0.022	0.45	0.0016 J	100	0.21	8.2	0.0056 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0028 J	3.9	0.03	0.53	0.0028 J	120	0.26	10	0.0067
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0018 J	2.3	0.027	0.35	0.00053 U	76	0.2	7.1	0.0054 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0007 U	1.4	0.011	0.21	0.00064 U	42	0.12	4.5	0.003 J
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.002 J	3.1	0.017	0.4	0.0016 U	100	0.2	8.6	0.0046 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00083 U	0.42	0.0039 J	0.037	0.00076 U	8.6	0.024	1.3	0.00086 U
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.0039 J	3.3	0.016	0.66	0.0024 J	230	0.31	10	0.0094
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00058 U	0.023	0.00054 U	0.043	0.00053 U	36	0.023	0.89	0.0006 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0016 J	2.4	0.028	0.36	0.00064 U	77	0.21	7.5	0.0059 J
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.00093 U	0.01	0.00086 U	0.05	0.00085 U	0.0063 J	0.0018 U	0.44	0.00095 U
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0008 U	0.87	0.0063	0.43	0.0018 J	200	0.24	8.6	0.0064
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.0074	3.2	0.019	0.57	0.0023 J	200	0.28	9.2	0.01
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.0008105	**2.853**	0.03066	**0.6027**	0.00212	**134**	**0.2884**	**11.156**	0.007729
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.0039	4.4078	0.0235	1.4185	0.0042	0.0063	0.6825	24.674	0.0173
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.0156	**20.62**	0.1699	**3.257**	0.008	**810**	**1.654**	**61.8**	0.046
Polychlorinated Biphenyls (PCBs)																				
PCB-aroclor 1016	mg/Kg	NA	NA	5.6	250	NE	NE	NE	NE	5.6	NE	NA	NA	NA	NA	NA	0.011 UJ	0.009 U	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.006 UJ	0.0051 U	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.007 UJ	0.0059 U	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.13 J	0.0019 U	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.0041 UJ	0.0035 U	NA	NA
PCB-aroclor 1254	mg/Kg	NA	NA	0.5	66	40	NE	NE	0.71	0.5	NE	NA	NA	NA	NA	NA	0.0021 UJ	0.0018 U	NA	NA
PCB-aroclor 1260	mg/Kg	NA	NA	0.5	66	NE	NE	NE	NE	0.5	NE	NA	NA	NA	NA	NA	0.0027 UJ	0.0023 U	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.00072 UJ	0.00061 U	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.0013 UJ	0.0011 U	NA	NA
Total PCB Aroclor (calc)	mg/kg	1.0	10	0.5	66	40	NE	0.65	NE	0.5	NE	NA	NA	NA	NA	NA	0.13	0.00061 U	NA	NA
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	NA	20,000	18,000	10,000	9,400	**50,000**	14,000	**43,000**	10,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	NA	2.1	4.7	2.5	1.9	3.2	3.4	2.7	1.9
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	NA	0.64	0.27	0.29 B	0.2 B	**1.3**	0.26 B	**1.3**	0.19 B
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	NA	13	13	16 J	16 J	27 J	27 J	17	19
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	NA	29	22	5.7 J	8.9 J	23 J	12 J	31	8.5
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	NA	19	5.1	7.3	8.1	20	4.5	**79**	7.7
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	NA	0.034	0.023	0.0058 U	0.0059 J	0.0083 U	0.0073 J	0.025 J	0.0074 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	NA	13	11	5.5	6.9	**38**	7.5	**37**	7.5
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	NA	**1**	**1**	**0.94**	**0.83**	**1.5**	**1.1**	**1.3**	**0.81**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	NA	**100**	63	45	41	**540**	54	**170**	42

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Ecological Indicator: Eco-SSL Soil Biota	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-NESI-TR10D-2.0 6/20/2016	SWMU31-NESI-TR10M-2.5 6/20/2016	SWMU31-NESI-TR10M-4.0 6/20/2016	SWMU31-NESI-TR4A-3.5 6/22/2016	SWMU31-NESI-TR4B-2.0 6/22/2016	SWMU31-NESI-TR5B-4.5 6/22/2016	SWMU31-NESI-TR5B-5.0 6/22/2016	SWMU31-NESI-TR6B-3.5 6/21/2016	SWMU31-NESI-TR6B-4.5 6/21/2016
Total Petroleum Hydrocarbons (TPHs)												NA								
Gasoline Range Organics	mg/Kg	100	100	NE	NE	120	120	1,000	NA	100	NA	NA	1.3 J	1.6 U	1 U	1.2 U	1.4 U	1.4 U	1.4 U	1.1 U
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	NA	21 J	12 U	31	12 U	**950**	14 U	160	13 U
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	NA	82	11 J	73	10 U	**3,900**	15 J	**390**	11 U
Volatile Organic Compounds																				
Benzene	mg/kg	0.03	0.03	18	2,400	NE	NE	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	0.00033 U	0.0003 U	NA	NA
Toluene	mg/kg	7.0	7.0	6,400	280,000	200	NE	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	0.00033 U	0.0003 U	NA	NA
Ethylbenzene	mg/kg	6.0	6.0	8,000	350,000	NE	NE	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	0.00044 U	0.0004 U	NA	NA
m, p-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	0.00022 U	0.0002 U	NA	NA
o-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	0.00029 U	0.00026 U	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	2.0	160,000	7,000,000	NE	NE	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	0.00033 U	0.0003 U	NA	NA
1,1,2-Trichloroethane	mg/Kg	NE	NE	18	2,300	NE	NE	NL	0.017	0.017	NE	NA	NA	NA	NA	NA	0.00028 U	0.00025 U	NA	NA
1,2-Dichloroethane	mg/kg	NE	NE	11	1,400	NE	NE	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	0.00017 U	0.00015 U	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	NE	160	7,000	NE	NE	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	0.00033 U	0.0003 U	NA	NA
Tetrachloroethene	mg/kg	0.05	0.05	480	21,000	NE	NE	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	0.00044 U	0.0004 U	NA	NA
Trichloroethene	mg/kg	0.03	0.03	12	1,800	NE	NE	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	0.00033 U	0.0003 U	NA	NA
Vinyl Chloride	mg/kg	NE	NE	0.67	88	NE	NE	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	0.00033 UJ	0.0003 UJ	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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						Ecological Indicator						Analytical Results					
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-NESI-TR8-2.0 6/21/2016	SWMU31-NESI-TR8-4.0 6/21/2016	SWMU31-NESI-TR9A-2.5 6/21/2016	SWMU31-NESI-TR9A-4.0 6/21/2016	SWMU31-NESI-TR11APRIME-2.5 6/21/2016	SWMU31-NESI-TR11APRIME-4.0 6/21/2016
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	2.1 UJ	2.2 UJ	2.4 UJ	2.5 UJ	2.2 UJ	2.5 UJ
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	90	83	62	16	**330**	**190**
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	8.2 J	12	47	32	8 J	22
Polycyclic Aromatic Hydrocarbons (PAHs)																	
1-Methylnaphthalene	mg/Kg	NL	NL	34	4,500	NE	NL	NL	0.082	0.082	NE	0.00066 U	0.00059 U	0.00075 U	0.00085 U	0.00077 U	0.00067 U
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00047 U	0.00042 U	0.00053 U	0.0006 U	0.00055 U	0.00048 U
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.00063 U	0.00057 U	0.00071 U	0.00081 U	0.00073 U	0.0028 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00052 U	0.00047 U	0.00059 U	0.00067 U	0.00061 U	0.00053 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.00063 U	0.00057 U	0.00071 U	0.00081 U	0.00073 U	0.0049 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0008 U	0.0023 J	0.0043 J	0.0014 J	0.002 J	0.047
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.00042 U	0.0033 J	0.0056 J	0.0019 J	0.0021 J	0.066
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00062 U	0.0043 J	0.0085	0.0023 J	0.0056 J	0.093
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00052 U	0.003 J	0.005 J	0.0014 J	0.0027 J	0.063
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00063 U	0.0021 J	0.0029 J	0.00081 U	0.0017 J	0.033
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0016 U	0.0027 J	0.0056 J	0.002 U	0.0071	0.065
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00075 U	0.00068 U	0.00086 U	0.00097 U	0.00088 U	0.0098
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.0021 J	0.0046 J	0.0083	0.0042 J	0.0058 J	0.064
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.00052 U	0.00047 U	0.00059 U	0.00067 U	0.00061 U	0.00053 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.00063 U	0.0029 J	0.0054 J	0.00081 U	0.0026 J	0.068
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.00084 U	0.00075 U	0.00095 U	0.0011 U	0.00097 U	0.00085 U
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0012 J	0.0018 J	0.0037 J	0.004 J	0.0024 J	0.024
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.0039 J	0.0064	0.01	0.0076	0.0087	0.06
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.0003895	0.004521	0.007809	0.0024095	0.003405	0.09173
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.0033	0.0064	0.012	0.0082	0.0082	0.0957
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.0039	0.027	0.0473	0.0146	0.0325	0.5048
Polychlorinated Biphenyls (PCBs)																	
PCB-aroclor 1016	mg/Kg	NA	NA	5.6	250	NE	NE	NE	NE	5.6	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	NA	0.5	66	40	NE	NE	0.71	0.5	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	NA	0.5	66	NE	NE	NE	NE	0.5	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1262	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
PCB-aroclor 1268	mg/Kg	NA	NA	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Total PCB Aroclor (calc)	mg/kg	1.0	10	0.5	66	40	NE	0.65	NE	0.5	NE	NA	NA	NA	NA	NA	NA
Metals																	
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	18,000	13,000	**39,000**	15,000	16,000	25,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	3.2	3.3	1.3	1.9	1.7	2.9
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.24	0.24	0.47	0.2	0.27	0.46
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	15	18	14	24	10	15
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	20	8.9	15	14	32	41
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.2	5.8	7.2	5.6	3.9	5.6
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.013 J	0.0063 U	0.015 J	0.0081 U	0.014 J	0.014 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	11	9.8	7.9	6.2	10	14
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**1.1**	**0.83**	**1.3**	**1.3**	**1.5**	**1.9**
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	55	46	39	46	67	63

Table 31-5
SWMU 31 - North of the East Surface Impoundment Initial RI Soil Results Summary
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Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Ecological Indicator: Eco-SSL Soil Biota	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-NESI-TR8-2.0 6/21/2016	SWMU31-NESI-TR8-4.0 6/21/2016	SWMU31-NESI-TR9A-2.5 6/21/2016	SWMU31-NESI-TR9A-4.0 6/21/2016	SWMU31-NESI-TR11APRIME-2.5 6/21/2016	SWMU31-NESI-TR11APRIME-4.0 6/21/2016
Total Petroleum Hydrocarbons (TPHs)																	
Gasoline Range Organics	mg/Kg	100	100	NE	NE	120	120	1,000	NA	100	NA	1.4 U	1 U	1.8 U	1.8 J	6.3 J	2 J
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	13 U	12 U	12 U	15 U	13 U	14 U
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	20 J	9.9 U	26 J	12 U	43 J	31 J
Volatile Organic Compounds																	
Benzene	mg/kg	0.03	0.03	18	2,400	NE	NE	0.255	0.027	0.027	NE	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	7.0	6,400	280,000	200	NE	5.45	4.5	4.5	NE	NA	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	6.0	8,000	350,000	NE	NE	5.16	5.9	5.16	NE	NA	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	9.0	16,000	700,000	NE	NE	10	14	10	NE	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	2.0	160,000	7,000,000	NE	NE	29.8	1.5	1.5	NE	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	mg/Kg	NE	NE	18	2,300	NE	NE	NL	0.017	0.017	NE	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	NE	11	1,400	NE	NE	21.2	0.023	0.023	NE	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	NE	160	7,000	NE	NE	30.2	0.078	0.078	NE	NA	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	0.05	480	21,000	NE	NE	9.92	0.05	0.05	NE	NA	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	0.03	12	1,800	NE	NE	12.4	0.025	0.025	NE	NA	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	NE	0.67	88	NE	NE	6.46	0.0017	0.0017	NE	NA	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
VOCs = Volatile Organic Compounds

Table 31-6
SWMU 31 - North of the East Surface Impoundment WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2020 and May 2021
(Page 1 of 5)

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU31-WPA-NESI-SS-1 12/1/2020	SWMU31-WPA-NESI-SS-2 12/1/2020	SWMU31-WPA-NESI-SS-3 12/1/2020	SWMU31-WPA-NESI-SS-4 12/1/2020	SWMU31-WPA-NESI-SS-5 12/1/2020	SWMU31-WPA-NESI-SS-6 12/1/2020	SWMU31-WPA-NESI-SS-7 12/1/2020	SWMU31-WPA-NESI-SS-52 (Duplicate of SWMU31-WPA-NESI-SS-7) 12/1/2020	SWMU31-WPA-NESI-SS-8 12/1/2020
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.46	0.42	0.58	0.64	0.78	0.09 U	0.08 U	0.13 J	0.12 J
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	43 J	81.8 J	15.9 J	41.1 J	**170 J**	**272 J**	87.4 J	94.8 J	40.5 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	34.4 J	135 J	134 J	30.6 J	424 J	131 J	3.8 J	19.2 J	46 J
Polycyclic Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.057	0.028	0.021	0.0081	0.048	0.0065 J	0.0023 B	0.0034 J	0.0012 B
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.51	0.29	0.18	0.076	0.38	0.059	0.017	0.025	0.0043 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0053 J	0.0021 J	0.0016 J	0.00082 J	0.0039 J	0.0014 J	0.00046 J	0.00051 J	0.00036 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.57	0.37	0.21	0.097	0.44	0.072	0.022 J	0.034 J	0.0048 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	5.2	3.6	2.1	0.97	4.2	0.74	0.24	0.3	0.068
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	6.8	5.2	2.8	1.4	5.9	1.1	0.36	0.41	0.11
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	9.4	7.2	4.2	1.9	8.2	1.6	0.52	0.59	0.16
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	4.6	3.6	2	1	4.2	0.89	0.27	0.3	0.082
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	3.3	2	1.3	0.65	2.7	0.55	0.17	0.19	0.053
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	6.3	4.5	2.5	1.2	5.1	1	0.3	0.37	0.087
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.3	0.85	0.52	0.27	1.1	0.23	0.073	0.08	0.019
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	8	5.5	3.2	1.4	6.2	1	0.37	0.47	0.098
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.3	0.17	0.11	0.044	0.23	0.035	0.0086 J	0.013 J	0.0021 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	5.2	4	2.2	1.2	4.8	1	0.31	0.35	0.093
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.089	0.047	0.036	0.015	0.08	0.012	0.0034 B	0.0059 B	0.0024 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	3.5	2.1	1.3	0.55	2.6	0.43	0.13	0.19	0.032
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	7.4	5	3	1.3	5.7	0.99	0.33	0.42	0.093
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.15	0.082	0.053	0.022	0.11	0.018	0.0044 J	0.0069	0.0014 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**9.303**	**7.01**	**3.857**	**1.911**	**8.051**	**1.522**	**0.4943**	**0.5647**	0.15017
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	13.0313	8.5071	5.0586	2.19092	9.9819	1.6159	0.55376	0.74181	0.1448
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**49.5**	**35.95**	**20.62**	**9.89**	**41.9**	**8.1**	**2.573**	**3.01**	0.765
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	10,500	9,820	9,470	9,030	10,300	14,300	9,410	9,400	11,500
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.34	2.32	2.69	2.04	2.05	2.9	2.06	2.14	2.83
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.211	0.196	0.2	0.179	0.273	0.133	0.14	0.145	0.193
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	9.8	9.24	8.82	7.42	7.72	18.9	9.21	9.19	11.5
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	19.9	19.6	21.9	19.2	20.8	19	20.2	19.6	22.8
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	8.83	7.26	7.05	6.44	11.2	5.1	4.72	5.13	6.28
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.02 J	0.007 J	0.013 J	0.01 J	0.021 J	0.003 J	0.01 J	0.01 J	0.005 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	10.5	10.5	9.51	8.64	11.5	9.62	8.36	8.34	10.3
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**0.5 J**	**0.9 J**	**0.7 J**	0.3 J	**0.4 J**	**0.4 J**	0.3 J	0.3 J	0.3 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	51.1	46.9	56	64.8	55	37.1	53.9	51.3	74
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	97	95	50	57	150 J	21 J	11 J	14 J	5.4 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	**460**	**540**	230	**370**	**700 J**	55 J	42 J	57 J	17 J

Notes:
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a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
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PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 31-6
SWMU 31 - North of the East Surface Impoundment WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2020 and May 2021

						Ecological Indicator						Analytical Results								
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-WPA-NESI-SS-9 12/1/2020	SWMU31-WPA-NESI-SS-10 12/2/2020	SWMU31-WPA-NESI-SS-11 12/2/2020	SWMU31-WPA-NESI-SS-12 12/2/2020	SWMU31-WPA-NESI-SS-13 12/2/2020	SWMU31-WPA-NESI-SS-14 12/2/2020	SWMU31-WPA-NESI-SS-15 12/2/2020	SWMU31-WPA-NESI-SS-16 12/2/2020	SWMU31-WPA-NESI-SS-17 12/2/2020
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.07 U	0.31	0.2 J	0.32	0.1 J	0.13 J	0.08 J	0.07 U	0.26
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	44 J	14.3 J	76 J	104 J	14.7 J	20.8 J	126 J	68.8 J	53.9 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	34 J	5.9	5.8	14.3	1.7 J	2.8	2.5	1.2 J	39.6
Polycyclic Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0013 B	0.0033 J	0.0018 B	0.013	0.0026 B	0.0077 J	0.0045 J	0.07	0.021
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0042 J	0.025	0.017	0.15	0.039	0.077 J	0.05	0.34	0.15
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00034 U	0.00072 J	0.00041 J	0.0016 J	0.00075 J	0.00093 J	0.0016 J	0.0043 J	0.0013 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.004 J	0.034	0.022	0.21	0.047	0.08 J	0.068	0.35	0.15
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.066	0.38	0.25	2.3	0.73	0.97 J	0.85	1.6	1.6
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.11	0.56	0.38	3.3	1.1	1.3 J	1.2	2	2.1
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.16	0.76	0.55	4.6	1.5	2 J	1.9	2.7	3.2
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.09	0.44	0.29	2.2	0.89	1 J	1	1.4	1.8
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.053	0.25	0.18	1.1	0.55	0.66 J	0.65	0.91	1.1
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.091	0.49	0.31	3	0.92	1.2 J	1.2	1.9	2.3
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.023	0.11	0.078	0.66	0.23	0.28 J	0.27	0.39	0.45
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.098	0.52	0.35	3.4	1	1.3 J	1.2	2.8	2.3
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0018 J	0.015	0.0085	0.084	0.017	0.036 J	0.022	0.2	0.08
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.1	0.48	0.34	2.5	1	1.2 J	1.1	1.7	1.9
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0025 B	0.0057 B	0.004 B	0.023	0.0042 B	0.01 J	0.0056 B	0.13	0.033
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.028	0.21	0.13	1.3	0.32	0.54 J	0.43	1.9	0.98
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.093	0.51	0.34	3.1	1	1.2 J	1.2	2.4	2.2
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0014 J	0.0086	0.0053 J	0.044	0.0084	0.018 J	0.012	0.16	0.041
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.15111	**0.7629**	**0.5229**	**4.446**	**1.5102**	**1.823**	**1.689**	**2.749**	**2.948**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.1398	0.81372	0.53371	5.1816	1.43055	2.05163	1.7817	5.7943	3.7153
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.786	**3.98**	**2.718**	**22.76**	**7.92**	**9.81**	**9.37**	**15**	**16.65**
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	11,700	7,880	11,900	15,700	10,000	8,600	11,700	11,700	11,100
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.63	1.6	1.8	2.03	2.03	2.33	2.34	2.52	3.25
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.153	0.185	0.183	0.253	0.171	0.157	0.198	0.217	0.242
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	12.5	8.71	10.4	12.2	10.2	7.57	9.76	14.8	9.72
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	18.8	22.2	23.8	23.8	15.8	14.7	16.7	18.9	17.3
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	5.45	4.01	5.68	7.14	6.24	4.57	6.11	7.28	8.25
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.004 J	0.01 J	0.011 J	0.01 J	0.011 J	0.006 J	0.007 J	0.004 J	0.004 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	9.22	8.03	8.21	10.7	8.9	8.31	10.5	12.2	11.4
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.2 J	**0.6 J**	**0.4 J**	**0.5 J**	0.2 J	**0.4 J**	0.3 J	0.2 J	0.3 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	62.2	66.3	79.8	58	54.4	45.2	56.5	66.7	50.9
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	3.5 J	15 J	9.4 J	44	19 J	35	21 J	44	93
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	13 J	75 J	52 J	**280**	95 J	160	100 J	170	**390**

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
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SWMU 31 - North of the East Surface Impoundment WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2020 and May 2021
(Page 3 of 5)

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-WPA-NESI-SS-18 12/2/2020	SWMU31-WPA-NESI-SS-53 (Duplicate of SWMU31-WPA-NESI-SS-18) 12/2/2020	SWMU31-WPA-NESI-SS-19 12/2/2020	SWMU31-WPA-NESI-SS-20 12/2/2020	SWMU31-WPA-NESI-SS-21 12/2/2020	SWMU31-WPA-NESI-SS-22 12/2/2020	SWMU31-WPA-NESI-SS-23 12/2/2020	SWMU31-WPA-NESI-SS-24 12/2/2020
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.08 U	0.09 J	1.46	0.2 J	0.36	0.24	0.34	0.18 J
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	133 J	126 J	63.3 J	25.1 J	12.9 J	8.8 J	26.2 J	16.9 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	30.9 J	16.1 J	8	2.6	5	6.6	12.9	2.9
Polycyclic Aromatic Hydrocarbons (PAHs)																			
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0015 B	0.0018 B	0.0079	0.0028 B	0.0022 B	0.0012 B	0.0097	0.0017 B
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.017	0.023	0.058	0.026	0.02 J	0.0056 J	0.091	0.015
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00037 U	0.00049 J	0.001 J	0.00054 J	0.00044 J	0.00042 J	0.00086 J	0.00043 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.019	0.024	0.083	0.028	0.026 J	0.0078	0.11	0.018
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.28 J	0.44 J	0.76	0.31	0.29 J	0.078	1.2	0.25
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.41 J	0.66 J	1	0.42	0.44 J	0.12	1.7	0.37
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.6 J	0.96 J	1.5	0.64	0.63 J	0.18	2.5	0.55
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.3 J	0.53 J	0.75	0.29	0.36 J	0.1	1.3	0.31
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.21 J	0.34 J	0.5	0.2	0.23 J	0.059	0.79	0.19
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.37 J	0.59 J	0.92	0.41	0.38 J	0.11	1.5	0.33
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.082 J	0.14 J	0.2	0.08	0.093 J	0.026	0.35	0.081
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.4 J	0.62 J	1.1	0.48	0.44 J	0.13	1.6	0.38
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0064 J	0.0088	0.034	0.012	0.01 J	0.0037 J	0.047	0.007
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.35 J	0.6 J	0.86	0.34	0.4 J	0.11	1.5	0.35
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0032 B	0.0027 B	0.015	0.0043 B	0.004 B	0.0023 B	0.016	0.0029 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.13	0.19	0.48	0.19	0.16 J	0.048	0.67	0.12
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.4 J	0.63 J	1	0.44	0.42 J	0.12	1.7	0.36
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0037 J	0.0047 J	0.021	0.0067	0.0058 J	0.0024 J	0.024	0.0042 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**0.5659**	**0.9139**	**1.3912**	**0.5811**	**0.6081**	0.1664	**2.349**	**0.5154**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.5771	0.87079	1.7789	0.74364	0.66264	0.19902	2.54456	0.54503
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**3.002**	**4.89**	**7.49**	**3.13**	**3.243**	0.903	**12.54**	**2.791**
Metals																			
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	11,600	11,100	24,700	10,400	9,930	9,690	10,100	10,900
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	1.84	1.88	2.94	2.16	1.8	1.41	1.51	1.64
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.15	0.156	0.499	0.168	0.201	0.131	0.165	0.132
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	8.74	8.63	37.2	8.79	7.36	6.56	7.29	7.73
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	18.4	18.2	37.9	20.2	18.9	17.7	19	17.8
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	4.38	4.54	20.1	5.17	6.06	3.57	5.37	4.24
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.008 J	0.008 J	0.013 J	0.012 J	0.016 J	0.008 J	0.007 J	0.005 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	7.69	8.24	14.5	7.55	8.16	6.97	7.38	6.95
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.2 J	0.2 J	**0.7 J**	0.3 J	**0.5 J**	**0.4 J**	0.3 J	0.3 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	51.9	50.9	**198**	83.8	77.1	63	65.8	58.6
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	7 J	8 J	30 J	8 J	25 J	8.4 J	26 J	9.1 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	28 J	31 J	160	41 J	140	34 J	130 J	41 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 31-6
SWMU 31 - North of the East Surface Impoundment WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2020 and May 2021
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Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator: Eco-SSL Plants	Ecological Indicator: Eco-SSL Soil Biota	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: SWMU31-WPA-NESI-SS-25 12/2/2020	SWMU31-WPA-NESI-SS-26 12/2/2020	SWMU31-WPA-NESI-SS-27 12/2/2020	SWMU31-WPA-NESI-SS-54 (Duplicate of SWMU31-WPA-NESI-SS-27) 12/2/2020	SWMU31-WPA-NESI-SS-28 12/2/2020	SWMU31-WPA-NESI-SS-29 12/2/2020	SWMU31-WPA-NESI-SS-30 12/2/2020	SWMU31-WPA-NESI-SS-31 12/2/2020
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.28	0.25	0.09 J	0.1 J	0.07 U	0.08 U	0.08 U	0.08 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	19.6 J	25 J	23.5 J	21.9	11.3	29.1	35.3	26
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	6.1	2.1 J	1.1 U	1.1 U	1.4 J	1.1 U	1.1 U	1.2 U
Polycyclic Aromatic Hydrocarbons (PAHs)																			
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0083	0.002 B	0.0095 J	0.015 J	0.00071 J	0.0012 J	0.0016 J	0.001 J
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.089	0.018	0.14 J	0.22 J	0.0047 J	0.013	0.017	0.0029 J
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.0011 J	0.00038 U	0.0012 J	0.0018 J	0.00031 U	0.00032 U	0.00038 J	0.00034 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.1	0.022	0.11 J	0.17 J	0.0051 J	0.011	0.015	0.0034 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.2	0.28	1.6	2.3	0.072	0.15	0.22	0.036
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	1.7	0.44	2.2 J	3.5 J	0.12	0.24	0.33	0.056
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	2.4	0.68	3.2 J	5 J	0.17	0.37	0.54	0.1
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	1.2	0.34	1.5 J	2.4 J	0.1	0.19	0.27	0.051
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.8	0.23	1.1 J	1.7 J	0.063	0.13	0.18	0.033
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.6	0.4	2.1	3.1	0.099	0.21	0.32	0.063
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.32	0.088	0.43 J	0.73 J	0.024	0.047	0.066	0.012
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	1.8	0.43	2.2 J	3.5 J	0.11	0.24	0.34	0.057
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.044	0.008	0.048 J	0.076 J	0.002 J	0.0051 J	0.0067	0.0018 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	1.4	0.39	1.8 J	2.8 J	0.1	0.2	0.29	0.052
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.013	0.0035 B	0.015 J	0.025 J	0.0013 B	0.0023 B	0.0023 B	0.0018 B
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.68	0.14	0.83 J	1.3 J	0.036	0.083	0.11	0.022
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	1.7	0.39	2.2	3.1	0.11	0.23	0.31	0.052
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.022	0.0046 J	0.027 J	0.041 J	0.0014 J	0.0029 J	0.0033 J	0.0013 J
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**2.328**	**0.6108**	**3.034**	**4.784**	0.16389	**0.3318**	**0.4628**	0.07993
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	2.7354	0.6235	3.3537	5.3078	0.15981	0.3556	0.49298	0.0899
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**12.32**	**3.238**	**16.13**	**24.63**	0.858	**1.767**	**2.526**	0.455
Metals																			
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	10,200	9,540	12,000	12,600	10,600	13,600	12,300	12,700
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	1.44	2.06	3.45	3.2	2.89	2.96	3.53	2.86
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.198	0.169	0.209	0.226	0.148	0.169	0.165	0.168
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	8.65	7.88	14	13.8	12.8	14.3	16.2	14.9
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	21.7	15.9	17.1	16.7	15.1	17.7	16.5	19.6
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	6.27	5.39	7.42	7.43	5.13	6.47	6.38	5.87
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.011 J	0.011 J	0.011 J	0.005 J	0.003 J	0.005 J	0.005 J	0.005 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	9.02	6.93	11.5	11.9	10	10.6	10.3	10.2
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	**0.4 J**	0.2 J	0.2 J	0.2 J	0.2 J	0.19 J	0.2 J	0.2 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	83.9	70.3	57.1	57.8	50	58.6	57	67.5
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	34	15 J	28 J	58 J	4 J	6.4 J	6.8 J	2.6 J
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	170	73 J	130 J	**280 J**	18 J	26 J	26 J	9 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
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NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

