TABLE 2-1. CHARACTERISTICS OF SIGNIFICANT STREAMS IN THE UBMC AREA

Stream	Drainage Area sq miles	Bankfull Elevation ft AMSL[1]	Peak Flow from 100-yr Storm cfs[(1)]	Location	Range in Measured Flows 1991-2001 cfs[(2)]
Mike Horse Creek	0.41	5556.8	96*	Lower MH Ck (BRSW-35)	0.02 – 2.6
Beartrap Creek	2.02	5311.5	293*	At mouth (BRSW-38)	0.005 – 10.4
Anaconda Creek	2.91	5346.6	726	At mouth (BRSW-6)	0.05 – 16.8
Stevens Gulch	0.56	5241.8	187	At mouth (BRSW-8)	0.006 – 2.0
Shave Gulch	3.28	5218.8	715	At mouth (BRSW-10)	0.042 – 16.8
Paymaster Creek	0.61	5230.1	193	Lower Paymaster Ck (BRSW-13)	0.041 – 5.1
Pass Creek	2.34	5194.8	416	At mouth (BRSW-11)	0.02 – 1.2
Blackfoot River	9.9	NA	921*	Upstream of Pass Ck (BRSW-12)	0.77 – 91.2

(1) Elevations and flows from Envirocon, 1993.
(2) Flows measured by Hydrometrics, Inc.
* Peak flow based on current modeling performed for EE/CA
cfs-cubic feet per second

ft AMSL - feet above mean sea level
sq miles - square miles

TABLE 2-2. MONTHLY CLIMATIC DATA SUMMARY FROM ROGERS PASS NOAA WEATHER STATION, 8/21/64 THROUGH 9/30/04

	Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***	***Annual***
Average Max. Temp (°F)	33.1	38.4	44.1	53.7	63.0	71.4	81.5	80.5	69.3	57.9	41.9	34.3	55.8
Average Min. Temp (°F)	13.4	18.1	22.3	29.6	37.7	44.5	49.8	48.4	39.2	32.5	23.0	15.9	31.2
Average Precip (inch)	0.86	0.65	1.22	1.75	2.93	3.10	1.36	1.69	1.68	1.12	0.70	0.92	17.99
Average Total Snow Fall (inch)	13.1	11.7	15.3	11.5	4.2	0.0	0.0	0.0	2.6	4.2	8.6	13.8	85.1

TABLE 3-1. MIKE HORSE TAILINGS IMPOUNDMENT SOIL/MINE WASTE CONCENTRATIONS

Mike Horse Tailings Impoundment		Parameter (mg/kg)						
		Al	As	Cd	Cu	Pb	Mn	Zn
Impounded Mine Waste (Tailings/Waste Rock)								
	n	7	9	9	9	9	7	9
	average	7246	260	26	645	3653	7242	4168
	minimum	3850	135	10	427	1040	2750	2360
	maximum	13700	426.4	57	815	15100	10800	7780
	95^{th} percentile	13370	411.56	50.4	795	10398.8	10188	7264.48
	75^{th} percentile	9480	299	30	751.6	2839.8	8490	4823
Dam Embankment Soils								
	n	4	4	4	4	4	4	4
	average	4940	62.3	5.5	153.3	502.5	1110.0	857.5
	minimum	3310	32	1	61	200	410	120
	maximum	5980	91	18	250	900	2580	2630
	95^{th} percentile	5980	90.85	15.6	245.5	858	2332.5	2313.5
	75^{th} percentile	5980	90.25	6	227.5	690	1342.5	1047.5
Combined Data (All Shallow Samples)								
	n	11	13	13	13	13	11	13
	average	6407	199	19	494	2683	5012	3150
	minimum	3310	32	1	61	200	410	120
	maximum	13700	426.4	57	815	15100	10800	7780
	95^{th} percentile	13150	404.14	47.1	785	8048.2	9780	7006.72
	75^{th} percentile	6170	263	23.3	744.3	2652.6	7624	4047.6
MDHES Background Data								
	minimum	6980	8.4	0.38	5.7	18.1	779	45.9
	maximum	10700	27.2	0.58	42.7	59.1	1010	56.3

n = number of samples; mg/kg = milligrams per kilogram

TABLE 3-2. MIKE HORSE TAILINGS IMPOUNDMENT SURFACE WATER QUALITY

	Concentration Range (mg/L)		
	BRSW-1	**BRSW-2**	**BRSW-3/3A**
Arsenic	<0.002 - <0.02	<0.003 - 0.005	<0.005 - <0.02
Cadmium	<0.001 - <0.008	<0.001 - <0.008	<0.0001 - 0.023
Copper	<0.005 - <0.01	<0.005 - 0.010	0.001 - 0.23
Iron	<0.03 - 0.042	<0.05 - 0.58	<0.02 - 1.9
Lead	<0.003 - <0.01	<0.003 - 0.033	<0.002 - 0.051
Manganese	<0.008 - <0.01	<0.008 - 0.096	<0.01 - 3.6
Zinc	<0.008 - 0.022	<0.01 - 0.17	<0.01 - 4.2

TABLE 3-3. MIKE HORSE TAILINGS DAM SEASONAL SEEPAGE WATER QUALITY

Parameter	**Concentration Range (mg/L)**	
	"Stained Area" Seepage	**"Clear" Seepage**
Arsenic	<0.005 - 0.007	<0.005
Cadmium	0.001 - 0.197	0.0004 - 0.0033
Copper	<0.001 - 0.74	0.002 - 0.01
Iron	<0.01 - 3.3	<0.01 - <0.05
Lead	<0.003 - 1.8	<0.003
Manganese	0.32 - 73.4	<0.01 - 1.21
Zinc	0.16 - 40.2	0.09 - 0.73

