Appendices

Appendix 2A

Acid Rock Characterization for the Wolverine Property

Sample	% Total	% Sulfate	Paste	Acid	Neutralization Potential (NP)		
	Sulfur	Sulfur	pH	Potential	Actual	Ratio	Net
WV96-58 Hanging wall	3.29	0.01	8	103	142	1.39	40
WV96-58 Foot wall	1.77	0.01	7.9	55	22.3	0.4	-33
WV96-72 Hanging wall	5.59	0.04	7.9	174.7	38.5	0.22	-136.2
WV96-72 Foot wall	1.09	<0.01	8.4	34.1	196	5.76	162
WV96 - 72 Hanging/foot	2.7	<0.01	7.5	84.4	33.7	0.4	-50.7
WV96-39 Hanging wall	3.44	<0.01	7.7	108	82.8	0.77	-25
WV96-39 Foot wall	0.28	<0.01	8.8	9	49.5	5.66	40.8
WV96-63 Hanging wall	1.57	<0.01	8.1	49.1	161	3.29	112
WV96-63 Foot wall	1.24	<0.01	8	38.8	91.5	2.36	52.8
WV96-60 Foot wall	2.11	<0.01	8	65.9	60.8	0.92	-5.2
Massive Sulphide Comp 3							
Massive Sulphide Comp 2							
Massive Sulphide Comp 1							
WV96-72 Foot wall (D)	1.07	<0.01	8.4	33.4	198	5.92	165
WV96-72 Hanging wall (D)					44.3		
WV96 - 72 Hanging/foot (D)	2.81	<0.01	7.4	87.8	34.9	0.4	-53

Sample	Al	Sb	As	Ba	Bi	Cd	Ca	Cr	Co	Cu	Fe	La	Pb	Mg	Mn	Hg
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
WV96-58 Hanging wall	6832	102	25	23	<2	94.3	26243	97	4	309	43628	<2	112	14081	1233	7
WV96-58 Foot wall	20061	19	30	49	<2	<0.1	6330	66	9	46	5.10%	13	26	18596	504	<3
WV96-72 Hanging wall	4551	25	103	14	<2	89.8	16027	88	8	763	6%	<2	1647	2417	424	<3
WV96-72 Foot wall	17700	21	43	104	<2	19.9	42105	31	5	413	40188	34	179	37847	648	<3
WV96 - 72 Hanging/foot	3734	78	129	20	<2	24.2	21526	119	4	278	28824	9	132	1518	207	<3
WV96-39 Hanging wall	3875	99	85	19	<2	74.5	31909	67	13	643	39332	2	1212	3494	1491	<3
WV96-39 Foot wall	25957	123	82	24	13	0.1m	10855	54	22	15670	8.10%	35	754	28384	666	<3
WV96-63 Hanging wall	2742	<5	43	39	<2	6.8	67022	93	4	68	16199%	4	97	1349	779	<3
WV96-63 Foot wall	9927	7	15	99	<2	6.9	39716	39	7	154	27957	27	56	11690	383	<3
WV96-60 Foot wall	2578	22	59	36	<2	33.4	25841	90	4	186	21723	3	69	1259	279	<3
Massive Sulphide Comp 3	1264	523	1401	16	<2	0.5m	32625	57	16	4968	17%	<2	3931	676	485	15
Massive Sulphide Comp 2	19100	323	171	28	15	0.7m	40087	68	38	2.10%	18%	14	1146	25427	1211	35
Massive Sulphide Comp 1	546	250	674	<2	65	2m	25400	37	30	9409	19%	<2	146525	482	493	72
WV96-72 Foot wall (D)																
WV96-72 Hanging wall (D)																
WV96 - 72 Hanging/foot (D)																

Sample	Mo	Ni	P	K	Sc	Ag	Na	Sr	Tl	Ti	W	V	Zn	Zr	Se
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
WV96-58 Hanging wall	9	26	424	1368	2	3.6	192	78	<10	<100	<5	63	10617	4	82
WV96-58 Foot wall	6	32	859	893	1	1	110	17	<10	<100	<5	10	126	9	12
WV96-72 Hanging wall	8	32	586	1060	2	12.1	151	54	<10	<100	<5	26	11666	15	108
WV96-72 Foot wall	19	21	371	1435	<1	8.1	151	116	<10	<100	<5	20	2497	29	37
WV96 - 72 Hanging/foot	20	105	4907	1497	<1	5.2	153	69	<10	<100	<5	65	2347	10	33
WV96-39 Hanging wall	16	69	696	1344	1	30.5	160	80	<10	<100	<5	23	8450	12	48
WV96-39 Foot wall	4	3	618	2029	1	0.1m	155	28	<10	<100	<5	8	16870	18	426
WV96-63 Hanging wall	5	30	619	960	3	1.3	134	291	<10	<100	<5	7	905	8	11
WV96-63 Foot wall	7	11	427	1194	<1	0.8	118	78	<10	<100	<5	5	590	10	14
WV96-60 Foot wall	9	28	805	1208	<1	2.2	148	96	<10	<100	<5	13	3596	14	27
Massive Sulphide Comp 3	13	66	1224	141	<1	0.1m	<100	56	<10	<100	<5	38	5.70%	9	261
Massive Sulphide Comp 2	20	42	589	2023	1	0.1m	120	95	<10	<100	<5	85	7.20%	23	1007
Massive Sulphide Comp 1	<1	63	391	<100	<1	0.2m	<100	63	<10	<100	<5	26	19%	6	45
WV96-72 Foot wall (D)															
WV96-72 Hanging wall (D)															
WV96 - 72 Hanging/foot (D)															

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC1

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-63 Hanging Wall Composite (Comp 1)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
Page: 1 of 3

		Cycle										
Element	Unit	0	1	2	3	4	5	6	7	8	9	10
Al	mg/L	0.18			0.11			0.08			0.10	
Sb	mg/L	<0.05			<0.05			<0.05			<0.05	
As	mg/L	<0.03			<0.03			<0.03			<0.03	
Ba	mg/L	0.063			0.028			0.021			0.018	
Be	mg/L	<0.001			<0.001			<0.001			<0.001	
Bi	mg/L	<0.1			<0.1			<0.1			<0.1	
B	mg/L	0.24			0.30			0.26			0.36	
Cd	mg/L	<0.005			<0.005			<0.005			<0.005	
Ca	mg/L	37.79			26.72			21.54			19.17	
Cr	mg/L	<0.01			<0.01			<0.01			<0.01	
Co	mg/L	<0.01			<0.01			<0.01			<0.01	
Cu	mg/L	<0.01			<0.01			0.02			0.02	
Fe	mg/L	<0.01			<0.01			<0.01			<0.01	
Pb	mg/L	<0.05			<0.05			<0.05			<0.05	
Li	mg/L	<0.02			<0.02			<0.02			<0.02	
Mg	mg/L	2.8			1.8			1.7			1.6	
Mn	mg/L	0.404			0.574			0.673			0.681	
Hg	mg/L	<0.02			<0.02			<0.02			<0.02	
Mo	mg/L	<0.01			<0.01			<0.01			<0.01	
Ni	mg/L	0.16			0.05			0.05			0.06	
P	mg/L	<0.1			<0.1			<0.1			<0.1	
K	mg/L	3			<2			<2			<2	
Se	mg/L	<0.05			<0.05			<0.05			<0.05	
Si	mg/L	0.46			0.18			0.12			0.28	
Ag	mg/L	<0.02			<0.02			<0.02			<0.02	
Na	mg/L	6			1.5			1.0			1.0	
Sr	mg/L	0.221			0.162			0.127			0.112	
Tl	mg/L	<0.2			<0.2			<0.2			<0.2	
Sn	mg/L	<0.1			<0.1			<0.1			<0.1	
Ti	mg/L	<0.01			<0.01			<0.01			<0.01	
W	mg/L	<0.1			<0.1			<0.1			<0.1	
V	mg/L	<0.01			<0.01			<0.01			<0.01	
Zn	mg/L	0.084			0.100			0.103			0.107	
Leachate Vol	mL	462	410	487	480	477	487	458	470	465	472	474
pH		7.4	7.1	6.8	7.3	6.7	7.1	6.9	6.8	6.7	6.9	6.9
Conductivity	µS	263	167	155	160	140	151	124	109	124	111	112
ORP	mV	120	117	119	90	120	93	103	106	118	114	270
Acidity	mg $CaCO_3$/L	4.6	3.8	3.6	4.0	4.7	2.3	2.7	2.8	3.7	3.3	3.0
Alkalinity	mg $CaCO_3$/L	2.5	11.4	10.5	12.9	11.5	8.8	8.6	6.4	9.5	8.4	7.9
Sulphate	mg/L	95	69	61	66	52	55	49	40	44	45	43
Cum. Sulphate	mg/kg	44	72	102	134	158	185	208	226	247	268	288

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC1

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-63 Hanging Wall Composite (Comp 1)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
Page: 2 of 3

		Cycle										
Element	Unit	11	12	13	14	15	16	17	18	19	20	21
Al	mg/L		0.06			0.12			0.07	0.05	<0.05	0.11
Sb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
As	mg/L		<0.03			<0.03			<0.03	<0.03	<0.03	<0.03
Ba	mg/L		0.017			0.016			0.013	0.013	0.012	0.011
Be	mg/L		<0.001			<0.001			<0.001	<0.001	<0.001	0.001
Bi	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
B	mg/L		0.35			0.39			0.28	0.28	0.38	0.31
Cd	mg/L		<0.005			<0.005			<0.005	<0.005	<0.005	<0.005
Ca	mg/L		17.63			17.08			14.25	14.47	13.52	13.13
Cr	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Co	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Cu	mg/L		0.02			0.02			0.01	<0.01	<0.01	0.02
Fe	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	0.11
Pb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Li	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mg	mg/L		1.5			1.5			1.7	1.6	1.2	0.9
Mn	mg/L		0.695			0.643			0.549	0.497	0.396	0.380
Hg	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mo	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Ni	mg/L		0.05			0.04			0.02	0.02	<0.01	0.03
P	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
K	mg/L		<2			<2			<2	<2	<2	<2
Se	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Si	mg/L		0.09			0.22			0.12	0.11	0.10	0.11
Ag	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Na	mg/L		1.0			0.9			1.0	0.7	0.9	1.4
Sr	mg/L		0.105			0.101			0.094	0.088	0.079	0.073
Tl	mg/L		<0.2			<0.2			<0.2	<0.2	<0.2	<0.2
Sn	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
Ti	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
W	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
V	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Zn	mg/L		0.097			0.114			0.067	0.063	0.057	0.075
Leachate Vol	mL	470	466	465	467	474	472	492	471	461	488	470
pH		6.9	7.0	6.7	6.7	7.0	6.9	6.7	6.9	6.6	6.9	6.5
Conductivity	µS	112	97	107	101	100	85	91	93	88	81	69
ORP	mV	290	235	244	212	193	206	257	223	205	221	150
Acidity	mg $CaCO_3$/L	3.5	2.3	4.2	3.3	2.5	3.7	1.8	2.7	3.9	3.2	4.6
Alkalinity	mg $CaCO_3$/L	11.0	9.3	10.2	8.0	6.4	8.0	5.8	9.1	9.5	9.1	6.4
Sulphate	mg/L	40	34	40	36	30	30	39	33	30	29	29
Cum. Sulphate	mg/kg	307	323	342	359	373	387	406	422	435	450	463

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC1

Reporting Date: January 29, 1998
Project: 96-121

Sample id: DDH-WV96-63 Hanging Wall Composite (Comp 1)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997

		Cycle										
Element	Unit	22	23	24	25	26	27	28	29	30	31	32
Al	mg/L	0.15	0.12	0.07	0.12	0.12						
Sb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
As	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03						
Ba	mg/L	0.012	0.011	0.008	0.011	0.010						
Be	mg/L	0.002	<0.001	<0.001	<0.001	<0.001						
Bi	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
B	mg/L	0.41	0.30	0.34	0.22	0.36						
Cd	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005						
Ca	mg/L	13.50	14.21	9.64	12.79	11.78						
Cr	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Co	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Cu	mg/L	0.06	0.02	0.06	0.05	<0.01						
Fe	mg/L	0.17	<0.01	0.05	0.02	<0.01						
Pb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Li	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mg	mg/L	1.3	1.4	1.0	0.9	0.9						
Mn	mg/L	0.439	0.444	0.282	0.328	0.277						
Hg	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mo	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Ni	mg/L	0.03	0.02	0.01	0.02	0.01						
P	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
K	mg/L	<2	<2	<2	<2	<2						
Se	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Si	mg/L	0.29	0.22	0.17	0.20	0.25						
Ag	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Na	mg/L	0.6	<0.2	1.2	0.4	0.6						
Sr	mg/L	0.081	0.081	0.046	0.073	0.067						
Tl	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2						
Sn	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
Ti	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
W	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
V	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Zn	mg/L	0.064	0.057	0.065	0.053	0.022						
Leachate Vol	mL	470	474	495	470	485						
pH		6.6	6.4	6.7	6.7	6.4						
Conductivity	µS	69	69	53	66	59						
ORP	mV	178	179	244	336	277						
Acidity	mg $CaCO_3$/L	4.6	3.7	3.8	4.0	4.4						
Alkalinity	mg $CaCO_3$/L	7.1	8.2	4.6	8.6	7.1						
Sulphate	mg/L	31	30	22	26	28						
Cum. Sulphate	mg/kg	478	492	503	515	529						