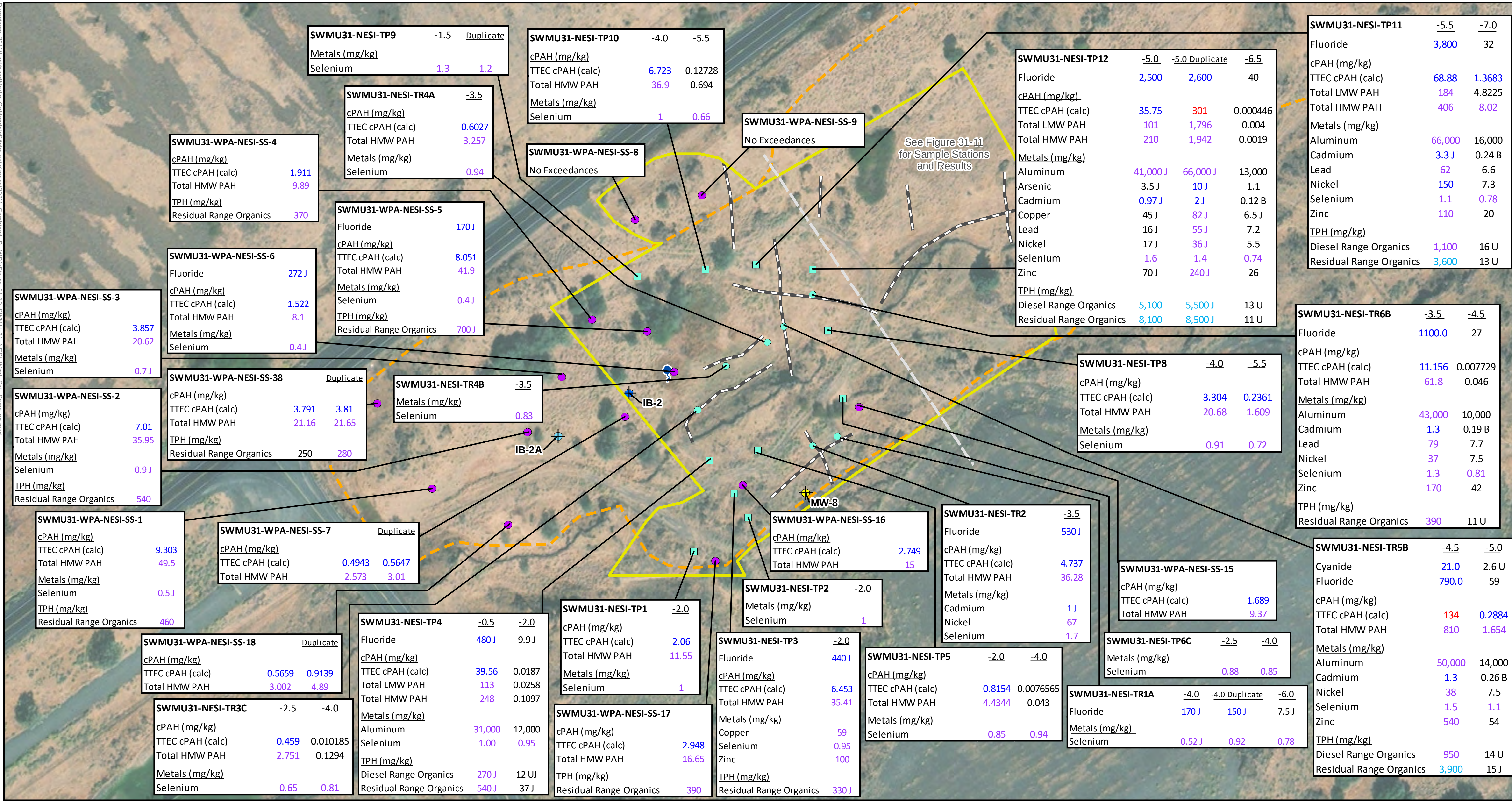
Table 31-6
SWMU 31 - North of the East Surface Impoundment WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
December 2020 and May 2021
(Page 5 of 5)

						Ecological Indicator						Analytical Results							
Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	SWMU31-WPA-NESI-SS-32 5/6/2021	SWMU31-WPA-NESI-SS-33 5/6/2021	SWMU31-WPA-NESI-SS-34 5/6/2021	SWMU31-WPA-NESI-SS-35 5/6/2021	SWMU31-WPA-NESI-SS-36 5/6/2021	SWMU31-WPA-NESI-SS-37 5/6/2021	SWMU31-WPA-NESI-SS-38 5/6/2021	SWMU31-WPA-NESI-SS-65 (Duplicate of SWMU31-WPA-NESI-SS-38) 5/6/2021
Aluminum Smelter																			
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.08 J	0.22	0.12 J	0.71	0.51	0.29	0.1 J	0.09 J
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	38.2	36.7	17.3	19.9	16.1	29.6	30.3 J	16.1 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	1.8 J	1.7 J	2	1.1 U	2.1 J	2 J	1.3 J	1.9 J
Polycyclic Aromatic Hydrocarbons (PAHs)																			
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.0019 J	0.0015 J	0.0012 J	0.0023 J	0.0022 J	0.0034 J	0.0092	0.0089
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.02	0.017	0.02	0.03	0.024	0.035	0.13	0.13
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00097 J	0.00047 J	0.0012 J	0.00063 J	0.00064 J	0.00093 J	0.0043 J	0.004 J
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.028	0.022	0.023	0.038	0.035	0.051	0.13	0.13
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.31	0.27	0.44	0.45	0.33	0.53	1.9	1.9
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.43	0.39	0.61	0.77	0.41	0.72	2.7	2.7
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.76	0.64	1.2	1.1	0.74	1.2	4.2	4.4
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.44	0.39	0.67	0.67	0.44	0.72	2.6	2.7
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.24	0.22	0.37	0.35	0.24	0.42	1.3	1.3
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.43	0.36	0.6	0.59	0.43	0.69	2.5	2.5
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.088	0.08	0.14	0.14	0.093	0.15	0.56	0.55
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.43	0.35	0.56	0.55	0.41	0.67	2.4	2.6
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.009	0.0083	0.0069	0.015	0.013	0.017	0.054	0.056
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.44	0.4	0.67	0.66	0.46	0.73	2.7	2.7
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.0027 J	0.0026 J	0.0018 J	0.0053 J	0.0039 J	0.006	0.017	0.016
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.16	0.14	0.16	0.23	0.19	0.29	0.9	0.92
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.51	0.43	0.69	0.69	0.51	0.83	2.7	2.9
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.0049 J	0.0051 J	0.0034 J	0.009	0.0075	0.011	0.03	0.029
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	**0.6181**	**0.5546**	**0.898**	**1.0459**	**0.6006**	**1.0299**	**3.791**	**3.81**
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.65257	0.54187	0.7741	0.87123	0.67874	1.07333	3.6445	3.8649
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	**3.648**	**3.18**	**5.39**	**5.42**	**3.653**	**5.99**	**21.16**	**21.65**
Metals																			
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	11,000	10,400	11,100	7,900	9,440	10,000	12,600	12,000
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.93	2	2.75	2.44	2.03	2.36	2.99	2.88
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.201	0.179	0.188	0.191	0.224	0.184	0.226	0.219
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	13	9.91	12.8	7.65	9.37	9.72	12.5	13.1
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	16.3	21	17.7	19.7	27.4	21.3	22.2	22
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	6.99	6.55	7.31	6.03	6.03	6.3	15.8	16.8
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.002 U	0.005 B	0.003 B	0.007 B	0.01 B	0.005 B	0.002 U	0.002 U
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	10.4	8.66	9.29	6.88	9.8	9.09	10.8	10.7
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.17 J	0.3 J	0.2 J	**0.7 J**	**0.7 J**	**0.4 J**	0.2 J	0.2 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	61.3	83.4	61.5	76.9	**91.4**	61.2	82.4	78.7
Total Petroleum Hydrocarbons (TPHs)																			
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	11 B	13 B	14 B	17 J	18 J	19 J	40	43
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NA	260	NA	60 J	79 J	80 J	160	150	120	250	**280**

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration



Legend

- NESI Area
- Trench Location
- RI Test Pit Location
- RI Soil Sampling Location
- WPA Sample Location
- Approximated Lateral Extent of Soil Screening Level Exceedances
- Figure Detail Area
- NESI Wetland Spring
- Unconsolidated Aquifer Well (UA)

Uppermost Basalt Aquifer Well (BAU)

- BAU_1 - Shallower Water-bearing Zone
- BAU_2 - Deeper Water-bearing Zone

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

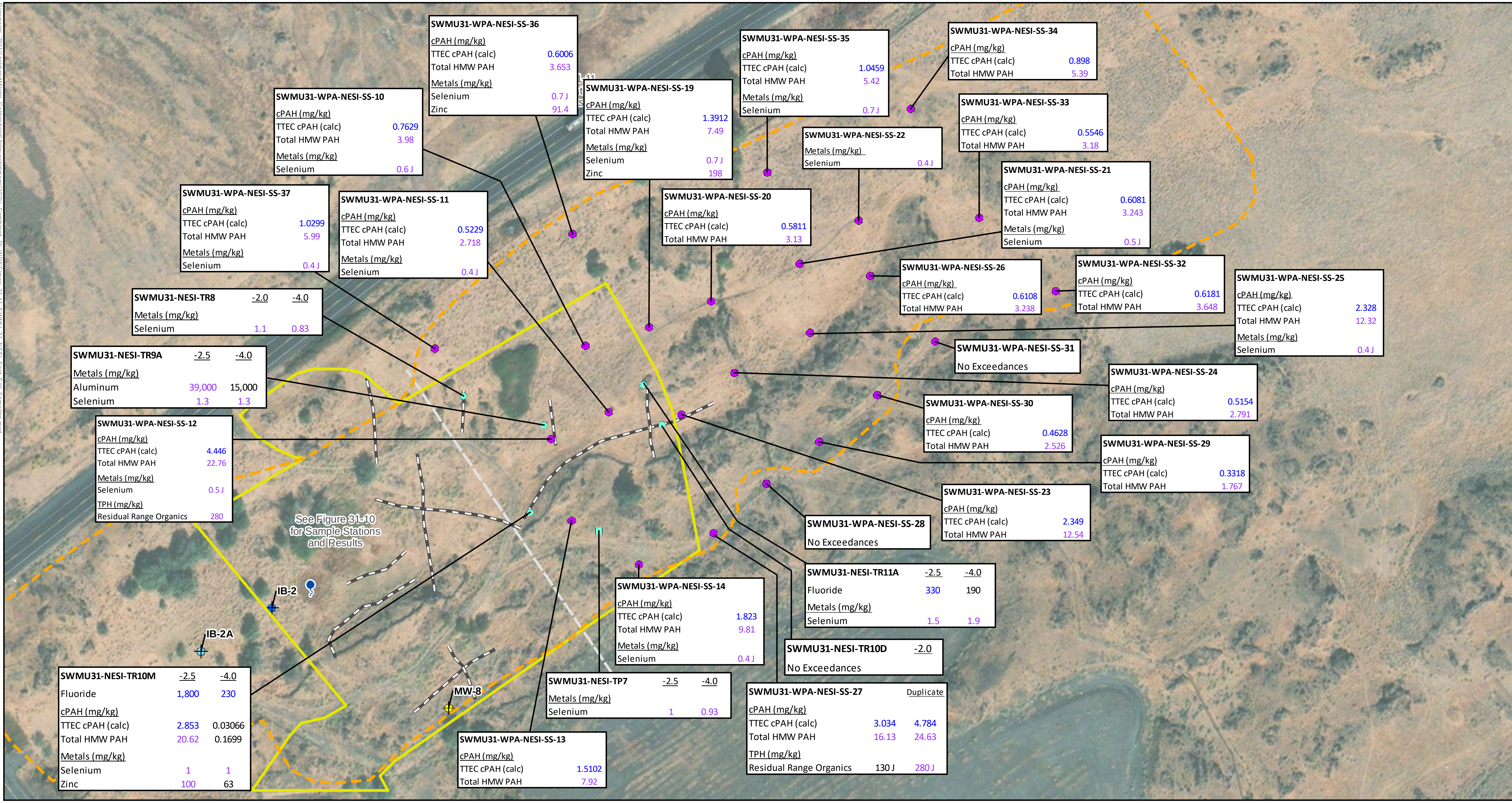
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
NA = Not Analyzed
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N S W E

0 50 100 200
Feet

Figure 31-10
SWMU 31
NESI Area (West)
Soil Sampling Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



Legend

- NESI Area
- Trench Location
- RI Test Pit Location
- RI Soil Sampling Location
- WPA Sample Location
- Approximated Lateral Extent of Soil Screening Level Exceedances
- Figure Detail Area
- NESI Wetland Spring
- Unconsolidated Aquifer Well (UA)
- Uppermost Basalt Aquifer Well (BAU)
- BAU_1 - Shallower Water-bearing Zone
- BAU_2 - Deeper Water-bearing Zone

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
NA = Not Analyzed
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N S W E

0 50 100 200
Feet

Figure 31-11
SWMU 31
NESI Area (East)
Soil Sampling Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Fluoride was detected at concentrations above the MTCA-derived soil screening level for protection of groundwater in 6 (including one field duplicate) of 43 samples. Soil samples that exceeded the fluoride screening were collected from the shallower of two soil sample depth intervals beneath the waste.

- The MTCA Method C screening level (130 mg/kg TEC) was exceeded in 2 of the 43 collected soil samples. Seven soil samples exceeded the MTCA-derived soil screening level for protection of groundwater of 3.9 mg/kg. In general, the soil samples that exceeded the PAH screening levels were collected from the shallower of two soil sample depth intervals beneath the waste or from the base of shallow test pits where no wastes were found.

- Sulfate was detected at low concentrations ranging from (4.6 J to 230 mg/kg) below the MTCA-derived soil screening for protection of groundwater of 2,150 mg/kg.

- PCBs were not detected in the two samples analyzed.

- For metals, concentrations of arsenic (maximum of 10 J mg/kg), cadmium (maximum of 3.3 J mg/kg), nickel (maximum of 150 mg/kg) exceeded MTCA-derived soil screening level for protection of groundwater and background concentrations. Selenium (maximum of 1.9 mg/kg) exceeded MTCA terrestrial ecological screening level for wildlife protection and background concentrations at all of the stations. Aluminum (maximum of 66,000 mg/kg) and lead (maximum of 82 J mg/kg) exceeded the terrestrial ecological soil screening level for protection of plants and background concentrations in two samples, and three samples, respectively. Zinc (maximum concentration of 540 mg/kg) and copper (maximum of 59 mg/kg) exceeded the terrestrial ecological screening level for protection of soil biota in two samples and one sample, respectively.

- Diesel (maximum of 5,500 J mg/kg) and/or motor oil (maximum of 8,500 J mg/kg) were detected in soils above MTCA Method A TPH-screening levels in 4 samples (three samples and one field duplicate). Gasoline-range TPH (maximum of 17 mg/kg) was detected at low concentrations below screening levels at all sample locations. The samples with diesel-range and motor-oil-range TPH concentrations above screening levels were found in the main area of solid and carbon waste material located immediately east of the main NESI wetland (stations NESI-TP11, NESI-TP12, and NESI-TR5).

- VOCs (BTEX and common chlorinated solvent constituents) were not detected in the two samples analyzed.

- Asbestos was not detected in soil in the two soil samples analyzed. Asbestos was also not detected in potential asbestos-containing material sampled during excavation activities for health and safety purposes.

WPA Investigation Results

The WPA investigation included collection of 42 surface soil samples to better delineate the lateral extent of surface soil contamination in the NESI area. Based on the results, the lateral extent of surface soil contamination extends significantly to the east and north from the main waste footprint with surface soil contamination also extending into the NESI wetland and along the site access road. In general, the detected concentrations represent low-level concentration compared to the NESI source area and may be indicative of aerial deposition or off-tracking by vehicles or cattle.

WPA surface soil results are summarized as follows:

- PAHs are fairly widespread above MTCA Method B (0.19 mg/kg as TEC) and terrestrial ecological soil screening levels for wildlife protection (1.1 mg/kg as HMW PAH). Thirty-seven of 42 samples exceed MTCA Method B, and 37 samples also exceed the terrestrial ecological screening levels. Of these, 5 samples also exceed MTCA-derived soil screening level for protection of groundwater of 3.9 mg/kg TEC.

- Fluoride (maximum of 272 mg/kg) exceeds the MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg) in two samples.

- Total cyanide and sulfate were detected at low concentrations below screening levels.

- For petroleum hydrocarbons, residual range organics and diesel range organics do not exceed MTCA Method A Soil Screening Level for Unrestricted land use of 2,000 mg/kg. Residual-range petroleum hydrocarbons exceed the terrestrial ecological screening level for protection of soil biota of 260 mg/kg in 8 samples.

- For metals, selenium (maximum of 0.9 mg/kg) was detected above terrestrial ecological screening level protective of wildlife and background concentrations in 16 samples. Zinc (maximum of 198 mg/kg) was detected above terrestrial ecological screening levels for plants (86 mg/kg) in two samples.

31.4.2.4 NESI Waste Volume Estimate

Figure 31-12 shows the thickness and lateral extent of aluminum smelter-related wastes in the NESI. The largest amount and thickness of wastes (about 8 ft thick) are found in the central portion of the NESI immediately east of the main wetland area.

Volume 5, Appendix B-31(C) shows the calculations and supporting figure used for the volume calculations. An estimated bulk volume of 7,708 cubic yards (13,875 tons) of smelter-related wastes is estimated for the NESI.

Legend

- NESI Area
- Trench Location
- Test Pit Location
- Waste Area
- 7.5-foot Waste Thickness Contour Interval

Carbon waste interval including intermixed suspected spent pot liner (SPL) 2.0-4.0 feet bgs

Cryolite waste interval 2.0-4.0 feet bgs

- NESI Wetland Spring
- Unconsolidated Aquifer Well (UA)

Uppermost Basalt Aquifer Well (BAU)

- BAU_1 - Shallower Water-bearing Zone
- BAU_2 - Deeper Water-bearing Zone

N W E S

0 50 100 200
Feet

Figure 31-12
SWMU 31
NESI Area
Waste Thickness and Extent

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

31.5 CONCLUSIONS AND RECOMMENDATIONS

Due to the presence of smelter-related waste and soil chemical concentrations in surface and subsurface soils above MTCA screening levels, the SSA and NESI will both be further evaluated in the FS.

Carbon wastes including suspected SPL were found at most locations where wastes were encountered. Suspected SPL was mixed in with carbon block anode wastes, other aluminum smelter-related wastes, and solid wastes. It appears that the suspected SPL represents the minority of the carbon wastes encountered. However, it does not appear that the aluminum smelter-related waste types can be readily segregated.

The waste geochemistry sample results were not completely reliable in distinguishing suspected SPL from other carbon wastes.

A minority of the sampled carbon wastes exceeded the Washington State Dangerous Waste Persistence Criteria for PAHs of 1 percent. However, it doesn't appear that wastes exceeding this criterion can be reliably determined based on field observations.

Leaching of COPC from wastes into groundwater in the UA or BAU zones is a transport pathway of potential concern particularly for the NESI that will be addressed in the FS. Refer to Volume 4, Section 2 for a summary of the groundwater contaminant distribution.

31.5.1 Smelter Sign Area Conclusions and Recommendations

Aluminum smelter-related wastes are localized in the SSA and the wastes do not occur at depth at the SSA. No wastes and only low levels of soil contamination was found beneath the lawn.

Based on field observations of surface staining, evidence of historical waste handling, and the waste and subsurface soil analytical results, it appears that surface soils (0.0-1.0 ft bgs) may exceed MTCA screening levels for PAHs over a relatively broad area.

31.5.2 NESI Conclusions and Recommendations

Buried aluminum smelter-related wastes including suspected SPL and carbon wastes that exceed MTCA Method C and Washington Dangerous Waste Criteria for PAHs are present in the NESI and extend within wetland boundaries. The maximum thickness of waste observed in the NESI area is about 8 ft. Smelter-related wastes are in contact with shallow groundwater in the NESI and a nearby seasonal spring sample was characterized by elevated concentrations of fluoride (about 20 mg/L). The seasonal spring is located in the main wetland depression in the NESI area (Figure 31-1). The NESI spring water results are presented in Volume 4, Section 2, Groundwater in the Upper Most Aquifer AOC. The soil-to groundwater and soil-to-spring/seep transport pathway will be addressed in the FS for this area.

Soils collected from beneath the aluminum smelter-related waste exceed screening levels only in a few the shallower sample intervals and not in the deeper soil intervals. This suggests that COPCs have not penetrated the underlying soils beneath the wastes significantly. In areas of greater waste thickness (greater than about 4 ft bgs), sidewall sloughing and difficulty accessing the base of the excavation may have resulted in some waste contamination being dragged downward during excavation activities and soil sampling.

There are areas where shallow soil concentrations (samples collected from 2 to 4 ft bgs from shallow test pits) are above MTCA-derived soil concentrations for protection of groundwater and no overlying wastes are present. This suggests that waste handling and or historical grading activities may have resulted in COPC exceedances outside of the current waste footprint.

The contact between the wastes and underlying soils in the portions of the NESI area could be readily identified in the field based on the occurrence of a brown clay layer that appears to represent native soil.

Section 32
Stormwater Pond and Appurtenant Facilities (SWMU 32)

The Stormwater Pond and Appurtenant Facilities (SWMU 32) is defined as the stormwater pond and associated system of stormwater catch basins and piping that collects stormwater, which then connects to the groundwater collection line prior to discharging to the stormwater retention pond (refer to Figure P-1 for pond location and Volume 3, Section 2.5 for stormwater and groundwater line system layouts). The Groundwater Collection System in the northern portion of the plant area collects shallow groundwater and discharges to the stormwater retention pond. The stormwater and groundwater systems consist of vertical catch basins and manholes with connecting horizontal piping. A line that conveys water from the stormwater pond to the industrial sump is also included in SWMU 32. Historically, water from the stormwater pond was commingled with process water in the industrial sump prior to discharge to the NPDES ponds (SWMU 1). In 2010, a bypass line was constructed to redirect water from the industrial sump for discharge at the NPDES permitted discharge point.

The stormwater pond was excavated into basalt bedrock and is used to temporarily store and settle out solids prior to discharge. In the early 2000s, the pond was expanded to the southeast to its current configuration. Documentation is not available to show whether accumulated sediments were removed during pond expansion. The pond is unlined and appears to locally recharge the shallow basalt aquifer zone. The stormwater pond was also used as a water supply for emergency fire suppression.

This section includes a summary of the stormwater pond results and the soil results for the adjacent down slope area that were investigated as part of the initial RI characterization effort. The Draft RI Report (Tetra Tech et al. 2019a) previously included a summary of the Stormwater Collection and Groundwater Collection Systems investigation as part of this section. For clarity and convenience, discussion of the Stormwater and Groundwater Collection Systems is included in the PAAOC and is addressed in Volume 3, Section 2.5.

The field investigation, analytical program, and associated results for the stormwater pond and adjacent area are discussed in the following sections.

32.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

The primary objective of the stormwater pond investigation is to characterize the nature and extent of COPC in sediment and surface water, as well as to evaluate the hydrogeologic relationship between the stormwater pond and groundwater. The primary stormwater pond investigation activities are discussed in the following sections and include:

- Stormwater pond sediment thickness assessment,
- Stormwater pond sediment and water sampling,
- Surface soil sampling adjacent to the pond, and
- Stormwater pond drawdown test.

32.1.1 Stormwater Pond Sediment Thickness Assessment

Poling measurements to estimate soft sediment thickness throughout the stormwater pond were collected in April 2016, in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Sediment thickness measurements were collected from 17 station locations using a steel pole calibrated with 0.1-ft increments. Each pole station location was established using real-time kinematic global positioning system (GPS). Results of this assessment are provided Section 32.2 and were used to help establish the locations for subsequent pond sediment sampling activities as discussed below.

32.1.2 Stormwater Pond Sediment and Water Sampling

Stormwater pond sediment and water sampling activities were conducted between 28-29 April 2016, in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Sample station locations are shown in Figure 32-1, and activities are discussed as follows:

Legend

- Sediment Sample Station
- Surface Soil Sample Station
- Sediment Core and Water Sample Station

N W E S

0 50 100 Feet

Figure 32-1
SWMU 32
Stormwater Pond and
Adjacent Areas Sampling Locations

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

- Pond sediment cores were collected from three sampling station locations (SC01, SC02, and SC03) in the main portion of the pond using a 4-ft long stainless-steel universal coring device with dedicated clear polycarbonate core barrels (refer to Figure 32-1). The sediment cores were in the original pond basin based on the presence of sediment as determined during the pond sediment thickness assessment. The sampling plan specified collection of three samples from each sediment core (top, middle, bottom) for laboratory analyses including total cyanide, fluoride, select metals, VOCs, PCBs, PAHs, and gasoline- and oil-range organics (TPH-Gx and TPH-Dx). However, due to the overall limited extent of sediment within the pond and associated sample core recovery, only two samples (top and bottom) were collected from cores SC01 and SC02 for laboratory analysis (for a total of seven project sediment core samples).

- Three pond water samples, designated as SW01, SW02, and SW03, were collected from the bottom of the water column, above the surface of pond sediments, at each of the sediment core station locations as shown on Figure 32-1. The pond water samples were collected prior to sediment core sampling using a peristaltic pump and with dedicated sample tubing. Pond water sample laboratory analyses included total cyanide, fluoride, sulfate, select metals, VOCs, PCBs, PAHs, and gasoline- and oil-range organics (TPH-Gx and TPH-Dx). In accordance with Work Plan specification, one pond water sample (SW01) was also analyzed for geochemical parameters including calcium, magnesium, potassium, sodium, chloride, total dissolved solids, alkalinity, and hardness.

  The stormwater pond was also sampled as part of the baseline RI groundwater sampling activity with associated results presented and discussed as part of the Groundwater in the Uppermost Aquifer AOC in Volume 3, Section 2.

- Three sediment grab station locations were sampled, including SED01 and SED02 located on deltaic sediment material presumably formed from discharge of the northeast pond inlet, and SED03 located near the northwest pond inlet adjacent to the stormwater pond pump station (refer to Figure 32-1). One surface (0-0.5 ft) grab sample was collected at SED01 and two sediment samples (0-0.5 ft) and (0.5-1.0 ft) were collected at SED02 using a clean stainless-steel hand auger device. Sample station SED03 represents a surface sediment grab sample collected from the pond at the southwest inlet using a clean stainless-steel ponar grab sampler. A total of four sediment samples were submitted for laboratory analysis including total cyanide, fluoride, select metals, PCBs, PAHs, and gasoline- and oil-range organics (TPH-Gx and TPH-Dx).

32.1.3 Soil Sampling Near Pond

Anecdotal information from site files indicate that the stormwater pond may have historically overflowed on one or more occasions (Tetra Tech et al. 2015a). If past pond overflow occurred, it may have reached a shallow ravine adjacent to the pond, which is oriented southeast and leads to a culvert beneath the John Day Dam road (refer to Figure 32-1). To evaluate this potential overflow pathway, four surface soil samples (SS01, SS02, SS03, and SS04) were collected on 5 May 2016. The surface soil samples were analyzed for total cyanide, fluoride, sulfate, select metals, PCBs, PAHs, and gasoline- and oil-range organics (TPH-Gx and TPH-Dx). Results of this investigation are discussed in Section 32.2 below.

32.1.4 Pond Drawdown Test

The stormwater pond is unlined and suspected to locally recharge the underlying shallow basalt aquifer system. To evaluate the hydrogeologic relationship between the stormwater pond and groundwater, a pond drawdown test was performed in May 2017, in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The test implementation and results of the pond drawdown test are presented in detail in Volume 4, Section 2 Groundwater in the Uppermost Aquifer AOC. A brief summary of these results is included in Section 32.2 below.