TABLE 3-4. MIKE HORSE TAILINGS IMPOUNDMENT GROUNDWATER QUALITY

Parameter	TDMW-1	TDMW-2S	TDMW-2D	TDMW-3D	TDMW-4S	TDMW-4D	TDMW-5
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.0001 - 0.0011	<0.0001 - <0.0002	<0.0001 - 0.00028	<0.0001 – 0.0001	0.0003	<0.0001	<0.0001
Copper	<0.001 – 0.003	<0.001 - 0.0015	<0.001 - 0.003	0.002-0.003	0.001	0.001 – 0.003	0.001 - 0.003
Iron	<0.02	<0.02 - 0.045	<0.01 - 0.05	<0.01	<0.01	<0.01	<0.01 -0.03
Lead	<0.003	<0.003	<0.003 - 0.010	<0.003	<0.003	<0.003	<0.003
Manganese	<0.01 - 0.03	<0.01 - 0.019	<0.01 - 0.20	<0.01	<0.01	<0.01 - 0.01	<0.01 – 0.06
Zinc	<0.01 - 0.097	<0.01 - 0.039	0.01 - 0.071	<0.01 – 0.06	0.06	<0.01	<0.01

mg/L = milligrams per liter

All concentrations are dissolved fraction

TABLE 3-5. LOWER MIKE HORSE 2000-2001
MINE WASTE SAMPLING RESULTS

Lower Mike Horse Area		Parameter (mg/kg)						
		Al	**As**	**Cd**	**Cu**	**Pb**	**Mn**	**Zn**
Combined Data								
	n	22	45	45	45	45	45	45
	average	4938	171	44	749	6779	3890	6809
	minimum	750	8	1	13	55	310	100
	maximum	8190	592	283	3300	28783	23700	45507
	95^{th} percentile	8145	458.4	134.8	2587.4	26472	9994	23587.2
	75^{th} percentile	6995	218	60	660	8347	5615	9142
Shallow Samples								
	n	22	22	22	22	22	22	22
	average	4938	144	28	787	6506	2913	4351
	minimum	750	8	1	13	55	310	100
	maximum	8190	320	90	3300	24600	23700	16200
	95^{th} percentile	8145	297.45	88.9	2683	14945	6640.5	14185
	75^{th} percentile	6995	215.25	38	651.5	7767.5	2607.5	5827.5
MDHES Background Data								
	minimum	6980	8.4	0.38	5.7	779	18.1	45.9
	maximum	10700	27.2	0.58	42.7	1010	59.1	56.3

n = number of samples; mg/kg = milligrams per kilogram

TABLE 3-6. LOWER MIKE HORSE CREEK 2000-2004 SURFACE WATER QUALITY DATA

Parameter (mg/L)	Upstream Site (BRSW-22) Concentration Range	Downstream Site (BRSW-35) Concentration Range
Arsenic	<0.005	<0.005
Cadmium	0.010 - 0.110	0.003 - 0.160
Copper	0.024 - 1.30	0.02 - 1.72
Lead	0.01 - 0.14	0.024 - 0.448
Manganese	0.02 - 3.1	0.1 - 6.2
Zinc	1.8 - 20	0.4 - 29

TABLE 3-7. LOWER MIKE HORSE CREEK GROUNDWATER QUALITY

Parameter (mg/L)	MHMW-8 Concentration Range	MIGW-1 Concentration Range
Arsenic	<0.005	<0.005
Cadmium	0.002 - 0.240	<0.0002
Copper	0.023 - 0.23	<0.001
Lead	<0.003	<0.003
Manganese	0.22 - 1.9	0.055 - 1.9
Zinc	0.76 - 53	0.012 - 0.024

mg/L = milligrams per liter

TABLE 3-8. LOWER MIKE HORSE CREEK SEDIMENT QUALITY

Lower Mike Horse		Parameter (mg/kg)					
		As	Cd	Cu	Pb	Mn	Zn
Bulk Samples							
	n	2	2	2	2	1	2
	average	105	57	2659	15598	29000	12267
	minimum	48	51.5	2020	2340	29000	10534.8
	maximum	161.7	63	3297	28855.2	29000	14000
	95^{th} percentile	156.015	62.425	3233.15	27529.44	29000	13826.74
	75^{th} percentile	133.275	60.125	2977.75	22226.4	29000	13133.7
Fine (<63 µm) Samples							
	n	2	2	2	2	2	2
	average	175	165.5	6545	6348	6068	78204
	minimum	170	21	1520	3095	3840	6960
	maximum	180	310	11570	9600	8296	149448
	95^{th} percentile	179.5	295.55	11067.5	9274.75	8073.2	142323.6
	75^{th} percentile	177.5	237.75	9057.5	7973.75	7182	113826
All Samples							
	n	4	4	4	4	3	4
	average	140	111.4	4602	10973	13712	45236
	minimum	48	21	1520	2340	3840	6960
	maximum	180	310	11570	28855.2	29000	149448
	95^{th} percentile	178.5	272.95	10329.05	25966.92	26929.6	129130.8
	75^{th} percentile	172.5	124.75	5365.25	14413.8	18648	47862