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC2

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-60 Foot Wall Composite (Comp 2)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
Page: 1 of 3

		Cycle										
Element	Unit	0	1	2	3	4	5	6	7	8	9	10
Al	mg/L	0.17			0.11			0.10			0.07	
Sb	mg/L	0.13			0.10			0.05			<0.05	
As	mg/L	<0.03			<0.03			<0.03			<0.03	
Ba	mg/L	0.052			0.021			0.019			0.015	
Be	mg/L	<0.001			<0.001			<0.001			<0.001	
Bi	mg/L	<0.1			<0.1			<0.1			<0.1	
B	mg/L	0.26			0.34			0.38			0.31	
Cd	mg/L	0.011			0.006			0.014			0.018	
Ca	mg/L	21.97			20.38			17.40			18.63	
Cr	mg/L	<0.01			<0.01			<0.01			<0.01	
Co	mg/L	<0.01			<0.01			<0.01			<0.01	
Cu	mg/L	0.03			0.02			0.06			0.02	
Fe	mg/L	0.02			<0.01			0.03			0.11	
Pb	mg/L	<0.05			<0.05			<0.05			<0.05	
Li	mg/L	<0.02			<0.02			<0.02			<0.02	
Mg	mg/L	2.9			2.2			1.8			1.7	
Mn	mg/L	0.083			0.066			0.080			0.100	
Hg	mg/L	<0.02			<0.02			<0.02			<0.02	
Mo	mg/L	<0.01			<0.01			<0.01			<0.01	
Ni	mg/L	0.11			0.02			0.12			0.07	
P	mg/L	<0.1			<0.1			<0.1			<0.1	
K	mg/L	18			8			3			<2	
Se	mg/L	0.13			<0.05			<0.05			<0.05	
Si	mg/L	0.55			0.25			0.27			0.15	
Ag	mg/L	<0.02			<0.02			<0.02			<0.02	
Na	mg/L	32.2			7.9			2.3			1.3	
Sr	mg/L	0.086			0.081			0.067			0.068	
Tl	mg/L	<0.2			<0.2			<0.2			<0.2	
Sn	mg/L	<0.1			<0.1			<0.1			<0.1	
Ti	mg/L	<0.01			<0.01			<0.01			<0.01	
W	mg/L	<0.1			<0.1			<0.1			<0.1	
V	mg/L	<0.01			<0.01			<0.01			<0.01	
Zn	mg/L	0.37			0.300			0.875			1.101	
Leachate Vol	mL	422	430	458	482	458	456	456	456	470	456	454
pH		7.3	7.0	6.6	6.9	6.7	6.7	6.7	6.7	6.6	6.5	6.6
Conductivity	μS	29	166	14	174	14	147	122	126	134	114	119
ORP	mV	111	157	128	90	136	96	121	117	125	123	276
Acidity	mg $CaCO_3$/L	6.3	4.0	3.4	4.0	2.8	4.2	3.6	3.9	3.9	3.7	3.9
Alkalinity	mg $CaCO_3$/L	18.0	5.5	5.9	7.3	6.4	4.4	3.8	3.8	3.8	3.9	4.9
Sulphate	mg/L	125	58	56	67	57	57	47	47	54	51	51
Cum. Sulphate	mg/kg	53	78	103	136	162	188	209	231	256	279	302

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC2

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-60 Foot Wall Composite (Comp 2)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
Page: 2 of 3

Element	Unit	Cycle										
		11	12	13	14	15	16	17	18	19	20	21
Al	mg/L		0.07			0.06			<0.05	<0.05	<0.05	0.1
Sb	mg/L		<0.05			<0.05			<0.05	<0.05	0.05	<0.05
As	mg/L		<0.03			<0.03			<0.03	<0.03	<0.03	<0.03
Ba	mg/L		0.011			0.010			0.011	0.011	0.011	0.009
Be	mg/L		<0.001			<0.001			<0.001	<0.001	<0.001	<0.001
Bi	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
B	mg/L		0.34			0.3			0.26	0.36	0.35	0.25
Cd	mg/L		0.019			0.013			0.007	0.008	0.012	0.013
Ca	mg/L		17.94			14.70			13.44	15.23	13.83	18.84
Cr	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Co	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Cu	mg/L		0.01			0.04			<0.01	<0.01	0.02	<0.01
Fe	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	0.02
Pb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Li	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mg	mg/L		1.5			1.3			1.2	1.2	1.1	1.4
Mn	mg/L		0.108			0.093			0.078	0.085	0.074	0.093
Hg	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mo	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Ni	mg/L		0.06			0.04			0.02	0.02	0.01	0.03
P	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
K	mg/L		<2			<2			<2	<2	<2	<2
Se	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Si	mg/L		0.13			0.12			0.15	0.18	0.16	0.15
Ag	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Na	mg/L		1.2			0.9			0.9	0.9	0.9	1.4
Sr	mg/L		0.064			0.053			0.056	0.058	0.053	0.069
Tl	mg/L		<0.2			<0.2			<0.2	<0.2	<0.2	<0.2
Sn	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
Ti	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
W	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
V	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Zn	mg/L		1.112			0.764			0.356	0.463	0.454	0.597
Leachate Vol	mL	440	447	445	460	458	467	499	493	478	496	484
pH		6.7	6.8	6.5	6.6	6.7	6.7	6.7	6.8	6.8	6.7	6.6
Conductivity	µS	116	103	104		94	72	83	88	91	84	96
ORP	mV	202	240	245	226	201	213	265	237	213	238	177
Acidity	mg $CaCO_3$/L	3.9	3.5	5.4	4.4	3.5	2.8	2.3	3.2	2.5	3.2	4.6
Alkalinity	mg $CaCO_3$/L	6.9	6.4	7.1	6.2	4.9	4.4	5.8	6.4	8.0	9.3	5.5
Sulphate	mg/L	45	45	42	37	34	29	35	33	33	31	46
Cum. Sulphate	mg/kg	322	342	361	378	394	407	425	441	457	472	494

Process Research Associates Ltd.

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC2

Reporting Date: January 29, 1998
Project: 96-121

Sample id: DDH-WV96-60 Foot Wall Composite (Comp 2)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
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		Cycle										
Element	Unit	22	23	24	25	26	27	28	29	30	31	32
Al	mg/L	0.11	0.11	0.09	0.10	0.10						
Sb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
As	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03						
Ba	mg/L	0.008	0.009	0.011	0.010	0.010						
Be	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001						
Bi	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
B	mg/L	0.33	0.27	0.30	0.20	0.31						
Cd	mg/L	0.009	0.011	0.009	0.011	0.010						
Ca	mg/L	14.11	13.71	11.79	10.51	11.32						
Cr	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Co	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Cu	mg/L	0.03	<0.01	0.08	0.03	0.01						
Fe	mg/L	0.02	<0.01	<0.01	<0.01	<0.01						
Pb	mg/L	<0.05	<0.05	0.06	<0.05	<0.05						
Li	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mg	mg/L	1.0	1.0	0.8	0.7	0.8						
Mn	mg/L	0.076	0.069	0.087	0.058	0.054						
Hg	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mo	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Ni	mg/L	0.02	0.03	0.03	0.02	0.02						
P	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
K	mg/L	<2	<2	<2	<2	<2						
Se	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Si	mg/L	0.18	0.20	0.23	0.20	0.28						
Ag	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Na	mg/L	0.5	<0.2	1.2	<0.2	0.5						
Sr	mg/L	0.051	0.049	0.035	0.039	0.040						
Tl	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2						
Sn	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
Ti	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
W	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
V	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Zn	mg/L	0.413	0.455	0.525	0.395	0.392						
Leachate Vol	mL	490	490	496	491	485						
pH		6.4	6.6	6.5	6.5	6.4						
Conductivity	µS	74	67	60	55	57						
ORP	mV	197	184	249	340	276						
Acidity	mg $CaCO_3$/L	4.5	3.6	3.7	4.2	4.4						
Alkalinity	mg $CaCO_3$/L	6.6	7.3	6.4	7.1	6.6						
Sulphate	mg/L	33	29	20	21	29						
Cum. Sulphate	mg/kg	510	525	535	545	559						

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC3

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-58 Foot Wall Composite (Comp 3)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
Page: 1 of 3

		Cycle										
Element	Unit	0	1	2	3	4	5	6	7	8	9	10
Al	mg/L	0.8			0.23			0.37			0.37	
Sb	mg/L	<0.05			<0.05			<0.05			<0.05	
As	mg/L	<0.03			<0.03			<0.03			<0.03	
Ba	mg/L	0.133			0.041			0.021			0.014	
Be	mg/L	<0.001			<0.001			<0.001			<0.001	
Bi	mg/L	<0.1			<0.1			<0.1			<0.1	
B	mg/L	0.24			0.26			0.39			0.35	
Cd	mg/L	<0.005			<0.005			<0.005			<0.005	
Ca	mg/L	31.92			38.14			22.64			20.65	
Cr	mg/L	<0.01			<0.01			<0.01			<0.01	
Co	mg/L	0.04			0.03			0.02			0.03	
Cu	mg/L	0.12			0.07			0.12			0.14	
Fe	mg/L	6.5			1.60			5.09			6.48	
Pb	mg/L	<0.05			<0.05			<0.05			<0.05	
Li	mg/L	<0.02			<0.02			<0.02			<0.02	
Mg	mg/L	5.7			5.3			5.1			6.3	
Mn	mg/L	0.698			0.891			0.999			1.174	
Hg	mg/L	<0.02			<0.02			<0.02			<0.02	
Mo	mg/L	<0.01			<0.01			<0.01			<0.01	
Ni	mg/L	0.8			0.31			0.30			0.31	
P	mg/L	<0.1			<0.1			<0.1			<0.1	
K	mg/L	3			<2			<2			<2	
Se	mg/L	<0.05			<0.05			<0.05			<0.05	
Si	mg/L	0.55			0.38			0.36			0.21	
Ag	mg/L	<0.02			<0.02			<0.02			<0.02	
Na	mg/L	8.9			1.9			1.1			1.1	
Sr	mg/L	0.1			0.093			0.061			0.055	
Tl	mg/L	<0.2			<0.2			<0.2			<0.2	
Sn	mg/L	<0.1			<0.1			<0.1			<0.1	
Ti	mg/L	<0.01			<0.01			<0.01			<0.01	
W	mg/L	<0.1			<0.1			<0.1			<0.1	
V	mg/L	<0.01			<0.01			<0.01			<0.01	
Zn	mg/L	0.788			0.563			0.610			0.697	
Leachate Vol	mL	467	420	490	420	407	449	430	458	452	446	451
pH		4.8	4.5	4.5	4.8	4.8	4.5	4.4	4.3	4.2	4.1	4.3
Conductivity	µS	308	444	358	246	224	140	186	164	220	190	260
ORP	mV	183	204	190	**134**	146	165	227	166	195	186	293
Acidity	mg $CaCO_3$/L	23.5	101.8	59.4	10.7	10.3	10.5	18.3	17.0	25.0	24.9	27.0
Alkalinity	mg $CaCO_3$/L	--	--	--	--	--	--	--	--	--	--	--
Sulphate	mg/L	140	225	180	110	95	60	90	75	95	95	100
Cum. Sulphate	mg/kg	65	160	248	294	333	360	399	433	476	518	563

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC3

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-58 Foot Wall Composite (Comp 3)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997

		Cycle										
Element	Unit	11	12	13	14	15	16	17	18	19	20	21
Al	mg/L		0.22			0.09			0.16	0.09	0.08	0.15
Sb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
As	mg/L		<0.03			<0.03			<0.03	<0.03	<0.03	<0.03
Ba	mg/L		0.011			0.010			0.011	0.011	0.01	0.006
Be	mg/L		<0.001			<0.001			<0.001	<0.001	<0.001	<0.001
Bi	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
B	mg/L		0.42			0.42			0.27	0.35	0.39	0.31
Cd	mg/L		<0.005			<0.005			<0.005	<0.005	<0.005	<0.005
Ca	mg/L		15.25			14.23			11.04	12.36	11.75	16.63
Cr	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Co	mg/L		0.02			<0.01			<0.01	<0.01	<0.01	<0.01
Cu	mg/L		0.13			0.06			0.08	0.05	0.07	0.07
Fe	mg/L		3.10			0.21			0.50	0.43	0.42	0.55
Pb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Li	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mg	mg/L		6.2			4.1			2.4	2.8	2.5	3.3
Mn	mg/L		1.159			0.654			0.343	0.393	0.366	0.480
Hg	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mo	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Ni	mg/L		0.24			0.11			0.05	0.06	0.05	0.07
P	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
K	mg/L		<2			<2			<2	<2	<2	<2
Se	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Si	mg/L		0.34			0.22			0.19	0.20	0.30	0.32
Ag	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Na	mg/L		1.0			1.0			0.9	0.8	0.8	1.4
Sr	mg/L		0.045			0.040			0.035	0.035	0.033	0.046
Tl	mg/L		<0.2			<0.2			<0.2	<0.2	<0.2	<0.2
Sn	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
Ti	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
W	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
V	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Zn	mg/L		0.559			0.235			0.148	0.135	0.130	0.143
Leachate Vol	mL	437	449	480	460	464	476	463	466	476	470	470
pH		4.3	4.6	4.6	4.8	4.9	4.9	5.2	5.1	5.3	5.3	5.2
Conductivity	µS	164	140	195	154	118	113	85	85	89	89	105
ORP	mV	291	263	288	239	235	196	157	147	171	176	240
Acidity	mg $CaCO_3$/L	16.0	14.0	14.0	8.4	5.1	6.0	5.8	4.6	5.7	6.2	7.6
Alkalinity	mg $CaCO_3$/L	--	--	--	--	--	--	0.4	--	0.4	0.2	--
Sulphate	mg/L	85	75	95	73	50	56	41	40	40	40	58
Cum. Sulphate	mg/kg	600	634	680	713	737	763	782	801	820	839	866

