J

Pond Plant (Horsetail) and Pond Sediment Metals Data for Site and Background Ponds and Sediment to Plant Uptake Factors

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Appendix J

Pond Plant (Horsetail) and Pond Sediment Metals Data for Site and Background Ponds and Sediment to Plant Uptake Factors

This appendix includes metals data for samples for pond plants (horsetail) and pond sediment from settling ponds in the former Main Processing Area of the Red Devil Mine site and from a background pond (i.e., reservoir) located at the upstream end of Red Devil Creek. Results for pond plants and pond sediment are provided in Tables J-1 and J-2, respectively. Sampling location maps are provided in the final Remedial Investigation (RI) report (E & E 2014). The data were used to calculate site and background sediment-to-aquatic plant uptake factors (UFs) using the following equation:

$$UF = C_p/C_s$$

Where:

UF = Sediment-to-aquatic plant uptake factor (unitless)

C_p = Pond plant metal concentration (mg/kg dry weight, except for mercury and methylmercury [ng/g dry weight])

C_s = Sediment metal concentration (mg/kg dry weight, except mercury and methylmercury [ng/g dry weight])

Sediment-to-aquatic plant UFs are provided in Table J-3.

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Table J-1. Pond Vegetation (Horsetail) Metals Data (Dry Weight) from Site and Background Locations.

Sample ID	Location Description	Moisture	Q	Arsenic	Q.	Antimony	Q	Mercury	Q	Methylmercury	Q	Barium	Q	Beryllium	Q	Cadmium	Q	Chromium	Q	Cobalt	Q	Copper	Q	Lead	Q	Manganese	Q	Nickel	Q	Selenium	Q	Silver	Q	Thallium	Q	Vanadium	Q	Zinc	Q
		%		(mg/kg)		(mg/kg)		(mg/kg)		(ng/g dry)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
Background Pond (Reservoir)																																							
11MP81PV	Upstream from reservoir	81		3.23		1.05	J	0.027	J	3.9	U	30.3		0.003	U	0.009	J	0.2	U	0.307		3.39		0.042	J	702		0.36		0.15	U	0.048		8	J	0.13	J	25.5	J
11MP82PV	Upstream from reservoir	79.2		1.24		0.386	J	0.071	J	--		47.5		0.004	J	0.023		0.2	J	0.592		4.27		0.068		1480		0.56		0.18	J	0.015	J	0.01	J	0.21		31.8	J
11MP83PV	From reservoir berm	83		2.66		0.794	J	0.045	J	--		120		0.013	J	0.053		0.5	J	0.77		5.02		0.207		635		1.45		0.16	J	0.012	J	0.018	J	0.73		38.2	J
Average		81.1		2.38		0.74		0.048		3.9		65.9		0.007		0.028		0.3		0.56		4.23		0.106		939		0.79		0.16		0.025		2.68		0.36		31.8	
Geometric Mean				2.20		0.69		0.044		3.9		55.7		0.005		0.022		0.27		0.52		4.17		0.084		871		0.66		0.16		0.021		0.11		0.27		31.4	
Red Devil Mine Site Settling Ponds																																							
11MP85PV	Largest, south-most pond	84.1		175		42.2	J	3.17	J	--		18.2		0.003	J	0.017	J	0.2	U	0.886		5.48		0.395		145		3.09		0.15	U	0.008	U	0.066		0.05	J	45	J
11MP86PV	Largest, south-most pond	81		309		97.4	J	0.923	J	--		23.1		0.004	J	0.009	J	0.2	J	0.308		3.4		0.32		46.8		3.14		0.15	U	0.008	U	0.083		0.09	J	36	J
11MP87PV	Largest, south-most pond	74.2		72.5		71.3	J	0.78	J	--		30		0.005	J	0.01	J	0.2	U	0.62		3.67		0.472		71		3.06		0.15	U	0.008	U	0.026		0.17	J	44.2	J
11MP88PV [A]	Largest, south-most pond	73.2		64.7		78.8	J	5.28	J	--		36.2		0.006	J	0.014	J	0.6	J	0.539		3.43		0.608		65.7		3.21		0.15	U	0.008	U	0.026		0.23		43.3	J
Average	Largest, south-most pond	79.8		186		72.8		3.12				25.8		0.004		0.013		0.3		0.605		4.18		0.441		88		3.15		0.15		0.008		0.058		0.12		41.7	
Geometric Mean	Largest, south-most pond			158		68.7		2.49				24.8		0.004		0.013		0.29		0.553		4.09		0.425		78		3.15		0.15		0.008		0.052		0.10		41.5	
11MP84PV	Smallest, north-most pond	89.7		32.1		4.92	J	2.7	J	6.9	J	28.2		0.006	J	0.22		0.2	U	0.438		9.62		1.18		199		1.11		0.81		0.008	U	0.017	J	0.29		55.7	J