n = number of samples; mg/kg = milligrams per kilogram

TABLE 3-9. BEARTRAP CREEK 2000-2001 MINE WASTE SAMPLING RESULTS

Beartrap Creek		Parameter (mg/kg)						
		Al	As	Cd	Cu	Pb	Mn	Zn
Concentrated Tailings/Mine Waste (All Shallow Samples)								
	n	2	6	6	6	6	6	6
	average	4540	273	8	544	2383	1050	1521
	minimum	3160	63	3	134	310	519	447
	maximum	5920	411	12	951	6510	1710	3125
	95th percentile	5782	400.5	11.5	911.25	5380.5	1678.5	2793.25
	75th percentile	5230	358	10	768.25	1988.75	1437.75	1767.75
Dispersed Tailings								
	n	6	18	18	18	18	18	18
	average	6062	171	21	654	2158	4511	3654
	minimum	5020	38	10	65	101	777	387
	maximum	6910	242	39	1153	7589	8565	7403
	95th percentile	6892.5	242	30.5	1026.35	5957.85	8059.25	6496.05
	75th percentile	6737.5	231	24.75	874	2344.5	6065	4573.75
Shallow Samples (Dispersed Tailings Only)								
	n	6	8	8	8	8	8	8
	average	6062	206	22	653	1492	3660	3033
	minimum	5020	131	15	487	718	777	1900
	maximum	6910	242	39	925	2370	6284	6246
	95th percentile	6892.5	241.65	33.75	878.8	2334.3	5785.6	5134.4
	75th percentile	6737.5	238.75	23.25	780.25	1924.5	4200	2935
Combined Samples								
	n	8	24	24	24	24	24	24
	average	5681	196	18	626	2215	3646	3120
	minimum	3160	38	3	65	101	519	387
	maximum	6910	411	39	1153	7589	8565	7403
	95th percentile	6885.5	362.4	28.7	996.05	6384	7953.5	6322.5
	75th percentile	6532.5	241.25	24	820	2293.5	5341.25	4090.75
MDHES Background Data								
	minimum	6980	8.4	0.38	5.7	779	18.1	45.9
	maximum	10700	27.2	0.58	42.7	1010	59.1	56.3

n = number of samples; mg/kg = milligrams per kilogram

TABLE 3-10. BEARTRAP CREEK 2000-2004 SURFACE WATER QUALITY DATA

Parameter (mg/L)	Upstream Site (BRSW-23) Concentration Range	Downstream Site (BRSW-38) Concentration Range
Arsenic	<0.005	<0.005 - 0.007
Cadmium	0.0019 - 0.067	0.003 - 0.065
Copper	0.004 - 0.6	0.004 - 0.49
Lead	0.004 - 0.16	<0.003 - 0.33
Manganese	0.36 - 3.9	0.2 - 7.3
Zinc	0.53 - 12	0.5 - 14

TABLE 3-11. BEARTRAP CREEK GROUNDWATER QUALITY

Parameter (mg/L)	Concentration Range
Arsenic	<0.005
Cadmium	0.001 - 0.076
Copper	<0.001 - 0.024
Lead	<0.003 - 0.036
Manganese	<0.01 - 21
Zinc	0.37 - 14.4

TABLE 3-12. BEARTRAP CREEK SEDIMENT QUALITY

Parameter (mg/kg)	Concentration Range
Arsenic	400 - 690
Cadmium	12 - 46
Copper	1736 - 2953
Lead	8618 - 9812
Manganese	6945
Zinc	8668 - 19662

mg/L = milligrams per liter; mg/kg = milligrams per kilogram

TABLE 3-13. UPPER BLACKFOOT RIVER 2001 MINE WASTE SAMPLING RESULTS

Blackfoot River		Parameter (mg/kg)					
		As	Cd	Cu	Pb	Mn	Zn
Shave Creek Tailings							
	n	16	16	16	16	16	16
	average	133	13	528	1902	2988	1580
	minimum	23	10	133	164	400	317
	maximum	313	42	2050	6779	10173	5239
	95th percentile	265	23.25	1265.5	3749	7383.75	4213
	75th percentile	209.75	10.5	535.5	2237	4472.25	2020.5
Dispersed Fine Tailings (All Shallow)							
	n	2	2	2	2	2	2
	average	283	10	446	2962	870	870
	minimum	276	10	441	2951	658	869
	maximum	289	10	450	2972	1081	871
	95th percentile	288.35	10	449.55	2970.95	1059.85	870.9
	75th percentile	285.75	10	447.75	2966.75	975.25	870.5
Coarse Tailings (Shallow)							
	n	1	1	1	1	1	1
	average	511	125	2936	18402	5786	22663
	minimum	NA	NA	NA	NA	NA	NA
	maximum	NA	NA	NA	NA	NA	NA
	95th percentile	NA	NA	NA	NA	NA	NA
	75th percentile	NA	NA	NA	NA	NA	NA
Shallow Samples (Shave Creek and Dispersed Fine Tailings)							
	n	13	13	13	13	13	13
	average	184	13	519	2438	2564	1424
	minimum	42	10	133	1273	400	439
	maximum	313	42	2050	6779	10173	5239
	95th percentile	298.6	24.6	1145.8	4494.8	7285.8	3476.2
	75th percentile	249	10	450	2739	3530	1550

TABLE 3-13. UPPER BLACKFOOT RIVER 2001 MINE WASTE SAMPLING RESULTS (continued)

Blackfoot River		Parameter (mg/kg)					
		As	Cd	Cu	Pb	Mn	Zn
Combined Samples							
	n	19	19	19	19	19	19
	average	169	18	646	2882	2912	2615
	minimum	23	10	133	164	400	317
	maximum	511	125	2936	18402	10173	22663
	95^{th} percentile	332.8	50.3	2138.6	7941.3	6825.9	6981.4
	75^{th} percentile	239	11	538	2574.5	4768.5	2114
MDHES Background Data							
	minimum	8.4	0.38	5.7	779	18.1	45.9
	maximum	27.2	0.58	42.7	1010	59.1	56.3

n = number of samples; mg/kg = milligrams per kilogram

TABLE 3-14. UPPER BLACKFOOT RIVER 2000-2004 SURFACE WATER QUALITY DATA

Parameter (mg/L)	Site BRSW-9 Concentration Range	Site BRSW-12 Concentration Range
Arsenic	<0.005	<0.005
Cadmium	0.003 - 0.0115	0.002 - 0.010
Copper	0.005 - 0.190	0.007 - 0.110
Lead	<0.003 - 0.044	<0.003 - 0.050
Manganese	0.2 - 3.8	0.1 - 0.9
Zinc	0.4 - 2.6	0.5 - 2.0