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC3

Reporting Date: January 29, 1998
Project: 96-121

Sample id: DDH-WV96-58 Foot Wall Composite (Comp 3)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
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		Cycle										
Element	Unit	22	23	24	25	26	27	28	29	30	31	32
Al	mg/L	0.15	0.15	0.11	0.12	0.12						
Sb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
As	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03						
Ba	mg/L	0.007	0.008	0.008	0.008	0.007						
Be	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001						
Bi	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
B	mg/L	0.40	0.29	0.30	0.19	0.31						
Cd	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005						
Ca	mg/L	11.54	11.97	11.19	11.34	10.69						
Cr	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Co	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Cu	mg/L	0.08	0.07	0.12	0.09	0.04						
Fe	mg/L	0.56	0.52	0.42	0.52	0.43						
Pb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Li	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mg	mg/L	2.5	2.6	2.3	2.1	1.9						
Mn	mg/L	0.400	0.403	0.363	0.336	0.290						
Hg	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mo	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Ni	mg/L	0.07	0.07	0.06	0.05	0.03						
P	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
K	mg/L	<2	<2	<2	<2	<2						
Se	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Si	mg/L	0.35	0.30	0.18	0.28	0.40						
Ag	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Na	mg/L	0.6	<0.2	1.2	<0.2	0.5						
Sr	mg/L	0.034	0.033	0.027	0.031	0.029						
Tl	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2						
Sn	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
Ti	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
W	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
V	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Zn	mg/L	0.129	0.127	0.124	0.107	0.075						
Leachate Vol	mL	465	474	484	468	470						
pH		4.8	5.0	5.3	5.5	5.4						
Conductivity	µS	78	75	75	70	67						
ORP	mV	210	193	200	253	216						
Acidity	mg $CaCO_3$/L	8.0	5.3	5.2	6.3	5.98						
Alkalinity	mg $CaCO_3$/L	--	--	1	0.2	0.2						
Sulphate	mg/L	40	42	34	35	40						
Cum. Sulphate	mg/kg	885	904	921	937	956						

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC4

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-72 Hanging Wall Composite (Comp 4)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
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		Cycle										
Element	Unit	0	1	2	3	4	5	6	7	8	9	10
Al	mg/L	0.17			0.12			0.11			0.12	
Sb	mg/L	<0.05			<0.05			<0.05			<0.05	
As	mg/L	<0.03			<0.03			<0.03			<0.03	
Ba	mg/L	0.067			0.036			0.033			0.025	
Be	mg/L	<0.001			<0.001			<0.001			<0.001	
Bi	mg/L	<0.1			<0.1			<0.1			<0.1	
B	mg/L	0.24			0.34			0.29			0.34	
Cd	mg/L	0.017			0.008			0.017			0.012	
Ca	mg/L	55.69			25.81			32.99			25.58	
Cr	mg/L	<0.01			<0.01			<0.01			<0.01	
Co	mg/L	0.01			<0.01			<0.01			<0.01	
Cu	mg/L	0.01			<0.01			0.04			0.03	
Fe	mg/L	<0.01			<0.01			<0.01			0.03	
Pb	mg/L	<0.05			<0.05			<0.05			<0.05	
Li	mg/L	<0.02			<0.02			<0.02			<0.02	
Mg	mg/L	9.8			4.0			6.9			4.8	
Mn	mg/L	1.033			0.323			0.514			0.366	
Hg	mg/L	<0.02			<0.02			<0.02			<0.02	
Mo	mg/L	<0.01			<0.01			<0.01			<0.01	
Ni	mg/L	0.14			0.01			0.02			<0.01	
P	mg/L	<0.1			<0.1			<0.1			<0.1	
K	mg/L	5			<2			<2			<2	
Se	mg/L	0.1			<0.05			0.07			<0.05	
Si	mg/L	0.62			0.27			0.25			0.28	
Ag	mg/L	<0.02			<0.02			<0.02			<0.02	
Na	mg/L	14.5			2.0			1.3			1.1	
Sr	mg/L	0.311			0.175			0.191			0.140	
Tl	mg/L	<0.2			<0.2			<0.2			<0.2	
Sn	mg/L	<0.1			<0.1			<0.1			<0.1	
Ti	mg/L	<0.01			<0.01			<0.01			<0.01	
W	mg/L	<0.1			<0.1			<0.1			<0.1	
V	mg/L	<0.01			<0.01			<0.01			<0.01	
Zn	mg/L	1.426			0.622			1.292			0.836	
Leachate Vol	mL	417	415	483	458	440	425	452	451	467	452	467
pH		7.1	6.6	7.0	6.8	6.7	6.6	6.5	6.7	6.3	6.5	6.7
Conductivity	µS	456	241	398	175	225	211	220	210	210	163	150
ORP	mV	112	168	115	164	142	111	140	124	142	157	275
Acidity	mg $CaCO_3$/L	8.4	5.3	4.2	3.7	3.9	4.2	3.8	3.7	3.9	3.9	3.5
Alkalinity	mg $CaCO_3$/L	17.7	6.4	8.6	7.5	5.9	3.9	5.1	3.5	4.2	3.5	4.4
Sulphate	mg/L	175	105	180	90	95	95	95	90	95	90	78
Cum. Sulphate	mg/kg	73	117	203	245	287	327	370	410	455	495	532

Process Research Associates Ltd.

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC4

Reporting Date: December 31, 1997
Project: 96-121

Sample id: DDH-WV96-72 Hanging Wall Composite (Comp 4)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997
Page: 2 of 3

		Cycle										
Element	Unit	11	12	13	14	15	16	17	18	19	20	21
Al	mg/L		0.06			0.08			<0.05	0.07	0.05	0.11
Sb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
As	mg/L		<0.03			<0.03			<0.03	<0.03	<0.03	<0.03
Ba	mg/L		0.023			0.021			0.016	0.014	0.018	0.013
Be	mg/L		<0.001			<0.001			<0.001	<0.001	<0.001	<0.001
Bi	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
B	mg/L		0.22			0.35			0.25	0.31	0.37	0.24
Cd	mg/L		0.009			0.009			0.006	0.006	0.011	0.010
Ca	mg/L		17.73			17.17			14.02	15.34	14.18	20.68
Cr	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Co	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Cu	mg/L		0.02			0.01			0.02	0.02	<0.01	<0.01
Fe	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	0.02
Pb	mg/L		<0.05			<0.05			<0.05	<0.05	<0.05	<0.05
Li	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mg	mg/L		3.9			3.7			3.0	3.4	3.1	4.1
Mn	mg/L		0.319			0.362			0.280	0.295	0.300	0.396
Hg	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Mo	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Ni	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
P	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
K	mg/L		<2			<2			<2	<2	<2	<2
Se	mg/L		<0.05			<0.05			<0.05	<0.05	0.05	<0.05
Si	mg/L		0.12			0.18			0.12	0.14	0.15	0.19
Ag	mg/L		<0.02			<0.02			<0.02	<0.02	<0.02	<0.02
Na	mg/L		0.9			0.8			0.8	0.8	0.9	1.4
Sr	mg/L		0.096			0.093			0.085	0.082	0.080	0.109
Tl	mg/L		<0.2			<0.2			<0.2	<0.2	<0.2	<0.2
Sn	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
Ti	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
W	mg/L		<0.1			<0.1			<0.1	<0.1	<0.1	<0.1
V	mg/L		<0.01			<0.01			<0.01	<0.01	<0.01	<0.01
Zn	mg/L		0.739			0.708			0.459	0.466	0.601	0.783
Leachate Vol	mL	455	456	460	459	459	482	474	479	483	482	480
pH		6.7	6.6	6.6	6.6	6.7	6.6	6.6	6.6	6.6	6.8	6.6
Conductivity	µS	159	117	133	129	130	104	110	106	108	102	122
ORP	mV	102	243	167	228	213	182	146	139	146	188	198
Acidity	mg $CaCO_3$/L	4.0	4.2	5.1	4.9	3.5	3.2	2.8	3.0	3.0	4.1	5.1
Alkalinity	mg $CaCO_3$/L	5.7	4.6	6.6	5.3	3.5	5.1	4.9	4.6	4.6	6.2	4.6
Sulphate	mg/L	75	57	60	64	50	45	45	41	45	40	66
Cum. Sulphate	mg/kg	566	592	620	649	672	694	715	735	756	776	807

Process Research Associates Ltd.

HUMIDITY CELL TEST REPORT

Client: Westmin Resources Limited (Wolverine Lake Project)
Test: HC4

Reporting Date: January 29, 1998
Project: 96-121

Sample id: DDH-WV96-72 Hanging Wall Composite (Comp 4)
Sample weight: 1 kg
Flush volume: 500 mL

Starting Date: July 15, 1997

		Cycle										
Element	Unit	22	23	24	25	26	27	28	29	30	31	32
Al	mg/L	0.14	0.07	0.08	0.10	0.12						
Sb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
As	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03						
Ba	mg/L	0.015	0.013	0.013	0.014	0.015						
Be	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001						
Bi	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
B	mg/L	0.42	0.23	0.34	0.19	0.33						
Cd	mg/L	0.009	0.007	0.008	0.008	0.008						
Ca	mg/L	14.90	13.82	11.61	12.08	11.33						
Cr	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Co	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Cu	mg/L	<0.01	<0.01	0.05	0.03	<0.01						
Fe	mg/L	0.03	<0.01	<0.01	<0.01	<0.01						
Pb	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Li	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mg	mg/L	3.4	3.0	2.6	2.6	2.5						
Mn	mg/L	0.342	0.300	0.273	0.283	0.251						
Hg	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Mo	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Ni	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
P	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
K	mg/L	<2	<2	<2	<2	<2						
Se	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05						
Si	mg/L	0.32	0.15	0.16	0.16	0.35						
Ag	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02						
Na	mg/L	0.7	<0.2	1.3	<0.2	0.5						
Sr	mg/L	0.080	0.073	0.054	0.067	0.062						
Tl	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2						
Sn	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
Ti	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
W	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
V	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01						
Zn	mg/L	0.584	0.537	0.545	0.575	0.513						
Leachate Vol	mL	480	486	492	478	478						
pH		6.4	6.4	6.6	6.2	6.4						
Conductivity	µS	94	82	75	75	70						
ORP	mV	172	160	172	259	195						
Acidity	mg $CaCO_3$/L	5.3	4.2	4.1	5.1	4.6						
Alkalinity	mg $CaCO_3$/L	6.6	6.6	6.0	6.9	6.6						
Sulphate	mg/L	43	37	31	33	38						
Cum. Sulphate	mg/kg	828	846	861	877	895						

Appendix 2B

Pre-feasibility Study – Proposed Wolverine Tailings Impoundment

KLOHN CRIPPEN

September 1, 2004

Expatriate Resources Ltd.
#701 - 475 Howe Street
Vancouver, B.C.
V6C 2B3

Mr. Bob McKnight, P.Eng
Vice President,
Finance and Corporate Development

Dear Mr. McKnight:

Pre-feasibility Study – Proposed Wolverine Tailings Impoundment

We are pleased to submit under cover of this letter __ copies of our report on Pre-feasibility Study – Proposed Wolverine Tailings Impoundment. We understand that our report will form part of an overall report, entitled Wolverine Project – Pre-feasibility Study, prepared by Hatch.

In preparing for this pre-feasibility design, the following tasks were performed:

- a review of relevant project data provided by Expatriate and Hatch as well as available literature;
- a site reconnaissance and subsoil investigation by Klohn Crippen along two dam alignments, involving hand-auger/hand-shovel holes and test pits by a D6 dozer; and
- a multi-electrode resistivity survey for the downstream dam alignment and mine plant site area by Frontier Geosciences.

A pre-feasibility design for the tailings storage facility was then carried out in consultation with Hatch and Expatriate. Dam related quantities were calculated by Klohn Crippen based on the pre-feasibility design, and the approximate costs associated with its construction were estimated by Hatch.

The proposed impoundment site, situated in a broad glaciated valley, has a very favourable storage-elevation characteristics. The downstream dam alignment was selected, as it could accommodate additional tailings storage for potential future

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expansion. The dam foundation appears to be competent at the valley slopes. However, the present foundation investigations, involving either shallow geotechnical exploration or indirect geophysical measurement, are rather limited.