32.2 STORMWATER POND AND ADJACENT AREA RESULTS

The following section summarizes the results for the stormwater pond and adjacent area, including stormwater pond sediment thickness assessment, pond sediment and water sampling, soil sampling in adjacent area, and pond drawdown testing.

32.2.1 Stormwater Pond Sediment Thickness Assessment Results

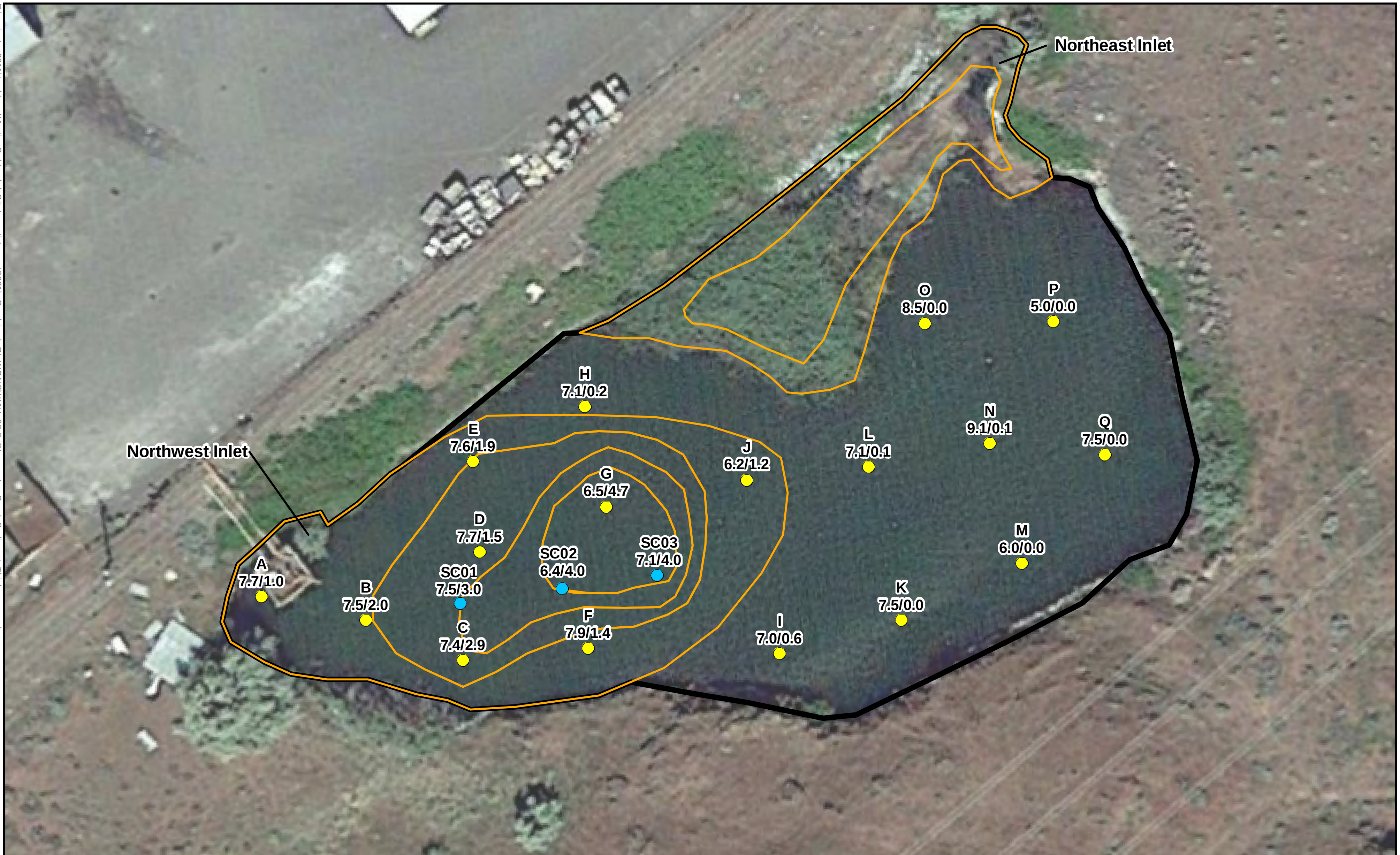
Stormwater pond soft sediment thickness measurements are summarized in Table 32-1, including location, water depth, and sediment thickness information for 17 pole station locations (A-Q) and three sediment core sample station locations (SC01-SC03). This information is graphically presented in Figure 32-2.

Table 32-1
SWMU 32 - Stormwater Pond Soft Sediment Thickness Survey (April 28, 2016)
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington

Pond Station Identification [a]	Measurement Point		Water Depth (ft)	Sediment Thickness (ft)
	Latitude	Longitude		
A	45.730238	-120.697825	7.7	1.0
B	45.730218	-120.697697	7.5	2.0
C	45.730184	-120.697579	7.4	2.9
D	45.730277	-120.697559	7.7	1.5
E	45.730354	-120.697568	7.6	1.9
F	45.730194	-120.697427	7.9	1.4
G	45.730315	-120.697405	6.5	4.7
H	45.730401	-120.697432	7.1	0.2
I	45.730190	-120.697193	7.0	0.6
J	45.730338	-120.697234	6.2	1.2
K	45.730219	-120.697045	7.5	0.0
L	45.730350	-120.697086	7.1	0.1
M	45.730268	-120.696899	6.0	0.0
N	45.730370	-120.696937	9.1	0.1
O	45.730473	-120.697017	8.5	0.0
P	45.730474	-120.696861	5.0	0.0
Q	45.730361	-120.696797	7.5	0.0
SC01	45.730232	-120.697582	7.5	3.0
SC02	45.730246	-120.697459	6.4	4.0
SC03	45.730257	-120.697343	7.1	4.0

a A-Q = Designates sediment poling stations.
SCO1 = Designates sediment core sample stations.

R:\projects_2011\LockheedMartin_GoldendaleSiteInvestig\maps\2021_Combined_RI_WPA\SWMU_32-2_Stormwater_Pond_Sediment_Thickness.mxd



Sediment Polling Station
Sediment Core Sample Station
Stormwater Pond
1-foot Sediment Thickness Contours

A Sample ID
7.7/1.0 Water Depth (ft)/Sediment Thickness (ft)

N
W E
S

0 25 50
Feet

Imagery Souce: NAIP 2017

Figure 32-2
SWMU 32
Stormwater Pond
Soft Sediment Thickness Assessment

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Results indicate that there is very little sediment accumulation in the eastern portion of the pond, except where sediments have accumulated at the mouth of the northeastern inlet. This area of the pond primarily represents the pond expansion that was completed in the early 2000s (Lockwood Green et al. 1999). The thickest sediment accumulation (up to 4.7 ft) was observed in the central basin of the original pond footprint (refer to Figure 32-2). This information was used in part to help identify appropriate pond sediment core and water sample station locations.

The base elevation of the pond, including expansion area, is about 461 ft with the adjacent shoreline rising in elevation to about 475 to 780 ft (Lockwood Green et al. 1999). The total area of the stormwater pond is about 31,110 ft^2 and includes the vegetation stand of about 3,950 ft^2 located along the northeastern portion of the pond as shown on Figure 32-2.

32.2.2 Stormwater Pond Sediment and Water Sampling Results

Stormwater pond sediment and water sample station locations are shown on Figure 32-1. All sediment and water samples were received by the laboratory in good conditions and under standard chain-of-custody protocol. The sediment and water samples were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Laboratory analytical data reports are provided in Volume 5, Appendix H-1 and associated data validation reports are provided in Volume 5, Appendix I-1. Copies of completed field forms are provided Volume 5, Appendix B-32.

Stormwater pond sediment sampling results are summarized in Table 32-2. Table 32-2 includes MTCA Method C soil screening levels, MTCA Method A Industrial soil screening levels (TPH only), MTCA-derived soil screening levels for protection of groundwater, terrestrial ecological screening levels for wildlife protection, and the Washington State Dangerous Waste persistence criteria for PAHs for comparative review. Site background concentrations are also provided for comparative review. These screening levels appear to be more appropriate for use at this SWMU than the Washington State Sediment Management given the man-made nature and function of the stormwater detention pond. Pond sediment screening level exceedances are shown on Figure 32-3. A summary of these results is provided as follows:

Table 32-2
SWMU 32 - Stormwater Pond Sediment Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
April 2016
(Page 1 of 2)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Washington Dangerous Waste Persistence Criteria	Analytical Results SWMU32-SC01-0-13 4/29/2016	SWMU32-SC01-13-21 4/29/2016	SWMU32-SC02-0-10 4/29/2016	SWMU32-SC02-10-18 4/29/2016	SWMU32-SC03-0-14 4/29/2016	SWMU32-SC03-14-32 4/29/2016	SWMU32-SC03-32-43 4/29/2016	SWMU32-SED01 4/28/2016	SWMU32-SED40 (Duplicate of SWMU32-SED01) 4/28/2016	SWMU32-SED02-0-0.5 4/28/2016	SWMU32-SED02-0.5-1 4/28/2016	SWMU32-SED03 4/29/2016
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	--	4.5 U	4.6 U	6.2 U	3.7 U	5 U	4 U	2.8 U	4 U	3.3 U	2.7 U	2.3 U	10 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	--	**300**	**290**	**320**	**250**	**280**	**3,200**	**860**	130 J	100 J	49	40	**170**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	690
Polycyclic Aromatic Hydrocarbons (PAHs)																				
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	--	**2.5**	**4**	**0.92 J**	**1.2**	**1.4**	**37**	**22**	**27**	**18**	0.048	**0.095**	**1.2**
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	--	**3.7**	**5.6**	1.3 J	1.6	**1.8**	**36**	**34**	**36 J**	**23 J**	0.051	0.11	**1.9**
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	--	49	63	18	24	25	**280**	**220**	**200**	**140**	0.6	1.2	21
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	--	0.12 U	0.11 U	0.16 U	0.093 U	0.13 U	1.6	0.93	1.3	0.97	0.011	0.011	0.22 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	--	50	61	20	29	24	270	190	190	140	0.71	1	20
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	--	480	500	210	290	230	2,300	1,500	2,100	1,500	8.4	11	240
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	--	490	530	240	320	250	2,100	1,300	2,300	1,600	9.8	13	300
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	--	710	710	370	500	370	3,500	2,100	3,500 J	2,200 J	15	18	490
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	--	380	400	190	250	190	1,500	930	1,800	1,200	8.9	11	240
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	--	210	270	110	180	120	1,100	670	920	750	5.3	6.1	140
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	--	670	700	300	470	310	3,200	2,000	2,400	1,800	11	13	360
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	--	72	78	35	49	36	360	230	370	300	1.9	2.4	69
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	--	**930**	**970**	390	**640**	450	**4,900**	**3,100**	**3,600**	**2,500**	14	19	360
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	--	29	36	10	15	14	**210**	**180**	100	78	0.26	0.5	10
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	--	430	450	230	290	230	1,700	1,100	2,000	1,400	9.9	12	300
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	--	0.29 J	0.62	0.15 J	0.82	0.51	**4.6**	**17**	**41 J**	**26 J**	0.067	0.13	3
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	--	240	320	100	150	120	1,500	1,100	1,100	780	5.4	6.1	98
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	--	**1,200**	**860**	340	560	400	**4,000**	**2,400**	**3,100**	**2,100**	13	17	240
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	--	**687**	**738**	**339**	**456**	**352**	**3,028**	**1,880**	**3,213**	**2,233**	**13.96**	**18.08**	**428**
Total PAHs (calc)	mg/Kg	NE	130	NE	NE	10,000	NE	10,000	5,951	5,964	2,567	3,772	2,775	**27,013**	**17,093**	**23,758**	**16,538**	104	132	2,893
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	--	0.29	0.62	0.15	0.82	0.51	4.6	17	**5,295**	**3,706**	21.147	28.146	**515**
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	--	**4,642**	**4,498**	**2,025**	**2,909**	**2,136**	**19,760**	**12,230**	**18,490**	**12,850**	**83.2**	**104**	**2,379**
Polychlorinated Biphenyls (PCBs)																				
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	--	0.017 U	0.017 U	0.024 U	0.015 U	0.019 U	0.015 U	0.013 U	0.05 J	0.031 J	0.0091 U	0.0077 U	0.038 UJ
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	--	0.0098 U	0.0094 U	0.014 U	0.0086 U	0.011 U	0.0085 U	0.0074 U	0.0083 UJ	0.0082 U	0.0052 U	0.0044 U	0.022 UJ
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	--	0.011 U	0.011 U	0.016 U	0.01 U	0.012 U	0.0099 U	0.0086 U	0.0097 UJ	0.0096 U	0.006 U	0.0051 U	0.025 UJ
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	--	0.0037 U	0.0036 U	0.0053 U	0.0033 U	0.004 U	0.051 J	0.07 J	0.0032 UJ	0.0031 U	0.002 U	0.0017 U	0.0083 UJ
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	--	0.0068 U	0.0065 U	0.0095 U	0.0059 U	0.0073 U	0.0059 U	0.0051 U	0.0057 UJ	0.0057 U	0.0036 U	0.003 U	0.087 J
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	--	0.046 J	0.067 J	0.046 J	0.095 J	0.047 J	0.003 U	0.0026 U	0.003 UJ	0.048 J	0.033 J	0.0066 J	0.073 J
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	--	0.0044 U	0.0042 U	0.0063 U	0.0039 U	0.0048 U	0.0038 U	0.0033 U	0.0037 UJ	0.0037 U	0.0023 U	0.002 U	0.0099 UJ
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	--	0.0012 U	0.0011 U	0.0016 U	0.001 U	0.0013 U	0.001 U	0.00088 U	0.00099 UJ	0.00098 U	0.00062 U	0.00052 U	0.0026 UJ
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	--	0.0021 U	0.002 U	0.003 U	0.0018 U	0.0023 U	0.0018 U	0.0016 U	0.0018 UJ	0.0018 U	0.0011 U	0.00093 U	0.0047 UJ
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	--	0.046	0.067	0.046	0.095	0.047	0.051	0.07	0.05	0.079	0.033	0.0066	0.16
Metals																				
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	--	110,000	100,000	53,000	110,000	100,000	47,000	48,000	35,000	34,000	19,000	13,000	38,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	--	**10**	**11**	**12**	**8.8**	**17**	**33**	**26**	**11**	**10**	5.6	5.4	**15**
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	--	**5**	**5.4**	**5.7**	**5.2**	**7.7**	**9.6**	**6.2**	**4.1**	**4.8**	**1.5**	0.66	**9.4**
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	--	66	55	40	59	**93**	37	34	48	50	26	50	61
Copper	mg/Kg	NA	140,000	217	280	217	28.4	--	79	79	64	86	210	37	29	45 J	60 J	46	32	85
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	--	94	73	60	60	94	**290**	**190**	**180 J**	**140 J**	26	9.6	68
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	--	0.14	0.11	0.15	0.17	0.15	0.17	0.22	0.13	0.11	0.019 J	0.015 J	0.16
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	--	**170**	**190**	**180**	**180**	**380**	**1,700**	**530**	**670 J**	**510 J**	42	52	**220**
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	--	**0.82 J**	**0.91 J**	**1.3**	**0.62 J**	**1.2**	**3.2**	**1.8**	**1.3**	**1.2**	**1.2**	**1.1**	**3.3**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	--	**610**	**670**	**700**	**630**	**990**	270	310	**460 J**	**590 J**	350	120	**1,300**

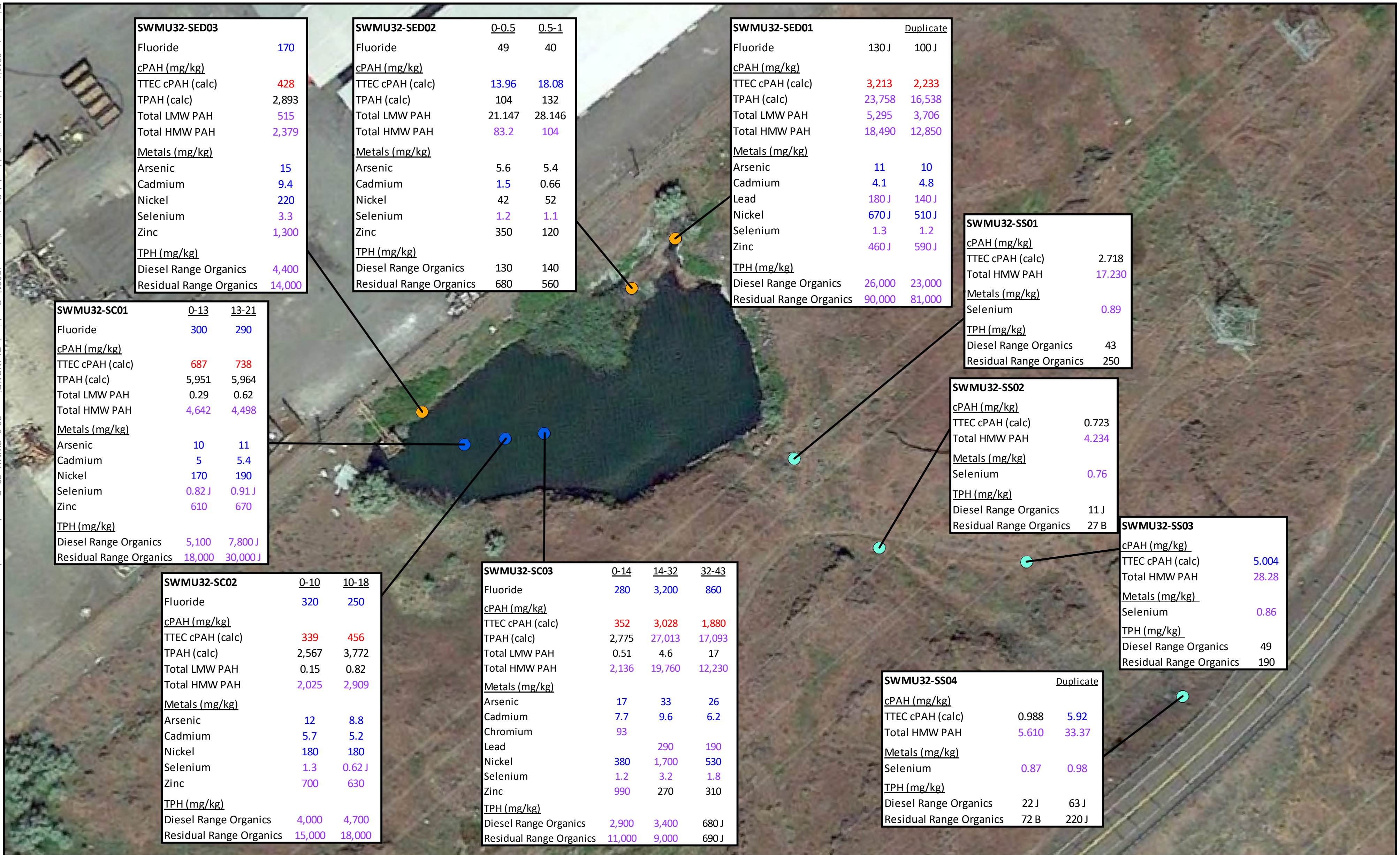
Table 32-2
SWMU 32 - Stormwater Pond Sediment Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
April 2016
(Page 2 of 2)

				Ecological Indicator					Analytical Results											
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Washington Dangerous Waste Persistence Criteria	SWMU32-SC01-0-13 4/29/2016	SWMU32-SC01-13-21 4/29/2016	SWMU32-SC02-0-10 4/29/2016	SWMU32-SC02-10-18 4/29/2016	SWMU32-SC03-0-14 4/29/2016	SWMU32-SC03-14-32 4/29/2016	SWMU32-SC03-32-43 4/29/2016	SWMU32-SED01 4/28/2016	SWMU32-SED40 (Duplicate of SWMU32-SED01) 4/28/2016	SWMU32-SED02-0-0.5 4/28/2016	SWMU32-SED02-0.5-1 4/28/2016	SWMU32-SED03 4/29/2016
Total Petroleum Hydrocarbons (TPHs)																				
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	--	14 J	16 J	5.5 J	13 J	6.8 J	5.4 J	5 J	1.8 J	2.1 J	1.1 J	0.67 U	28 J
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	--	**5,100**	**7,800 J**	**4,000**	**4,700**	**2,900**	**3,400**	680 J	**26,000**	**23,000**	130	140	**4,400**
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	--	**18,000**	**30,000 J**	**15,000**	**18,000**	**11,000**	**9,000**	690 J	**90,000**	**81,000**	680	560	**14,000**
Volatile Organic Compounds (VOCs)																				
Benzene	mg/kg	0.03	2,400	0.255	0.027	0.027	NE	--	0.016 U	0.014 U	0.015 U	0.012 U	0.012 U	0.012 U	0.011 U	NA	NA	NA	NA	NA
Toluene	mg/kg	7.0	280,000	5.45	4.5	4.5	NE	--	0.052 U	0.046 U	0.048 U	0.061 J	0.04 U	0.089 J	0.036 U	NA	NA	NA	NA	NA
Ethylbenzene	mg/kg	6.0	350,000	5.16	5.9	5.16	NE	--	0.051 U	0.045 U	0.047 U	0.04 U	0.039 U	0.27	0.63	NA	NA	NA	NA	NA
m, p-Xylene	mg/kg	9.0	700,000	10	14	10	NE	--	0.29 U	0.26 U	0.27 U	0.23 U	0.22 U	0.36 J	0.46 J	NA	NA	NA	NA	NA
o-Xylene	mg/kg	9.0	700,000	10	14	10	NE	--	0.023 U	0.02 U	0.021 U	0.018 U	0.017 U	0.14 J	0.49	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	mg/kg	2.0	7,000,000	29.8	1.5	1.5	NE	--	0.043 U	0.038 U	0.039 U	0.033 U	0.033 U	0.033 U	0.029 U	NA	NA	NA	NA	NA
1,2-Dichloroethane	mg/kg	NE	1,400	21.2	0.023	0.023	NE	--	0.025 U	0.022 U	0.023 U	0.019 U	0.019 U	0.02 U	0.017 U	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	mg/kg	NE	7,000	30.2	0.078	0.078	NE	--	0.037 U	0.033 U	0.035 U	0.029 U	0.028 U	0.029 U	0.026 U	NA	NA	NA	NA	NA
Tetrachloroethene	mg/kg	0.05	21,000	9.92	0.05	0.05	NE	--	0.04 UJ	0.036 UJ	0.037 UJ	0.031 UJ	0.031 UJ	0.031 UJ	0.028 UJ	NA	NA	NA	NA	NA
Trichloroethene	mg/kg	0.03	1,800	12.4	0.025	0.025	NE	--	0.024 U	0.021 U	0.022 U	0.018 U	0.018 U	0.018 U	0.016 U	NA	NA	NA	NA	NA
Vinyl Chloride	mg/kg	NE	88	6.46	0.0017	0.0017	NE	--	0.054 U	0.048 U	0.05 U	0.042 U	0.041 U	0.042 U	0.037 U	NA	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds



SWMU32-SED03	
Fluoride	170
cPAH (mg/kg)	
TTEC cPAH (calc)	428
TPAH (calc)	2,893
Total LMW PAH	515
Total HMW PAH	2,379
Metals (mg/kg)	
Arsenic	15
Cadmium	9.4
Nickel	220
Selenium	3.3
Zinc	1,300
TPH (mg/kg)	
Diesel Range Organics	4,400
Residual Range Organics	14,000

SWMU32-SED02	0-0.5	0.5-1
Fluoride	49	40
cPAH (mg/kg)		
TTEC cPAH (calc)	13.96	18.08
TPAH (calc)	104	132
Total LMW PAH	21.147	28.146
Total HMW PAH	83.2	104
Metals (mg/kg)		
Arsenic	5.6	5.4
Cadmium	1.5	0.66
Nickel	42	52
Selenium	1.2	1.1
Zinc	350	120
TPH (mg/kg)		
Diesel Range Organics	130	140
Residual Range Organics	680	560

SWMU32-SED01		Duplicate
Fluoride	130 J	100 J
cPAH (mg/kg)		
TTEC cPAH (calc)	3,213	2,233
TPAH (calc)	23,758	16,538
Total LMW PAH	5,295	3,706
Total HMW PAH	18,490	12,850
Metals (mg/kg)		
Arsenic	11	10
Cadmium	4.1	4.8
Lead	180 J	140 J
Nickel	670 J	510 J
Selenium	1.3	1.2
Zinc	460 J	590 J
TPH (mg/kg)		
Diesel Range Organics	26,000	23,000
Residual Range Organics	90,000	81,000

SWMU32-SS01	
cPAH (mg/kg)	
TTEC cPAH (calc)	2.718
Total HMW PAH	17.230
Metals (mg/kg)	
Selenium	0.89
TPH (mg/kg)	
Diesel Range Organics	43
Residual Range Organics	250

SWMU32-SC01	0-13	13-21
Fluoride	300	290
cPAH (mg/kg)		
TTEC cPAH (calc)	687	738
TPAH (calc)	5,951	5,964
Total LMW PAH	0.29	0.62
Total HMW PAH	4,642	4,498
Metals (mg/kg)		
Arsenic	10	11
Cadmium	5	5.4
Nickel	170	190
Selenium	0.82 J	0.91 J
Zinc	610	670
TPH (mg/kg)		
Diesel Range Organics	5,100	7,800 J
Residual Range Organics	18,000	30,000 J

SWMU32-SS02	
cPAH (mg/kg)	
TTEC cPAH (calc)	0.723
Total HMW PAH	4.234
Metals (mg/kg)	
Selenium	0.76
TPH (mg/kg)	
Diesel Range Organics	11 J
Residual Range Organics	27 B

SWMU32-SS03	
cPAH (mg/kg)	
TTEC cPAH (calc)	5.004
Total HMW PAH	28.28
Metals (mg/kg)	
Selenium	0.86
TPH (mg/kg)	
Diesel Range Organics	49
Residual Range Organics	190

SWMU32-SC02	0-10	10-18
Fluoride	320	250
cPAH (mg/kg)		
TTEC cPAH (calc)	339	456
TPAH (calc)	2,567	3,772
Total LMW PAH	0.15	0.82
Total HMW PAH	2,025	2,909
Metals (mg/kg)		
Arsenic	12	8.8
Cadmium	5.7	5.2
Nickel	180	180
Selenium	1.3	0.62 J
Zinc	700	630
TPH (mg/kg)		
Diesel Range Organics	4,000	4,700
Residual Range Organics	15,000	18,000

SWMU32-SC03	0-14	14-32	32-43
Fluoride	280	3,200	860
cPAH (mg/kg)			
TTEC cPAH (calc)	352	3,028	1,880
TPAH (calc)	2,775	27,013	17,093
Total LMW PAH	0.51	4.6	17
Total HMW PAH	2,136	19,760	12,230
Metals (mg/kg)			
Arsenic	17	33	26
Cadmium	7.7	9.6	6.2
Chromium	93		
Lead		290	190
Nickel	380	1,700	530
Selenium	1.2	3.2	1.8
Zinc	990	270	310
TPH (mg/kg)			
Diesel Range Organics	2,900	3,400	680 J
Residual Range Organics	11,000	9,000	690 J

SWMU32-SS04		Duplicate
cPAH (mg/kg)		
TTEC cPAH (calc)	0.988	5.92
Total HMW PAH	5.610	33.37
Metals (mg/kg)		
Selenium	0.87	0.98
TPH (mg/kg)		
Diesel Range Organics	22 J	63 J
Residual Range Organics	72 B	220 J

Legend

- Sediment Sample Station
- Surface Soil Sample Station
- Sediment Core and Water Sample Station

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100
Feet

Figure 32-3
SWMU 32
Stormwater Pond and Adjacent Area
Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

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- Concentrations of cPAHs exceeded MTCA Method C screening levels in 10 of the 12 collected samples and MTCA-derived soil screening levels for protection of groundwater in all 12 of the collected samples. Two of the deepest core samples (SC03, 14 to 32 inches, and 32 to 43 inches) exceeded the one percent Washington Dangerous Waste persistence criterion for PAHs. One of the grab sediment samples (SED01 and associated field duplicate) also exceeded the one percent Washington Dangerous Waste persistence criterion.

- Some individual PAHs (1-methylnaphthalene, 2-methylnaphthalene, fluoranthene, fluorene, pyrene, and naphthalene) that are not included in the total PAH summed screening levels exceeded soil screening levels for groundwater protection.