TABLE 3-15. UPPER BLACKFOOT RIVER GROUNDWATER QUALITY

Parameter (mg/L)	Anaconda Mine Area	Mary P Area	Shave Creek Tailings Area	Edith Mine Area
Arsenic	<0.002	Not Analyzed	<0.005 - 0.038	Not Analyzed
Cadmium	<0.001 - 0.042	<0.005 - 0.014	0.014 - 0.80	<0.005
Copper	<0.005 - 0.70	<0.025 - 0.342	0.19 - 11	<025 - 0.118
Lead	<0.002 - 0.005	<0.003	0.027 - 2.1	<0.003 - 0.01
Manganese	<0.01 - 9.5	0.03 - 1.028	2.1 - 171	0.3 - 1.32
Zinc	<0.01 - 6.3	0.191 - 2.792	2.6 - 114	0.065 - 0.578

TABLE 3-16. UPPER BLACKFOOT RIVER SEDIMENT QUALITY

Parameter (mg/kg)	Bulk Sample Concentration Range	<63 µm Sample Concentration Range
Arsenic	18.9 - 181	84 - 554
Cadmium	1.1 - 34	26 - 119
Copper	122 - 975	826 - 5081
Lead	253 - 4350	2400 - 8702
Manganese	422 - 3750	5150 – 22460
Zinc	361 - 6500	7810 - 51950

mg/L = milligrams per liter; mg/kg = milligrams per kilogram; µm = micrometer

TABLE 3-17. COMPARATIVE GROUNDWATER CHEMISTRY FROM TAILINGS IMPOUNDMENT WEST SHORELINE WELLS, PIEZOMETERS AND TAILINGS POND

Parameter	Units	TDMW-3D	TDMW-4S	TDMW-4D	TDMW-5	Pond
Field Parameters						
Static Water Level	feet	34.28	8.88	10.89	54.85	na
pH	S.U.	7.04	7.43	7.3	7.52	6.90
Specific Conductance	µmhos/cm	175	153	144	273	200
Dissolved Oxygen	mg/L	7.62	8.59	8.62	na	9.80
Water Temp	ºC	8.4	10.3	6.7	7.1	11.6
Laboratory Parameters						
pH	S.U.	7.6	7.9	7.5	8.2	8.2
TDS	mg/L	112	92	92	186	92
Total Alkalinity	mg/L	77	82	77	110	84
Sulfate	mg/L	20	5	6	84	4
Calcium	mg/L	20	17	17	32	16
Magnesium	mg/L	10	9	9	13	9
Sodium	mg/L	<1	<1	1	8	1
Potassium	mg/L	<1	<1	<1	1	<1

Samples collected on May 17, 2007
TDMW-3S was dry at the time of sampling.

TABLE 4-1. SOIL/MINE WASTE DATA SCREENING OF POTENTIAL CONTAMINANTS OF CONCERN

	Aluminum	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Mike Horse Tailings Imp	No	Yes	Yes	Yes	Yes	Yes	Yes
Lower Mike Horse Creek	No	Yes	Yes	Yes	Yes	Yes	Yes
Beartrap Creek							
Concentrated Tailings	No	Yes	Yes	Yes	Yes	No	Yes
Intermixed Tailings	No	Yes	Yes	Yes	Yes	No	Yes
Blackfoot River							
Concentrated Tailings	No	Yes	No	Yes	Yes	No	Yes
Coarse Tailings	No	Yes	Yes	Yes	Yes	Yes	Yes
Fine Tailings	No	Yes	No	Yes	Yes	No	Yes

TABLE 4-2. HAZARD QUOTIENTS FOR EXPOSURE TO COMBINED SOIL IN THE UPPER BLACKFOOT RIVER DRAINAGE BOTTOM

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	169	18	646	2,882	2,912	2,615
ATV/Motorcycle Risk-Based Criteria, mg/kg[(2)]	27	415	103,000	3,935	1,595	835,000
Hazard Quotients[(3)]	**6.26**	0.04	0.01	0.73	**1.83**	0.003

Notes:
<0.01 = the HQ is less than 0.01.
(1) Arithmetic average soil concentration of combined mine waste/soil samples in milligrams per kilogram (see Table 3-13).
(2) Per Tetra Tech, 2004, Tables A-4 and A-5, Overall Guideline 15 day exposure frequency column, revised for a 5E-6 risk level for arsenic and cadmium and HQ of 0.5 for remaining constituents.
(3) Tailings concentrations divided by the ATV/motorcycle criteria. A value greater than 1.0 (shown in Bold text) indicates an unacceptable potential for adverse health impacts under the exposure assumptions used in this assessment.

TABLE 4-3. HAZARD QUOTIENTS FOR EXPOSURE TO COMBINED MINE WASTE/SOIL IN THE BEARTRAP CREEK DRAINAGE BOTTOM

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	196	18	626	2,215	3,646	3,120
ATV/Motorcycle Risk-Based Criteria, mg/kg[(2)]	27	415	103,000	3,935	1,595	835,000
Hazard Quotients[(3)]	**7.26**	0.04	0.01	0.56	**2.29**	0.004

See notes for Table 4-2.
(1) Concentrations represent mean values of combine shallow and deep mine waste/soil samples (see Table 3-9).

TABLE 4-4. HAZARD QUOTIENTS FOR EXPOSURE TO MINE WASTE/SOIL IN THE LOWER MIKE HORSE AREA

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	171	44	749	6,779	3,890	6,809
ATV/Motorcycle Risk-Based Criteria, mg/kg[(2)]	27	415	103,000	3,935	1,595	835,000
Rock Hound Risk-Based Criteria, mg/kg[(4)]	16.7	1,750	54,200	2,200	129,000	440,000
Hazard Quotients – ATV/Motorcycle[(3)]	**6.33**	0.11	0.01	**1.72**	**2.44**	0.01
Hazard Quotients –Rock Hound[(3)]	**10.24**	0.03	0.01	**3.08**	0.03	0.02

See notes for Table 4-2.
(1) Concentrations represent mean values of combine shallow and deep mine waste/soil samples (see Table 3-5).
(4) Per Tetra Tech, 2004, Table A-3, Gold Panner/Rock Hound columns, modified from 50 to 25 days of site use per year, revised for a 5E-6 risk level for arsenic and cadmium and HQ of 0.5 for remaining constituents.