Our pre-feasibility study concluded that by adopting appropriate engineering design measures, a safe and cost-effective tailings impoundment can be constructed at the proposed site with adequate protection of the surrounding environment both during mining operation and after mine closure. Further foundation information would be needed to better define the nature and extent of additional foundation preparation work at the dam site and plant site.

We appreciate the opportunity to participate in this pre-feasibility study, and the help we have received from Expatriate and Hatch. We look forward to seeing the progress of this proposed mining development.

Yours truly,

KLOHN CRIPPEN CONSULTANTS LTD.

Robert C. Lo, P.Eng.
Project Manager

RCL:dl

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APPENDICES

1. INTRODUCTION

1.1 Project Background

The Wolverine mining project site is located near the Wolverine Lake, Yukon, approximately 300 km east of Whitehorse (see Figure A-001). The mine site will be accessed via a proposed road (see Figure B-002) from the Robert Campbell Highway about 270 km northwest of Watson Lake. The overall site plan is shown in Figure B-003. The underground mine would operate at approximately 1240 tpd. Metals of value at this massive sulphide deposit include: zinc, silver, selenium, copper, lead and gold. This report covers the investigations and design for the tailings storage facility at the pre-feasibility level. It is prepared to supplement Hatch Associates' overall pre-feasibility study for the proposed Wolverine Mining Project.

1.2 Scope of Work

In preparing for this report, the following tasks were carried out:

- a review of relevant project data provided by Expatriate and Hatch as well as available literature;
- a site reconnaissance and subsoil investigation by Klohn Crippen, involving hand-auger/hand-shovel holes and test pits by a D6 dozer along two dam alignments;
- a multi-electrode resistivity survey by Frontier Geosciences for the downstream dam alignment and mine plant site area;
- design of the tailings impoundment in consultation with Hatch and Expatriate, covering geotechnical, hydrotechnical and geochemical aspects; and
- estimation of construction quantities related to the tailings dam and its ancillary structures.

1.3 Organization of Report

The report consists of a main report and two appendices. In the main report, Section 2 covers the project site conditions including its general setting and subsoil conditions inferred from the two site investigations presented in Section 3. Section 4 describes design considerations and ancillary structures related to the tailings impoundment, while Section 5 presents the tailings dam design and geotechnical design analyses. Section 6 summarizes construction quantities of the tailings dam and its ancillary structures. Finally, conclusions and recommendations are given in Section 7. Appendix I is the reproduction of the multi-electrode resistivity survey report prepared by Frontier Geosciences; and Appendix II presents test hole/pit logs and laboratory test results.

1.4 Limitations and Use of Report

This report is an instrument of service of Klohn Crippen Consultants and has been prepared for the exclusive use of Expatriate Resources Ltd. and Hatch Associates. The contents of this report may not be relied upon by any other party without the express written permission of Klohn Crippen. The contents of this report reflect Klohn Crippen's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Klohn Crippen accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This is a draft report only and we solicit your review and comments within *four weeks* of submission. Upon issue of the final reports, we request that all draft reports be destroyed or returned to Klohn Crippen Consultants Ltd. This draft report should not be relied upon as a final document for design and/or construction.

2. SITE CONDITIONS

2.1 Physical and Geological Setting

The project area falls into the Pelly River and Pelly Mountain ecoregions. The major part of the Pelly River eco-region is underlain by metamorphic rock; however, large areas of volcanic and intrusive rocks and small areas of sedimentary rocks occur throughout. During the last glacial period, ice moved across the eastern part of the ecoregion (including the general project area) in a northwesterly to westerly direction and extended to heights of about 1525 m (Hatch, 2004).

Yukon Territory has been glaciated four times over the last two millions years. The Wolverine Lake area lies within the limits of the McConnell Glaciation (youngest of the four glaciations) and most of the geomorphic features are related to this glaciation. McConnell glacial ice covered this area between 14,000 and 35,000 years ago. As the McConnell ice retreated and down-wasted a complex network of ice tongues developed in valley bottoms. Morainal deposits are found at lower to mid-elevation and valley floors, and may contain a more complex assemblage of glacio-fluvial, colluvial and fluvial sediments. In this area, the upper, steep slopes are covered by rock, and are often weathered and frost shattered. Colluvial veneers, with morainal blankets and colluviated moraine and rock cover the mid to lower slopes. Depressions and small valleys are often covered with morainal deposits, and contain narrow belts of fluvial deposits (Mougeot, 1996).

Figure B-004, reproduced from Mougeot (1966), shows the Quaternary surficial geology units in the area. This local mapping is in general agreement with that shown in a large surficial geology map for Rainbow Creek area (Jackson, 1993). Superimposed on Figure B-004 is the approximate exploration bedrock geology map prepared by Expatriate (2004). As shown in the figure, the area is underlain by bedrock strata generally paralleling the valley trend, i.e., striking in the direction of the valley.

A portion of Mougeot’s map is enlarged for the tailings impoundment area in the site investigation plan as shown in Figure B-008. As shown in the figure, pertinent map units in the impoundment area include the following:

- Mb - Morainal blanket (1-3 m)
- Cb - Colluvial blanket (1-3 m)
- ZS - Permafrost, slow mass movement (solifluction, creep, mudflow)
- Fp - Fluvian plain
- OW - Organic, poorly drained
- FG - Glacial fluvial (sand and gravel)
- Z - Permafrost

Note that the thicknesses given above may not reflect local conditions of thicker deposits.

The project site is located in the northern part of scattered permafrost sub-zone within the discontinuous permafrost zone of Canada. In the local and regional surficial geology maps, the presence of permafrost in the tailings impoundment area is noted. Also in the log of Puck Drillhole PK96-6, permafrost within the overburden (0 m to 7.9 m) is indicated.

2.2 Impoundment Foundation and Source of Borrow Materials

The proposed tailings dam foundation was investigated by shallow test holes/pits and geophysical measurements as described later in Section 3 of this report. The inferred foundation conditions are summarized as follows:

- Surficial peat and silt deposits in the valley bottom - These deposits could be up to 10 m deep and consist of about 2 m of peat deposits overlying firm silt. Additional investigations are required to confirm the depth and strength of these materials. The peat deposits would be excavated from the dam footprint. The silt deposits may be sufficiently firm to be left in situ.

- Morainal Silt-Sand-Gravel-Cobble - These deposits overlie bedrock and could be up to 35 m thick on the left (northeast) abutment of the dam. The material appears to be medium dense to dense, although loose zones could be encountered. The permeability of the material is expected to be variable and could range from 10^{-3} cm/s to 10^{-6} cm/s.
- Bedrock - Comprising rhyolitc volcanics intercalated with carbonaceous argillites/schist. Bedrock is expected to be near surface on both dam abutments.

Permafrost was not observed in the limited site investigations, however it could be present at the site. This will need to be confirmed during the next phase of the site investigation.

Good quality dam construction materials are readily available from the morainal soils in the impoundment area. The material is a silt-sand-gravel-cobble mixture with a trace to some plasticity. Cleaner sand-gravel-cobble creek deposits could be borrowed selectively and used as filter/drain material.

2.3 Site Seismicity

2.3.1 Tectonic Setting

The rocks underlying the project area include the Slide Mountain and Yukon-Tanana terranes. The Slide Mountain terrane is interpreted to be the remnants of oceanic crust that separated the Yukon-Tanana terrane from North America. The Yukon-Tanana terrane may be a distal equivalent of North America or an unrelated allochthonous terrane (Plint and Gordon, 1996).

The project site is located about 50 km northeast of the Tintina Fault or Trench, which is the northwestern extension of the Rocky Mountain Trench. Gabrielse (1985) postulated approximately 750 km to 950 km of dextral strike-slip motion along this fault about 100 to 30 Ma ago. The Tintina Fault is seismically active, but the historical earthquakes have not exceeded magnitude 5 (Doig, 1998).

2.3.2 Historical Earthquakes

Data on recent earthquakes that occurred within about 600 km from the project site from January 1973 to July 2004 was extracted from the USGS/NEIC(PDE) database. The epicenters of these events, with magnitude equal to or greater than 3, are plotted in Figure B-005. As shown in the figure, no earthquakes with magnitude greater than 5 have occurred within 300 km from the site in the last thirty-one and half years. However, a magnitude 5 event did occur about 28 km northwest of the project site with a focal depth of 5 km on May 12, 1999. Table 2.1 lists these recent events within 300 km from the site in the order of decreasing magnitude.

Table 2.1 Summary of Recent Earthquakes within 300 km Distance from Project Site

Year	Month	Day	Hour	Min	Sec	Latitude	Longitude	Depth	Magnitude	Magnitude Type	Epicentral Distance (km)	Hypocentral Distance (km)
1999	5	12	3	34	6.81	61.63	-130.34	5	5.0	ML	28	28
1979	7	11	14	7	28.90	62.77	-127.72	10	5.0	mb	197	198
2001	8	11	21	22	7.00	62.50	-128.54	5	4.9	ML	147	147
1996	10	26	20	5	34.01	63.97	-130.21	10	4.7	ML	285	286
2002	11	6	6	55	26.00	61.97	-132.81	1	4.6	ML	158	158
2002	12	14	19	51	20.00	62.10	-135.47	5	4.6	mb	297	297
1978	11	19	9	24	39.50	62.81	-128.20	33	4.3	ML	186	189
1998	9	26	5	13	4.67	63.44	-126.64	5	4.3	Mn	292	292
1989	2	13	20	56	7.70	61.10	-131.25	18	4.2	ML	71	73
2001	9	16	1	23	31.86	63.64	-129.52	10	4.2	ML	250	251
1975	3	5	9	46	49.30	63.49	-130.03	33	4.1	mb	232	234
1999	5	26	9	44	59.79	63.26	-127.00	10	4.1	mb	264	264
1989	1	2	5	0	2.08	63.22	-127.65	10	4.0	ML	240	240
2001	7	14	20	18	8.00	63.77	-130.77	10	4.0	ML	265	266
2002	8	23	16	40	8.00	63.90	-130.23	5	4.0	ML	278	278
1996	1	16	22	3	10.29	62.03	-132.53	10	3.9	ML	147	148
1998	11	1	17	26	6.00	61.56	-130.35	0	3.8	ML	22	22
1990	2	1	14	18	40.00	60.85	-131.27	18	3.8	ML	89	90
1998	4	27	4	28	10.61	61.25	-133.74	33	3.6	ML	196	198
1999	1	16	16	12	34.00	61.98	-133.57	0	3.6	ML	196	196
2003	2	17	12	7	8.00	60.90	-133.94	17	3.6	ML	213	214
2001	9	3	17	8	45.00	60.81	-130.31	10	3.3	ML	68	69
2001	2	19	15	49	21.00	62.69	-125.46	1	3.3	Mn	285	285
1994	10	30	22	33	29.58	63.08	-130.71	10	3.1	ML	189	189
1998	2	22	23	31	35.85	63.32	-131.34	0	3.0	ML	223	223

2.3.3 Probabilistic Seismic Hazard Assessment

The probabilistic seismic hazard assessment was carried out for the project site using both the GSC-H and GSC-R seismic source zonal models developed by the Geological Survey of Canada for the proposed new National Building Code of Canada-NBCC 2005 (Adams and Halchuk, 2003). The characteristics of the source zones are selected based on the consideration of historical seismicity and geological controls. The shallow and deep seismic events are modeled with different source zones and attenuation relations. The GSC-H seismogenic zonal boundaries within the Western Canada and the approximate location of the project site are shown in Figure A-006. The project site is located in the SYT (Southern Yukon Territory) zone close to the MCK (Mackenzie Mountains) zone. The upper bound magnitudes assigned to these two zones SYT and MCK in the GSC-H model are 7.3 and 7.5, respectively.

The probabilistic seismic hazard analysis was carried out using the Cornell-Mcguire method embodied in the computer program EZ-FRISK (Risk Engineering, 1997). In the analyses, the “best estimate” values of the zonal parameters for the GSC-H and GSC-R model were used. Similarly, the analyses adopted the attenuation relations by Joyner, Boore and Fumal (1993, 1994) and Youngs et al. (1997). More conservative results were obtained with the GSC-H model for the project site and these results are summarized in Table 2.2 and shown in Figure A-007. The annual probability of exceedance of 0.0021, 0.001, 0.00040 and 0.0001 corresponding to return periods of 475, 1,000, 2,475 and 10,000 years, respectively, are highlighted in Figure A-007.

Table 2.2 Peak Horizontal Ground Acceleration at Project Site for Various Annual Probability of Exceedance

Annual Probability of Exceedance	Return Period (years)	Peak Ground Acceleration PGA (g)
0.01	100	0.04
0.005	200	0.06
0.0021	475	0.08
0.001	1,000	0.1
0.00040	2,475	0.14
0.0001	10,000	0.20

2.4 Climate

Except for a small northeastern part of the territory, Yukon is located in the Cordilleran climate region (Environment Canada, 1987). Yukon's climate in the broadest sense is sub-arctic continental. Criteria for continental climate are large annual, day-to-day, and daily ranges in temperature, low to moderate atmospheric moisture content, and moderate or light and irregular precipitation. The classification of sub-arctic rather than arctic is used for the Yukon to recognize that although severe cold spells can develop, storm tracks and proximity of the Pacific Ocean result in frequent intrusions of mild air in winter.