- Total PCBs were detected at low concentrations significantly below MTCA soil screening levels.

- Metals were not detected at concentrations above MTCA Method C screening levels in any of the 11 sediment samples submitted for laboratory analysis. However, some metals (As, Cd, Cr, Pb, Ni, Se, and Zn) were detected above one or more screening levels as well as background soil concentrations.

- Petroleum hydrocarbons in the diesel and motor-oil range were consistently detected (9 of 11 samples) above the MTCA Method A Industrial screening level of 2,000 mg/kg. Low levels of gasoline-range petroleum hydrocarbons were detected at concentrations below screening levels.

- Total cyanide was not detected in any of the collected samples sent for laboratory analysis.

- Fluoride concentrations exceeded the screening level of 147.6 mg/kg in 8 of 12 collected samples.

Pond water samples were collected at each of the sediment core locations in the pond as shown on Figure 32-1. Pond water results are summarized in Table 32-3 and have been compared to MTCA groundwater protection standards (screening levels) because the site hydrogeologic conceptual model suggests that the stormwater pond recharges the basalt aquifer system. Results are presented in Table 32-3 and summarized as follows:

- Total cyanide was not detected; however, the laboratory reporting limit for cyanide was above the associated MTCA Method A Industrial and Method C groundwater screening levels. Sulfate was detected but at concentrations below the secondary MCL of 250 mg/L.

Table 32-3
SWMU 32 - Stormwater Pond Initial RI Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
April 2016
(Page 1 of 2)

Parameter Name	Units	Groundwater Screening Levels				Selected Screening Level	Fraction Analyzed	Analytical Results				
		MTCA Method A	MTCA Method B	MTCA Method C	MCL			SWMU32-SW01 4/29/2016	SWMU32-SW40 (Duplicate of SWMU32-SW01) 4/29/2016	SWMU32-SW02 4/28/2016	SWMU32-SW03 4/29/2016	SWMU32-SW40 4/29/2016
Aluminum Smelter												
Cyanide	mg/L	NE	0.010	0.021	0.2	0.01	Total	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
Fluoride	mg/L	NE	0.96	2.1	4	0.96	Total	**1.6 J**	**1.7 J**	**1.6**	**1.7 J**	**1.7 J**
Sulfate	mg/L	NE	NE	NE	250	250	Total	50 J	50 J	50	50 J	50 J
Polycyclic Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	µg/L	160	1.51	15.1	NE	1.5	Total	0.0021 U	0.002 U	0.0049 J	0.0021 U	0.002 U
2-Methylnaphthalene	µg/L	160	32	70	NE	32	Total	0.0064 U	0.0061 U	0.0095 J	0.0062 U	0.0061 U
Acenaphthene	µg/L	NE	960	2,100	NE	960	Total	0.0074 J	0.0061 U	0.0064 U	0.0062 U	0.0061 U
Acenaphthylene	µg/L	NE	NE	NE	NE	NE	Total	0.0032 U	0.003 U	0.0032 U	0.0031 U	0.003 U
Anthracene	µg/L	NE	4,830	10,500	NE	4,800	Total	0.0021 UJ	0.002 UJ	0.0054 J	0.004 J	0.002 UJ
Benz[a]anthracene	µg/L	NE	0.12	1.2	NE	0.12	Total	0.019 J	0.011 J	0.013 J	0.014 J	0.011 J
Benzo(a)pyrene	µg/L	0.1	0.012	0.12	0.2	0.1	Total	0.013 J	0.0068 J	0.0083 J	0.009 J	0.0068 J
Benzo(b)fluoranthene	µg/L	NE	0.12	1.2	NE	0.12	Total	0.045	0.033	0.031	0.039	0.033
Benzo(ghi)perylene	µg/L	NE	NE	NE	NE	NE	Total	0.019 J	0.013 J	0.015 J	0.016 J	0.013 J
Benzo(k)fluoranthene	µg/L	NE	1.2	12	NE	1.2	Total	0.015 J	0.012 J	0.015 J	0.02 J	0.012 J
Chrysene	µg/L	NE	12	120	NE	12	Total	0.051	0.04	0.04	0.043	0.04
Dibenzo(a,h)anthracene	µg/L	NE	0.012	0.12	NE	0.12	Total	0.0032 U	0.004 J	0.0064 J	0.0058 J	0.004 J
Fluoranthene	µg/L	NE	640	1,400	NE	640	Total	0.063	0.049	0.047	0.052	0.049
Fluorene	µg/L	NE	640	1,400	NE	640	Total	0.012 J	0.0061 U	0.0079 J	0.0062 U	0.0061 U
Indeno(1,2,3-cd)pyrene	µg/L	NE	0.12	1.2	NE	0.12	Total	0.025	0.018 J	0.021	0.019 J	0.018 J
Naphthalene	µg/L	160	160	350	NE	160	Total	0.011 J	0.012 J	0.052	0.012 J	0.012 J
Phenanthrene	µg/L	NE	NE	NE	NE	NE	Total	0.017 J	0.011 J	0.014 J	0.014 J	0.011 J
Pyrene	µg/L	NE	480	1,050	NE	480	Total	0.034 J	0.022 J	0.02 J	0.025	0.022 J
Total TEC cPAH (calc)	µg/L	0.1	0.2	0.2	NE	0.1	Total	0.02407	0.015	0.01734	0.01921	0.015
Total PAHs (calc)	µg/L	NE	NE	NE	NE	NE	Total	0.3314	0.2318	0.3055	0.2728	0.2318
LMW PAH	µg/L	NE	NE	NE	NE	NE	Total	0.1104	0.072	0.1407	0.082	0.072
HMW PAH	µg/L	NE	NE	NE	NE	NE	Total	0.221	0.1598	0.1697	0.1908	0.1598
Polychlorinated Biphenyls (PCBs)												
PCB-aroclor 1016	µg/L	NE	1.12	12.5	NE	1.1	Total	0.016 UJ	0.016 UJ	0.021 UJ	0.016 UJ	0.016 UJ
PCB-aroclor 1221	µg/L	NE	NE	NE	NE	NE	Total	0.028 UJ	0.028 UJ	0.03 UJ	0.028 UJ	0.028 UJ
PCB-aroclor 1232	µg/L	NE	NE	NE	NE	NE	Total	0.014 UJ	0.014 UJ	0.027 UJ	0.014 UJ	0.014 UJ
PCB-aroclor 1242	µg/L	NE	NE	NE	NE	NE	Total	0.013 UJ	0.013 UJ	0.028 UJ	0.013 UJ	0.013 UJ
PCB-aroclor 1248	µg/L	NE	NE	NE	NE	NE	Total	0.013 UJ	0.013 UJ	0.021 UJ	0.013 UJ	0.013 UJ
PCB-aroclor 1254	µg/L	NE	0.0438	0.438	NE	0.044	Total	0.014 UJ	0.014 UJ	0.02 UJ	0.014 UJ	0.014 UJ
PCB-aroclor 1260	µg/L	NE	0.0438	0.438	NE	0.044	Total	0.037 UJ	0.037 UJ	0.026 UJ	0.037 UJ	0.037 UJ
PCB-aroclor 1262	µg/L	NE	NE	NE	NE	NE	Total	0.012 UJ	0.012 UJ	0.031 UJ	0.012 UJ	0.012 UJ
PCB-aroclor 1268	µg/L	NE	NE	NE	NE	NE	Total	0.013 UJ	0.013 UJ	0.025 U	0.013 UJ	0.013 UJ
Total PCB Aroclor (calc)	µg/L	0.1	0.0438	0.438	0.5	0.044	Total	0.012 U	0.012 U	0.02 U	0.012 U	0.012 U
Metals												
Aluminum	mg/L	NE	16	35	NE	16	Dissolved	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Aluminum	mg/L	NE	16	35	NE	16	Total	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Arsenic	mg/L	0.005	0.0000583	0.000583	0.1	0.000058	Dissolved	**0.0014**	**0.0014**	**0.0014**	**0.0014**	**0.0014**
Arsenic	mg/L	0.005	0.0000583	0.000583	0.1	0.000058	Total	**0.0014**	**0.0014**	**0.0014**	**0.0015**	**0.0014**
Cadmium	mg/L	0.005	0.008	0.0175	0.005	0.005	Dissolved	0.000028 U	0.000028 U	0.000028 U	0.000028 U	0.000028 U
Cadmium	mg/L	0.005	0.008	0.0175	0.005	0.005	Total	0.000031 J	0.000028 U	0.000052 J	0.000031 J	0.000028 U
Chromium	mg/L	0.05	24	52.5	0.1	0.05	Dissolved	0.00043	0.00045 J	0.00049	0.00037 J	0.00045 J
Chromium	mg/L	0.05	24	52.5	0.1	0.05	Total	0.0027 J	0.00062 J	0.00058	0.00044 J	0.00062 J
Copper	mg/L	NE	0.64	1.4	13	0.64	Dissolved	0.00088 J	0.00062 J	0.00099 J	0.00062 J	0.00062 J
Copper	mg/L	NE	0.64	1.4	13	0.64	Total	0.00076 J	0.00085 J	0.00072 J	0.00068 J	0.00085 J
Lead	mg/L	0.015	NE	NE	0.015	0.015	Dissolved	0.000036 J	0.0001 J	0.000039 J	0.000034 U	0.0001 J
Lead	mg/L	0.015	NE	NE	0.015	0.015	Total	0.00011 J	0.000072 J	0.00013 J	0.00012 J	0.000072 J

Table 32-3
SWMU 32 - Stormwater Pond Initial RI Water Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
April 2016
(Page 2 of 2)

Parameter Name	Units	Groundwater Screening Levels				Selected Screening Level	Fraction Analyzed	Analytical Results				
		MTCA Method A	MTCA Method B	MTCA Method C	MCL			SWMU32-SW01 4/29/2016	SWMU32-SW40 (Duplicate of SWMU32-SW01) 4/29/2016	SWMU32-SW02 4/28/2016	SWMU32-SW03 4/29/2016	SWMU32-SW40 4/29/2016
Mercury	mg/L	0.002	NE	NE	0.002	0.002	Dissolved	0.000041 U	0.000052 J	0.000041 U	0.00012 J	0.000052 J
Mercury	mg/L	0.002	NE	NE	0.002	0.002	Total	0.000041 U	0.00009 J	0.000041 U	0.00011 J	0.00009 J
Nickel	mg/L	NE	0.000096	0.00096	0.1	0.000096	Dissolved	**0.00079 J**	**0.0008 J**	**0.00079 J**	**0.00076 J**	**0.0008 J**
Nickel	mg/L	NE	0.000096	0.00096	0.1	0.000096	Total	**0.0022 J**	**0.00089 J**	**0.00094 J**	**0.00081 J**	**0.00089 J**
Selenium	mg/L	NE	0.08	0.18	0.05	0.05	Dissolved	0.00068 J	0.00074 J	0.00078 J	0.00079 J	0.00074 J
Selenium	mg/L	NE	0.08	0.18	0.05	0.05	Total	0.00085 J	0.00085 J	0.00082 J	0.00084 J	0.00085 J
Zinc	mg/L	NE	4.8	10.5	NE	4.8	Dissolved	0.002 J	0.0019 U	0.0019 U	0.0019 U	0.0019 U
Zinc	mg/L	NE	4.8	10.5	NE	4.8	Total	0.0028 J	0.0035 J	0.0026 J	0.0033 J	0.0035 J
Total Petroleum Hydrocarbons (TPHs)												
Gasoline	mg/L	1	NE	NE	NE	1	Total	NA	NA	0.027 U	NA	NA
#2 Diesel	mg/L	5	NE	NE	NE	0.5	Total	0.076 B	0.063 B	0.088 B	0.055 B	0.063 B
Motor Oil	mg/L	5	NE	NE	NE	0.5	Total	0.17 B	0.081 B	0.086 J	0.054 B	0.081 B
Geo Chemistry												
Magnesium	mg/L	NE	NE	NE	NE	NE	Total	14	NA	NA	NA	NA
Potassium	mg/L	NE	NE	NE	NE	NE	Total	4.8	NA	NA	NA	NA
Sodium	mg/L	NE	NE	NE	NE	NE	Total	11	NA	NA	NA	NA
Chloride	mg/L	NE	NE	NE	NE	NE	Total	11	NA	NA	NA	NA
Calcium	mg/L	NE	NE	NE	NE	NE	Total	25	NA	NA	NA	NA
Total Dissolved Solids	mg/L	NE	NE	NE	NE	NE	Total	210	NA	NA	NA	NA
Magnesium	mg/L	NE	NE	NE	NE	NE	Total	14	NA	NA	NA	NA
Total Suspended Solids	mg/L	NE	NE	NE	NE	NE	Total	2 UJ	2 UJ	2 U	2 UJ	2 UJ
Alkalinity, Total	mg/L	NE	NE	NE	NE	NE	Total	84	NA	NA	NA	NA
Alkalinity as Bicarbonate	mg/L	NE	NE	NE	NE	NE	Total	48	NA	NA	NA	NA
Alkalinity as Carbonate	mg/L	NE	NE	NE	NE	NE	Total	36	NA	NA	NA	NA
Alkalinity as Hydroxide	mg/L	NE	NE	NE	NE	NE	Total	5 U	NA	NA	NA	NA
Hardness as CaCO3	mg/L	NE	NE	NE	NE	NE	Total	130	NA	NA	NA	NA

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/L = milligrams per liter
µg/L = micrograms per liter
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCBs = Polychlorinated Biphenyls
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

- Fluoride was detected at concentrations slightly above the MTCA Method B groundwater screening level of 0.0096 mg/L in all three samples, but below the associated MTCA Method C and MCL screening levels in all three samples.
- PCBs were not detected.
- Petroleum hydrocarbons were either not detected or detected at concentrations significantly below MTCA Method A groundwater screening levels.

Pond water sample results included geochemical parameters for one pond water sample (SW01) including calcium, magnesium, potassium, sodium, chloride, total dissolved solids, alkalinity, and hardness. The purpose of the geochemical analysis is to determine if there is a clear chemical signature between the pond and underlying aquifer zones at the site. The geochemical characteristics between the stormwater pond and groundwater is evaluated as part of the Groundwater in the Uppermost Aquifer AOC, and is discussed in detail in Volume 4, Section 2. Monitoring well RI-MW2-BAU was installed southwest and adjacent to the stormwater pond in part to determine if there was hydraulic communication between the pond and underlying BAU zone. The geochemical results indicate that both the pond and monitoring well RI-MW2-BAU have a similar geochemical signature characterized primarily in the calcium carbonate facies (refer to Volume 4, Section 2).

32.2.3 Soil Sampling Near Pond Results

Four surface soil samples collected along the shallow ravine trending southeast of stormwater pond are shown on Figure 32-1. Surface soil sampling results are summarized in Table 32-4. Surface soil screening level exceedances are shown on Figure 32-3. A summary of these results is provided as follows:

- Concentrations of PAHs exceeded the terrestrial ecological screening for HMW PAHs in all 5 samples. The TTEC cPAH soil screening level for protection of groundwater was exceeded in 2 of 5 samples.
- Total cyanide was not detected; fluoride and sulfate were detected at low concentrations significantly below MTCA soil screening levels.
- PCBs were not detected in any of the soil samples, except for sample SS01 at very low concentration of 0.0068 mg/kg, well below screening levels.

Table 32-4
SWMU 32 - Stormwater Pond Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
May 2016

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results SWMU32-SS01 5/5/2016	SWMU32-SS02 5/5/2016	SWMU32-SS03 5/5/2016	SWMU32-SS04 5/5/2016	SWMU32-SS42 (Duplicate of SWM32-SS04) 5/5/2016
Aluminum Smelter												
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2.1 UJ	1.9 UJ	1.8 UJ	2 UJ	2.2 UJ
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	36	33	28	26	24
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	4.6 B	4.2 B	4.1 U	4.1 U	5.6 B
Polycyclic Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	mg/Kg	5.0	4,500	NL	0.082	0.082	NE	0.0071	0.0026 J	0.02	0.0055 J	0.029 J
2-Methylnaphthalene	mg/Kg	5.0	14,000	NL	1.7	1.7	NE	0.0078	0.0028 J	0.025	0.0073 J	0.036 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.094	0.033	0.24	0.075 J	0.33 J
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0029 J	0.0005 U	0.0035 J	0.00046 U	0.0047 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.13	0.029	0.21	0.06 J	0.28 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.8	0.51 J	2.7	0.63 J	3.3 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1.9	0.51 J	3.6	0.72 J	4.3 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	2.9	0.76 J	5.2	0.9 J	5.7 J
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	1.7	0.45 J	3	0.55 J	3.4 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1	0.22 J	1.9	0.35 J	2.3 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	2.5	0.56 J	3.6	0.8 J	4.3 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.33	0.084	0.58	0.1 J	0.67 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	3.4	0.71 J	4.7	1 J	5.7 J
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.045	0.012	0.087	0.03 J	0.15 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	1.9	0.5 J	3.3	0.62 J	3.8 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.013	0.0046 J	0.04	0.013 J	0.06 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.89	0.22 J	1.6	0.4 J	2.1 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	3.2	0.64 J	4.4	0.94 J	5.6 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	2.718	0.723	**5.004**	0.988	**5.92**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	4.5898	1.014	6.9255	1.5908	8.6897
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**17.23**	**4.234**	**28.28**	**5.61**	**33.37**
Polychlorinated Biphenyls (PCBs)												
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0069 U	0.007 U	0.0073 U	0.0068 U	0.0087 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0039 U	0.004 U	0.0041 U	0.0039 U	0.0049 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0046 U	0.0047 U	0.0048 U	0.0045 U	0.0058 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0015 UJ	0.0015 UJ	0.0016 UJ	0.0015 UJ	0.0019 UJ
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0027 UJ	0.0028 UJ	0.0029 UJ	0.0027 UJ	0.0034 UJ
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	0.0068 J	0.0014 UJ	0.0015 UJ	0.0014 UJ	0.0018 UJ
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0018 UJ	0.0018 UJ	0.0019 UJ	0.0017 UJ	0.0022 UJ
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00047 UJ	0.00048 UJ	0.00049 UJ	0.00046 UJ	0.00059 UJ
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00084 UJ	0.00086 UJ	0.00089 UJ	0.00083 UJ	0.0011 UJ
Total PCB Aroclor (calc)	mg/kg	10	66	0.65	NE	0.65	NE	0.0068	0.00048 U	0.00049 U	0.00046 U	0.00059 U
Metals												
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	12,000	12,000	12,000	12,000	12,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	3.1	2.7	2.9	2.7	2.8
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.35	0.21	0.26	0.2 J	0.13 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	15 J	14 J	14 J	14 J	15 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	20 J	16 J	16 J	16 J	16 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	7.9	6.3	6.5	5.5	5.1
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.015 B	0.0088 B	0.01 B	0.0096 B	0.012 B
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	23 J	13 J	15 J	12 J	12 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.89**	**0.76**	**0.86**	**0.87**	**0.98**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	93	53	65	52	49
Total Petroleum Hydrocarbons (TPHs)												
Gasoline Range Organics	mg/Kg	100	NE	1,000	NA	1,000	NA	1.1 J	1.1 U	1.1 U	1.1 J	1.9 J
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	43	11 J	49	22 J	63 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	250	27 B	190	72 B	220 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable

NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

- Petroleum hydrocarbons were generally not detected or detected at very low concentrations below MTCA soil screening levels.
- Selenium (maximum of 0.98 mg/kg) was detected above the terrestrial ecological screening level for wildlife protection and background concentration in all five samples.

32.2.4 Pond Drawdown Test

The pond drawdown test was conducted in May 2017 in accordance with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Testing consisted of transducer water-level monitoring of the stormwater pond and nearby monitoring wells during a routine facility stormwater NPDES discharge event. The pumping rate for this test was approximately 350 to 400 gpm over a 5-day period. An immediate response to pumping was observed in well RI-MW2-BAU, which suggests that the stormwater pond likely recharges the BAU in this area. Also, the stormwater pond level recovered quickly after pumping (no rainfall/runoff during test), suggesting potential recharge from the BAU zone. No response was observed in well RI-MW2-BAL suggesting that the deep BAL zone is not hydraulically connected with the pond.

The pond drawdown test was conducted and evaluated as part of the Groundwater in the Uppermost Aquifer AOC, and is discussed in detail in Volume 4, Section 2.

32.2.5 Pond Contaminated Sediment Volume Estimate

Figure 32-2 shows the thickness of sediment in the stormwater pond. Volume 5, Appendix B-32(B) shows the calculations and supporting figure used for the contaminated sediment volume calculations. An estimated bulk volume of 2,104 cubic yards (3,786 tons) of contaminated sediment was estimated for the Stormwater Pond.

32.3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations relating to the stormwater pond and adjacent area include the following:

- Pond Sediments – Sediment accumulation within the pond is primarily within the central basin of the original (pre-expansion) pond footprint where the maximum sediment thickness was measured at 4.7 ft. Additional sediment accumulation was noted at the mouth of the northeast inlet where a small delta of sediment has formed. Concentrations of cPAHs exceed MTCA Method C screening levels in most of the sediment sampled, with two locations exhibiting concentrations in excess of the Washington State Dangerous Waste Persistence criteria for PAHs.

- Pond Water – Fluoride (maximum concentration of 1.7 mg/L) exceeded the MTCA Method B groundwater screening level of 0.96 mg/L in all of the collected water samples. The geochemistry of the pond is generally similar to that of the underlying BAU and appears in hydraulic communication with the BAU at this location based on results of the pond drawdown test. Periodic pond discharge is managed by the facility under NPDES permit.

- Adjacent Area Soils – The surface soils along the shallow ravine southeast of the stormwater pond do not appear to be significantly impacted, but do exhibit PAH concentrations in excess of MTCA-derived soil screening levels for protection of groundwater.

The stormwater pond contains elevated concentrations of PAHs in sediment. The pond is unlined and appears to have hydraulic connection with the underlying BAU and is therefore recommended for further evaluation in the FS. Soils along the adjacent swale southeast of the pond exceed PAH screening levels and will also be further evaluated in the FS.

Section 33
Additional Investigation Area Ditch Near West SPL Storage Area

Ecology (2015b) comments on the Draft RI Phase 1 Work Plan identified further investigation of this feature as a RI data need for the West SPL Storage Area (SWMU 13). The ditch on the southern side of the West SPL Storage Area (SWMU 13) historically contained the scrubber slurry line leading to the WSI and there is some evidence of releases to this historically unlined drainage as summarized in detail in the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) in the section regarding the West SPL Storage Area (SWMU 13). Because the WSI slurry lines were in the ditch over a sustained period (WSI was operated from 1982 to 2005), there is potential for the sludge lines (or other potential sources, e.g., other miscellaneous drainage lines) to have released contaminants to this historically unlined ditch. Because the ditch represents a separate feature from the West SPL Storage Area (SWMU 13), it is described as an additional investigation area for planning purposes.

The southern surface drainage ditch was repaired and modified in both 1996 and 1997. In 1996, in response to a blocked culvert, slumped slopes, and an associated spike in shallow groundwater concentrations in nearby wells, a slope-repair grading plan was prepared, and repairs were subsequently made (CH2MHill 1996; Wayne Wooster, e-mail communication, May 5, 1997). Based on the design drawings for the proposed work (CH2MHill 1996), the grade of the south and west slopes was reduced and the ditch along the base of the southern slope was rebuilt, lined with 30-mil PVC liner, and covered with crushed rock. During winter 1997, a front-end loader got stuck in the ditch during snow removal operations and damaged about 50 ft of the liner in the southern ditch (Wayne Wooster, e-mail communication, May 5, 1997). This damage was subsequently repaired during summer 1997. The plan was to use a 60-mil HDPE liner placed in a shingled fashion in the affected area, covering it with fabric, and installing a final crushed rock cover (CH2MHill 1997).

Ecology (2015b) comments on the Draft RI Phase 1 Work Plan requested characterization of the ditch. The objective of the investigation is to determine the current layout and physical condition of the ditch, characterize chemical concentrations in ditch soils, and evaluate if a release has occurred that may serve as an ongoing source of contamination.

The objective of the initial RI investigation was to determine the current layout and physical condition of the ditch, characterize chemical concentrations in ditch soils, and evaluate if a release has occurred that may serve as an ongoing source of contamination.

The objective of the initial RI investigation was to determine the current layout and physical condition of the ditch, characterize chemical concentrations in ditch soils, and evaluate if a release has occurred that may serve as an ongoing source of contamination. Based on the initial RI results and Ecology and Yakama Nation comments of the Draft RI, additional characterization of the West SPL ditch was included in the Work Plan Addendum. The WPA investigation objectives included additional characterization of the extent of soil contamination within the ditch and to verify that the pipe that could potentially drain the West SPL Storage area cap does not contain water.

Five surface soil samples were planned, including two within the drainage ditch and three in the area of the ditch discharge point located to the southwest. One deeper sample will also be collected with a hand-auger from this area or from beneath the armored and lined portion of the ditch based on field observations and subsurface conditions.

Removal of the rip-rap armor in the ditch was attempted using hand tools. If feasible, a soil sample will be collected from below the riprap and liner (if present).

The discharge pipe was inspected at the time of soil sampling. If flowing water was found, collection of a grab water sample was planned.

The soil samples will be analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and diesel/oil-range petroleum hydrocarbons. The pipe discharge will be sampled for this same analytical program (with the addition of dissolved metals and free cyanide) if sufficient discharge is present for sampling.

33.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

This section summarizes the scope of work for the initial RI and WPA field investigation of the West SPL Ditch, which represent an additional investigation area identified during development and preparation of the Final RI Phase 1 and Phase 2 Work Plans (Tetra Tech et al. 2015a,b).

33.1.1 Initial RI Field Investigation

The southern ditch along the southern side of the West SPL Storage Area was inspected during June 2016 to verify the layout of the ditch, identify areas of sediment/soil accumulation, identify any blockages or drainage problems, and to attempt to verify the lined portion of the ditch and its condition. Any observed extensions of the ditch to the east or south of the West SPL Storage Area were also inspected for a distance of up to 300 ft along the ditch alignment.

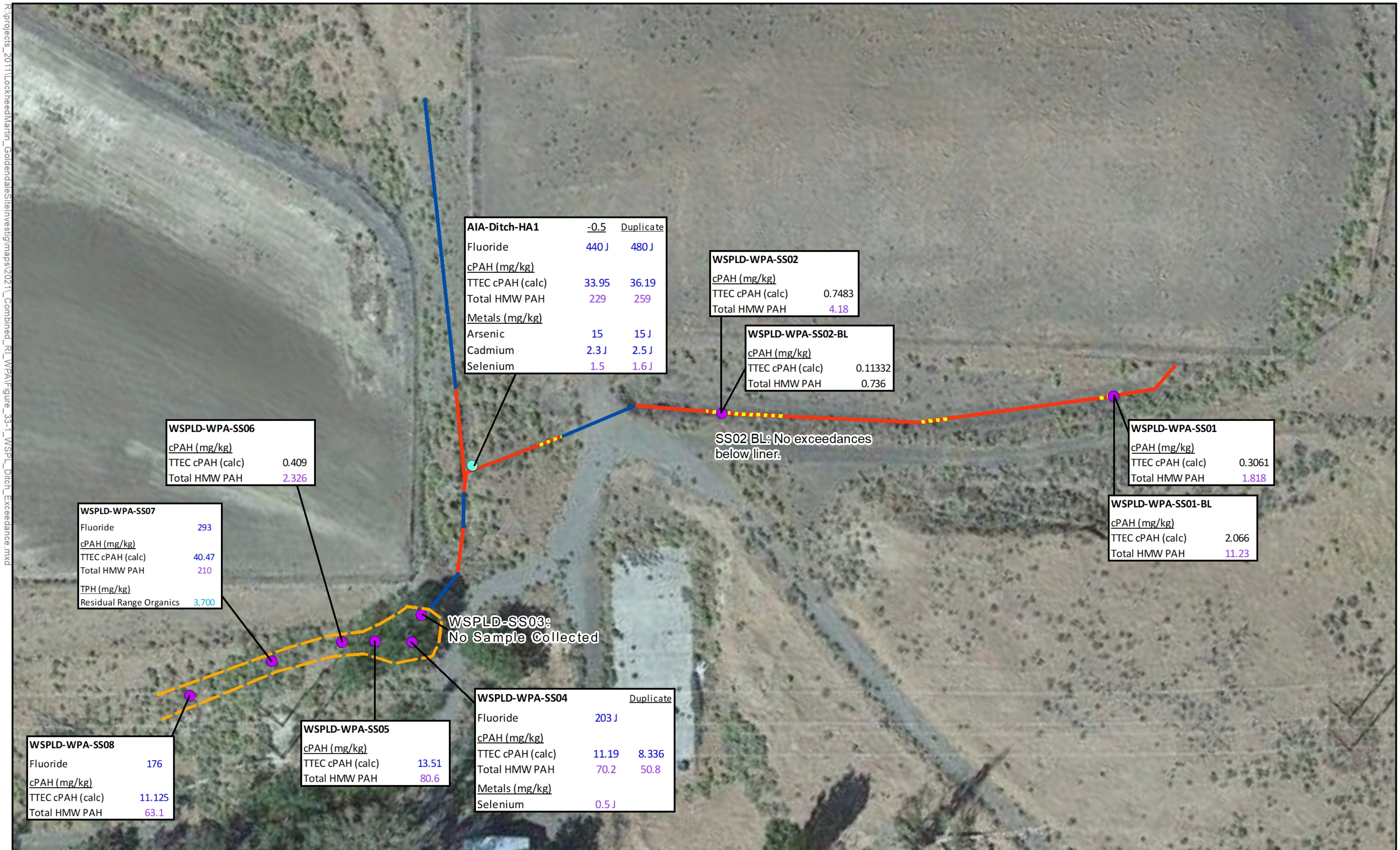
Based on the results of the visual inspection, one soil sample and one field duplicate was collected from the unlined ditch extension downstream (south) of the West SPL Storage Area (refer to Figure 33-1). A surface soil grab sample was collected from the ditch with a hand-auger and analyzed for PAHs, total cyanide, fluoride, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), sulfate, PCBs, and TPH-Dx to characterize soil concentrations.