TABLE 4-5. HAZARD QUOTIENTS FOR EXPOSURE TO IMPOUNDED MINE WASTE/SOIL IN THE MIKE HORSE TAILINGS IMPOUNDMENT

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	260	26	645	3,653	7,242	4,168
ATV/Motorcycle Risk-Based Criteria, mg/kg[(2)]	27	415	103,000	3,935	1,595	835,000
Hazard Quotients[(3)]	**9.6**	0.06	0.01	0.9	**4.5**	<0.01

See notes for Table 4-2.
Concentrations represent mean values of impounded mine waste/soil samples (see Table 3-1).

TABLE 4-6. HAZARD QUOTIENTS FOR EXPOSURE TO SOIL IN THE MIKE HORSE TAILINGS IMPOUNDMENT – EMBANKMENT FACE

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	62	6	153	503	1,110	858
ATV/Motorcycle Risk-Based Criteria, mg/kg[(2)]	27	415	103,000	3,935	1,595	835,000
Hazard Quotients[(3)]	**2.3**	0.01	<0.01	0.1	0.7	<0.01

See notes for Table 4-2.
Concentrations represent mean values of dam embankment soil samples (see Table 3-1).

TABLE 4-7. HAZARD QUOTIENTS FOR EXPOSURE TO SURFACE WATER

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Water Concentration in ug/L[(1)]						
Mike Horse Tailings Impoundment	0.009	0.0035	0.008	0.01	0.037	0.031
Upper Blackfoot River	0.005U	0.0054	0.04	0.016	0.67	1.39
Risk-Based Criteria in mg/kg						
Fisherman[(2)]	1.115	104	6,900	60	443,000	43,400
Hazard Quotients[(3)]						
Mike Horse Tailings Impoundment	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Upper Blackfoot River	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

U = Value shown is the detection limit.

(1) Arithmetic average concentration of surface water samples in micrograms per liter. The detection limit is used to estimate concentrations for results reported by the laboratory as "not detected".

(2) Per Tetra Tech, 2004, Table A-7, 7.9 days of site use per year, revised for a 5E-6 risk level for arsenic and cadmium and HQ of 0.5 for remaining constituents.

(3) Water concentrations divided by the Fisherman criteria. A value greater than 1.0 indicates an unacceptable potential for adverse health impacts under the exposure assumptions used in this assessment. Values reported as <0.01 indicate that the HQ is less than 0.01.

TABLE 4-8. ECOLOGICAL SOIL SCREENING VALUES

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Plants	18[(1)]	32[(2)]	100[(5)]	120[(3)]	500[(5)]	50[(5)]
Invertebrates	60[(6)]	140[(2)]	60[(4)]	1700[(3)]	NA	200[(6)]
Birds	43[(1)]	0.77[(2)]	515[(4)]	11[(3)]	NA	8.5[(4)]
Mammals	46[(1)]	0.36[(2)]	370[(4)]	56[(3)]	NA	1600[(4)]

NA - Insufficient data available to support setting a standard.

(1) Ecological Soil Screening Levels for Arsenic Interim Final OSWER Directive 9285.7-62, March 2005.

(2) Ecological Soil Screening Levels for Cadmium Interim Final, OSWER Directive 9285.7-65, March 2005.

(3) Ecological Soil Screening Levels for Lead Interim Final, OSWER Directive 9285.7-70, March 2005.

(4) Preliminary Remediation Goals for Ecological Endpoints, R. A. Efroymson, et. al., ES/ER/TM-162/R2, August 1997.

(5) Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision, R. A. Efroymson, et. al., ES/ER/TM-85/R3, November, 1997.

(6) Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision, R. A. Efroymson, et. al., ES/ER/TM-126/R2, November, 1997.

TABLE 4-9. ECOLOGICAL HAZARD QUOTIENTS IN THE BLACKFOOT RIVER DRAINAGE BOTTOM

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	169	18	646	2,882	2,912	2,615
Hazard Quotients[(2)]						
Plants	**9.4**	0.6	**6.5**	**24**	**5.8**	**52**
Invertebrates	**2.8**	0.1	**11**	**1.7**	NA	**13.1**
Birds	**3.9**	**23**	**1.3**	**262**	NA	**307**
Mammals	**3.7**	**50**	**1.7**	**52**	NA	**1.6**

NA = not applicable, no eco-SSL.
(1) Arithmetic average soil concentration of surface samples in milligrams per kilogram.
(2) Soil concentrations divided by the appropriate eco-SSLs (presented in Table 4-8). A value greater than 1.0 (shown in Bold text) indicates an unacceptable potential for adverse health impacts.

TABLE 4-10. ECOLOGICAL HAZARD QUOTIENTS IN THE BEARTRAP CREEK DRAINAGE BOTTOM

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	196	18	626	2,215	3,646	3,120
Hazard Quotients[(2)]						
Plants	**11**	0.6	**6.3**	**19**	**7.3**	**62**
Invertebrates	**3.3**	0.1	**10**	**1.3**	NA	**15**
Birds	**4.6**	**23.4**	**1.2**	**201**	NA	**367**
Mammals	**4.3**	**50**	**1.7**	**40**	NA	**2.0**

See notes for Table 4-9.

TABLE 4-11. ECOLOGICAL HAZARD QUOTIENTS IN THE LOWER MIKE HORSE AREA

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	171	44	749	6,779	3,890	6,809
Hazard Quotients[(2)]						
Plants	**9.5**	**1.4**	**7.5**	**57**	**7.8**	**136**
Invertebrates	**2.9**	0.3	**13**	**4.0**	NA	**34**
Birds	**4.0**	**57**	**1.5**	**616.3**	NA	**801**
Mammals	**3.7**	**122**	**2.0**	**121**	NA	**4.3**

See notes for Table 4-9.