Environment Canada has divided Yukon into nine climatic sub-regions, and the Wolverine Mine site falls into the Liard Basin sub-region. Precipitation in this basin is moderate, between 400 mm and 600 mm annually. There are more days with precipitation in this zone than elsewhere in the interior of Yukon and a substantial amount is in solid form. Summers in the region are warm, but arctic air can remain entrenched for long periods in the Liard Valley to cause protracted cold spells. Winds in the region are moderate.

The following climate data has been assumed and used for this pre-feasibility study:

- Mean annual precipitation from Watson Lake A (Station No. 2101200) — 404.5 mm
- Mean annual lake evaporation 1951-1980 normal from Whitehorse A (Station No. 2101300) — 483.0 mm
- Mean annual runoff from Regional Hydrologic Analysis for the Finlayson Project Site (Gartner Lee, 2001) — 325.5 mm

2.5 Tailing Properties

2.5.1 Physical Properties

The tailings have high sulphide content and a specific gravity of 3.85. The estimated in situ density is 1.85 tonnes/m^3. The tailings will be transported to the impoundment at a density of 17% solids (by weight).

2.5.2 Geochemical Properties

According to the Hatch (2004) report: The Wolverine deposit, consisting of both the Lynx and Wolverine zones, is a volcanogenic massive sulphide deposit. The mineralized zones contain an abundance of pyrite with the average mill feed containing in the order of 35% sulphide sulphur. In addition to pyrite, the major sulphide minerals in the Wolverine ore are sphalerite, galena and chalcopyrite. Pyrrhotite, arsenopyrite, marcasite and sulphosalts (tetrahedrite, meneghinite, boulangerite) are present in lesser amounts but will account for arsenic and antimony impurities in the concentrates. The tetrahedrite also carries most of the silver in the ore, containing about 19% (w/w) silver. The sphalerite is iron-bearing, with an iron content up to 7.95% by weight and also contains about 0.45% cadmium. A noteworthy feature of the Wolverine deposit is the elevated content of selenium in the sulphide minerals resulting from the substitution of this element for sulphur in the mineral lattice.

The Wolverine deposit is a highly pyritic massive sulphide ore containing silver, copper, lead and zinc. A flowsheet consisting of a fine primary grind, sequential flotation of copper, lead and zinc with fine regrind was shown to be viable. The mineralogy of the Wolverine deposits is such that the flotation concentrates will contain impurity elements, some of which will incur smelter penalties. Arsenic, selenium, and antimony are anticipated to incur the largest penalties

Without kinetic test data on the tailings, it is not possible to predict with any confidence how long tailings could be left exposed to air before beginning to oxidize and leach heavy metals. The presence of pyrrhotite and the very fine-grained nature of the tailings will both lead towards the possibility of relatively rapid oxidation kinetics. Nevertheless, under typical beaching operations, it is probable that previously exposed tailings would be regularly covered with fresh tailings, both of which will contain lime. This will probably be sufficient to minimize acid generation potential during operations. The sub-aerial tailings disposal would help ensure good tailings phase separation (solid/liquid) and accelerate the initial consolidation of the tailings. It is recommended that, if any "fresh" tailings remains from process development testwork, a large-diameter tailings humidity-cell kinetic test program be initiated to confirm that sufficient neutralizing potential exists within the tailings solids to delay the onset of ML/ARD for a period of months to a year.

3. SITE INVESTIGATIONS

Two investigation programs were carried out for this pre-feasibility study:

- a site reconnaissance and subsoil investigation by Klohn Crippen described in Section 3.1; and
- a multi-electrode resistivity survey by Frontier as described in Appendix I and summarized in Section 3.2.

Figure B-008 shows the locations of the test holes/pits along two dam alignments and the survey lines for the downstream dam alignment and plant site.

3.1 Reconnaissance and Subsoil Investigation

General

A site reconnaissance and subsoil investigation was carried out by Klohn Crippen with the assistance of Expatriate staff on July 22 and 23, 2004. A total of fourteen test holes/pits were dug using a hand-auger, or a hand-shovel or a D6 dozer. Figure B-008 shows the location of these test holes/pits along two dam alignments: the upstream alignment was considered earlier, but the downstream alignment was later adopted due to its potential for future expansion beyond the current storage requirement.

Due to the constraint of regulations, test pits could only be excavated by a D6 dozer on the northeast side of the valley to avoid disturbing Go Creek, which meanders through the valley floor. Thus, test holes on the valley floor, the southwest valley slope and the upper steep portion of the northeast valley slope were dug by a hand-auger or hand shovel.

Subsoil Conditions

Subsoil conditions revealed by the test holes/pits are summarized in Table 3.1 for the upstream dam alignment and in Table 3.2 for the downstream dam alignment. As shown in the tables, the subsoil conditions at shallow depths along the two alignments are similar. Test hole/pit logs and laboratory soil test results including: grain-size analyses, falling-head permeability tests and standard Proctor tests are presented in Appendix II.

Along the downstream dam alignment, a 2 m thick peat layer was encountered in the swamp area on the valley floor at Hole TP04-11 and TP04-5. Beneath the peat layer, no sample was recovered from TP04-11 and a firm silt sample was recovered from Hole TP04-5. Advancement of the hand-auger beyond the peat layer was difficult at both holes. Outside the swamp area, glacio-fluvial silt-sand-gravel-cobble material is encountered on the valley floor. Along existing and abandoned creek channels, cleaner sand-gravel-cobble material is present. Up the northeast valley slope, glacial morainal silt-sand-gravel-cobble material is found above the water table. In general, morainal deposits is denser than the glacio-fluvial deposits. The overburden thickness appears to be thinner at upper valley slopes. Bedrock outcrop appears to be present in the general area around TP04-2 and TP04-3 along the upstream dam alignment.

3.2 Multi-electrode Resistivity Survey

3.2.1 General

During the period of July 27th to Aug. 6th, 2004, Frontier Geosciences Inc. carried out a multi-electrode resistivity survey for the proposed downstream tailings dam site and plant site. Details of this work are presented in a report by Frontier, which is included in Appendix I. Salient features of this program are summarized in this section.

Table 3.1 Summary of Shallow Subsoil Profile Along Upstream Dam Alignment

Dam Alignment	**U/S**	**U/S**	**U/S**	**U/S**	**U/S**	**U/S**
Side of Valley	**Southwest**	**Southwest**	**Southwest**	**Northeast**	**Northeast**	**Northeast**
Test Pit/Hole Number	TP04-2	TP04-3	TP04-1	TP04-12	TP04-13	TP04-14
Coordinates	N 6,808,922 E 441,059	N 6,808,957 E 441,133	N 6,809,017 E 441,224	N 6,809,058 E 441,310	N 6,809,112 E 441,371	N 6,809,460 E 441,567
Ground El.	~1348 m	~1338 m	~1323 m	~1323 m	~1325 m	~1355 m
Date	July 22/04	July 22/04	July 22/04	Dug on July 22/04 Logged on July 23/04	Dug on July 22/04 Logged on July 23/04	July 23/04
Type of Pit/Hole	Hand Shovel	Hand Shovel	Hand Auger/Shovel	D6 Dozer	D6 Dozer	Hand Shovel
Subsoil Profile and Relevant Notes	0-0.05 m MOSS	0 - 0.15 m MOSS - dark brown	0-0.3 m MOSS - dark brown, Sa 1 @ 0.15 m	0-0.15 m TOPSOIL - rooty	0-0.15 m TOPSOIL - rooty	0-0.13 m MOSS
	• black, mottled brown weathered schist rock fragment at 0.05 m	0.15 m-0.18 m VOLCANIC ASH- White River ash, greyish white	0.3-0.46 m SILT - organic, tan to dark grey, Sa 2 @ 0.4 m	0.15 -1.22 m SAND-GRAVEL - with trace of silt, Sa 1 @ 0.76 m	0.15 -0.61 m SILT/SAND - layers of low plastic silt alternating with sand layers, Sa 1 @ 0.3 to 0.46 m	0.13 -0.3 m SILT-SAND-GRAVEL - dark brown, Sa 1 @ 0.3 m
	• SAND-GRAVEL in a creek bed east of TP04-2 at a lower elevation	0.18 - 0.46 m SILT-SAND-GRAVEL - greyish tan Sa 1 @ 4.6 m	0.46-0.85 m SILT-SAND-GRAVEL - tan to dark grey, low to medium plastic silt, Sa 3 @ 0.76 m, Sa 4 @ 0.85 m	1.22 -1.83 m SILT-SAND-GRAVEL - Sa 1 @ 1.31 m	0.61-2.13 m SAND-GRAVEL-COBBLE - Sa 2 @ 0.91 -1.07 m	
	• Bedrock outcrop encountered on valley slope below TP04-2	• boulders or possibly bedrock encountered on valley slope below TP04-3	• In the vicinity of TP04-1 SILT-SAND-GRAVEL was encountered along a creek down to 1.27 m			

Table 3.2 Summary of Shallow Subsoil Profile Along Downstream Dam Alignment

Dam Alignment	**D/S**	**D/S**	**D/S**	**D/S**	**D/S**	**D/S**	**D/S**	**D/S**
Side of Valley	**Southwest**	**Southwest**	**Southwest**	**Southwest**	**Northeast**	**Northeast**	**Northeast**	**Northeast**
Test Pit/Hole Number	TP04-9	TP04-10	TP04-11	TP04-5	TP04-4	TP04-7	TP04-8	TP04-6
Coordinates	N 6,808,119	N 6,808,301	N 6,808,380	N 6,808,418	N 6,808,506	N 6,808,596	N 6,808,687	N 6,808,756
	E 441,659	E 441,792	E 441,865	E 441,926	E 442,024	E 442,147	E 442,275	E 442,389
Ground El.	~1352 m	~1324 m	~1305 m	~1305 m	~1310 m	~1325 m	~1322 m	~1355 m
Date	July 23/04	July 23/04	July 23/04	July 22/04	July 22/04	July 23/04	July 23/04	July 23/04
Type of Pit/Hole	Hand Shovel	Hand Shovel	Hand Auger	Hand Auger	Hand Shovel	D6 Dozer	D6 Dozer	Hand Shovel
Subsoil Profile and Relevant Notes	0-0.13 m MOSS - with lichen	0-0.25 m MOSS - with peat	0-1.5 m PEAT – dark brown	0-1.83 m PEAT - dark brown	0-0.61 m SILT-SAND-GRAVE-Cobble - dense, greyish brown, low plastic silt, Sa 1 @ 0.3 m	0-0.46 m TOPSOIL – rooty	0-0.46 m TOPSOIL - rooty	0-0.05 m MOSS - dark brown, with lichen
	0.13-0.16 m VOLCANIC ASH - White River ash, greyish white	0.25-0.28 m VOLCANIC ASH - White River ash, greyish white	• firm ground was encountered at 1.5 m, however, no auger progress was made with three trials	1.83 -1.86 m SILT - organic, low plasticity, greyish blue, Sa 1 @ 1.86 m	• TP04-4 is a ditch cut slope along the airstrip	0.46 -2.13 m SILT-SAND-GRAVEL-COBBLE-BOULDER - greyish tan with sandy pockets, Sa 1 @ 0.76 -1.37 m	0.46 -1.83 m SILT-SAND-GRAVEL-COBBLE-BOULDER - medium dense, greyish tan, Sa 1 @ 0.61 - 1.22 m	0.05-0.08 m VOLCANIC ASH – White River ash, greyish white
	0.16 -0.46 m SILT-SAND-GRAVEL - dark grey, Sa 1 @ 0.46 m	0.28 -0.51 m SILT-SAND-GRAVEL - greyish tan, Sa 1 @ 0.51 m		• little auger progress beyond 1.86 m				0.08-0.3 m SILT - with rock fragments, tan

The survey was carried out with a rented system from Advanced Geosciences Inc. of Austin, Texas. The system consists of a SuperSting resistivity meter, a multiplexer and a 56 electrode cable system. The field procedure consisted of driving 56 metal electrodes into the shallow subsurface at intervals of 6.1 m along the survey traverse connected to the cable system. The cable system is grouped into four individual cables of 14 electrode take-outs each connected to the multiplexing controller. The controller allows the electrodes to be in either standby, current or measuring potential modes. The SuperSting system is able to make simultaneous measurements on eight electrode pairs, while a given electrode pair are injecting current. The intended procedure was to set an initial run of 56 electrodes and then to advance the array down the line by rolling a 14 electrode cable ahead in sequence. Due to a flaw in the rented system, a more time-consuming procedure involving the advance of the entire array had to be adopted. The electrodes were sequenced to measure the dipole-dipole electrode configuration with good sensitivity to lateral variation as well as the Schlumberger configuration with improved signal-to-noise ratio with depth.