33.1.2 WPA Field Investigation

Based on the results of the initial RI investigation of the West SPL ditch, and Ecology and Yakama Nation comments on the Draft RI Report, further investigation of the West SPL Ditch was performed. The WPA investigation objectives are to better characterize the extent of soil contamination within the ditch and to verify that the pipe that could potentially drain the West SPL Storage area cap does not contain water.

Five surface soil samples were proposed in the Final WPA to be collected including two within the drainage ditch and three in the area of the ditch discharge point located to the southwest. One deeper sample was also to be collected with a hand-auger from this area or from beneath the armored and based on field observations and subsurface conditions. Removal of the rip-rap armor in the discharge ditch outlet was attempted using hand tools. The discharge pipe was inspected at the time of soil sampling. A grab water sample was planned to be collected from the pipe if flow was observed.

The initial sampling of the ditch during the WPA was performed during December 2020. Based on the investigation findings and Ecology verbal comments during an April 2020 site visit, sampling of three locations in a drainage swale west of the discharge pipe and sampling of two locations beneath the liner was included in the sampling program.



Legend

- RI Sample Location
- WPA Sample Location
- Armored Ditch
- Culvert
- Area of Minor Sediment and Vegetation
- Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
LMW = Low Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

W N S E

0 25 50 100
Feet

Figure 33-1
West SPL Ditch
Sampling Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The WPA soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, PCBs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and diesel/oil-range petroleum hydrocarbons. The pipe discharge would be sampled for this same analytical program (with the addition of dissolved metals and free cyanide) if sufficient discharge is present for sampling.

33.2 INVESTIGATION RESULTS

During the initial RI, field reconnaissance of the ditch was performed consistent with the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). The field team noted the ditch alignment, areas of sediment accumulation, rip-rip, and exposed liner material, and these observations are shown on Figure 33-1.

Based on the field reconnaissance, the ditch extends from the eastern portion of the West SPL Storage Area and passes through three short culverts and ends in a treed area. There is a rip-rap flow dissipation structure at the mouth of the culvert in the treed area. Based on WPA site reconnaissance, it appears that stormwater drainage from the northern side of the West SPL Storage Area as well as the WSI are connected to the culvert in the open treed area (refer to Figure 33-1). Much of the ditch is armored with riprap and there does not appear to be much accumulation of sediment.

A 4-inch PVC pipe was observed that extends towards the West SPL Storage area cap. This pipe may correspond to the “SPL pile leak detection pipe” alluded to in a 1996 groundwater monitoring report (CH2MHill 1996) or the original drain line for the concrete pad that underlies the capped SPL. Refer to the Final RI Phase 1 Work Plan (Tetra Tech et al. 2015a) for further discussion of the West SPL Storage Area and associated data. No water was observed in the pipe or within the ditch at the time of the initial RI or WPA site reconnaissance and field sampling.

Exposed liner was found in the ditch west of the gravel access spur road that leads to the West SPL Storage Area. However, the field team was initially unable to verify the extent or the condition of a liner beneath the ditch due to the riprap. During the WPA, the liner was exposed at two locations and was found to consist of a geofabric layer and underlying poly-liner (HDPE or similar). The liner was cut to allow for sampling and subsequent repair with a double layer of impermeable patch material that was glued in place.

Soil samples collected from the additional investigation area in June 2016, November 2020, and May 2021 were received by the project analytical laboratory in reported good condition and under standard chain-of-custody protocol. The soil sample results were validated by an independent, third-party data validation contractor and associated data qualifiers are included as appropriate on all data summary tables. Completed soil sampling logs are provided in Volume 5, Appendix B-33. The laboratory data report and data validation report for the initial RI project soil samples are provided in Volume 5, Appendix H-1 and I-1, respectively. The laboratory data report and data validation for the WPA data for this site are included in Appendix H-3 and I-3, respectively.

The RI and WPA soil sample analytical results for the West SPL Ditch are summarized in Table 33-1 and Table 33-2. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA Method A Industrial (TPH only), MTCA-derived soil screening levels for protection of groundwater, terrestrial ecologic screening levels for wildlife protection. Figure 33-1 shows the sampling locations and summarizes the exceedances of soil screening levels.

The Initial RI and WPA soil results show the following:

- Concentrations of cPAHs exceed MTCA-derived soil screening level for protection of groundwater of 3.9 mg/L as TTEC cPAH in 7 of 12 samples collected. PAHs exceeded terrestrial ecological screening levels for wildlife protection (1.1 mg/kg as HMW PAH) in 11 of 12 samples. Concentrations of HMW PAH (11.23 mg/kg) were detected above terrestrial ecologic screening levels in one of two samples collected beneath the ditch liner (WSPLD-WP-SS01-BL). No samples exceeded MTCA Method C screening levels.
- Total cyanide was not detected.
- Fluoride was detected above the soil screening level for protection of groundwater of 147.6 mg/kg in 5 of 12 samples collected from the ditch including the furthest downstream samples.
- Sulfate was detected at low concentrations below MTCA-derived soil screening levels for protection of groundwater.
- Arsenic (15 mg/kg) and cadmium (2.5 J mg/kg) were detected above MTCA-derived soil screening levels for protection of groundwater and soil background concentrations in the initial RI sample collected from the mouth of the ditch (AIA-Ditch-HA-0.5). Selenium (maximum of 1.6 J mg/kg) was detected above terrestrial ecological screening levels for wildlife protection in 3 of 12 samples.

Table 33-1
West SPL Ditch RI Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
June 2016
(Page 1 of 2)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results AIA-Ditch-HA1-0.5 6/30/2016	AIA-Ditch-HA40-0.5 (Duplicate of AIA-Ditch-HA1-0.5) 6/30/2016
Aluminum Smelter									
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	2 U	2 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	**440 J**	**480 J**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	28 J	28 J
Polycyclic Aromatic Hydrocarbons (PAHs)									
1-Methylnaphthalene	mg/Kg	NL	4,500	NL	0.082	0.082	NE	0.022 J	0.023 J
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.029	0.029
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.39	0.38
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.021 J	0.023 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.65	0.68
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	11	11
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	21	21
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	47	57
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	39	47
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	15	17
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	20	20
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	5.5	5.9
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	16	16
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.18	0.18
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	49	59
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.052	0.05
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	3.2	3.1
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	21	21
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**33.95**	**36.19**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	20.544	20.465
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**229**	**259**
Polychlorinated Biphenyls (PCBs)									
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.0072 U	0.0073 U
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.0041 U	0.0042 U
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.0047 U	0.0048 U
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.0015 U	0.0016 U
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.0028 U	0.0029 U
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	0.0098	0.014
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.0018 U	0.0019 U
PCB-aroclor 1262	mg/Kg	NA	NE	NE	NE	NE	NE	0.00048 UJ	0.00049 UJ
PCB-aroclor 1268	mg/Kg	NA	NE	NE	NE	NE	NE	0.00087 U	0.00089 U
Total PCB Aroclor (calc)	mg/Kg	10	66	0.65	NE	0.65	NE	0.0098	0.014
Metals									
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	43,000	45,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	**15**	**15 J**
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**2.3 J**	**2.5 J**
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	22	22
Copper	mg/Kg	NA	140,000	217	280	217	28.4	18	19 J
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	20	21
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.02	0.019
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	120	130 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**1.5**	**1.6 J**
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	130	140 J
Total Petroleum Hydrocarbons (TPHs)									
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	120	130
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	1,100	1,200

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

Total TEC = Total Toxicity Equivalent Concentration

TPH = Total Petroleum Hydrocarbons

Table 33-2
West SPL Ditch WPA Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	WSPLD-WPA-SS01 11/13/2020	WSPLD-WPA-SS01-BL 5/11/2021	WSPLD-WPA-SS02 11/13/2020	WSPLD-WPA-SS02-BL 5/11/2021	WSPLD-WPA-SS04 11/13/2020	WSPLD-WPA-SS47 (Duplicate of WSPLD-WPA-SS04) 11/13/2020	WSPLD-WPA-SS05 11/13/2020	WSPLD-WPA-SS06 5/11/2021	WSPLD-WPA-SS07 5/11/2021	WSPLD-WPA-SS08 5/11/2021
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.34	0.07 U	0.08 U	0.07 U	0.07 U	0.07 U	0.07 J	0.07 U	0.07 U	0.12 J
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	33.5	63.3	41.5	36.8	**203 J**	140 J	52.9	58.3	**293**	**176**
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	10	2.3	1.4 J	3.6	5.9 J	3.9 J	1.2 J	3	3.7	11.3
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.013	0.016	0.0016 B	0.00059 J	0.069	0.056	0.042	0.0022 J	0.091	0.023
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.017	0.13	0.012	0.0037 J	0.28	0.21	1.4 J	0.014	3.6	0.26
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0084	0.0018 J	0.00066 J	0.0003 U	0.07	0.062	0.038	0.0025 J	0.026 J	0.017
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.035	0.081	0.018	0.0031 J	0.56	0.49	1.8 J	0.017	2.3	0.36
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.17	0.98	0.3	0.055	6.2	5	11	0.19	20	5
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.21	1.5	0.52	0.073	7.5	5.8	9.6	0.29	30	7.8
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.4	2.2	0.94	0.17	14	10	14	0.46	41	13
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.18	1.3	0.54	0.096	8.6	6	5	0.33	22	8.5
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.11	0.64	0.28	0.047	4.4 J	1.8 J	4.6	0.13	11	4
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.23	1.3	0.33	0.082	10 J	6.6 J	11	0.24	23	6.5
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.048	0.31	0.13	0.023	1.9	1.3	1.9 J	0.066	5.4	1.5
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.3	1.4	0.43	0.076	9.3	9.7	23	0.28	35	7.6
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.03	0.046	0.0064	0.0015 J	0.29	0.24	1.1 J	0.01	1.3	0.16
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.21	1.4	0.6	0.1	9.4	6.6	6.5	0.32	25	9.1
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.036	0.024	0.0029 J	0.00084 J	0.17	0.14	0.075	0.0051	0.12	0.041
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.21	0.57	0.12	0.022	3.4	3.3	12	0.11	15	2.5
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.26	1.6	0.54	0.09	8.2	7.7	17	0.3	33	7.7
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.022	0.024	0.0041 J	0.00087 J	0.15	0.13	0.41 J	0.0059	0.56	0.09
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.3061	2.066	0.7483	0.11332	**11.19**	**8.336**	**13.51**	0.409	**40.47**	**11.125**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.6494	2.2688	0.59156	0.10773	14.139	14.198	39.455	0.4408	57.437	10.961
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**1.818**	**11.23**	**4.18**	0.736	**70.2**	**50.8**	**80.6**	**2.326**	**210**	**63.1**
Polychlorinated Biphenyls (PCBs)																	
PCB-aroclor 1016	mg/Kg	NA	250	NE	NE	250	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
PCB-aroclor 1221	mg/Kg	NA	NE	NE	NE	NE	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
PCB-aroclor 1232	mg/Kg	NA	NE	NE	NE	NE	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
PCB-aroclor 1242	mg/Kg	NA	NE	NE	NE	NE	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
PCB-aroclor 1248	mg/Kg	NA	NE	NE	NE	NE	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
PCB-aroclor 1254	mg/Kg	NA	66	NE	0.71	66	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
PCB-aroclor 1260	mg/Kg	NA	66	NE	NE	66	NE	0.004 U	NA	0.0036 U	NA	0.0032 U	0.0032 U	0.0033 U	NA	NA	NA
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	6,790	9,600	9,410	10,900	12,600	10,300	9,120	7,090	13,400	15,000
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4.73	2.8	2.46	3.26	6.49	5.3	4.21	5.67	4.68	5.58
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.13	0.148	0.314	0.131	0.595 J	0.333 J	0.297	0.124	0.434	0.56
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	8.57	5.58	3.12	6.73	15.1	13.3	12.9	9.95	16.1	15.6
Copper	mg/Kg	NA	140,000	217	280	217	28.4	15.5	14.9	15.5	14.9	13.6	12.4	12.1	11.9	12.5	13
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	6.73	4.72	6.3	5.37	12.6 J	9.2 J	7.34	5.34	17.1	9.18
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.003 U	0.002 U	0.003 J	0.002 U	0.008 J	0.004 J	0.005 J	0.002 U	0.002 U	0.002 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	9.49	8.02	17	8.37	33.5 J	22.7 J	16.6	11.3	27.9	33.4
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	0.1 J	0.2 J	0.2 J	0.2 J	**0.5 J**	0.3 J	0.2 J	0.13 J	0.3 J	0.3 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	147	53.4	70.7	58.8	75.7	73.9	54.4	43.1	48.7	57
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	45 B	26 J	11 B	3.1 J	140 B	950 J	66 B	9 J	910	180
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	370	89 J	65 B	14 J	720 J	2,000 J	290	26 B	**3,700**	650

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established

NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyls
SSL = Soil Screening Level
Total TEC = Total Toxicity Equivalent Concentration
WSPLD = West Spent Pot Liner Ditch

- PCBs (Aroclor 1254, 0.014 mg/kg) were detected at low concentrations below MTCA screening levels.
- Residual-range organics were detected at or above the MTCA Method A Industrial TPH-screening level of 2,000 mg/kg in 2 of 10 samples.

33.3 CONCLUSIONS AND RECOMMENDATIONS

Based primarily on PAH and fluoride concentrations above screening levels at several surface soil sample locations and one sample collected from beneath the ditch liner, the ditch should be further evaluated in the FS.

Based on further review of historical documentation, recent field observations, and the WPA ditch results, the slopes on the south side and west side of the West SPL Storage Area (in addition to the ditch) likely have residual soil contamination that includes surface and shallow subsurface soils (less than about 5 feet thick). A conservative estimate of the volume/extent of contaminated soil in this area be included in the analysis of cleanup alternatives for the FS. Provisions for additional characterization and confirmation sampling will be included in the FS cost estimate for the evaluated cleanup action alternatives and in the remedial action work plan.

Section 34
Additional Investigation Area – ESI Fence Line Area

The ESI Fence Line Area was discovered in June 2016 during a routine inspection of the ESI cap. In 2018, shallow soils in the ESI Fence Line Area were sampled, excavated, and removed offsite for disposal as documented in an ESI post-closure monitoring report (Tetra Tech 2018b). The soil removal action was subsequently reported to Ecology as an Interim Action Work Plan (Tetra Tech et al. 2019b). Refer to Appendix B-34 for relevant figures and table for the ESI Fence Line Interim Measure Work Plan (Tetra Tech et al. 2019b).

Approximately 435 tons of PAH-contaminated soils were excavated and sent for disposal to the Columbia Ridge Landfill. Approximately 15 cubic yards of stockpiled material was segregated during excavation work, stockpiled and covered inside the ESI fence line. The stockpiled soil was re-sampled, and the waste profile was approved by Ecology. The stockpile was removed and disposed of at the Chemical Waste Management Facility, in Arlington, Oregon during August 2021. Soil confirmation samples collected from the base of the excavations are below MTCA industrial soil screening levels and MTCA-derived soil screening levels for protection of groundwater. Comparison with the recently adopted terrestrial ecological screening levels show that one of five confirmation samples collected from within the excavation (confirmation sample ESI-CONF01) exceed the 1.1 mg/kg screening level for total HMW PAHs.

Additional site reconnaissance and characterization was performed as part of WPA field activities to verify that additional waste areas are not present and to better characterize the lateral and vertical extent of soil contamination in the ESI Fence Line Area. Under the Ecology-approved Final Work Plan Addendum, this area is being investigated as an additional investigation area. Site reconnaissance included inspection of areas within 500 ft of the soil excavation area both inside and outside the ESI fence line. This specific area was informally gridded-out and transects were walked and inspected by foot along a series of north-south and east-west oriented transects at an approximately 175-foot spacing.

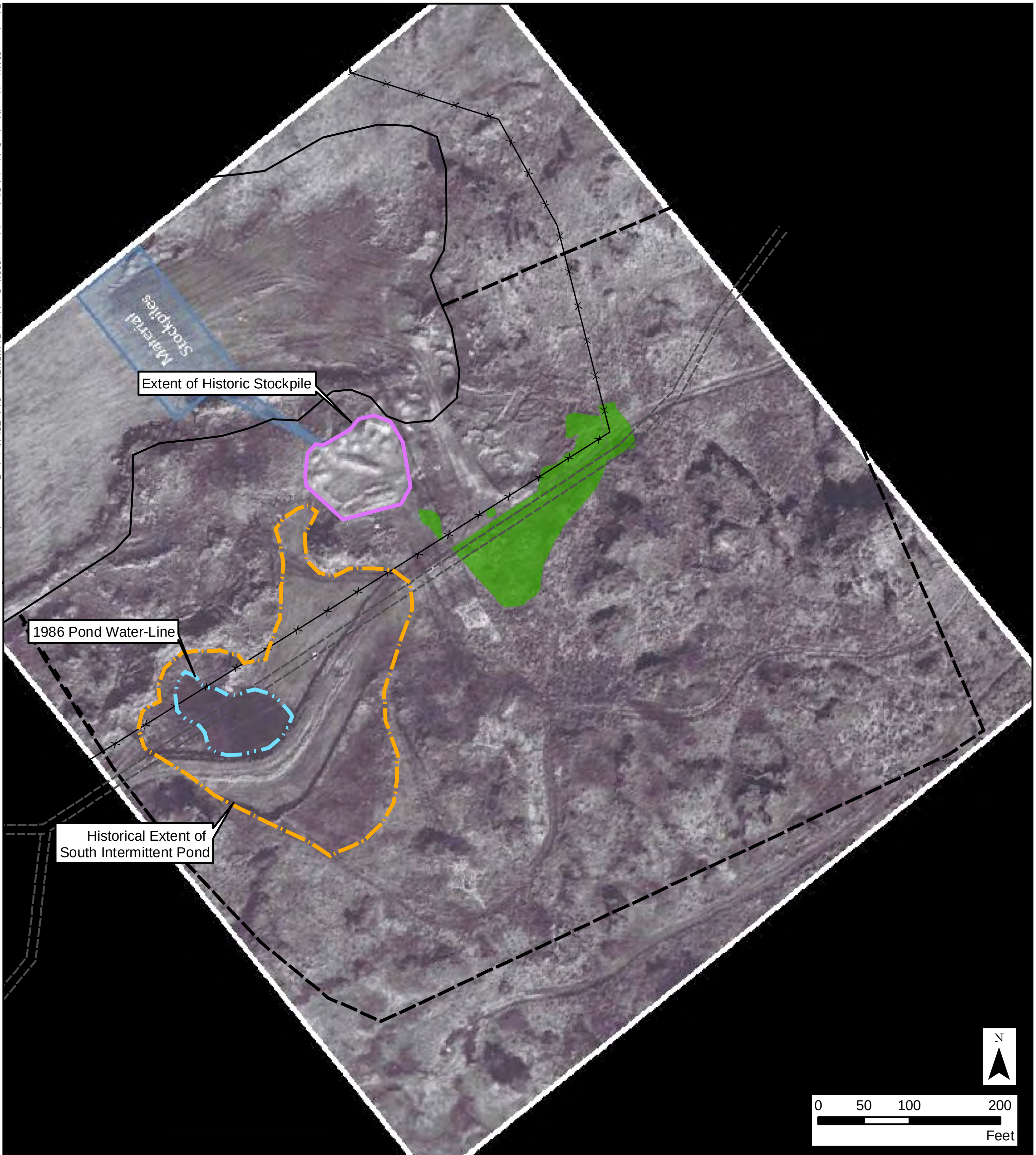
Note that the location of the South Intermittent Pond is within the site reconnaissance area for the ESI Fence Line Area. This feature represents one of three historical depressions associated with the ESI (SWMU 2). The depressions were addressed by the ESI closure around 1987 through excavation and subsequent cover placement. During the WPA site reconnaissance and project scoping, a 1986 historical aerial photograph was found that showed the South Intermittent Pond and large stockpile, and an area of disturbed soil in the ESI Fence Line Area. Figure 34-1 shows these features as well as the soil excavation area.

The initial WPA sampling program conducted during included four test pit locations within the fence line and six test pit locations outside the fence line and included collection of two soil samples at each station location based on field observations. The soil samples were analyzed for total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and diesel/oil-range petroleum hydrocarbons. The initial sampling program was implemented during Fall 2020 and was expanded during that mobilization based on the site reconnaissance and field observations. Based on the sample results and site reconnaissance findings from the fall WPA mobilization, additional surface soil and shallow subsurface sampling was performed during November 2020 and May 2021 to the east and southeast of the ESI Fence Line Area soil removal footprint and including the area of the South Intermittent Pond.

34.1 INVESTIGATION RESULTS

Completed soil sampling and test pit logs are provided in Volume 5, Appendix B-34. The laboratory data reports and data validation for the WPA data for this site are included in Appendix H-3 and I-3, respectively

The results show the widespread presence of PAH and other related soil contamination in this area extending to the north, west, and south of the former excavation area. Figure 34-2 shows the sample stations and results for the eastern portion of ESI Fence Line Area including the area surrounding the former soil removal excavation area that were initially sampled as part of the WPA during November 2020. Figure 34-3 shows the sample stations and results for areas to the west and south and including the historical footprint of the South Intermittent Pond. Investigation to the west and the south were performed during Spring 2021 to characterize the lateral extent of soil contamination.



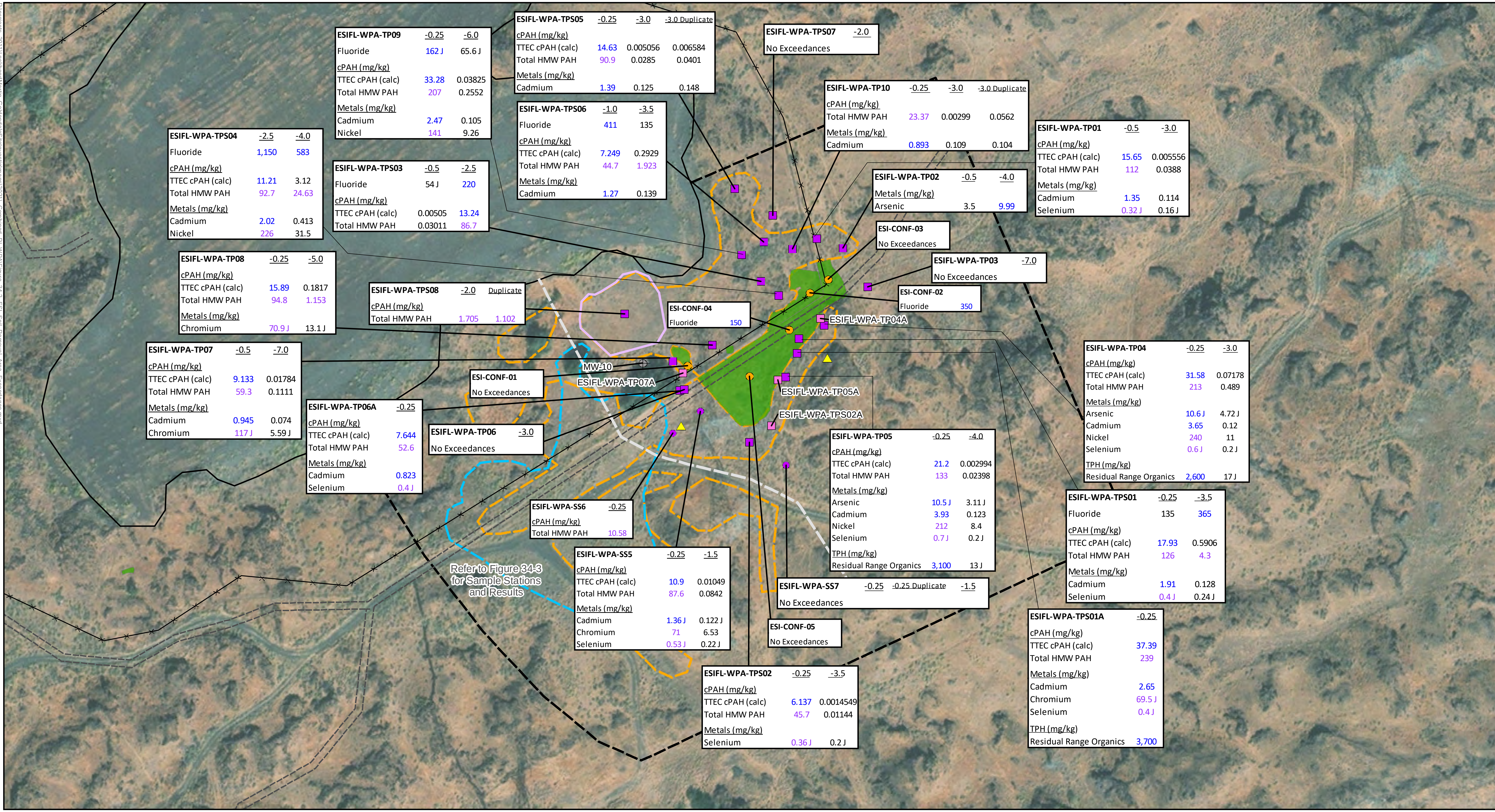
Legend

- ESI Fenceline Reconnaissance Area
- Fenceline
- Approximate Gravel Road Location
- ESI Cap Boundary
- Excavated Area

Extent of pond based on 1986 historic aerial photograph, 1986 Geraghty & Miller Final Grading Plan, and 2011 ARCADIS Groundwater Monitoring Report figure.