TABLE 4-12. ECOLOGICAL HAZARD QUOTIENTS IN THE MIKE HORSE TAILINGS IMPOUNDMENT - TAILINGS

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	260	26	645	3,653	7,242	4,168
Hazard Quotients[(2)]						
Plants	**14**	0.8	**6.5**	**30**	**14.0**	**83**
Invertebrates	**4.3**	0.2	**10.8**	**2.1**	NA	**21**
Birds	**6.0**	**34**	**1.3**	**332**	NA	**490**
Mammals	**5.7**	**72**	**1.7**	**65**	NA	**2.6**

See notes for Table 4-9.

TABLE 4-13. ECOLOGICAL HAZARD QUOTIENTS IN THE MIKE HORSE TAILINGS IMPOUNDMENT – DAM FACE

	Arsenic	Cadmium	Copper	Lead	Manganese	Zinc
Concentrations, mg/kg[(1)]	62	6	153	503	1,110	858
Hazard Quotients[(2)]						
Plants	**3.4**	0.2	**1.5**	**4.2**	**2.2**	**17**
Invertebrates	**1.0**	0.04	**2.6**	0.3	NA	**4.3**
Birds	**1.4**	**7.8**	0.3	**45.7**	NA	**101**
Mammals	**1.3**	**16.7**	0.4	**9.0**	NA	0.5

See notes for Table 4-9.

TABLE 5-1. ARAR-BASED REMOVAL ACTION GOALS FOR SURFACE WATER AT THE UBMC

Parameter	Existing Concentrations mg/L		ARAR-Based Goal mg/L	Applicable Standard
	Mean	Range		
Aluminum	0.083	<0.05 - 0.38	0.087	CALS
Arsenic	0.006	<0.002 - 0.02	0.010	HHS
Cadmium	0.0134	<0.001 - 0.16	0.0003	CALS
Copper	0.114	0.004 - 1.72	0.0093	CALS
Iron	0.454	<0.01 - 9.5	0.30	NS
Lead	0.042	<0.002 - 0.448	0.0032	CALS
Manganese	0.886	<0.008 - 7.3	0.05	NS
Zinc	2.58	0.0092 - 29.0	0.12	CALS

mg/L = milligrams per liter
HHS- Human Health Standard from Circular DEQ-7
CALS- Chronic Aquatic Life Standard from Circular DEQ-7
NS-Narrative Standard
Al concentrations are dissolved fraction; all other total recoverable.
Note: Surface water goals not intended to be more stringent that natural background concentrations.

TABLE 5-2. ARAR-BASED REMOVAL ACTION GOALS FOR GROUNDWATER AT THE UBMC

Parameter	Concentration Range* mg/L	ARAR-Based Goal mg/L	Applicable Standard
Arsenic	<0.005 - 0.038	0.01	HHS
Cadmium	<0.0001 - 0.80	0.005	HHS
Copper	<0.001 - 11.0	1.3	HHS
Lead	<0.002 - 2.1	0.015	HHS
Manganese	<0.005 - 171	0.05	SMCL
Zinc	<0.01 - 114	2.0	HHS

mg/L = milligrams per liter
HHS- Human Health Standard
SMCL- Maximum Contaminant Level
*Maximum concentration for all metals recorded in Shave Creek Concentrated Tailings shallow (5-ft) piezometer.

TABLE 5-3. RISK-BASED SOIL CLEANUP GOALS FOR MODERATE RECREATIONAL USE

Parameter	Soil Background (1) mg/kg		Human Health Risk Goal mg/kg		Ecological Risk Goal mg/kg				Recommended Goal mg/Kg (3)
	Maximum	UCL (2)	ATV/ Motorcycle	Rock Hound/Gold Panner (4)	Plants	Invertebrates	Birds	Mammals	
Arsenic	187	**44**	27	16.7	18	60	43	46	**44**
Cadmium	15	**1.6**	NA	NA	32	140	0.77	0.36	**1.6**
Copper	447	**62**	NA	NA	100	60	515	**370**	**62 - 370**
Lead	5,110	**217**	3,935 (5)	2,200 (6)	120	1700	11	56	**217**
Manganese	11,900	**1,484**	1,595	**129,000**	500	NA	NA	NA	**1,484 – 129,000 (4)**
Zinc	3,530	**245**	NA	NA	50	200	8.5	1600	**245**

mg/kg = milligrams per kilogram

NA = The risk evaluation (Section 4) indicated these metals did not pose an unacceptable risk.

(1) Tetra Tech, 2004, Table UB-1.

(2) Upper Confidence Limit (UCL) of the mean concentration (presumably the 95th percent, but guidance does not state).

(3) Based on the lowest of the human health or ecological risk-based goals, except where such values are less than background. Site-specific background values may later be shown to differ from the UCL values reported in Tetra Tech, 2004, and may be as high as the maximum values shown. A range of cleanup goals is shown where cleanup goals are influenced by cleanup goals for plants or invertebrates to reflect the large uncertainty in determining these standards and the lower priority given to these organisms.

(4) Rock hound/gold panner only applicable to the Lower Mike Horse Area (see Section 4.2). Upper range of the recommended cleanup goal is 1,595 for areas other than the Lower Mike Horse Area.

(5) An alternative value of 15,866 mg/kg is obtained using the LeadSpread model in Appendix C.

(6) An alternative value of 10,829 mg/kg is obtained for the adult rock hound and value of 6,310 mg/kg is obtained for the child rock hound (0 to 6 years of age) using the LeadSpread model in Appendix C.

TABLE 5-4. FUTURE POTENTIAL RISK-BASED SURFACE WATER CLEANUP GOALS FOR MODERATE RECREATIONAL USE

Parameter	Upgradient (background)[1]	Fisherman	Chronic Aquatic[2]
Arsenic	<0.005	0.0011	0.015
Cadmium	0.010 - 0.110	0.10	0.0003
Copper	0.024 - 1.30	6.90	0.0093
Lead	0.01 - 0.14	0.060	0.0032
Manganese	0.02 - 3.1	443	NA
Zinc	1.8 - 20	43.4	0.12

Units in mg/L.