Key:

Bkgd = background

J = estimated value

MDL = method detection limit

Q = Qualifier

U = not detected (MDL listed)

Note:

A = Field duplicate of 11MP87PV.

Table J-2. Pond Sediment Metals Data From Site and Background Locations.

Sample ID	Location Description	Arsenic (mg/kg)	Q.	Antimony (mg/kg)	Q	Mercury (mg/kg)	Q	Methylmercur (ng/g dry)	Q	Barium (mg/kg)	Q	Beryllium (mg/kg)	Q	Cadmium (mg/kg)	Q	Chromium (mg/kg)	Q	Cobalt (mg/kg)	Q	Copper (mg/kg)	Q	Lead (mg/kg)	Q	Manganese (mg/kg)	Q	Nickel (mg/kg)	Q	Selenium (mg/kg)	Q	Silver (mg/kg)	Q	Thallium (mg/kg)	Q	Vanadium (mg/kg)	Q	Zinc (mg/kg)	Q
Background Pond (Reservoir)																																					
10RD01SD	Upstream from reservoir	65		0.54	UJ	0.18		0.177		159		0.5		0.3		20.4		12.3		21.7		8		579		32		0.78	U	0.53	U	0.33	U	35.4		80	
Red Devil Mine Site Settling Ponds																																					
10MP32SS	Largest, south-most pond	9880		1430		127		--		126		0.7		0.12	U	19		16		71		180		708		48		3.5	U	0.24	U	1.5	U	21		112	
10MP34SS	Middle pond	8510		780		79		--		101		0.7		0.11	U	10		16		73		160		814		52		3.2	U	0.22	U	1.4	U	20		109	
10MP36SS	Smallest, north-most pond	7050		690		75		--		145		0.8		0.059	U	18		16.9		64.2		198		1090		54		1.7	U	0.118	U	0.7	U	25.3		110	
10MP84SS[A]	Smallest, north-most pond	6390		660	J	85		--		140		0.7		0.057	U	17		18.1		65.8		185		1020		58	J	1.7	U	0.113	U	0.7	U	24.5		111	

Key:

-- (dash) = not analyzed

Bkgd = background

J = estimated value

MDL = method detection limit

Q = Qualifier

U = not detected (MDL listed)

Note:

A = Field duplicate of 10MP36SS.

Table J-3. Sediment-to-Plant (Horsetail) Uptake Factors for Site and Background Pond Locations.

Location Description	Sediment-to-Plant Uptake Factor (Unitless)[A]																	
	Arsenic	Antimony	Mercury	Methylmercury	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Background Pond (Reservoir)																		
Upstream from reservoir	0.034	1.269	0.245	22.0	0.350	0.011	0.074	0.013	0.042	0.192	0.010	1.504	0.021	0.209	0.039	0.342	0.008	0.393
Red Devil Mine Site Settling Ponds																		
Largest, south-most pond	0.016	0.048	0.020	--	0.197	0.006	0.107	0.015	0.035	0.058	0.002	0.111	0.066	0.043	0.033	0.035	0.005	0.371
Middle pond	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Smallest, north-most pond	0.005	0.007	0.032	--	0.194	0.008	3.729	0.011	0.024	0.146	0.006	0.183	0.019	0.476	0.068	0.024	0.011	0.502

Key:
-- (dash) = not available
Bkgd = background
UF = uptake factor

Note:
A = Plant concentration (Table J-1) divided by sediment concentration (Table J-2). Background UF based on three plant samples (geometric mean) and one sediment sample. Site (largest pond) UF based on three site sample (geometric mean) and one sediment sample.

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