Figure 34-1
ESI Fence Line Area
1986 Historic Aerial Basemap
& 2018 Removal Action Area

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



WPA Sampling Location
Test Pit
Test Pit (logging only)
Suspect Area
Confirmation Sample
Monitoring Well
ESI Fenceline Reconnaissance Area
Fenceline

Figure Detail Area
Approximate Gravel Road Location
ESI Cap Boundary
Excavated Area
Historic Stockpile
Historical Extent of South Intermittent Pond
Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

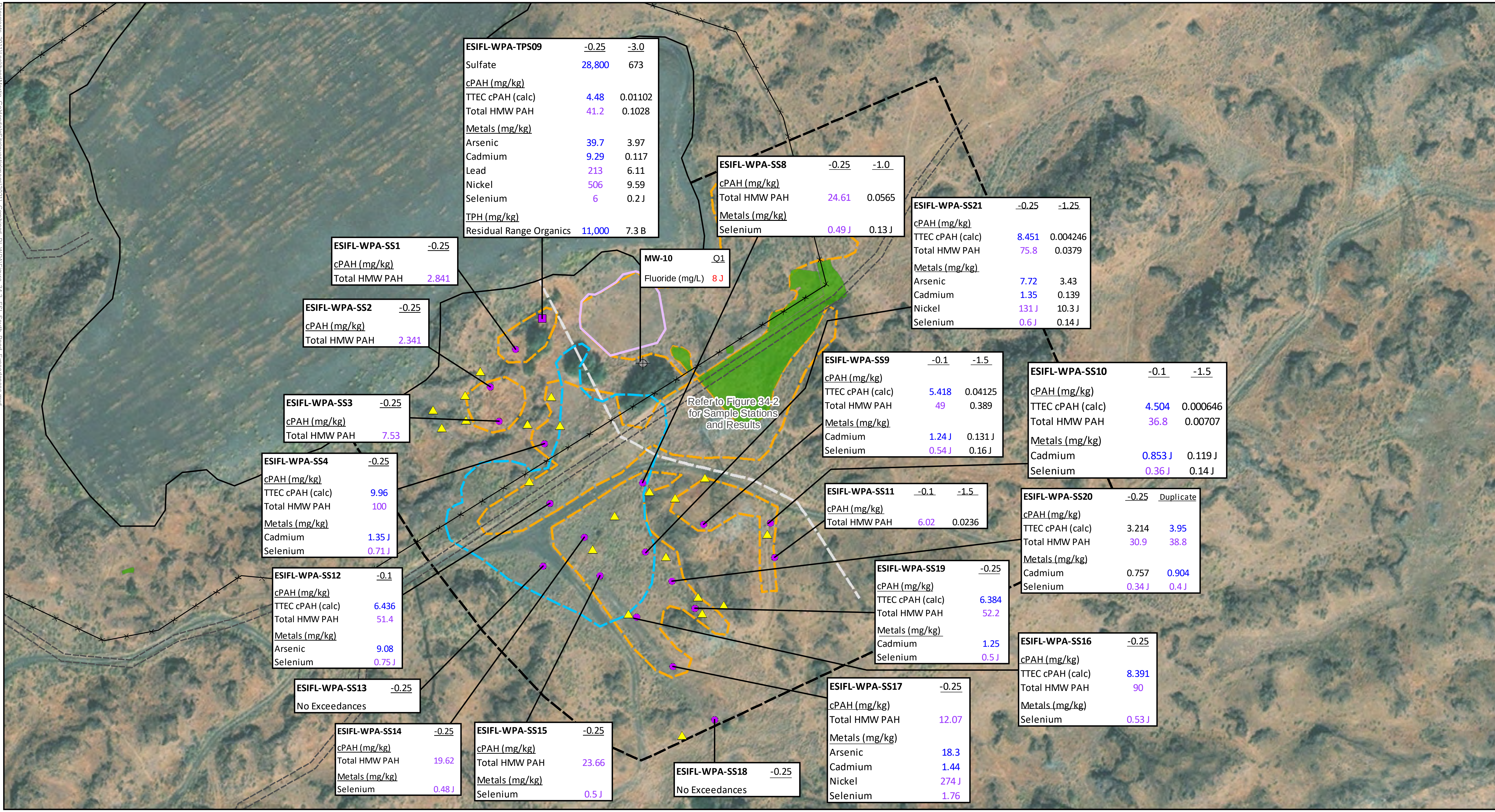
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TPH = Total Petroleum Hydrocarbons
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 34-2
ESI Fence Line, Soil Removal Adjacent Area Sampling Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington



WPA Sampling Location
Test Pit
Suspect Area
Monitoring Well
ESI Fenceline Reconnaissance Area
Fenceline
Figure Detail Area
Approximate Gravel Road Location
ESI Cap Boundary
Excavated Area
Historic Stockpile
Historical Extent of South Intermittent Pond
Approximated Lateral Extent of Soil Screening Level Exceedances

red: Exceeds MTCA Method C Soil Screening Level
cyan: Exceeds MTCA Method A Soil Screening Level (TPH Only)
blue: Exceeds MTCA Soil Screening Level for Protection of Groundwater
purple: Exceeds Terrestrial Ecological Soil Screening Level
black: Below Screening Levels

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
HMW = High Molecular Weight
PAH = Polycyclic Aromatic Hydrocarbon
TPH = Total Petroleum Hydrocarbons
TTEC (calc) = Total Toxicity Equivalent Concentration (calculated)

N W E S

0 50 100 200
Feet

Figure 34-3
ESI Fence Line, South Intermittent Pond Area Sampling Locations and Soil Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

The WPA soil sample analytical results for the ESI Fence Line Area are summarized in Table 34-1. This table includes comparison against applicable soil screening levels, including MTCA Method C, MTCA Method A Industrial (TPH only), MTCA-derived soil screening levels for protection of groundwater, and terrestrial ecologic screening levels for wildlife protection.

The fill material and appearance of contamination varies for different areas of the site as follows:

- In the adjacent areas to the south of the former excavation (e.g., station ESIFL-WPA-TP05, see Figure 34-2), the soils are typically silts underlain by basalt bedrock and the contamination typically occurs below the root zone of the grasses in the area as a gray, white-gray, or buff silt or sandy silt layer that is typically 0.5 to 2 ft thick. This material is also present inside of the ESI Fence Line between the former excavation area and the ESI cap (e.g., stations ESIFL-TP10 and -TP02, and -TPS05, see Figure 34-2), and to the east among the basalt outcrops within the ESI Fence Line (e.g., stations ESIFL-WPA-SS3 and -SS4, see Figure 34-3). The fine-grained nature of the material suggests potential for airborne deposition as a potential release mechanism.

- The area of the former 1986 stockpile within ESI Fence Line consists of gray, silty gravel, fill material that is present to the total depth that was excavated (about 3 ft bgs). The area of this fill can be seen on Figures 34-1 through 34-3. Station ESIFL-WPA-TPS08 is in this area (see Figure 34-2).

- To the northwest of the 1986 former stockpile there is an area of silty black to dark brown soil at the edge of the gravel fill and near the slope leading up to edge of the ESI cap (sample stations ESIFL-WPA-TPS09 and ESIFL-WPA-TPSS1, see Figure 34-3). This material appears to represent smelter waste (potential bag house dust or sludges) and is about 2.5 feet thick.

- The area outside of the Fence Line, including the footprint of the South Intermittent Pond consist of dense, silty, gravel fill (e.g., at stations ESFL-SS15, -SS12, -SS13, -SS15, see Figure 34-3). This area was backfilled as part of the remediation and closure of the ESI, the backfilled area can be seen through comparison of the 1986 and current aerial photographs.

- There is a northwest-southeast trending ditch (along the alignment of ESIFL-WPA-SS15, -SS16, -SS17, and -SS18, see Figure 34-3) present within the South Intermittent Pond Area. A short segment of old silt fencing was found that extends across the ditch that may have been installed during Intermittent Sludge Disposal Ponds (SWMU 3) removal action in 2007. The soil stockpile area for the SWMU 3 removal action was reportedly present in this area (URS 2008b).

Table 34-1
ESI Fence Line Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021
(Page 1 of 7)

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	ESIFL-WPA-TP01-0.5 11/10/2020	ESIFL-WPA-TP01-3.0 11/10/2020	ESIFL-WPA-TP02-0.5 11/10/2020	ESIFL-WPA-TP02-4.0 11/10/2020	ESIFL-WPA-TP03-7.0 11/10/2020	ESIFL-WPA-TP04-0.25 11/11/2020	ESIFL-WPA-TP04-3.0 11/11/2020	ESIFL-WPA-TP05-0.25 11/11/2020	ESIFL-WPA-TP05-4.0 11/11/2020	ESIFL-WPA-TP06-3.0 11/11/2020
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.44	0.07 U	0.07 U	0.07 U	0.08 U	0.25	0.07 U	0.31	0.07 U	0.07 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	147 J	62 J	62.9 J	67.8 J	12.7 J	127 J	86.3 J	83.5 J	70.2 J	32 J
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	163	82	10.5	24.1	21.3	26.1 J	1.9 J	27.3 J	1,290	302 J
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.056	0.00039 U	0.0004 U	0.00041 U	0.00043 U	0.18	0.00086 J	0.14	0.00084 J	0.00054 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.46	0.00032 U	0.00033 U	0.00033 U	0.00035 U	1	0.0029 J	0.84	0.00054 J	0.00043 J
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.01 J	0.0003 U	0.0003 U	0.00031 U	0.00033 U	0.018 J	0.0003 U	0.014 J	0.00032 U	0.00031 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.59	0.00031 U	0.00032 U	0.00032 U	0.00034 U	1.2	0.0035 J	0.91	0.00034 U	0.0004 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	7.2	0.003 J	0.00043 U	0.00047 U	0.00038 B	16	0.035	11	0.0016 B	0.0031 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	9.1	0.0034 J	0.00041 U	0.00042 U	0.00045 U	20	0.045	14	0.0016 J	0.0039 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	23	0.0075	0.00041 U	0.00042 U	0.00045 U	42	0.09	26	0.0047 J	0.0099
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	16	0.0055	0.00043 U	0.00044 U	0.00047 U	33	0.078	19	0.0043 J	0.0093
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	13	0.0043 J	0.00026 U	0.00027 U	0.00028 U	11	0.035	8.6	0.0018 J	0.0033 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	13	0.0046 J	0.00034 U	0.00034 U	0.00036 U	25	0.058	17	0.0026 J	0.0058
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	4	0.0011 J	0.00025 U	0.00026 U	0.00027 U	7.3	0.019	4.7	0.00098 J	0.002 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	12	0.0047 J	0.00068 U	0.00069 U	0.00074 U	27	0.051	17	0.0021 J	0.0043 J
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.27	0.0006 U	0.00062 U	0.00063 U	0.00067 U	0.64	0.0016 J	0.55	0.00065 U	0.00064 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	17 J	0.0052 J	0.00039 UJ	0.0004 UJ	0.00042 UJ	37	0.083	20	0.0046 J	0.0085
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.069	0.0005 U	0.00051 U	0.00052 U	0.00055 U	0.23	0.0015 B	0.19	0.0016 B	0.0012 B
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	3.8	0.0015 J	0.00064 U	0.00065 U	0.00069 U	7.8	0.019	6.1	0.0012 J	0.0023 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	9.7	0.0042 J	0.00035 U	0.00035 U	0.00038 U	22	0.046	13	0.0018 J	0.0041 J
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.12	0.00063 U	0.00065 U	0.00066 U	0.0007 U	0.35	0.001 J	0.28	0.00069 U	0.00067 U
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**15.65**	0.005556	0.0003152	0.0003262	0.0003358	**31.58**	0.07178	**21.2**	0.002994	0.006638
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	17.255	0.0062	0.0003 U	0.00031 U	0.00033 U	38.068	0.08036	25.744	0.00628	0.00917
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**112**	0.0388	0.00043	0.00047	0.00038	**213**	0.489	**133**	0.02398	0.0499
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	26,100	8,400	7,940	8,220	9,240	108,000	9,940	116,000	7,810	7,790
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	6.33	4.78	3.5	**9.99**	4.76	**10.6 J**	4.72 J	**10.5 J**	3.11 J	3.41 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**1.35**	0.114	0.092	0.131	0.057	**3.65**	0.12	**3.93**	0.123	0.099
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	13.9	9.72	9.14	9.32	11	61.8 J	11.4 J	51.4 J	8.58 J	8.37 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	19.2	12.2	11.9	14.6	12.3	63.9	14.6	63.5	12.5	13.6
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	34.6	5.4	5.32	7.25	7.17	87.3	5.03	97.7	3.8	4.89
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.035	0.005 J	0.009 J	0.004 J	0.006 J	0.068	0.007 J	0.047	0.003 J	0.005 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	85.4	10.1	9.79	10.6	8.87	**240**	11	**212**	8.4	8.31
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.32 J**	0.16 J	0.15 J	0.13 J	0.13 J	**0.6 J**	0.2 J	**0.7 J**	0.2 J	0.24 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	70.5	42.6	40.4	39.9	42.4	58	39.3	57.5	36.6	38.3
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	210 J	2 U	2.3 J	2.1 U	2.2 U	440	2.6 J	440	2.4 J	3 J
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	1,900	10 J	14 J	4.5 U	4.8 U	**2,600**	17 J	**3,100**	13 J	15 J

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 34-1
ESI Fence Line Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021
(Page 2 of 7)

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	ESIFL-WPA-TP06A-0.25 11/11/2020	ESIFL-WPA-TP07-0.5 11/11/2020	ESIFL-WPA-TP07-7.0 11/11/2020	ESIFL-WPA-TP08-0.25 11/11/2020	ESIFL-WPA-TP08-5.0 11/11/2020	ESIFL-WPA-TP09-0.25 11/11/2020	ESIFL-WPA-TP09-6.0 11/11/2020	ESIFL-WPA-TP10-0.25 11/11/2020	ESIFL-WPA-TP10-3.0 11/11/2020	ESIFL-WPA-TP44-3.0 (Duplicate of ESIFL-WPA-TP10-3.0) 11/11/2020
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.1 J	0.28	0.07 U	0.15 J	0.07 U	0.08 U	0.07 U	0.14 J	0.07 U	0.07 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	75.1 J	80.8 J	23.3 J	48.4 J	41 J	**162 J**	65.6 J	86.4 J	37 J	42.8 J
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	72.9 J	18 J	3.9 J	3.9 J	2.9 J	90.3 J	279	13.8 J	149 J	162 J
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.072	0.079	0.00053 J	0.081	0.0012 J	0.32	0.00066 J	0.0093	0.00053 J	0.00064 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.32	0.41	0.0008 J	0.48	0.0054	1.9	0.0018 J	0.079	0.00048 J	0.00058 J
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0068	0.005 J	0.0003 U	0.0051 J	0.0003 U	0.018 J	0.00029 U	0.0017 J	0.00029 U	0.0003 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.42	0.41	0.0006 J	0.77	0.0072	2.8	0.0022 J	0.13	0.0003 U	0.00058 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	5	5.7	0.0087	10	0.09	21	0.02	1.5	0.00052 B	0.0044 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	4.9	6.1	0.012	11	0.12	23	0.025	1.9	0.0004 U	0.0056
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	12	12	0.023	19	0.23	40	0.045	5	0.0006 J	0.01 J
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	6.5	8.1	0.016	9.3	0.17	22	0.04	3.6	0.00059 J	0.0082 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	2.1	2.1	0.0069	6	0.072	11	0.018	1.7	0.00025 U	0.0043 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	8.4	8.3	0.013	14	0.14	29	0.033	2.8	0.00032 U	0.0068
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.4	1.7	0.0035 J	2.5	0.041	4.9	0.0082	0.77	0.00024 U	0.0019 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	7.5	8.6	0.013	15	0.13	40	0.03	2.1	0.00083 J	0.0067 J
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.19	0.29	0.0006 U	0.35	0.003 J	1.2	0.001 J	0.044	0.00059 U	0.00061 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	6.1	8	0.015	10	0.17	23	0.038	4.1	0.00066 J	0.009 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.063	0.086	0.0012 B	0.091	0.0016 B	0.56	0.0011 B	0.013	0.0011 B	0.0012 B
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	2.8	3.7	0.0049 J	5.9	0.044	16	0.011	0.7	0.0013 J	0.0032 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	6.2	7.3	0.013 J	13	0.12	33	0.028	2	0.00062 B	0.006 J
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.11	0.16	0.00063 U	0.2	0.0019 J	0.62	0.00064 J	0.02	0.00062 U	0.00064 U
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**7.644**	**9.133**	0.01784	**15.89**	0.1817	**33.28**	0.03825	3.235	0.0004041	0.008628
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	11.3718	13.58	0.02103	22.6771	0.1924	62.798	0.04776	3.077	0.00424	0.0129
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**52.6**	**59.3**	0.1111	**94.8**	**1.153**	**207**	0.2552	**23.37**	0.00299	0.0562
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	44,100	182,000	6,780	88,800	10,200	115,000	9,310	19,900	7,820	8,250
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4.57 J	3.24 J	2.76 J	2.79 J	3.82 J	3.74 J	4.7 J	4.63 J	5.33 J	4.85 J
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**0.823**	**0.945**	0.074	0.571	0.102	**2.47**	0.105	**0.893**	0.109	0.104
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	31 J	**117 J**	5.59 J	**70.9 J**	13.1 J	55.7 J	8.08 J	11.2 J	9.51 J	9.73 J
Copper	mg/Kg	NA	140,000	217	280	217	28.4	41.6	165	16.5	81.2	17.6	110	17.4	15.1	11.2	11.1
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	18.9	24.3	3.64	15.4	5.39	60.2	5.23	22.5	4.89	4.81
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.017 J	0.008 J	0.003 J	0.008 J	0.005 J	0.081	0.006 J	0.028	0.002 J	0.002 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	48.2	60.5	6.93	34.5	11.9	**141**	9.26	59.2	9.83	9.87
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.4 J**	0.3 J	0.2 J	0.2 J	0.2 J	0.3 J	0.18 J	0.3 J	0.1 J	0.15 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	74.2	41.6	45.8	59.3	45.4	142	42.3	45.9	40.5	39.8
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	110	170 J	2 U	320	3.9 J	880	2.3 J	47	2 U	2 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	640	790 J	8.4 J	1,400	20 J	**4,200**	8.9 J	320	8.2 J	9.9 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 34-1
ESI Fence Line Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: ESIFL-WPA-TPS01-0.25 11/11/2020	ESIFL-WPA-TPS01-3.5 11/11/2020	ESIFL-WPA-TPS01A-0.25 11/11/2020	ESIFL-WPA-TPS02-0.25 11/11/2020	ESIFL-WPA-TPS02-3.5 11/11/2020	ESIFL-WPA-TPS03-0.5 11/10/2020	ESIFL-WPA-TPS03-2.5 11/11/2020	ESIFL-WPA-TPS04-2.5 11/11/2020	ESIFL-WPA-TPS04-4.0 11/11/2020	ESIFL-WPA-TPS05-0.25 11/12/2020
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.2 J	0.07 U	0.18 J	0.17 J	0.07 U	0.07 U	0.09 J	0.07 U	0.07 U	0.08 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	135	**365**	90 J	63.2 J	35.9	54 J	**220**	**1,150**	**583**	119
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	256	1,480	18.8 J	207 J	809	7.3	22.4	68.1	110	38.9
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.15	0.0041 J	0.4	0.028	0.00096 J	0.0004 U	0.14	0.0095	0.026	0.14
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.87	0.018	2.1	0.16	0.00044 J	0.00033 U	0.63	0.062	0.11	0.69
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.013 J	0.00044 J	0.023 J	0.0064	0.00031 U	0.00031 U	0.0073	0.0034 J	0.0015 J	0.0072
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.95	0.023	2.4	0.21	0.00032 U	0.00032 U	0.68	0.11	0.14	1.2
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	11	0.3	22	2.6	0.0012 B	0.0029 J	8.1	4.4	1.7	9.8
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	11	0.35	25	3.6	0.0008 J	0.0035 J	8.7	6.1	1.8	10
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	25	0.91	46	7.9	0.002 J	0.0055	17	20	5.4	17
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	17	0.58	29	9.1	0.0019 J	0.0039 J	11	15	3.5	9.9
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	8.6	0.35	16	3.5	0.00076 J	0.0024 J	5.5	7.4	1.4	5.8
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	16	0.66	33	4.7	0.00099 J	0.0039 J	13	18	4.7	13
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	4.1	0.16	6.6	1.8	0.00039 J	0.00061 J	2.5	3.5	0.73	2.4
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	17	0.4	40	4.3	0.0015 J	0.004 J	13	4.8	3.1	16
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.55	0.011	1.4	0.1	0.00063 U	0.00062 U	0.47	0.031	0.062	0.39
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	19	0.62	30	9.1	0.0021 J	0.0037 J	11	14	3.5	10
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.21	0.0066	0.55	0.044	0.0016 B	0.00054 J	0.17	0.013	0.046	0.23
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	6.5	0.14	17	1.2	0.0012 J	0.0016 J	5.2	0.68	0.85	6.5
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	14	0.37	31	3.4	0.0013 B	0.0037 J	9.9	4.3	1.9	13
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.27	0.0056	0.73	0.058	0.00067 U	0.00065 U	0.26	0.015	0.033	0.22
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	**17.93**	0.5906	**37.39**	**6.137**	0.0014549	0.00505	**13.24**	**11.21**	3.12	**14.63**
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	26.243	0.60314	63.873	6.0484	0.0057	0.00614	20.2973	5.7089	4.3355	25.1572
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**126**	**4.3**	**239**	**45.7**	0.01144	0.03011	**86.7**	**92.7**	**24.63**	**90.9**
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	62,600	9,150	117,000	21,200	7,870	8,680	30,300	66,000	14,500	81,500
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	6.18 J	3.32 J	5.96 J	4.86 J	4.86 J	4.2	4.78 J	5.1 J	5.76 J	1.27
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	**1.91**	0.128	**2.65**	0.809	0.109	0.105	0.795	**2.02**	0.413	**1.39**
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	35.5 J	9.6 J	**69.5 J**	16.1 J	8.04 J	9.55	19.5	8.52	13.3	13.7
Copper	mg/Kg	NA	140,000	217	280	217	28.4	41.8	12.6	71	19.2	12.7	11.9	23.6	11	15.3	35.8
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	45.5	4.75	57.4	19.6	4.26	5.45	19.3	68.4	11.4	36.3
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.025	0.006 J	0.039	0.01 J	0.005 J	0.004 J	0.017 J	0.02 J	0.012 J	0.01 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	106	11	129	50.8	8.62	9.54	48.6	**226**	31.5	85.7
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.4 J**	0.24 J	**0.4 J**	**0.36 J**	0.2 J	0.17 J	0.3 J	0.2 J	0.2 J	0.1 U
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	56.8	35.6	63.6	97.4	39.3	42.4	46.4	34.2	46.6	54
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	320	20 J	770	61	2.1 U	3 J	160 J	87 J	26	380 B
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	1,700	110	**3,700**	530	7.9 J	17 J	760 J	880 J	200	1,700

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 34-1
ESI Fence Line Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021
(Page 4 of 7)

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results ESIFL-WPA-TPS05-3.0 11/12/2020	ESIFL-WPA-TPS45-3.0 (Duplicate of ESIFL-WPA-TPS05-3.0) 11/12/2020	ESIFL-WPA-TPS06-1.0 11/12/2020	ESIFL-WPA-TPS06-3.5 11/12/2020	ESIFL-WPA-TPS07-2.0 11/12/2020	ESIFL-WPA-TPS08-2.0 11/12/2020	ESIFL-WPA-TPS46-2.0 (Duplicate of ESIFL-WPA-TPS08-2.0) 11/12/2020	ESIFL-WPA-TPS09-0.25 11/12/2020	ESIFL-WPA-TPS09-3.0 11/12/2020
Aluminum Smelter																
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.19 J	0.07 U	0.08 U	0.07 U	0.07 U	0.09 U	0.07 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	40.2	47.1	**411**	135	78.1	21.7	24.5	45.3	60.4
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	1 U	1 U	199	161	1.2 J	1 U	2.8	**28,800**	673
Polycyclic Aromatic Hydrocarbons (PAHs)																
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.00053 B	0.0024 J	0.026	0.0016 B	0.00088 B	0.0043 J	0.00094 B	0.14	0.00054 B
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.00051 B	0.00052 B	0.15	0.0091	0.0013 B	0.0045 J	0.0034 J	0.079	0.001 B
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0003 U	0.0003 U	0.0033 J	0.00031 J	0.00036 J	0.00069 J	0.00058 J	0.37	0.00031 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.0005 J	0.00068 J	0.27	0.019	0.0019 J	0.0071	0.0044 J	0.46	0.00072 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0027 J	0.0039 J	3.6	0.15	0.018	0.08 J	0.053 J	1.1	0.0029 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.0036 J	0.0045 J	4.9	0.19	0.022	0.11	0.075	2.4	0.0057
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0048 J	0.0072	8.8	0.37	0.048	0.3	0.2	5.4	0.011
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0034 J	0.0047 J	6.5	0.25	0.027	0.43 J	0.27 J	10	0.028
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0023 J	0.0029 J	2.1	0.15	0.019	0.096	0.068	2.2	0.0057
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0036 J	0.0054	5.9	0.26	0.03	0.26 J	0.17 J	7	0.013
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0008 J	0.0013 J	1.5	0.063	0.0076	0.059 J	0.038 J	1.6	0.0053 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.0047 J	0.0063	5.4	0.24	0.028	0.11 J	0.067 J	1.6	0.0038 B
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0006 U	0.00063 J	0.09	0.0058	0.0011 J	0.0026 J	0.0027 J	0.13	0.00079 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.0036 J	0.005 J	6.9	0.27	0.03	0.26 J	0.16 J	9.8	0.027
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.00087 B	0.0027 J	0.038	0.002 B	0.0015 B	0.0043 J	0.0015 B	0.25	0.00094 B
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0041 B	0.0052 B	1.3	0.089	0.011	0.036	0.027	1.1	0.0048 B
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.0037 J	0.0052	4.5	0.22	0.024	0.11 J	0.068 J	1.7	0.0042 J
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.00063 U	0.00063 U	0.044	0.0029 J	0.00073 U	0.0017 J	0.0018 J	0.36	0.00069 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.005056	0.006584	**7.249**	0.2929	0.03456	0.1921	0.1286	**4.48**	0.01102
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.01121	0.01843	7.2773	0.36681	0.04604	0.16949	0.10752	4.129	0.01259
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	0.0285	0.0401	**44.7**	**1.923**	0.2256	**1.705**	**1.102**	**41.2**	0.1028
Metals																
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	11,200	11,200	59,200	11,100	10,400	8,630	8,990	33,900	8,480
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	4.11	4.15	3.98	3.85	2.56	3.26	3.86	**39.7**	3.97
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.125	0.148	**1.27**	0.139	0.133	0.15	0.147	**9.29**	0.117
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	15.6	19.1	21.7	13.2	11.1	9.17	9.26	19.9	9.4
Copper	mg/Kg	NA	140,000	217	280	217	28.4	14.7	16	29.7	15.7	15.5	16.4	16	17.4	13.6
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	6.08	6.06	34.6	6.44	5.09	6.59	6.23	**213**	6.11
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.007 J	0.007 J	0.067	0.012 J	0.009 J	0.004 J	0.003 J	0.021 J	0.003 J
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	11.5	12	91.7	12.9	8.53	10.3	11.9	**506**	9.59
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	0.25 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	0.2 J	**6**	0.2 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	49.2	48.4	55.3	45.5	53.9	55.1	55.6	61.9	48.1
Total Petroleum Hydrocarbons (TPHs)																
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	1.9 U	1.9 U	140 B	6.8 B	3.3 B	2.6 B	2.9 B	660 B	2 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	8 B	8.3 B	1,100 J	60 B	15 B	18 B	20 B	**11,000**	7.3 B