NA = The risk evaluation indicated these metals did not pose an unacceptable risk.

(1) Average concentration at sample location BRSW-22 on Mike Horse Creek for the monitoring period 2000-2005. Ongoing remediation efforts are expected to improve these concentrations over time.

(2) Based on a hardness of 100 mg/L.

TABLE 6-1. POTENTIAL REPOSITORY SITES FOR UBMC EE/CA

Site	Distance from Impoundment	Distance to Surface Water (waterbody name)	Ground Slope	Available Capacity cy	Land Ownership	Haul Roads/ Conditions	Other Considerations	
							Pros	Cons
West Impoundment	<0.25 mi	~100 ft	33%	Up to 245,000	USFS	Roads currently in place; some upgrade needed.	No ownership issues. Close proximity to removal areas. No new roads required to access site. No highway haul necessary. No off-site disturbance necessary.	Additional information on subsurface conditions necessary to ensure site suitability. Higher level of engineering may be required.
Old Townsite	0.25 mi	~50 ft	25%	125,000	USFS	Roads currently in place; some upgrade needed.	No ownership issues. Close proximity to removal areas. No new roads required to access site. No highway haul necessary. No off-site disturbance necessary.	Additional information on subsurface conditions necessary to ensure site suitability. Higher level of engineering may be required.
Paymaster	2.5 mi	>200 ft	20% to 25%	200,000 to >500,000	Asarco	Roads currently in place to within 0.5 miles of site.	Relatively close to removal areas. No new roads required to access site. No highway haul necessary. No off-site disturbance necessary.	Access agreements may be required. Additional information on subsurface conditions necessary to ensure site suitability.
First Gulch	6 mi	~ 300 ft	20% to 25%	300,000 to 770,000	USFS	Roads currently in place; some upgrade needed. 2 mile haul on Highway 200	No ownership issues. No new roads required to access site (upgrades needed). Potential to handle larger volume of material than in-drainage sites.	Moderate haul distance. Highway haul necessary (2 mi). Requires 15 to 20 acre off-site disturbance. Additional information on subsurface conditions necessary to ensure site suitability.
Horsefly Creek	10 miles	~ 200 ft	5% to 12%	In excess of 500,000	Stimson Lumber Company	1.5 miles new road needed with Blackfoot River crossing. 6 mile haul on Highway 200	Large, relatively low slope area. Potential to handle larger volume of material than in-drainage sites.	Access agreements or ownership transfer required. Relatively long haul (10 mi). Highway haul necessary (6 mi). Requires 15 to 20 acre off-site disturbance. Additional information on subsurface conditions necessary to ensure site suitability.

TABLE 6-2. SUBAREA-SPECIFIC REMOVAL ACTION OPTIONS MATRIX - ENGINEERING EVALUATION/COST ANALYSIS FOR THE UPPER BLACKFOOT MINING COMPLEX

SUBAREA	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
Mike Horse Tailings Impoundment	**No Action-** Continue with current monitoring program and emergency action plan.	**In-Place Stabilization of Dam**: Line interior dam face; construct emergency overflow spillway; construct toe drains; place soilcover over dam face and seed.	**Removal of Dam from Service and Partial Removal of Impounded Tailings from Beartrap Creek**: Partial removal of dam and impounded tails down to native ground and construction of engineered channel for conveyance of Beartrap Ck. Place removed material in west impoundment repository site.	**Total Removal of Dam and Impounded Tailings:** Removal of entire dam and impounded tailings and all contaminated native material and restore Mike Horse and Beartrap Ck drainage bottoms to extent practicable. Place removed material in Paymaster area repository or other in-drainage location.	**Total Removal of Dam and Impounded Tailings**: Removal of entire dam and impounded tailings and all contaminated native material and restore Mike Horse and Beartrap Ck drainage bottoms to extent practicable. Place removed material in Horsefly Creek, First Gulch or other out-of-drainage location.
Lower Mike Horse Creek	**No Action**	**Partial Mine Waste Removal**: Remove mine waste below high water mark and consolidated waste from drainage walls; regrade, stabilize and cover remaining mine waste in place. Place removed material above high water mark or in in-drainage repository.	**Total Mine Waste Removal and Placement in In-drainage Repository**: Remove all mine waste material and a minimum of one-foot of underlying native soil. Restore Mike Horse Creek to stable, functioning condition. Place removed material in in-drainage repository. Estimated volume: 15,000 cy.	Not Applicable	Not Applicable
Beartrap Creek	**No Action**	**Remove Concentrated Tailings Only**: Remove concentrated tails and minimum one-foot underlying native soils; amend post-excavation surface as needed prior to seeding. Place removed material in in-drainage repository. Estimated volume: 5,000 cy.	**Remove Concentrated Tailings; In-Place Reclamation of Intermixed Tailings**: Remove concentrated tailings and minimum one-foot underlying native soils same as Option 2. Amend upper 2 feet of drainage bottom to neutralize intermixed tailings and promote revegetation. Place removed material in in-drainage repository. Estimated volume: 5,000 cy.	**Remove Concentrated Tailings; Remove Intermixed Tailings Within Stream Channel Migration Corridor:** Remove concentrated tailings and minimum one-foot underlying native soils same as Option 2 and 3. Remove intermixed tailings peripheral to channel to provide a tailings-free floodplain/migration corridor for Beartrap Creek. Remaining intermixed tailings may be amended as in Option 3. Place removed material in Paymaster area repository or other in-drainage location. Estimated volume: 30,000 cy (preliminary).	**Total Mine Waste Removal**: Remove all concentrated and intermixed tailings between the tailings dam and confluence with Anaconda Ck. Import clean fill as necessary to maintain suitable post-removal grade through drainage. Restore Beartrap Ck to a functioning stream channel and floodplain/riparian area. Place removed material in in-drainage or out-of-drainage repository location. Estimated volume: 62,500 cy.
Upper Blackfoot River	**No Action**	**Remove Shave Ck Concentrated Tailings and Larger Dispersed Tailings Deposits**: Remove Shave Ck conc. tailings; tailings deposits UBDT-100, 101, 102; fine tailings deposits located adjacent to and approximately 600 ft downstream of Anaconda Mine; deposit of coarse tailings immediately downstream of constructed wetlands; and minimum 1-ft underlying soil. Place clean backfill as necessary to maintain suitable post-removal grade through drainage. Revegetate excavation areas. Place removed material in in-drainage repository. Estimated volume: 35,000 cy.	**Remove Shave Ck Concentrated Tailings and Larger Dispersed Tailings Deposits; In-Place Reclamation of Remaining Dispersed Tailings**: Remove Shave Ck conc. tailings and larger dispersed tailings deposits per Option 2. Reclaim remaining tailings in-place through amendment and/or covering with clean soil, and revegetation. Place removed material in in-drainage repository. Estimated volume: 35,000 cy.	**Complete Mine Waste Removal**: Remove all concentrated and dispersed tailings and minimum 1-foot of underlying native soil. Import clean fill as necessary to maintain suitable post-removal grade through drainage. Restore Blackfoot River to a functioning stream channel and floodplain/riparian area; possible relocation of channel through Shave Ck tailings removal area and relocation of County Road. Place removed material in in-drainage or out-of-drainage repository location. Estimated volume: 40,000+ cy.	Not Applicable