Two parameters of the electrical properties of the subsoil were measured simultaneously, i.e., the electrical resistivity, and chargeability. The resistivity to the applied electric current of the in situ material is affected by porosity, water content, composition (clay mineral and metallic mineral content), salinity of the pore water, and grain size distribution. The chargeability expresses the degree to which the ground discharges the induced polarization after the applied current is turned off and gradually returns to its natural equilibrium. The chargeability response of clay rich horizons may often be elevated as compared to zones of lower clay content. In rock, this measurement indicates the degree to which particular mineral grains are present. The presence of grains of metallic sulfide, graphite, and sometimes clay disseminated throughout a rock mass results in an increase in chargeability.

The multi-electrode resistivity method results in repeatable measurement of geoelectric section information in a wide variety of environments. Limitations are present due to variation in electrode coupling, presence of cultural noise or buried services, etc. As well, limitations are imposed by the modelling software in terms of maximum gradients allowed, data density, etc. The geological information is based upon our estimate of subsurface conditions considering the resistivity data and all other information available to us. While some aspects of the soils types can be classified, the geology of horizons identified in a multi-electrode resistivity investigation would have to be established by borehole intersections.

The results are interpretive in nature and are considered to be a reasonably accurate representation of existing subsurface conditions within the limitations of the multi-electrode resistivity method.

3.2.2 Survey Results

The field data were downloaded from the instrument and converted to the input file format for the AGI EarthImager package. This package uses a finite-difference modelling approach to calculate the resistivity values that best fit the observed data. An iterative least-squares regression was carried out to improve progressively the fit for each run of the forward code. The elevation of each electrode was included in the inversion process. The resulting subsoil sections representing the best estimate of the resistivity and chargeability sections are displayed in colour-contour format in Figures 3 to 6 in Appendix I, and reproduced here as Figures B-009 to B-012.

The inverted data was plotted in colour geoelectric section format on Figures B-009 to B-012. The upper panel shows the resistivity information in ohm-metres, and the lower section shows the chargeability section in milliseconds. The location of the survey lines are shown on Figure B-008.

In general the bedrock appears to correspond to the more uniform, lower resistivity sections (trending to blue in the resistivity sections). The soil layers are resistive and also more variable in resistivity, reflecting the often observed relation that at constant water saturation, coarser materials (i.e., sand and gravel) are higher in resistivity.

The chargeability of the soil appears to be uniformly lower than that of the lower rock strata. The areas interpreted as rock show more variable chargeability, reflecting the presence of more intact crystalline minerals. Chargeability can also be induced by certain clays.

The above relations were used in conjunction to interpret the geoelectric boundary marked as a black line on the sections. In general, this boundary could be inferred as intact "bedrock", which is likely the bottom of the weathered and fractured near-surface sub-crop materials.

3.2.3 Inferred Subsoil Conditions

Tailings Impoundment Area

Line 1 follows the proposed alignment of the tailings dam. The resistivity section shows uniformly high resistivities in the southwest segment of the survey line. This is interpreted as a shallow resistive rock area, or resistive dry soils overlying bedrock.

Northeast of Sta. 150E, a geoelectric break is interpreted to extend across the valley all the way to the northeast end. This break is indicated as a black line on the sections. The general configuration of this boundary is consistent with the base of, or a horizon within, the valley infilling sediments. The thickness of the material overlying the break generally tends to be thickest in the central valley areas (approximately 25 m thick) thinning towards the valley walls. Between Stas. 550E and 800E, the overburden material seems to be thicker in the range of 25 m to 50 m. This thickened zone appears to represent a moraine feature. The slightly elevated terrain at the crest of this moraine-like feature exhibits a near-surface resistive layer of up to 10 m thickness. This is likely related to higher resistivity materials above the water table in this location.

Line 2 is located in the central valley perpendicular to Line 1 and shows relatively uniform resistivity layering structure. The data shows a shallow layer of approximately 8 to 10 m thickness and 300 ohm-metres resistivity, underlain by a thin resistive layer. This layer is fairly uniformly present over the section, and attains resistivities of 900 ohm-metres. These two layers show low chargeability response and thus are less likely to be clay rich.

On Line 2, at a depth of approximately 25 m, the major geoelectric break is indicated. Beneath this level an increase in chargeability variation is noted. This can be interpreted to represent the approximate depth to bedrock. The corresponding bottom layer resistivities are somewhat low for crystalline bedrock. A possible explanation is that a strongly conductive layer exists at this depth, possibly just above bedrock, and the conductive response of this layer dominates the section to depth. It could imply that a clayey bedrock such as sedimentary or highly weathered rock is present.

Plant Site Area

Lines 3 and 4 are located in the proposed plant site location (see Figure B-008). These show similar characteristics to Lines 1 and 2, although with the geoelectric break interpreted slightly shallower. Line 4, which runs parallel to the valley walls, shows a strongly defined shallow resistive layer of up to eight metres thickness. This may represent more resistive, dry material at surface. The decrease in resistivities below this depth (dotted line) is interpreted to be associated with the water table in this location. The lower line (solid line) likely represents the maximum depth to the intact bedrock, generally in a range of 8 m to 12 m with greater depth in local area. Competent but fractured bedrock may be found at a shallower depth.

4. TAILINGS IMPOUNDMENT

4.1 General

The tailings from the Wolverine mill are anticipated to be susceptible to acid generation due to their high sulphide content. Sub-aqueous disposal of tailings was selected as the design basis. A 2 m depth of water was assumed to cover over the tailings impoundment both during mining operation and after mine closure (Hatch, 2004). Thus, the tailings dam is to be designed as a water-retention structure, and a net water balance is to be maintained in the impoundment. Other design parameters for the tailings impoundment include:

- a nominal storage capacity of 4.5 million m^3 of tailings;
- in situ density of stored tailings estimated at 1.85 tonnes/m^3, thus the maximum amount of tailings that could be stored is estimated at 9.25 million tonnes;
- tailings are produced at an average rate of 983 tonnes/day or 0.35 million tonnes per year; and
- a total tailings in the order of 2.8 million tonnes corresponds to the current ore resources. However, it is anticipated that this will increase with future exploration.

Underwater tailings discharge would require the use of floating tailings line mounted on pontoons. During winter months the discharge point could be situated over a deep portion of the impoundment to reduce the need for relocation. An air bubbler system might be employed, if required, to prevent pond from freezing in the tailings discharge area. During summer months the discharge point would be moved around the impoundment to raise the tailings surface more uniformly. As discussed in Section 2.5.2 - Geochemical Properties, temporary exposure of tailings deposits above water may not cause significant oxidation and a more flexible method of sub-aerial tailings disposal could be considered during mining operation. After closure, the minimum water cover depth to be maintained could also be reduced to about 0.5 m.

The proposed tailings impoundment facility includes a Seepage Recovery Dam downstream of the Tailings Dam to intercept seepage from the tailings pond in the event that the seepage water quality is not suitable for release to downstream receiving waters. In this case, the tailings pond seepage, and the precipitation and runoff collected in the Seepage Recovery Pond would be recycled to the Tailings Pond.

4.2 Storage Capacity

The tailings impoundment plan, together with the storage volume versus dam crest elevation curve, is shown in Figure B-013. As indicated in the figure the impoundment surface area increases with the dam height rather quickly, thus provides very favourable storage volume versus dam height characteristics. Also shown in the figure are the valley sections of the Starter and Ultimate Tailings Dam and the outlines of the initial and ultimate tailings pond corresponding to the respective dam crest elevations. The crest elevation of the Starter Dam was set at El. 1323 m to provide 1.5 million m^3 tailings storage for the initial eight years of mining operation, and the crest of the Ultimate Dam was set at El. 1330 m to provide approximately a total storage of 4.5 million m^3 for tailings and water. The water depth of 2 m is provided in the above selected dam crest elevations. As the adopted depth of water cover is reduced, the actual dam height at various stages could be reduced accordingly.

4.3 Dam Failure Consequence Classification

The consequence classification of the Wolverine Tailings Impoundment facility has been assessed to guide the selection of criteria for the flood and seismic design. This assessment was based on a preliminary screening-level review with consideration of the potential incremental life safety, socioeconomic, financial and environmental consequences of failure, and the associated hazard ratings as provided for in the Canadian Dam Safety Guidelines (CDA, 1999). The Tailings Dam will be approximately 27.5 m high at closure and will have a tailings and water storage capacity of up to 4.5 million cubic metres. The tailings impoundment is located in a remote area of Yukon and, except for a campsite on Frances Lake, there are no major population centres or commercial and industrial activities downstream of the impoundment. In the event of an incident at the tailings impoundment, the discharge from the facility would enter Go Creek and then Money Creek. Money Creek discharges into Frances Lake, which is located east of the mine about 40 km downstream of the tailings impoundment. The most significant infrastructure crossing along this flow path is the Robert Campbell Highway over Money Creek just before the creek enters Frances Lake. We are not aware of other infrastructure crossings, such as power transmission lines or oil/gas pipelines, but this needs to be confirmed during the feasibility study.

Regionally significant wildlife resources occur in the Wolverine project area, notably the Finlayson caribou herd. The herd uses the uplands around the project area from the spring to the fall, and the lowlands of the Pelly River in the winter. These caribou provide a valuable food source for the Ross River Dena First Nation and are also of economic significance to sport hunters and the guiding industry. Moose are also a significant wildlife resource. Furbearer populations are also utilized by the Ross River Dena First Nation. Fish in the larger lakes (including Finlayson Lake) and streams include arctic grayling, whitefish, lake trout and Dolly Varden char (Hatch, 2004).

The exposed tailings are expected to be acid generating. Thus, some potential for acid rock drainage problem could exist, should the tailings be released from the water covered tailings impoundment. In the event of a breach at the Tailings Dam, no fatalities are anticipated, and only moderate socio-economic, financial and environmental damages are expected. Therefore, the tailings impoundment is classified as a "Low" consequence facility.

4.4 Geochemical Aspects

The tailings from the Wolverine mill are anticipated to be susceptible to acid generation due to their high sulphide content and permanent underwater (saturated) disposal of tailings has been selected as the project basis. On closure, the impoundment is intended to form a lake, in perpetuity, by maintaining a constant net water balance at this location and by remaining a stable structure requiring minimal maintenance.

The maintenance of a 2 m water cover is likely unnecessary on closure. A shallower water cover is almost certainly going to be sufficient to preclude oxygen penetration into the bulk of the tailings. Recent studies by MEND (1996) at Anderson Lake in Manitoba suggest that as little as 10 cm to 15 cm of water cover is sufficient, particularly in the presence of organic-rich sediment as would typically occur on closure (perhaps encouraged by fertilizing the tailings pond after closure and/or inclusion of sewage sludge with the final tailings.

The minimum water cover depth required is a function of the site water balance considering direct precipitation, run-in to the pond, lake evaporation and seepage losses. A minimum water depth able to prevent de-saturation of the tailings during a 1 in 100 year dry year is more likely to be an acceptable design criterion. For this site, this could be expected to be approximately 0.5 m. Since the submerged beach will slope towards the centre of the impoundment, there could be on the order of 2 m of water cover at the low point, where the reclaim barge would have been located during operations. Design of the outlet control structure will need to consider the potential for entrainment of tailings during peak flows. However, this can likely be addressed through the placement of a riprap inlet erosion control blanket.

No tailings process water chemistry data was available for this assessment. Therefore, it is not possible to predict tailings pond water quality during operations or immediately on closure. The water balance presented in Section 4.7 suggests that excess water in the impoundment will require discharge throughout the life of the mine. Expatriate has committed to ensuring that the discharge water quality does not exceed Metal Mining Effluent Regulations MMER (MFO, 2002) discharge limits. Should tailings process water chemistry data become available, it should be verified that the tailings process water meets these criteria. The water treatment plant proposed in the Water Licence Application for the test mining operation could be adapted to treat tailings pond water, if necessary, prior to discharge.

4.5 Design Earthquake

The design earthquake selected for the tailings dam was based on the Canadian Dam Safety Guidelines (CDA, 1999) and the Mine Reclamation Guide for the Northwest Territories and Yukon (INAC, 1992). Although the tailings impoundment is classified as a “Low” consequence facility in Section 3.3, the annual probability of exceedance of horizontal peak ground acceleration is chosen as 0.001, corresponding to a return period of 1,000 years. Thus, the site horizontal peak ground acceleration value is selected as 0.1 g as shown in Table 2.2. This value will be used to assess foundation liquefaction potential, when appropriate subsoil information is acquired. Moreover, although historical earthquakes along the Tintina Fault do not exceed magnitude 5, the pseudo-static stability analysis for the tailings dam presented in Section 5.5.3 applied a seismic coefficient k_h of 0.1, which corresponds to a design event of magnitude 6.5.

4.6 Design Floods

The design flood criteria selected for the various components of the water management facilities associated with the tailings impoundment are summarized in Table 4.1 below. The selection of the design floods was based on the Canadian Dam Safety Guidelines (CDA, 1999) and the Mine Reclamation Guide for the Northwest Territories and Yukon (INAC, 1992). The expected operating life of the mine was also taken into account in the selection of the design floods for temporary facilities, such as the surface runoff diversion ditches, the Starter Dam Spillway and the Seepage Recovery Pond. The mine is expected to be active for a period of about 9 to 14 years. During this time all facilities related to the tailings impoundment would be closely and frequently monitored, and personnel, equipment and materials are expected to be readily available in the event that remedial measures are required to be taken under routine and/or emergency maintenance. Therefore, a lower design criteria for temporary facilities is justifiable.