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	ESIFL-WPA-SS1-0.25 5/3/2021	ESIFL-WPA-SS2-0.25 5/3/2021	ESIFL-WPA-SS3-0.25 5/3/2021	ESIFL-WPA-SS4-0.25 5/3/2021	ESIFL-WPA-SS5-0.25 5/4/2021	ESIFL-WPA-SS5-1.5 5/4/2021	ESIFL-WPA-SS6-0.25 5/4/2021	ESIFL-WPA-SS7-0.25 5/4/2021	ESIFL-WPA-SS63-0.25 (Duplicate of ESIFL-WPA-SS7-0.25) 5/4/2021	ESIFL-WPA-SS7-1.5 5/4/2021
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.41	0.07 U	0.12 J	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	6.2 J	6.2	21.1	76.3	102	61.1	29.2	21.9	19.4	18.9
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	2.1	2	33.2	39.5	18.7	6.6	36.1	1.7 J	1.9 J	2.4
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0016 J	0.0012 J	0.0034 J	0.017	0.054	0.00044 J	0.021	0.00039 U	0.00044 J	0.0004 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.017	0.012	0.036	0.086	0.3	0.0004 J	0.085	0.00066 J	0.0011 J	0.00033 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0007 J	0.00045 J	0.00095 J	0.024	0.017	0.00029 U	0.0058	0.00029 U	0.00028 UJ	0.00031 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.02	0.016	0.039	0.15	0.44	0.0011 J	0.066	0.00081 J	0.0013 J	0.00032 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.24	0.18	0.5	2.7	5.1	0.0035 J	0.75	0.0097 J	0.016 J	0.0016 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.35	0.3	0.78	4.9	6.5	0.0061	0.93	0.013 J	0.027 J	0.0023 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.55	0.48	1.3	14	14	0.014	2	0.033 J	0.056 J	0.0036 J
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.35	0.31	1.4	31	19	0.02	2	0.043	0.064 J	0.0034 J
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	0.19	0.16	0.5	4.7	4.9	0.0052	0.6	0.015	0.02 J	0.0013 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.37	0.26	0.75	11	11	0.01	1.5	0.018 J	0.028 J	0.0026 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.071	0.061	0.24	4.1	2.9	0.0032 J	0.3	0.0069 J	0.012 J	0.00025 U
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.3	0.24	0.59	3.6	6.5	0.004 J	0.88	0.013 J	0.024 J	0.0018 J
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0074	0.0051 J	0.017	0.052	0.2	0.00059 U	0.043	0.00059 U	0.00082 J	0.00062 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	0.35	0.31	1.3	24	16	0.017	1.4	0.039	0.055 J	0.003 J
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0029 J	0.0023 J	0.0071	0.023	0.094	0.00063 J	0.014	0.00057 J	0.00083 J	0.00052 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.13	0.095	0.26	0.9	2.7	0.0027 J	0.44	0.0048 J	0.0092 J	0.00091 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.37	0.28	0.76	3.7	8.2	0.0052	1.1	0.016	0.022 J	0.0021 J
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.0052	0.0037 J	0.012	0.061	0.14	0.00062 U	0.027	0.00062 U	0.00071 J	0.00065 U
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	0.4938	0.4217	1.1715	**9.96**	**10.9**	0.01049	1.45	0.02354	0.04318	0.0032885
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.4796	0.37205	0.95345	4.852	10.305	0.00927	1.5548	0.01984	0.03769	0.00323
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**2.841**	**2.341**	**7.53**	**100**	**87.6**	0.0842	**10.58**	0.1936	0.3	0.0199
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	8,340	8,990	9,300	21,600	93,700	6,780	9,850	5,930	6,500	6,240
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	2.56	3.29	2.66	6.91	6.71	2.55	4.14	2.77	2.71	2.2
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.195 J	0.163 J	0.253 J	**1.35 J**	**1.36 J**	0.122 J	0.26 J	0.129 J	0.138 J	0.11 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	7.51	9.82	8.47	12.5	**71**	6.53	10.3	7.71	8.52	7.39
Copper	mg/Kg	NA	140,000	217	280	217	28.4	15.9	17.6	15.5	12.6	104	12.4	14.4	11.6	11.9	11.4
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	5.65	6.74	8.32	37.6	37.7	4.28	9.07	5.03	5.68	4.34
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.005 U	0.004 U	0.005 U	0.012 J	0.011 J	0.005 U	0.019	0.004 U	0.005 U	0.005 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	8.9	9.88	16.1	91.7	91.5	7.15	20.3	8.8	9.41	8.43
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	0.13 J	0.2 J	0.2 J	**0.71 J**	**0.53 J**	0.22 J	0.3 J	0.11 J	0.12 J	0.12 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	51.2	49.5	50.7	58	59.9	40.3	48.8	45	47.7	41
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	7.5 B	8.5 B	17 J	65	110	4 B	19 J	5.3 B	4.7 B	4.2 B
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	32 J	41 J	210	1,300	1,100	11 B	130	28 B	30 J	13 B

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Table 34-1
ESI Fence Line Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021

Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Ecological Indicator: Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results: ESIFL-WPA-SS8-0.25 5/5/2021	ESIFL-WPA-SS8-1.0 5/5/2021	ESIFL-WPA-SS9-0.1 5/5/2021	ESIFL-WPA-SS9-1.5 5/5/2021	ESIFL-WPA-SS10-0.1 5/5/2021	ESIFL-WPA-SS10-1.5 5/5/2021	ESIFL-WPA-SS11-0.1 5/5/2021	ESIFL-WPA-SS11-1.5 5/5/2021	ESIFL-WPA-SS12-0.1 5/5/2021	ESIFL-WPA-SS13-0.25 5/5/2021
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.06 U	0.06 U	0.08 J	0.07 U	0.095 J	0.06 U	0.06 U	0.06 U	0.067 J	0.06 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	71.3	19.4	59.8	36.1	55.3	27.6	38.6	20.6	66.5	16
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	7.6	2.1 J	7.3	7.9	7.6	1.3 J	2.2	2.3	8.5	1.7 J
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0025 J	0.00039 U	0.0074	0.00041 U	0.01	0.0004 U	0.0012 J	0.00042 J	0.0056	0.00051 J
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.031	0.00041 J	0.078	0.00071 J	0.081	0.00032 U	0.013	0.00054 J	0.088	0.0045 J
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.0028 J	0.0003 U	0.012	0.00031 U	0.007	0.0003 U	0.0018 J	0.00029 U	0.0054	0.00033 J
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.042	0.00036 J	0.11	0.00081 J	0.095	0.00031 U	0.016	0.0003 U	0.1	0.0033 J
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.81	0.0043 J	1.8	0.012	1.6	0.00085 J	0.31	0.002 J	1.9	0.049
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	1.4	0.0046 J	2.6	0.019	2.4	0.00041 U	0.51	0.0035 J	3.6	0.074
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	3.4	0.011	8.3	0.064	6.7	0.0023 J	1.2	0.0047 J	7.2	0.13
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	6.8	0.0089	12	0.093	7.8	0.0019 J	1.1	0.003 J	13	0.099
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.9	0.0038 J	4.6	0.038	3.5	0.00082 J	0.49	0.0015 J	3.6	0.045
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	1.5	0.0062	3.8	0.035	3.4	0.0012 J	0.58	0.0027 J	3.6	0.078
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1.2	0.0017 J	2.1	0.014	1.5	0.00025 U	0.21	0.00024 U	2.3	0.019
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.94	0.0059	2.4	0.019	2	0.00067 U	0.39	0.0025 J	2.6	0.077
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.012	0.00061 U	0.034	0.00063 U	0.039	0.00061 U	0.0044 J	0.00059 U	0.038	0.0015 J
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	6.3	0.0094	11	0.091	7.4	0.00039 U	1.1	0.0028 J	13	0.11
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0041 J	0.0005 U	0.012	0.00052 U	0.016	0.0005 U	0.0018 J	0.00049 U	0.01	0.00075 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.32	0.0025 J	0.76	0.0058	0.73	0.00065 J	0.12	0.0015 J	0.9	0.027
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	1.3	0.0066	2.8	0.023	2.5	0.00034 U	0.52	0.0034 J	3.2	0.087
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.012	0.00064 U	0.03	0.00066 U	0.03	0.00064 U	0.0038 J	0.00062 U	0.033	0.0011 J
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	2.776	0.007682	**5.418**	0.04125	**4.504**	0.000646	0.8468	0.004639	**6.436**	0.11008
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	1.3544	0.00917	3.4134	0.02632	2.978	0.00065	0.5482	0.00496	3.747	0.11489
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**24.61**	0.0565	**49**	0.389	**36.8**	0.00707	**6.02**	0.0236	**51.4**	0.691
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	12,800	7,480	19,600	11,400	15,200	7,840	12,100	10,300	19,800	7,750
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	5.51	2.79	6.76	4.06	5.13	2.96	3.27	3.47	**9.08**	2.95
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.621 J	0.126 J	**1.24 J**	0.131 J	**0.853 J**	0.119 J	0.331 J	0.151 J	0.643 J	0.108 J
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	11.1	7.2	16.5	17.6	13.7	9.43	12.8	14.5	17.8	11.1
Copper	mg/Kg	NA	140,000	217	280	217	28.4	14.2	14.9	15.4	16.2	17.3	14.2	14.1	16	20.2	11.7
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	27.5	4.99	33.1	6.04	21.3	5.18	8.99	5.96	41.5	5.37
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.005 J	0.003 U	0.011 J	0.005 J	0.007 J	0.005 U	0.004 U	0.005 U	0.01 J	0.004 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	64.7	9.04	90	11.7	59.9	9.48	22.5	12.6	109	10.5
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.49 J**	0.13 J	**0.54 J**	0.16 J	**0.36 J**	0.14 J	0.18 J	0.1 J	**0.75 J**	0.1 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	71.4	52.3	103	48.1	108	48.1	79	49.2	77.8	46.6
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	15 J	3.5 B	51	3.3 B	25	3.4 B	15 J	3.6 B	31	5 B
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	240	11 B	1,100	7.7 B	380	11 B	190	13 B	400	22 B

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
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CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram
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NA = Not Applicable
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SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Table 34-1
ESI Fence Line Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020 and May 2021

				Ecological Indicator				Analytical Results									
Parameter Name	Units	MTCA Method A Industrial	MTCA Method C	Eco-SSL Wildlife	Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	ESIFL-WPA-SS14-0.25 5/5/2021	ESIFL-WPA-SS15-0.25 5/5/2021	ESIFL-WPA-SS16-0.25 5/5/2021	ESIFL-WPA-SS17-0.25 5/5/2021	ESIFL-WPA-SS18-0.25 5/5/2021	ESIFL-WPA-SS19-0.25 5/5/2021	ESIFL-WPA-SS20-0.25 5/5/2021	ESIFL-WPA-SS64-0.25 (Duplicate of ESIFL-WPA-SS20-0.25) 5/5/2021	ESIFL-WPA-SS21-0.25 5/5/2021	ESIFL-WPA-SS21-1.25 5/5/2021
Aluminum Smelter																	
Cyanide[b]	mg/Kg	NA	2,200	5.0	1.9	1.9	NE	0.07 U	0.07 U	0.06 U	0.06 U	0.06 U	0.1 J	0.084 J	0.082 J	0.114 J	0.06 U
Fluoride	mg/Kg	NA	210,000	NE	147.6[c]	147.6	14.11	54.3 J	68.8	65	74.6	4.4	59.5	52.8	54.4	67.8	20.2
Sulfate	mg/Kg	NA	NE	NE	2,150[c]	2,150	NE	6.7	7.7	7.6	44.5	1.4 J	7.3	6.9	7.4	8.2	2.4
Polycyclic Aromatic Hydrocarbons (PAHs)																	
2-Methylnaphthalene	mg/Kg	NL	14,000	NL	1.7	1.7	NE	0.0012 J	0.0024 J	0.0072	0.0071	0.00037 U	0.011	0.0065	0.007	0.011	0.00038 U
Acenaphthene	mg/Kg	NA	210,000	NL	98	98	NE	0.0074	0.029	0.076	0.087	0.00059 J	0.095	0.046	0.05	0.099	0.00031 U
Acenaphthylene	mg/Kg	NA	NE	NL	NE	NL	NE	0.002 J	0.0025 J	0.0088	0.0014 J	0.00028 U	0.0084	0.0062	0.0076	0.013	0.00029 U
Anthracene	mg/Kg	NA	NE	NL	2,300	2,300	NE	0.017	0.044	0.11	0.09	0.0005 J	0.11	0.07	0.083	0.13	0.0003 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	0.35	0.76	1.8	1.1	0.0075	2	1	1.2	2.5	0.0014 J
Benzo(a)pyrene	mg/Kg	2.0	NL	NL	NL	NL	NE	0.97	1.2	3.2	1.6	0.014	3.4	1.5	1.8	4.4	0.0023 J
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	2.7	3	9.9	2.4	0.031	9.3	4.6	5.5	12	0.0052
Benzo(ghi)perylene	mg/Kg	NA	NE	NL	NE	NL	NE	5.8	6.9	28	1.4	0.058	12	8.5	11	21	0.011
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NL	NE	1.5	1.5	6.9	0.75	0.0092	4.8	1.9	2.6	4.9	0.0025 J
Chrysene	mg/Kg	NL	NL	NL	NL	NL	NE	0.91	1.5	4.1	1.4	0.017	4.4	2.4	3	7.1	0.0036 J
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NL	NE	1 J	1.2	4.9	0.32	0.005	2.3	1.6	1.9	3.4	0.0013 J
Fluoranthene	mg/Kg	NA	140,000	NL	630	630	NE	0.35	0.88	2.3	1.3	0.01	2.5	1.2	1.3	2.8	0.0015 J
Fluorene	mg/Kg	NA	140,000	NL	100	100	NE	0.0043 J	0.014	0.036	0.042	0.00057 U	0.043	0.023	0.026	0.051	0.00058 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NL	NE	5.8	6.4	28	1.5	0.045	11	7.8	10	17	0.0087
Naphthalene	mg/Kg	5.0	70	NL	4.5	4.5	NE	0.0023 J	0.0044 J	0.013	0.015	0.00049 J	0.015	0.01	0.011	0.014	0.00049 J
Phenanthrene	mg/Kg	NA	NE	NL	NE	NL	NE	0.11	0.32	0.84	0.6	0.0038 J	0.85	0.45	0.51	0.92	0.00074 J
Pyrene	mg/Kg	NA	110,000	NL	650	650	NE	0.59	1.2	3.2	1.6	0.014	3	1.6	1.8	3.5	0.0019 J
Dibenzofuran	mg/Kg	NA	NL	NL	NL	NL	NE	0.0071	0.014	0.047	0.025	0.0006 U	0.035	0.022	0.026	0.045	0.00061 U
Total TEC cPAH (calc)	mg/Kg	2.0	130	NE	3.9	3.9	NE	2.1141	2.501	**8.391**	2.221	0.02394	**6.384**	3.214	**3.95**	**8.451**	0.004246
LMW PAH	mg/Kg	NA	NE	100	NE	100	NE	0.4942	1.2963	3.391	2.1425	0.01538	3.6324	1.8117	1.9946	4.038	0.00273
HMW PAH	mg/Kg	NA	NE	1.1	NE	1.1	NE	**19.62**	**23.66**	**90**	**12.07**	0.2007	**52.2**	**30.9**	**38.8**	**75.8**	0.0379
Metals																	
Aluminum	mg/Kg	NA	3,500,000	NE	480,000	480,000	28,299	14,100 J	14,900 J	15,500 J	40,500 J	7,500 J	18,100 J	14,100 J	14,700 J	21,400 J	7,630 J
Arsenic	mg/Kg	20	88	132	2.9	7.61	7.61	5.91	6.48	7.17	**18.3**	4.21	7.28	5.3	5.71	**7.72**	3.43
Cadmium	mg/Kg	2.0	3,500	14	0.69	0.81	0.81	0.399	0.49	0.554	**1.44**	0.13	**1.25**	0.757	**0.904**	**1.35**	0.139
Chromium	mg/Kg	2,000	5,300,000	67	490,000	67	31.88	9.95	14.1	14.8	25.4	9.05	13.6	12	12.5	12.9	8.27
Copper	mg/Kg	NA	140,000	217	280	217	28.4	16.5	16	17.6	32.4	15.4	14.1	12.8	13.1	16.8	14.9
Lead	mg/Kg	1,000	NE	118	3,000	118	13.1	25.6	26.9	29.4	107	4.78	33.7	20.9	25.3	37.1	5.7
Mercury	mg/Kg	2.0	NE	5.5	2.1	2.1	0.04	0.002 U	0.002 U	0.001 B	0.015 J	0.002 U	0.009 J	0.005 B	0.009 J	0.007 B	0.002 U
Nickel	mg/Kg	NA	70,000	980	130	130	24.54	62.9 J	68.4 J	75.3 J	**274 J**	9.93 J	115 J	61 J	71.3 J	**131 J**	10.3 J
Selenium	mg/Kg	NA	18,000	0.3	5.2	0.3	0.29	**0.48 J**	**0.5 J**	**0.53 J**	**1.76**	0.13 J	**0.5 J**	**0.34 J**	**0.4 J**	**0.6 J**	0.14 J
Zinc	mg/Kg	NA	1,100,000	360	6,000	360	80.91	57.9	64.8	68.9	109	43.4	69.2	65.7	68.8	67.9	51
Total Petroleum Hydrocarbons (TPHs)																	
Diesel Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	5.5 J	19 J	30	19 J	3 J	22 J	20 J	24 J	32	1.9 U
Residual Range Organics	mg/Kg	2,000	NE	2,000	NA	2,000	NA	91 J	260	710	140	18 J	260	310	370	470	13 J

Notes:
Bold and shaded values denote exceedances of one or more screening levels and background concentrations.
a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.
b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.
c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).
B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.
J = The result is an estimated value.
U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.
UJ = Chemical was not detected. The associated limit is estimated.
CLARC = Cleanup Level and Risk Calculations
cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram
MTCA = Model Toxics Control Act
NA = Not Applicable
NE = Not Established
NL = Not Listed
PAHs = Polycyclic Aromatic Hydrocarbon
SSL = Soil Screening Level
TPH = Total Petroleum Hydrocarbons
Total TEC = Total Toxicity Equivalent Concentration

Shallow soil contamination is widespread in this area in the top 0.5 ft to 2 ft of soil exceeding screening levels. In general, surface soil samples exhibit higher concentrations than the underlying samples at a given station. In many cases, the contaminated interval can be identified based on soil color and texture. The distribution of chemicals of potential concern are summarized as follows:

- PAHs are the most widespread chemical of concern at the site and exceed MTCA-derived soil screening level of 3.9 mg/kg as TTEC cPAH in 24 of 69 samples. PAHs exceed the terrestrial ecological screening levels for wildlife protection in 41 of 69 samples. None of the samples exceeded the MTCA Method C soil screening level of 130 mg/kg as TTEC cPAH.

- Fluoride was detected at concentrations above MTCA-derived soil screening level for protection of groundwater of 147.6 mg/kg in 6 of 69 samples.

- Sulfate exceeded the MTCA-derived soil screening level protective of groundwater of 2,150 mg/kg in 1 of 69 samples (station ESIFL-WPA-TPS09-0.25, 28,800 mg/kg).

- Total cyanide did not exceed screening levels in any of the collected samples.

- Of petroleum hydrocarbons, residual-range organics exceeded MTCA Method A Industrial Cleanup Levels in 5 of 61 samples.

- Among metals, arsenic (maximum of 39.7 mg/kg), cadmium (maximum of 9.29 mg/kg), nickel (maximum of 506 mg/kg), and selenium (maximum of 6 mg/kg) exceed screening levels for protection of groundwater. Chromium (maximum of 117 mg/kg), and lead (maximum of 213 mg/kg) exceed terrestrial ecologic screening levels protective of wildlife. Selenium also exceeds terrestrial ecological levels for wildlife protection.

34.2 CONCLUSIONS AND RECOMMENDATIONS

Based on the widespread extent of surface and shallow subsurface soil contamination in this area, the ESI Fence Line additional investigation area will be carried forward into the FS.

Section 35
Additional Investigation Area – Eastern Reconnaissance Area

Based on the discovery of waste and contaminated soil in the ESI Fence Line Area, Ecology has requested further documentation that adequate site reconnaissance has been performed to verify that all areas of truck-haul waste dumping have been identified and to address the potential for buried wastes to occur in these areas.

The Final RI Phase 1 Work Plan included compilation and review of historical aerial photographs as well as a comprehensive review and summary of past environmental investigations and other records. A site-wide reconnaissance was previously performed to identify dumping areas in the vicinity of the Smelter Sign and NESI subareas (SWMU 31) (Tetra Tech 2011a,b). In addition, several investigation, remediation, and long-term monitoring projects have been performed in the eastern area of the Site that included site reconnaissance activities:

- Characterization and remediation of the Intermittent Sludge Disposal Ponds (SWMU 3) (ARCADIS 2007; URS 2008a).
- Long-term monitoring and inspection of the ESI cap (SWMU 2) and site characterization and soil removal at the ESI Fence Line Area.
- RI reconnaissance and characterization work including well network verification, groundwater sampling, NESI and Smelter Sign site reconnaissance, and site characterization.

The objectives of the Eastern Area site reconnaissance include:

- Documentation and verification that additional waste disposal areas are not present based on visual inspection.
- Limited subsurface characterization through test pit excavation to address the potential for buried wastes.
- Limited characterization of chemical concentrations in surface and subsurface soils to verify absence of contamination above soil screening levels.

35.1 FIELD INVESTIGATION AND ANALYTICAL PROGRAM SUMMARY

Site reconnaissance was performed including inspection and documentation in the eastern portion of the Site using a grid system as specified in the WPA. Each grid area was inspected by walking lines at an approximate 250-foot spacing. The grid corners were established using a hand-held GPS. Photographs were taken in each grid area and coordinates of relevant features were determined, using a hand-held GPS. Areas of historical disturbance and adjacent to vehicle tracks were visually examined.

Because no surface indications of soil contamination or waste are found, the historical borrow pit area south of SR 14, was assessed through excavation and sampling of 4 test pits to a depth of 7 ft bgs with two samples collected at 0.5 and 7.0 ft bgs from each test pit. The analytical program included: total cyanide, fluoride, sulfate, PAHs, metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, and Zn), and petroleum hydrocarbons (diesel-range organics and residual-range organics).

35.2 INVESTIGATION RESULTS

Figure 35-1 shows the sample stations and soil screening level exceedance for the Eastern Reconnaissance area. Table 35-1 summarizes the analytical results. The GPS track and representative photographs are provided in Volume 5, Appendix B-35. Test pit logs are also included in Volume 5, Appendix B-35. The WPA laboratory and data validation reports for the Eastern Reconnaissance area are presented in Volume 5, Appendix H-3 and I-3, respectively.

The results of the site reconnaissance and sampling in this area did not show the evidence of smelter waste disposal. Evidence of past excavation activities (borrow pits) were noted in the field and it appears that wetland vegetation has become established in some of the former excavations. Based on the test pit excavations, soils in area consist of gravelly silt, and silt gravel, in some areas an indurated silt was present near the base of the excavation.

The Eastern Reconnaissance area is located on NSC-owned land that is currently zoned for Extensive Agriculture. For this reason, waste and soil results have been screened against MTCA Method A unrestricted land use screening levels (petroleum hydrocarbons only), MTCA Method B screening levels, MTCA-derived soil screening levels for groundwater protection, and MTCA

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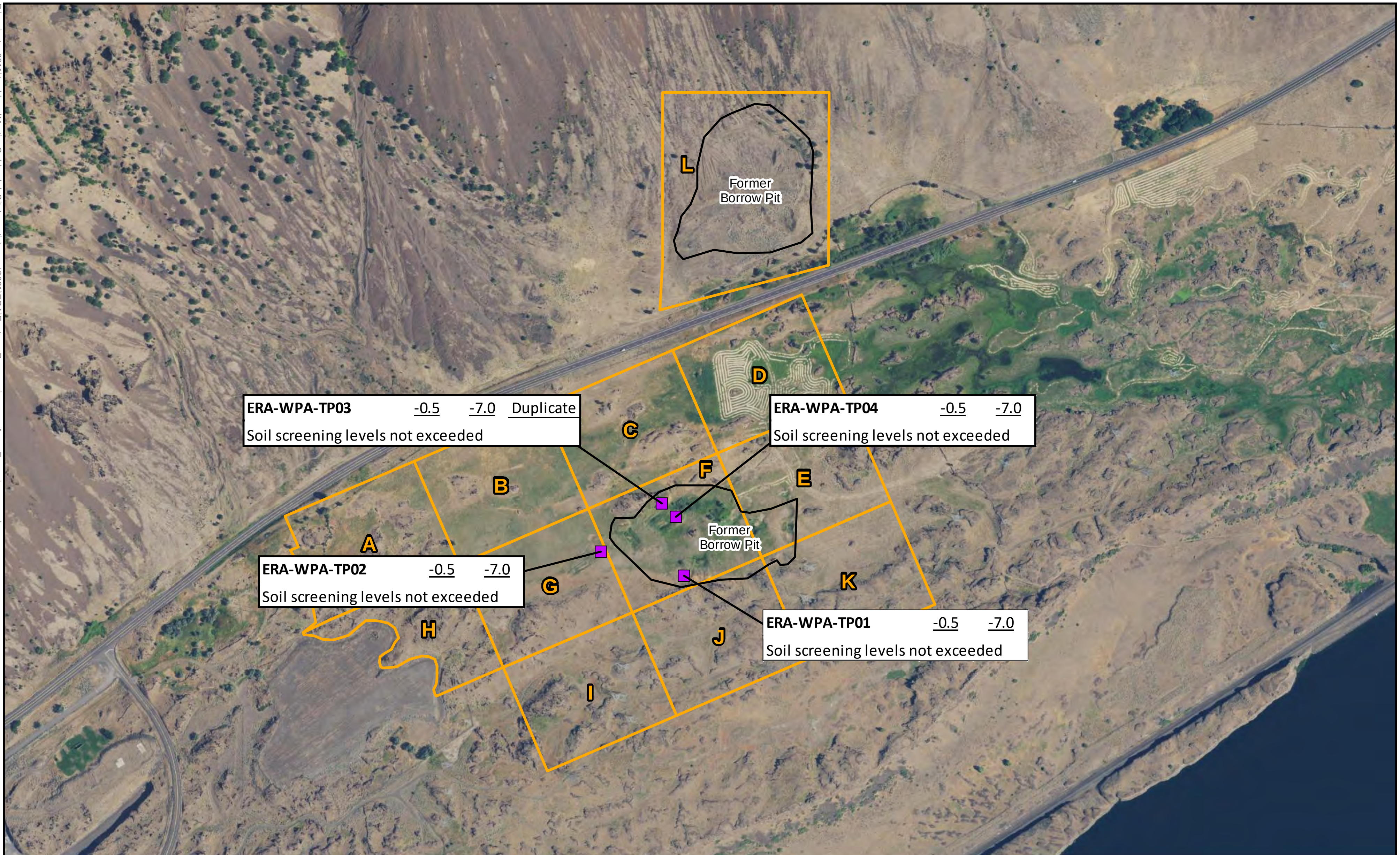

Legend

Eastern Reconnaissance Area

Test Pit Location

N
W E
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0 500 1,000
Feet

Figure 35-1
Eastern Reconnaissance Area
Sampling Locations and Soil
Screening Level Exceedance Summary

Columbia Gorge Aluminum Smelter Site
Goldendale, Washington

Table 35-1
Eastern Reconnaissance Area Soil Results Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
November 2020