Shaded options not retained for detailed analysis in EECA based on preliminary screening.

TABLE 6-3. SITE-WIDE REMOVAL ACTION ALTERNATIVES FOR UBMC EE/CA

	Tailings Impoundment	Lower Mike Horse Creek	Beartrap Creek	Upper Blackfoot River	Total Removal Volume cy	Repository Options	Cost
Alternative 1 No Action	**Option 1 -No Action** Continue with current monitoring program and emergency action plan.	**Option 1- No Action** Conduct site monitoring.	**Option 1- No Action** Conduct site monitoring.	**Option 1- No Action** Conduct site monitoring.	0	No Repository Needed	$2,448,000
Alternative 2 Partial Removal with Dam Spillway and Liner	**Option 2** In-Place Stabilization of Dam and Impoundment (13,000 cy removal minimum)	**Option 2** Partial Mine Waste Removal (5,000 cy removal)	**Option 2** Remove Concentrated Tailings Deposits Only (6,500 cy removal)	**Option 2** Remove Shave Ck Concentrated Tailings and Larger Dispersed Tailings Deposits (35,000 cy removal)	60,000	Place in one in-drainage repository in following order of preference: 1. Paymaster 2. Old Townsite 3. West Impoundment	$5,221,000
Alternative 3 Partial Removal with Impound. Taken Out of Service	**Option 3** Removal of Dam from Service and Partial Removal of Impounded Tailings (66,000 cy removal).	**Option 3** Total Mine Waste Removal (15,000 cy removal)	**Option 2** Remove Concentrated Tailings Deposits Only (6,500 cy removal)	**Option 2** Remove Shave Ck Concentrated Tailings and Larger Dispersed Tailings Deposits (35,000 cy removal)	123,000	Place in one or more in-drainage repositories in following order of preference: 1. West Impoundment Repository 2. Paymaster Repository 3. Old Townsite Repository	$7,778,000
Alternative 4 Total Removal with In-Drainage Disposal	**Option 4** Total Removal of Dam and Impounded Tailings with In-drainage Disposal (370,000 cy removal)	**Option 3** Total Mine Waste Removal (15,000 cy removal)	**Option 4** Remove All Concentrated Tailings; Remove Intermixed Tailings adjacent to Stream Channel (30,000 cy removal)	**Option 4: Total** Mine Waste Removal (40,000+ cy removal minimum)	455,000	Place in in-drainage repository (or out-of-drainage repository if in-drainage not available) in following order of preference: 1. Paymaster Repository 2. First Gulch Repository	$19,224,000
Alternative 5 Total Removal with Out-of-Drainage Disposal	**Option 5** Total Removal of Dam and Impounded Tailings with Out-of-drainage Disposal (370,000 cy removal)	**Option 3** Total Mine Waste Removal (15,000 cy removal)	**Option 5** Total Mine Waste Removal (62,500 cy removal)	**Option 4: Total** Mine Waste Removal (40,000 cy removal minimum)	490,000	Place in one out-of-drainage repository in following order of preference: 1. Horsefly Ck 2. First Gulch 3. Other out-of-drainage repository.	$30,550,000

TABLE 7-1. COMPARATIVE ANALYSIS OF SITE-WIDE REMOVAL ACTION ALTERNATIVES FOR UBMC EE/CA

CRITERION	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
Effectiveness					
Overall Protection of Human Health and the Environment	Low	Moderate	Moderate	High	High
Short-Term Effectiveness	Low	Moderate	Low to Moderate	Moderate	Moderate
Long-Term Effectiveness and Permanence	Low	Low to Moderate	Moderate	Moderate to High	High
Reduction of Toxicity, Mobility or Volume	Low	Low to Moderate	Moderate	Moderate to High	High
Compliance with ARARs	Low	Low to Moderate	Moderate	High	High
Implementability					
Technical Feasibility	High	High	Moderate	Moderate	Moderate
Availability of Services and Materials	High	Moderate	Moderate	Moderate	Moderate
Administrative Feasibility	Low	Low	Moderate	High	Moderate to High
Cost					
Capital	$0	$3,255,000	$6,279,000	$18,144,000	$29,551,000
O&M (Present Worth)	$2,448,000	$1,966,000	$1,499,000	$1,080,000	$999,300
Total Cost	$2,448,000	$5,221,000	$7,778,000	$19,224,000	$30,550,000