Table 4.1 Selected Flood Design Criteria for Water Management Facilities

Facility	Minimum Design Flood Return Period (years)	Comments
Surface Water Diversion Ditches	50	-
Starter Dam Spillway	200	Assume that surface water diversion ditches are functioning.
Tailings Dam Closure Spillway	1,000	Assume that surface water diversion ditches have been decommissioned.
Seepage Recovery Pond Spillway	50	Assume that surface water diversion ditches are functioning.

4.7 Water Balance

A mean annual water balance analysis was completed for the tailings impoundment. As shown in Figure A-015, inflows to the tailings pond during mine operation include:

- Direct precipitation on the Tailings Pond;
- Surface water runoff from the Tailings Pond catchment; and
- Tailings transport water from the Mill.

Outflows from the Tailings Pond include:

- Evaporation from the pond;

- Reclaim recycled water to the Mill;
- Water lost to tailing voids;
- Water conveyed to the Water Treatment Plant; and
- Seepage losses from the Tailings Pond.

The data presented in the report on Regional Hydrologic Analysis for the Finlayson Project Site (Gartner Lee, 2001) was used for estimating the surface runoff. That report presents regional runoff characterization, flow analysis and flood frequency analysis, and extends the results to the Wolverine site. The mean annual runoff for the Wolverine site, as presented in the Gartner Lee report and assumed for the water balance analysis, is 325.5 mm. The Tailings Pond has a total catchment area of about 9.74 km^3 (see Figure A-014). Our initial water balance analysis, assuming that the runoff from the entire natural Tailings Pond and the Seepage Recovery Pond catchments report to the Tailings Pond, indicated that there would be a large surplus of water during an average year. Therefore, for water balance analysis during mine operation, it was assumed that diversion ditches are constructed to minimize runoff into the two ponds. Further details on the proposed diversion ditches are presented in Section 4.8 below.

Direct precipitation on the Tailings and the Seepage Recovery Ponds were assumed to be the same as the mean annual precipitation for Watson Lake A (Station No. 2101200).

Tailings transport water discharged into the Tailings Pond, available reclaimed water and reclaim water recycled to the Mill were assumed to be 202.4 m^3/hr, 192.14 m^3/hr and 167.48 m^3/hr, respectively, as provided by Hatch.

For estimation of evaporation loses from the Tailings and the Seepage Recovery Ponds, the 1951-80 lake evaporation normal for Whitehorse A (Station No. 2101300) was used.

Although evaporation was measured at Watson Lake A (Station No. 2101200) for a few years, this data is not readily available. Watson Lake is located closer to the mine site than Whitehorse hence data from Watson Lake may be more applicable to the site.

For the water balance analysis, it has been assumed that the seepage from the Tailings Pond is relatively small and that it is of suitable quality for release to downstream receiving waters, i.e., Tailings Pond seepage is not required to be intercepted in the Seepage Recovery Pond and recycled to the Tailings Pond.

The mean annual water balances, with and without the diversion ditches, are summarized in Table 4.2. As the table indicates, there will still be a surplus of water with the construction of diversion ditches, albeit the surplus will be much smaller than without the ditches.

Should it be necessary to intercept and recycle Tailings Pond seepage back to the pond, the recycled water would include not just the seepage water but precipitation and runoff intercepted by the Seepage Recovery Pond as well. In this case, there would be an additional surplus of 10.0 m^3/hr and 13.7 m^3/hr for the schemes with and without the diversion ditches, respectively.

Table 4.2 Mean Annual Water Balances with and without Diversion Ditches

Description	First Year of Operation		Final Year of Operation	
	With Diversion Ditches (m^3/hr)	Without Diversion Ditches (m^3/hr)	With Diversion Ditches (m^3/hr)	Without Diversion Ditches (m^3/hr)
INFLOW:				
• Runoff into Tailings Pond	34.2	359.0	19.3	344.1
• Direct Precipitation on Tailings Pond	3.7	3.7	22.2	22.2
• Tailings transport water	202.4	202.4	202.4	202.4
• Seepage water recycled from Seepage Recovery Pond	(see note)	(see note)	(see note)	(see note)
• Precipitation and runoff transferred from Seepage Recovery Pond	N/A	N/A	N/A	N/A
TOTAL INFLOW	240.3	565.1	243.9	568.7
OUTFLOW:				
• Evaporation	4.4	4.4	26.5	26.5
• Loss to tailing voids	10.3	10.3	10.3	10.3
• Reclaim of water to treatment plant then Mill	34.9	34.9	34.9	34.9
• Reclaim water directly to Mill	167.5	167.5	167.5	167.5
• Seepage losses	(see note)	(see note)		
TOTAL OUTFLOW	217.1	217.1	239.2	239.2
SURPLUS	**23.2**	**348**	**4.7**	**329.5**

NOTE: Seepage from the Tailings Pond is relatively small and is assumed to be acceptable for release to downstream receiving waters. Should it be necessary to intercept seepage and recycle it to the Tailings Pond, there will be an additional surplus of 10.0 m^3/hr and 13.7 m^3/hr for the schemes with and without the diversion ditches, respectively.

4.8 Diversion Channels

As noted in Section 4.7, the mean annual water balance analysis indicated that there would be a substantial water surplus in the Tailings Pond and, therefore, diversion ditches are required to minimize runoff into the pond. The proposed layout of the diversion ditches is shown in Figure B-016. These ditches would be constructed on both sides of the Tailings Pond and the Seepage Recovery Pond.

On the southwest side, Ditch A would intercept runoff from the area uphill of the Tailings and Seepage Recovery Ponds and would discharge into a natural gully downstream of the ponds. The second diversion ditch on the southwest side (Ditch B) would intercept runoff and direct it towards Little Wolverine Lake.

On the northeast side, Ditch E would divert the upper catchment of Go Creek past the Tailings and Seepage Recovery Ponds. Ditch E would discharge into a natural gully, which would carry the diverted flow back into Go Creek downstream of the Seepage Recovery Pond. An examination of the air photos indicates that only a short diversion ditch would be required, however this needs to be confirmed on site and with more detailed topographic mapping. Ditch C on the northeast side of the Tailings Pond would divert water towards Little Wolverine Lake as shown. The proposed diversion structures for Ditch E and Ditch C consist of earth berms constructed across the stream channel. The berms would be provided with gated culverts to allow release of water into the Tailings Pond if and when required.

The estimated catchments, the design criteria and the design flows for the diversion ditches are presented in Table 4.3, and the preliminary sizes of the diversion ditches are shown in Figure B-016. The layout and sizing of the diversion ditches are based on 5 m contour topography, the limited field investigations carried out for this pre-feasibility study and the assumption that the ditches are located in silt/sand and gravel. We understand that bedrock may be found at shallow depth along some of the diversion ditches and, as such, additional geotechnical field investigations should be conducted during subsequent studies such that the ground conditions along the proposed ditch alignments can be determined, and the layout and design of the ditches and associated structures can be further refined. In the event that bedrock is found at shallow depth downstream of the Tailings Dam on the southwest side, it may be possible to combine Diversion Ditch A, the Starter Dam Spillway and the Closure Spillway into a common channel alignment. The existence of bedrock would allow drop chutes to be constructed, without extensive erosion protection works, to carry the flow from the upper channels to a common channel at a lower elevation.

Table 4.3 Estimated Catchment Areas, Design Flood Flows and Assumed Freeboards

Water Management Component	Catchment Area (km^2)	Design Flood Return Period (years)	Design Flood (m^3/s)	Channel Freeboard (m)	Min. Dam Freeboard (m)	Assumptions
Diversion Ditch A	1.8	50	0.42	0.3	N/A	
Diversion Ditch B	0.18	50	0.05	0.3	N/A	
Diversion Ditch C	1.0	50	0.25	0.3	N/A	
Diversion Ditch D	1.18	50	0.3	0.3	N/A	
Diversion Ditch E	4.33	50	1.0	0.3	N/A	
Starter Dam Spillway	1.0	200	0.3	0.3	1.0	Surface water diversion ditches are functioning
Tailings Dam Closure Spillway	9.74	1,000	2.82	0.6	1.0	Surface water diversion ditches decommissioned
Seepage Recovery Pond Spillway	0.29	50	0.1	0.3	0.6	Surface water diversion ditches are functioning
Year 1 Tailings Pond free water surface (El. 1210 m)	0.07					
Year 4 Tailings Pond free water surface (El. 1321 m)	0.32					
Year 14 Tailings Pond free water surface (El. 1328 m)	0.53					
Seepage Recovery Pond water surface area (El. 1297.4 m)	0.02					

4.9 Flood Handling and Spillways

The estimated catchments, the design criteria and the design floods for the Tailings Pond and the Seepage Recovery Pond are summarized in Table 4.3. Since the Starter Dam Spillway and the Seepage Recovery Pond are considered to be temporary facilities, the design floods for the Starter Dam Spillway and the Seepage Recovery Pond Spillway were based on the assumption that the diversion ditches are functioning as intended. On the other hand, the design flood for the Closure Spillway is based on the assumption that the diversion ditches are decommissioned. The design flows shown in Table 4.3 are peak instantaneous flows based on the flood frequency analysis results presented in the report on Regional Hydrologic Analysis for the Finlayson Project Site (Gartner Lee, 2001). For the design of the spillways, it has been assumed that no attenuation of the flood peak occurs as the flood passes through the ponds.

The preliminary layout and sizes of the spillways are shown in Figure B-016. These layouts and sizing are based on 5 m contour topography, the limited field investigations carried out for this pre-feasibility study and the assumption that the spillway channels are located in silt/sand and gravel. We understand that bedrock may be found at shallow depth in some areas and, as such, additional geotechnical field investigations should be conducted during subsequent studies such that the ground conditions along the proposed spillway alignments can be determined, and the layout and design of the spillway control sections and the channels can be further refined. In the event that bedrock is found at shallow depth downstream of the Tailings Dam on the southwest side, it may be possible to combine Diversion Ditch A, the Starter Dam Spillway and the Closure Spillway into a common channel alignment.

5. TAILINGS DAM

5.1 General

The Starter and Ultimate Tailings Dam are shown in plan in Figure B-013, together with their maximum sections in the valley segment. The following factors are considered for the current design:

- a 2 m freeboard for normal pond water level, this freeboard could be reduced after the construction of a closure spillway and permission is granted by the government to release pond water to the environment;
- a 1 m freeboard for design flood level;
- a 2 m water cover, this depth of cover could potentially be reduced as discussed in Section 4.4; and
- the layout of the access road on the northeast valley slope above the dam abutment.

Although the present dam alignment has been shifted downstream of an earlier alignment, it does not represent the optimal location. The topography of the impoundment site would allow further shifting of the dam alignment towards downstream, if significant increase in the required tailings storage volume is anticipated. However, the alignment of the access road in the area should be reviewed together with the dam alignment, should further storage optimization needs to be considered.

5.2 Dam Foundation

The dam foundation at both valley slopes appears to be competent after the stripping of the organic topsoil layer. A peat layer of about 2 m thickness was encountered at two test holes located on the valley floor. Also numerous beaver dams are present on the floor creating elevated pond levels in the area. Removal of the beaver dams and drainage of these surface ponds would facilitate the stripping of the swamp deposits in preparing the dam foundation in the valley segment. The stripped topsoil and swamp deposits are to be stockpiled for future reclamation use in preparation for mine closure.

Due to limitation of the present investigations, little is known about the nature of materials underlying the peat layer and the in situ shear strength and/or densities of these materials. Although permafrost condition has been identified for the general site, no specific information on the extent of potential permafrost and its nature is available at the present time. Potential foundation remediation measures, if required, such as densification, etc. would be determined at the feasibility study stage after test pitting and drilling investigations are carried out. Similarly, any potential permafrost related issues would be addressed later. However, if the permafrost is not ice-rich, it may not represent a significant problem.

5.3 Construction Materials

The test pits excavated on the northeast side of the valley as well as the road cuts and airstrip on the same side indicate that competent silt-sand-gravel-cobble morainal deposits of large quantities are available. Similar materials with cleaner sand-gravel-cobble creek deposits are present on the valley floor. However, the creek deposits tend to be variable as the meandering patterns of the existing and abandoned creeks on the floor shift with time. Thus, selective borrowing or even screening may be required to obtain free-draining filter/drain materials for the tailings dam.

5.4 Dam Design

Along the currently selected dam alignment, the ground surface of the valley floor is at about El. 1302.5 m. Thus, the maximum height of the Ultimate Dam will be about 27.5 m. For this dam height, a dam crest width of 10 m would be appropriate. The upstream dam slope of 2 H:1 V was selected to take advantage of the lateral support offered by the upstream tailings deposits. A flatter downstream dam slope of 3 H:1 V was selected to reduce the potential foundation improvement work that might be needed as additional investigations may reveal. The dam will consist of a homogeneous fill dam, using selected lower permeability morainal soils. A downstream toe blanket drain, 1.5 m thick, will be placed to control the long term phreatic level in the dam.