Parameter Name	Units	MTCA Method A Unrestricted Land Use	MTCA Method A Industrial	MTCA Method B	MTCA Method C	Ecological Indicator			Protection of Groundwater Vadose Zone[a]	Selected Screening Level	Natural Background	Analytical Results								
						Eco-SSL Plants	Eco-SSL Soil Biota	Eco-SSL Wildlife				ERA-WPA-TP01-0.5 11/10/2020	ERA-WPA-TP01-7.0 11/10/2020	ERA-WPA-TP02-0.5 11/10/2020	ERA-WPA-TP02-7.0 11/10/2020	ERA-WPA-TP03-0.5 11/10/2020	ERA-WPA-TP43-0.5 (Duplicate of ERA-WPA-TP03-0.5) 11/10/2020	ERA-WPA-TP03-7.0 11/10/2020	ERA-WPA-TP04-0.5 11/10/2020	ERA-WPA-TP04-7.0 11/10/2020
Aluminum Smelter																				
Cyanide[b]	mg/Kg	NA	NA	50	2,200	NE	NE	5.0	1.9	1.9	NE	0.08 U	0.07 U	0.1 J	0.08 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Fluoride	mg/Kg	NA	NA	4,800	210,000	NE	NE	NE	147.6[c]	147.6	14.11	14.4	5.3	24.3	3 J	24.2	22.3	12.6 J	29.4 J	12.8 J
Sulfate	mg/Kg	NA	NA	NE	NE	NE	NE	NE	2,150[c]	2,150	NE	12.6	28.2	1.1 U	11.8	3.3	1.1 U	38.4	12.3	47.3
Polycyclic Aromatic Hydrocarbons (PAHs)																				
2-Methylnaphthalene	mg/Kg	NL	NL	320	14,000	NE	NL	NL	1.7	1.7	NE	0.00058 J	0.0004 U	0.00049 J	0.00046 U	0.0004 U	0.00041 U	0.0004 U	0.00042 U	0.00043 U
Acenaphthene	mg/Kg	NA	NA	4,800	210,000	NL	NL	NL	98	98	NE	0.0023 J	0.00032 U	0.002 J	0.00038 U	0.00058 J	0.00092 J	0.00033 U	0.00052 J	0.00035 U
Acenaphthylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.00034 U	0.0003 U	0.00031 U	0.00035 U	0.00031 U	0.00031 U	0.00031 U	0.00032 U	0.00033 U
Anthracene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	2,300	2,300	NE	0.0021 J	0.00031 U	0.0028 J	0.00036 U	0.0006 J	0.00091 J	0.00032 U	0.0006 J	0.00034 U
Benzo(a)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.023	0.00043 U	0.029 J	0.00043 U	0.0074 J	0.012 J	0.0028 U	0.0057	0.0004 U
Benzo(a)pyrene	mg/Kg	0.1	2.0	NL	NL	NE	NL	NL	NL	NL	NE	0.031	0.00041 U	0.044 J	0.00047 U	0.011 J	0.018 J	0.0035 J	0.0079	0.00044 U
Benzo(b)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.052	0.00041 U	0.072 J	0.00047 U	0.017 J	0.028 J	0.0054	0.011	0.00044 U
Benzo(ghi)perylene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.027	0.00043 U	0.042 J	0.0005 U	0.0097 J	0.016 J	0.0033 J	0.0064	0.00046 U
Benzo(k)fluoranthene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.022	0.00026 U	0.029 J	0.0003 U	0.0077 J	0.012 J	0.0025 J	0.0044 J	0.00028 U
Chrysene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.036	0.00033 U	0.046 J	0.00039 U	0.011 J	0.018 J	0.0039 J	0.0076	0.00036 U
Dibenzo(a,h)anthracene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.0062	0.00025 U	0.0084 J	0.00029 U	0.0017 J	0.0028 J	0.00054 J	0.00088 J	0.00027 U
Fluoranthene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	630	630	NE	0.04	0.00067 U	0.047 J	0.00078 U	0.012 J	0.019 J	0.0042 J	0.0093	0.00073 U
Fluorene	mg/Kg	NA	NA	3,200	140,000	NE	NL	NL	100	100	NE	0.0012 J	0.00061 U	0.0013 J	0.00071 U	0.00062 U	0.00062 U	0.00062 U	0.00065 U	0.00066 U
Indeno(1,2,3-cd)pyrene	mg/Kg	NL	NL	NL	NL	NE	NL	NL	NL	NL	NE	0.026 J	0.00038 UJ	0.039 J	0.00045 UJ	0.009 J	0.015 J	0.003 J	0.0059 J	0.00042 UJ
Naphthalene	mg/Kg	5.0	5.0	1.6	70	NE	NL	NL	4.5	4.5	NE	0.00084 J	0.0005 U	0.00069 J	0.00059 U	0.00051 U	0.00051 U	0.00051 U	0.00058 J	0.00054 U
Phenanthrene	mg/Kg	NA	NA	NE	NE	NE	NL	NL	NE	NL	NE	0.015	0.00063 U	0.018	0.00073 U	0.0043 J	0.0066	0.0016 J	0.0047 J	0.00068 U
Pyrene	mg/Kg	NA	NA	2,400	110,000	NE	NL	NL	650	650	NE	0.038	0.00034 U	0.045 J	0.0004 U	0.011 J	0.018 J	0.0041 J	0.0088	0.00037 U
Dibenzofuran	mg/Kg	NA	NA	NL	NL	NE	NL	NL	NL	NL	NE	0.00073 U	0.00064 U	0.00082 J	0.00075 U	0.00065 U	0.00066 U	0.00065 U	0.00068 U	0.00069 U
Total TEC cPAH (calc)	mg/Kg	0.1	2.0	0.19	130	NE	NE	NE	3.9	0.19	NE	0.04428	0.00031465	0.0622	0.00035545	0.01539	0.02516	0.004963	0.010764	0.0003323
LMW PAH	mg/Kg	NA	NA	NE	NE	NE	29	100	NE	29	NE	0.06202	0.0003 U	0.07228	0.00035 U	0.01748	0.02743	0.0058	0.0157	0.00033 U
HMW PAH	mg/Kg	NA	NA	NE	NE	NE	18	1.1	NE	1.1	NE	0.2612	0.00025 U	0.3544	0.00029 U	0.0855	0.1398	0.02904	0.05858	0.00027 U
Metals																				
Aluminum	mg/Kg	NA	NA	80,000	3,500,000	50	NE	NE	480,000	28,299	28,299	12,600	7,270	12,700	8,940	17,300	16,100	9,160	16,800	13,100
Arsenic	mg/Kg	20	20	0.67	88	10	60	132	2.9	7.61	7.61	2.76	2.46	3.6	6.34	2.58	2.47	2.51	2.27	1.97
Cadmium	mg/Kg	2.0	2.0	80	3,500	4.0	20	14	0.69	0.81	0.81	0.112	0.09	0.133	0.114	0.086	0.094	0.071	0.083	0.047
Chromium	mg/Kg	2,000	2,000	120,000	5,300,000	42	42	67	490,000	42	31.88	11.3	6.1	9.32	10.1	13.8	12.5	12.1	6.9	20.6
Copper	mg/Kg	NA	NA	3,200	140,000	100	50	217	280	50	28.4	20.5	14.1	18.6	19.1	27 J	20.7 J	12	13.6	18.5
Lead	mg/Kg	250	1,000	NE	NE	50	500	118	3,000	50	13.1	4.74	3.65	4.71	7.89	5.84	5.78	7.49	4.31	5.79
Mercury	mg/Kg	2.0	2.0	24	NE	0.3	0.1	5.5	2.1	0.1	0.04	0.008 J	0.002 J	0.007 J	0.002 J	0.009 J	0.007 J	0.002 U	0.006 J	0.002 J
Nickel	mg/Kg	NA	NA	880	70,000	30	200	980	130	30	24.54	9.49	8.33	9.39	13	9.31	8.97	6.21	5.73	9.28
Selenium	mg/Kg	NA	NA	400	18,000	1.0	70	0.3	5.2	0.3	0.29	0.23 J	0.17 J	0.27 J	0.12 J	0.2 J	0.23 J	0.19 J	0.21 J	0.14 J
Zinc	mg/Kg	NA	NA	24,000	1,100,000	86	200	360	6,000	86	80.91	39.9	41.5	48.5	48	41.9	40.5	32.1	31.6	37.3
Total Petroleum Hydrocarbons (TPHs)																				
Diesel Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NE	260	NE	3 J	2 U	3.1 J	2.3 U	2.3 J	2.1 U	2 U	3 J	2.1 U
Residual Range Organics	mg/Kg	2,000	2,000	NE	NE	1,600	260	2,000	NE	260	NE	13 J	4.2 U	18 J	4.9 U	13 J	18 J	9.9 J	17 J	4.5 U

Notes:

Bold and shaded values denote exceedances of one or more screening levels and background concentrations.

a Soil screening levels for protection of groundwater from Ecology CLARC website except where specifically noted.

b Soil screening levels for cyanide are based on the free cyanide form. Results are for total cyanide unless specifically noted.

c Soil screening levels for protection of groundwater derived from literature or empirical demonstration (refer to Volume 1 for discussion).

B = The result is less than 5 times the blank contamination. The result is considered as non-positive because cross-contamination is suspected.

J = The result is an estimated value.

U = The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit.

UJ = Chemical was not detected. The associated limit is estimated.

CLARC = Cleanup Level and Risk Calculations

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon

mg/Kg = milligrams per kilogram

MTCA = Model Toxics Control Act

NA = Not Applicable

NE = Not Established

NL = Not Listed

PAHs = Polycyclic Aromatic Hydrocarbon

SSL = Soil Screening Level

TPH = Total Petroleum Hydrocarbons

Total TEC = Total Toxicity Equivalent Concentration

Terrestrial Ecological screening levels protective of plants, soil biota, and protection of wildlife. Background soil concentrations are also provided in the data summary tables.

No chemicals were detected above screening levels in the soil samples collected in this area.

35.3 CONCLUSIONS AND RECOMMENDATIONS

Based on the site reconnaissance and the soil analytical results, no further action is recommended, and the Eastern Reconnaissance Area will not be carried forward into the FS.

Section 36
SWMU Summary of Recommendations

This section summarizes the RI recommendations for site SWMUs as well as an additional area of investigation. The sampling program for the SWMUs and additional area of investigation are fully described in the Final RI Phase 2 Work Plan (Tetra Tech et al. 2015b). Table 36-1 provides a summary of the primary RI findings and associated recommendations for individual SWMUs, including identification of those SWMUs recommended for further evaluation in the FS.

Table 36-1
Solid Waste Management Unit (SWMU) Major Findings and Recommendation Summary
Columbia Gorge Aluminum Smelter Site, Goldendale, Washington
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Solid Waste Management Unit (SWMU) Identification	Major RI Findings Summary	RI Recommendation	FS Evaluation [a] (Yes/No)
SWMU 1 NPDES Ponds	A removal action was previously performed at the NPDES Ponds during 2010. PAHs concentrations in shallow soil exceed MTCA-soil screening levels for protection of groundwater and terrestrial ecological screening levels in the vicinity of Pond A were detected in most samples. The PAH contamination is above screening levels at all 4 ponds and the stormwater bypass channel. Detected concentrations and the size of the impacted areas decrease downstream through the ponds. Other chemicals above screening levels and background concentrations include fluoride and a few metals (As, Cd, Cr, Cu, Ni, Pb, Se, and Zn) with scattered exceedances. The slope of the southern lobe of the EELF located near and topographically upslope from Pond A was characterized by high concentrations and represents a likely source of recontamination for Pond A. The discharge pipe (SE Line) at the head of Pond A discharges water with elevated fluoride concentrations.	Based on detection of elevated PAHs in shallow soils, SWMU 1 is recommended for further evaluation in the FS. The discharge pipe at the head of Pond A will be carried forward into the FS as part of the Plant Area AOC.	Yes
SWMU 2 East Surface Impoundment (ESI)	The East Surface Impoundment (ESI) was not included in the RI program because this SWMU was formerly closed under RCRA, with an engineered cap installed in 1987 and required post-closure monitoring. PAH-contaminated soils from inside and outside the southeast corner of the ESI fence line was reported to Ecology as a maintenance activity in an ESI Post-Closure Monitoring Report (Tetra Tech 2018b). However, Ecology notified Lockheed Martin (Ecology 2018) that this activity should have been conducted as an interim action under the 2014 Agreed Order No. 10483. Further investigation of the ESI Fence Line Area was included as part of the WPA field investigation with the ESI Fence Line Area categorized as an Additional Investigation Area. See below for a summary of the ESI Fence Line Investigation Findings		No
SWMU 3 Intermittent Sludge Disposal Ponds	The Intermittent Sludge Disposal Ponds was not originally included in the RI program because this SWMU was formerly investigated, and an independent soil removal action was completed in 2007 (URS 2008b) under an industrial land use scenario. This site was characterized during WPA based on Ecology and Yakama Nation comments on the Draft RI Report that stated that industrial land use was not appropriate. Surface soil results show the presence of PAHs, fluoride, sulfate, and a few metals above MTCA-derived soil screening levels for protection of groundwater and/or terrestrial ecological screening levels for wildlife protection. Field observations and analytical data suggest that the contamination at the site represents residual contamination from the 2007 removal action.	Based on the elevated PAH, fluoride, sulfate, and metals concentrations in surface soils, SWMU 3 should be carried forward to the FS for evaluation of remedial alternatives and cleanup levels.	Yes
SWMU 4 West Surface Impoundment (WSI)	The West Surface Impoundment (WSI) was not included in the RI program because this SWMU was formerly investigated and closed under RCRA. A Closure and Post-Closure Plan was prepared in November 2004, including provisions for long-term maintenance and groundwater monitoring (Parametrix 2004c).		No
SWMU 5 Line A Secondary Scrubber Recycle Station	Soil chemical concentrations for PAHs exceed MTCA-derived screening levels for protection of groundwater in one surface soil sample. This same sample was characterized by elevated concentration of As, Cd, Ni, Se, and Zn, above MTCA-derived soil screening levels for protection of groundwater and/or terrestrial ecological screening levels for wildlife protection.	Elevated concentrations of fluoride were detected in nearby shallow temporary well RI-GW5 and a fluoride plume in the main plant area (refer to Volume 3, Section 2.0). However, based on the low fluoride concentrations in soil at SWMU 5, the source of the elevated fluoride concentrations in this well is unclear and appears to likely be related to piping leaks in the site vicinity. The site is proximity to the SE line. Groundwater contamination in this area of the site will be further evaluated in the FS.	Yes

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Solid Waste Management Unit (SWMU) Major Findings and Recommendation Summary
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Solid Waste Management Unit (SWMU) Identification	Major RI Findings Summary	RI Recommendation	FS Evaluation [a] (Yes/No)
SWMU 6 Line B, C, D Secondary Scrubber Recycle Stations	Soil chemical concentrations were generally below screening levels except for one surface soil sample that exceeded terrestrial ecologic soil screening levels for wildlife protection. Selenium exceeded terrestrial ecological screening levels for wildlife in all the collected samples This SWMU is adjacent to SWMU 8.	Elevated fluoride chemical concentrations were detected in nearby wells screened in the UA aquifer-zone (RI-GW7) and BAU aquifer zone (RI-MW6-BAU) near this SWMU and there is a significant amount of underground piping present that may have leaked and resulted in a release. Groundwater contamination in this area will be further evaluated in the FS.	Yes
SWMU 7 Decommissioned Air Pollution Control Equipment	SWMU 7 was located overhead above Courtyard B which was investigated as part of the PAAOC. Data collected in Courtyard B will be evaluated with other PAAOC RI and WPA data.	SWMU 7 will not be recommended as a discrete SWMU for further evaluation in the FS. Data collected in the vicinity of SWMU 7 will be evaluated in the FS as part of the PAAOC.	No
SWMU 8 Tertiary Treatment Plant	Soil chemical concentrations for PAHs, fluoride, and metals (Cd and Se) were above screening levels in surface soil samples. This SWMU is adjacent to SWMU 6.	Based on the soil results, historical waste handling and treatment processes, and high potential for historical piping releases in the site vicinity, further evaluation in the FS is recommended. Elevated fluoride chemical concentrations were detected in nearby wells screened in the UA aquifer-zone (RI-GW7) and BAU aquifer zone (RI-MW6-BAU) near this SWMU. Groundwater contamination in this area will be further evaluated in the FS.	Yes
SWMU 9 Paste Plant Recycle Water System	Elevated concentrations of cPAHs above MTCA Method C soil screening levels were found in samples collected in one soil boring location drilled during the RI. PAH concentration also exceeded MTCA-derived soil screening levels for groundwater protection and terrestrial ecological screening levels for wildlife protection in a few samples. Of metals, cadmium and selenium also exceeded screening levels. No groundwater was encountered during drilling that extended to a maximum depth of 16 ft bgs.	Based on detection of elevated PAHs in soils SWMU 9 is recommended for further evaluation in the FS. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	Yes
SWMU 10 North Pot Liner Soaking Station	Concentrations of PAHs in soil exceed MTCA-derived soil screening levels for groundwater protection, and terrestrial ecologic screening levels for wildlife over a wide area. Fluoride was also found in several samples above MTCA-derived soil screening levels protective of groundwater. A few metals (As, Cd, Cr, Cu, and Se) were also detected above screening levels and background concentrations Groundwater was encountered during drilling that extended to a maximum depth of about 20 ft bgs in fractured bedrock in 2 of 4 borings.	SWMUs 10 and 11 are recommended for further evaluation in the FS based on 1) PAH-impacted soils detected during completion of this RI, and 2) results from the previous 2008 site investigation (URS 2008e). Groundwater in the vicinity of these SWMUs was characterized during the RI and WPA as part of the Groundwater in the Uppermost Aquifer AOC and was found to be contaminated with fluoride in the site vicinity.	Yes
SWMU 11 South Pot Liner Soaking Station	SWMU 11 was combined with SWMU 10 in support of this RI (see above).		
SWMU 12 East SPL Storage Area	Concentrations of PAHs in soil exceed screening levels for protection of groundwater or wildlife protection at most sample station locations. Fluoride concentration also exceed MTCA-derived soil screening levels for protection of groundwater in several samples, and total cyanide was found at elevated concentration above MTCA-derived soil screening levels for protection of groundwater in a few locations.	SWMU 12 is recommended for further evaluation in the FS primarily based on 1) PAH and fluoride-impacted soils detected during completion of this RI, and 2) results from the previous 2008 site investigation (URS 2008c). Groundwater in the vicinity of this SWMU was characterized during the RI and fluoride groundwater contamination is present in the site vicinity.	Yes
SWMU 13 West SPL Storage Area	The West SPL Storage Area (SWMU 13) was not included in the RI field program because this unit was formerly investigated, closed, and capped. The West SPL Storage Area was closed in 1988 under solid waste regulations, at which time a closure plan was prepared, and an engineered cap was constructed (CH2MHill 1988a,b). Groundwater in this area will be further evaluated as part of the GWAOC FS.		No

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Solid Waste Management Unit (SWMU) Identification	Major RI Findings Summary	RI Recommendation	FS Evaluation [a] (Yes/No)
SWMU 14 North SPL Containment Building	Detected concentrations of metals do not exceed MTCA Method C Industrial protection of groundwater, and ecological wildlife screening levels in 21 of 22 samples. Total fluoride exceeds the site-specific protection of groundwater screening level in one sample, and HMW PAH exceeds ecological wildlife screening level in three samples.	SWMU 14 is not recommended for further evaluation in the FS primarily based on 1) one sample only exceeds the site-specific soil screening level for protection of groundwater, and 2) three samples exceed ecological wildlife screening level, and 3) this is a closed RCRA facility. Soil and groundwater in the vicinity of this SWMU were characterized during the RI and WPA, and the results are summarized in Volume 2 SE18 Investigation Area and in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.	No
SWMU 15 South SPL Storage Building	Detected concentrations of total cyanide, sulfate, PAHs, and metals detected in the 11 soil samples do not exceed the MTCA Method A Industrial, MTCA Method C, protection of groundwater, and ecological wildlife screening levels. Total fluoride exceeds the site-specific protection of groundwater screening level on one sample collected during the RI and one surface soil sample collected during the 1995 closure investigation. Arsenic exceeds the MTCA soil screening level for protection of groundwater in three samples but does not exceed the natural background concentration.	Based on the fluoride soil sample results and Ecology (2022) comments on the Revised RI Report, SWMU 15 is recommended for further evaluation in the FS Groundwater in the vicinity of this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.	Yes
SWMU 16 SPL Handling Containment Building	The SPL Handling Containment Building (SWMU 16) was not included in the RI field program because this unit was formerly investigated and cleaned up concurrent with plant demolition activities. SWMU 16 was closed under RCRA in 2011 (PGG 2011)		No
SWMU 17 East End Landfill (EELF)	Aluminum smelter-related wastes, including carbon wastes and suspected SPL as well as solid wastes, were found at SWMU 17. The smelter waste and some soils exceed screening levels with PAHs and fluoride representing the main chemicals of concern. Smelter wastes appear to be present beneath John Day Dam Road. In some cases, PAH concentrations in wastes exceed MTCA Method C and Washington Dangerous Waste Persistence Criteria.	SWMU 17 is recommended for further evaluation in the FS due to the presence of suspected SPL and other smelter-related wastes as well as PAH and fluoride waste and soil concentrations.	Yes
SWMU 18 West End Landfill (WELF)	The West End Landfill (WELF) was not included in the RI field program because it was previously investigated, and no RI field investigation data needs were identified during the RI planning process. A Cleanup Action Plan (Tetra Tech 2010) was previously prepared for SWMU 18 and remedial alternatives will be re-evaluated in the FS.		Yes
SWMU 19 Plant Construction Landfill	Solid waste and aluminum smelter-related wastes were not found in this area. Chemical concentrations in soils were below screening levels except for low levels of selenium that barely exceeded MTCA terrestrial ecological screening levels for wildlife protection in all the collected samples and one sample that exceeded these same screening levels for PAHs. Selenium does not appear to represent a chemical of concern associated with historical waste handling and disposal at this site.	Other than implementation of institutional controls, no further action is needed.	No
SWMU 20 Drum Storage Area	The Drum Storage Area (SWMU 20) was not included in the RI field program because this unit was formerly characterized as part of an independent site investigation in 2008 (URS 2008d) and found to require no additional data needs. Based on comparison of the 2008 results with the RI PAH soil screening levels, the 2008 soil results exceed RI screening levels for protection of groundwater and terrestrial ecological screening levels for protection of wildlife. SWMU 20 will be further evaluated in the FS.		Yes
SWMU 21 Construction Rubble Storage	Concentrations of total cyanide, total fluoride, sulfate, metals, and total petroleum hydrocarbons do not exceed the MTCA Method Industrial, protection of groundwater, and ecological wildlife screening levels.	SWMU 21 is not recommended for further evaluation in the FS because none of the detected constituents exceed site soil screening levels. Groundwater in the vicinity of this SWMU was characterized during the RI, and the results are summarized in Volume 4, Section 2, Groundwater in the Uppermost Aquifer AOC.	No

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Solid Waste Management Unit (SWMU) Identification	Major RI Findings Summary	RI Recommendation	FS Evaluation [a] (Yes/No)
SWMU 22 Wood Pallet Storage Area	Concentrations of PAHs in detected in soil exceed protection of groundwater and ecological wildlife screening levels. Cadmium exceeds the protection of groundwater screening level in one sample. Total CDD and CDF exceed MTCA Method C and ecological wildlife screening levels in two samples. No groundwater was encountered during drilling that extended to a maximum depth of 15 ft bgs.	SWMU 22 is recommended for further evaluation in the FS based the impact of the burn pile on underlying surface soil by PAH, total CDD and CDF, and cadmium. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	Yes
SWMU 23 Reduction Cell Skirt Storage Area	Concentrations of total fluoride, PAHs as TTEC and HMW PAH, arsenic, cadmium, chromium, and nickel exceed one or both protection of groundwater and ecological wildlife screening levels in shallow soil. Only Fluoride exceeds the protection of groundwater screening level at 5 ft bgs.	Based on detection of total fluoride, PAHs, and metals in shallow soil SWMU 23 is recommended for further evaluation in the FS. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	Yes
SWMU 24 Carbon Waste Roll-off Area	SWMU 24 was investigated as part of the PAAOC. Detected contamination in soil at potential locations of SWMU 24 roll-off bins will be evaluated with other PAAOC RI data.	SWMU 24 is not recommended for further evaluation as a discrete SWMU in the FS. Data collected at SWMU 24 will be evaluated in the FS as part of the PAAOC. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	No
SWMU 25 Solid Waste Collection Bin and Dumpsters	SWMU 25 was investigated as part of the PAAOC. Detected contamination in soil at potential locations of SWMU 25 bins and dumpsters will be evaluated with other PAAOC RI data.	SWMU 25 is not recommended for further evaluation as a discrete SWMU in the FS. Data collected at SWMU 25 will be evaluated in the FS as part of the PAAOC. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	Yes
SWMU 26 HEAF Filter Roll-off Bin	SWMU 26 was investigated as part of the PAAOC. Detected contamination in soil at the potential location of SWMU 26 roll-off bin will be evaluated with other PAAOC RI data.	SWMU 26 is not recommended for further evaluation as a discrete SWMU in the FS. Data collected at SWMU 26 will be evaluated in the FS as part of the PAAOC. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	No
SWMU 27 Tire and Wheel Storage Area	The Tire and Wheel Storage Area (SWMU 27) overlaps physically with the Drum Storage Area (SWMU 20) and was not included in the RI field investigation (see SWMU 20).		Yes, see SWMU 20
SWMU 28 90-Day Drum Storage Area	The 90-Day Drum Storage Area (SWMU 28) was not carried forward into RI field investigation because there was no data need identified. No further action is recommended for SWMU 28.		No
SWMU 29 Caustic Spill	Chemical concentrations in surface and subsurface soil did not exceed screening levels. Based on the results, the historical spill does not appear to represent an ongoing source.	Observations of soil made during water-line repair suggest potential for PAH soil contamination in the area that is recommended for further evaluation as part of the PAAOC FS.	No
SWMU 30 Paste Plant Spill	Detected concentrations of total cyanide, sulfate, and most metals do not exceed MTCA Method C, protection of groundwater, and ecological wildlife screening levels. PAH as TTEC, LMW PAH, and HMW PAH exceed protection of groundwater and ecological wildlife screening levels. Total fluoride and arsenic exceed protection of groundwater screening levels in one sample each. Cadmium, mercury, and zinc exceed protection of groundwater and ecological wildlife screening levels in the pipe outlet surface soil sample.	Based on detection of total fluoride, PAHs, and metals in shallow soil south of the plant area fence line, SWMU 30 is recommended for further evaluation in the FS. Groundwater in the vicinity of this SWMU was characterized during the RI as part of the Groundwater in the Uppermost Aquifer AOC.	Yes

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Solid Waste Management Unit (SWMU) Identification	Major RI Findings Summary	RI Recommendation	FS Evaluation [a] (Yes/No)
SWMU 31 Smelter Sign Area	Aluminum-smelter related wastes including suspected SPL were found at both the SSA and the NESI. The wastes and soils were characterized by elevated concentrations of cPAHs and fluoride above screening levels. Shallow groundwater is in contact with smelter wastes at the NESI wetland.	This site will be carried forward into the FS. The FS will address both the waste and contaminated soil in the SSA and NESI. Groundwater in the vicinity of the NESI will be further evaluated as part of the GWAOC FS.	Yes
SWMU 32 Stormwater Pond and Adjacent Area	Concentrations of cPAHs exceed MTCA Method C screening levels in most of the sediment sampled, with two locations exhibiting concentrations above the Washington State Dangerous Waste Persistence criteria for PAHs. Relatively few detections of organic compounds or metals were found in excess of groundwater screening levels in the pond water. The stormwater pond is in hydraulic connection with BAU aquifer at this location and the geochemistry of the pond is generally like that of the underlying BAU aquifer. Surface soils adjacent to the pond have concentration of PAHs above screening levels.	The stormwater pond will be carried forward into the FS based on the high levels of PAHs and other chemicals in the pond sediments and hydraulic interconnection of the pond with the shallow basalt aquifer system. The surface soils adjacent to the pond will also be addressed based on their elevated PAH concentrations.	Yes
SWMU 32 Stormwater Pond and Appurtenant Facilities (Continued)	**Stormwater Pond and Adjacent Area** Concentrations of cPAHs exceed MTCA Method C screening levels in most of the sediment sampled, with two locations exhibiting concentrations more than the Washington State dangerous waste persistence criteria for PAHs. Sediment accumulation within the pond is primarily associated with the central basin of the original (pre-expansion) pond footprint. Relatively few detections of organic compounds or metals in Pond water more than associated screening levels. The geochemistry of the pond is generally like that of the underlying BAU aquifer and appears in hydraulic communication with the BAU aquifer at this location. The surface soils along the shallow ravine southeast of the stormwater pond do not appear to be significantly impacted.	**Stormwater Pond and Adjacent Area** Stormwater pond sediments are recommended for further evaluation in the FS due to elevated concentrations of cPAHs and the apparent hydraulic communication between the Pond and underlying BAU aquifer system. Soils along the shallow ravine southeast of the pond are characterized by low to moderate concentrations	Yes
Additional Area of Investigation-Ditch near the West SPL Storage Area	There are only small amounts of soil/sediment in the ditch located on the south side of West SPL Storage Area. Most of the ditch is armored with riprap. In collected samples, some PAH and fluoride concentrations exceeded MTCA-derived screening levels for protection of groundwater and/or terrestrial ecological screening levels for wildlife protection. Cyanide was not detected, and sulfate was detected at low concentrations below screening levels.	Based on cPAH and fluoride soil concentrations above screening levels, the ditch should be carried forward into the FS for further evaluation.	Yes
Additional Area of Investigation-ESI Fence Line Area	Concentrations of PAHs and fluoride exceeded MTCA-derived screening levels of protection of groundwater and/or terrestrial ecological screening levels for wildlife protection is surface and near surface soil samples. Metals (As, Cd, Cr, Pb, Ni, and Se) also exceeded these same screening levels at a few stations. Of petroleum hydrocarbons, residual-range organics exceeded MTCA Method A Industrial screening levels in a few samples. Sulfate exceeded MTCA-derived soil screening levels of protection of groundwater in one sample.	Based primarily on the widespread shallow PAH and fluoride-contaminated soils in this area, the ESI Fence Line will be further evaluated in the FS.	Yes
Additional Area of Investigation-Eastern Reconnaissance Area	No evidence of waste disposal was found during site reconnaissance activities and chemicals of potential concern did not exceed screening levels in the 9 collected samples.	The based on the WPA findings, this area will not be carried forward for evaluation in the FS. No further action is recommended.	No

a The application of industrial soil cleanup levels for many areas of the site is appropriate based on future land use considerations as discussed in Volume 1, Section 2 and 5 of this report. Although no further action is recommended for various SWMUs, the application of MTCA Method C for site cleanup requires consideration of appropriate institutional controls to be implemented in accordance with the Washington Administrative Code (WAC) 173-340-440. The FS will include institutional controls for all SWMUs where Method C Cleanup Levels are adopted as appropriate and consistent with MTCA requirements.