5.5 Seepage and Stability Analyses

Steady-state seepage analysis of the ultimate dam was carried out to determine the pore pressure distribution within the dam and its foundation. These pore pressures were subsequently used in the limit-equilibrium stability analysis to determine the static and pseudo-static factors of safety of the ultimate dam.

5.5.1 Material Properties

Figures A-017 and A-018 show the geometry and zoning of the ultimate dam used in the seepage and stability analyses, respectively. The crest of the dam is at El. 1330 m and the upstream and downstream slopes are 2H:1V and 3H:1V, respectively. The surface of tailings and water elevations were taken at El. 1326 m and El. 1328 m, respectively. Table 5.1 lists the material properties of the dam, foundation and tailings used in the seepage and limit-equilibrium analyses.

Table 5.1 Material Properties Used in the Seepage and Stability Analyses

Description	Unit Weight, γ (kN/m^3)	Friction, ϕ' (deg)	Cohesion, C (kPa)	Hydraulic Conductivity, k (cm/s)
Tailings	19	20	0	$2x10^{-6}$
Silt-Sand-Gravel (Dam Fill)	23	35	0	$2x10^{-6}$
Sand and Gravel (Drainage Blanket)	23	35	0	$2x10^{-3}$
Silt-Sand-Gravel (Foundation)	20	30	0	$2x10^{-5}$

The hydraulic conductivities of the dam fill and foundation material were estimated from laboratory falling-head permeability tests on samples prepared at simulated field densities. The shear strength parameters are conservative engineering estimates for the general materials involved.

5.5.2 Results of Seepage Analysis

Steady-state seepage analysis was carried out using the computer program SEEP/W (Geo-Slope, 2003a). The pond water elevation above the tailings was taken at El. 1328 m in the analysis. Top figure in Figure A-017 shows the finite-element mesh of the dam and foundation, and the hydraulic conductivities of various material zones.

The bottom figure in Figure A-017 shows the results from the seepage analysis including the equipotential lines, flow lines and the phreatic line. (Note that the total head values shown in the figure are the actual total head minus 1000). The rate of seepage at this maximum dam section is 9×10^{-7} m^3/s per metre length of the dam.

5.5.3 Results of Stability Analysis

Static and pseudo-static stability analyses were carried out using the computer program SLOPE/W (Geo-Slope, 2003b) and the Morgenstern-Price method to determine the factor of safety.

<u>Static Stability</u>

Static stability analysis of the ultimate dam was carried out for the steady-state seepage condition. The pore pressure distribution within the tailings, dam fill and foundation obtained from the seepage analysis shown in Figure A-017 was used as input in the stability analysis. The minimum factor of safety against static failure of the downstream slope is 1.9. The slip surface corresponding to this factor of safety is shown in Figure A-018. Figure A-018 also shows a shallower slip surface with a factor of safety of 2 that extends up to the upstream slope of the dam. As expected, the factor of safety of the shallow slip surfaces is higher than the minimum value of 1.9.

Pseudo-Static Stability Analysis

Pseudo-static analysis of the ultimate dam was carried out by applying a seismic coefficient (k_h) of 0.1, corresponding to a design earthquake magnitude of 6.5 (Seed, 1979). The analysis showed that the minimum factor of safety against the downstream slope failure with k_h=0.1 is 1.4. The same pore pressure distribution under the steady-state condition obtained from the seepage analysis was used, and no seismic-induced excess pore pressure was assumed in either the dam or foundation material.

5.6 Seepage Recovery

In the event that Tailings Pond seepage water quality is unsuitable for discharge to downstream receiving waters, a Seepage Recovery Dam would be constructed downstream of the Tailings Dam to intercept and recycle the seepage to the Tailings Pond. Figure B-013 shows the proposed location of the Seepage Recovery Dam. Assuming a 5 m high dam, the Seepage Recovery Pond at this location would have a total storage capacity of approximately 30,000 m^3 with a 0.6 m freeboard allowance for the dam. The average runoff for the month of June, the month with the highest runoff, is 88.47 mm (Gartner Lee, 2001). This would result in a runoff volume of 25,660 m^3 for the Seepage Recovery Pond with the diversion ditches functioning. Assuming that the water from the Seepage Recovery Pond is pumped to the Tailings Pond only once a week, the Seepage Recovery Pond would have a surplus flood storage capacity of about 23,890 m^3. This flood storage capacity is more than five times the runoff volume expected from a 50-year, 24-hour event, therefore the Seepage Recovery Pond as currently proposed has more than adequate capacity.

5.7 Dam Monitoring

Standard dam monitoring instruments such as standpipe piezometers and surface survey pins will be employed to monitor the phreatic surface within the Tailings Dam and foundation pore pressure in its foundation as well as any post-construction dam settlement and/or horizontal movements. Special instruments such as inclinometers and/or thermisters may be used in case potential seats of foundation movement and/or the presence of permafrost are defined in further investigations for the feasibility study. Seepage ditches and weirs will also be used to collect and measure rates of seepage downstream of the Tailings Dam.

5.8 Surface and Groundwater Water Quality Monitoring

The existing surface and groundwater monitoring data for the project site will be reviewed to establish the baseline water quality condition at the feasibility study stage. Additional monitoring stations will be recommended based on the review to replace and/or supplement existing monitoring stations in order to monitor any changes that might occur in the surrounding environment due to the mining operation.

6. CONSTRUCTION QUANTITIES

6.1 Diversion Channels and Spillways

The estimated excavation quantities for the proposed diversion channels emergency and closure spillways are presented in Table 6.1. Channel excavation quantities are based on the assumption that the channels are located in silt-sand-gravel overburden. Channel size and excavation quantities would change if the channels are located in bedrock. It should be noted that, although not shown separately in Table 6.1, erosion protection such as riprap will be required at the head of the channels, the channel outfalls, and possibly in some local areas depending on ground conditions. Erosion protection will also be required for the diversion berms.

Table 6.1 Estimated Quantities for Water Handling Related Facilities

Item	Unit	Estimated Quantity
Seepage Collection Pond		
Foundation preparation - topsoil and swamp excavation (2.5m deep)	m^3	4,600
Foundation preparation - foundation backfill (2.5m deep)	m^3	4,600
Dam fill	m^3	6,600
Spillway Channel - excavation	m^3	100
Spillway Channel – 600 mm dia. CSP half-pipe drop chute	m	70
Tailings Pond Diversion Ditches		
Diversion Ditch A - excavation	m^3	9,800
Diversion Ditch B - excavation	m^3	600
Diversion Ditch C - excavation	m^3	3,800
Diversion Ditch D - excavation	m^3	4,900
Diversion Ditch E - excavation	m^3	1,700
Diversion Ditch C - diversion berm (including 600 mm dia. CSP gated culvert)	lump sum	1
Diversion Ditch E - diversion berm (including 600 mm dia. CSP gated culvert)	lump sum	1
Tailings Pond Spillways		
Starter Dam Spillway Channel excavation (Temporary Spillway)	m^3	4,700
Closure Spillway Channel excavation	m^3	20,400

Notes:
1. Channel excavation quantities are based on the assumption that the channels are located in silt-sand- gravel overburden. Channel size and excavation quantities would change for those segments located in bedrock.
2. The diversion ditches and spillway channels have been designed such that erosion protection is not required along most of the channel. Erosion protection, such as riprap, will be required at the head of the channel, the channel outfalls, and possibly in some local areas depending on ground conditions. An allowance for erosion protection should be included in the cost estimate.
3. Relocation of temporary spillway will be required as the Tailings Dam is raised beyond the Starter Dam.

6.2 Dam Construction

The preliminary estimates for dam-related construction quantities are summarized in Table 6.2.

Table 6.2 Estimated Quantities for Tailings Dam

Excavation or Fill Items	Description of Materials or Extent	Quantities (m^3)	
		Starter Dam	Ultimate Dam
Dam Fill above Original Ground Surface	Select Pit-run Silt-Sand-Gravel	280,000	560,000
Filter/Drainage Blanket	Screened Sand and Gravel Creek Deposits	5,000	26,000
Foundation Topsoil Stripping	0.5 m depth within dam footprint area	17,000	27,000
Foundation Swamp Deposits Stripping	2 m depth within swamp area	38,000	52,000
Foundation Backfill	Select Pit-run Silt-Sand-Gravel	55,000	79,000

Based on Hatch 2004 March Report, we assumed that there will be a minimum of 8 years of tailings storage at a yearly rate of 352,000 tonnes and a total amount of 2.8 million tonnes tailings. Assuming a density of 1.85 tonnes/ m^3, this is equivalent to 1.5 million m^3, plus pond water depth and freeboard. Dam volumes for incremental raises of the Starter Dam are shown in Table 6.3.

Table 6.3 Estimated Yearly Dam-Raise Quantities Above Starter Dam

Dam Crest El. (m)	Dam Crest Raise (m)	Dam Volume (m^3)	Incremental Dam Volume (m^3)
1323.00	Starter Dam	284,000	-
1324.00	1.00	319,000	35,000
1324.84	0.85	351,000	32,000
1325.61	0.77	381,000	30,000
1326.41	0.79	415,000	34,000
1327.26	0.86	452,000	37,000
1327.99	0.73	485,000	33,000
1328.68	0.69	518,000	33,000
1329.34	0.66	551,000	33,000
1330.00	0.66	586,000	35,000

Notes: 1. The above table shows incremental dam volumes above the original ground surface, including the volume of clean sand and gravel filter/drainage blanket.
2. For other items included in Table 6.2 incremental quantities could be obtained approximately by dividing the differences between the corresponding items for the Ultimate Dam and Starter Dam by the number of intervening years, assumed 9 years in Table 6.3.

7. CONCLUSIONS AND RECOMMENDATIONS

This report presents a pre-feasibility design for the tailings storage facility at Wolverine based on our site investigations, laboratory tests and design analyses as well as in consultation with Hatch and Expatriate. Dam related quantities were calculated by Klohn Crippen based on the pre-feasibility design, and the approximate costs associated with its construction were estimated by Hatch and are reported separately by Hatch. Our conclusions and recommendations are summarized below.

7.1 Conclusions

The proposed impoundment site, situated in a broad glaciated valley, has a very favourable storage-elevation characteristics. The downstream dam alignment was selected, as it could accommodate additional tailings storage for potential future expansion. Further optimization of the impoundment storage capacity by moving the dam alignment further downstream is feasible, if required. The dam foundation at valley slopes appears to be competent. However, the present foundation investigations, involving either shallow geotechnical exploration or indirect geophysical measurement, are rather limited.

Given the above limitation, our pre-feasibility study concluded that by adopting appropriate engineering design measures, a safe and cost-effective tailings impoundment can be constructed at the proposed site with adequate protection of the surrounding environment both during mining operation and after mine closure.

7.2 Recommendations

For the feasibility level study, additional subsoil investigations using backhoe and geotechnical drilling rig would be required. These additional programs would better determine the foundation conditions at the tailings dam site and plant site to appropriate depths. At the dam site, the potential presence of permafrost and the nature of foundation material on the valley floor below the peat layer and its in situ strength and/or density should be ascertained. Similarly, at the valley slopes of the dam foundation and plant site, possible permafrost condition and depth to competent bedrock should be determined. At the current pre-feasibility level, allowance should be made for potential dam foundation work related to possible presence of permafrost, soft and/or loose foundation material. Similarly, allowance should be made for excavation down to competent bedrock level for the plant site, including excavation of potential frozen overburden and weathered bedrock materials. The quantification of these allowances should be reviewed and confirmed at the feasibility design stage, as more definitive subsoil information becomes available. Moreover, sufficient contingency allowance should be included in the cost estimate for the tailings impoundment associated structures to reflect the limited site investigations carried out to date.

Additional geochemical related issues also require further study. Large-diameter tailings humidity-cell kinetic test program should be conducted in order to confirm the feasibility of adopting a more flexible and cost effective sub-aerial tailings deposition scheme in the impoundment. Moreover, tailings process water chemistry data should be reviewed to address the water quality issue of excess water in the tailings impoundment.

The tailings process water chemistry data should be reviewed to verify whether the process water needs to be treated prior to release to the environment.

We understand that some climate data has been recorded at the mine site but this data was not available for this study. The local climate data should be reviewed during the feasibility study and correlated with long-term data from nearby stations, if possible.

More detailed topographic maps of the site are required for subsequent studies such that the layout and design of the proposed spillways and diversion ditches can be further refined. Additional geotechnical field investigations and site reconnaissance should also be conducted for the ancillary structures during subsequent studies. Thus, the ground conditions along the proposed spillway and diversion ditch alignments can be determined, and the layout and design of these facilities can be further refined.

The consequence classification assessment for the tailings impoundment assumed that the Robert Campbell Highway is the only significant infrastructure crossing. This should be confirmed during the feasibility study.

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APPENDIX I

Multi-electrode Resistivity Survey Report by Frontier

KLOHN CRIPPEN

REPORT ON A MULTI-ELECTRODE RESISTIVITY SURVEY WOLVERINE PROJECT, YUKON TERRITORY

by

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JUNE, 2004 **PROJECT FGI-769**

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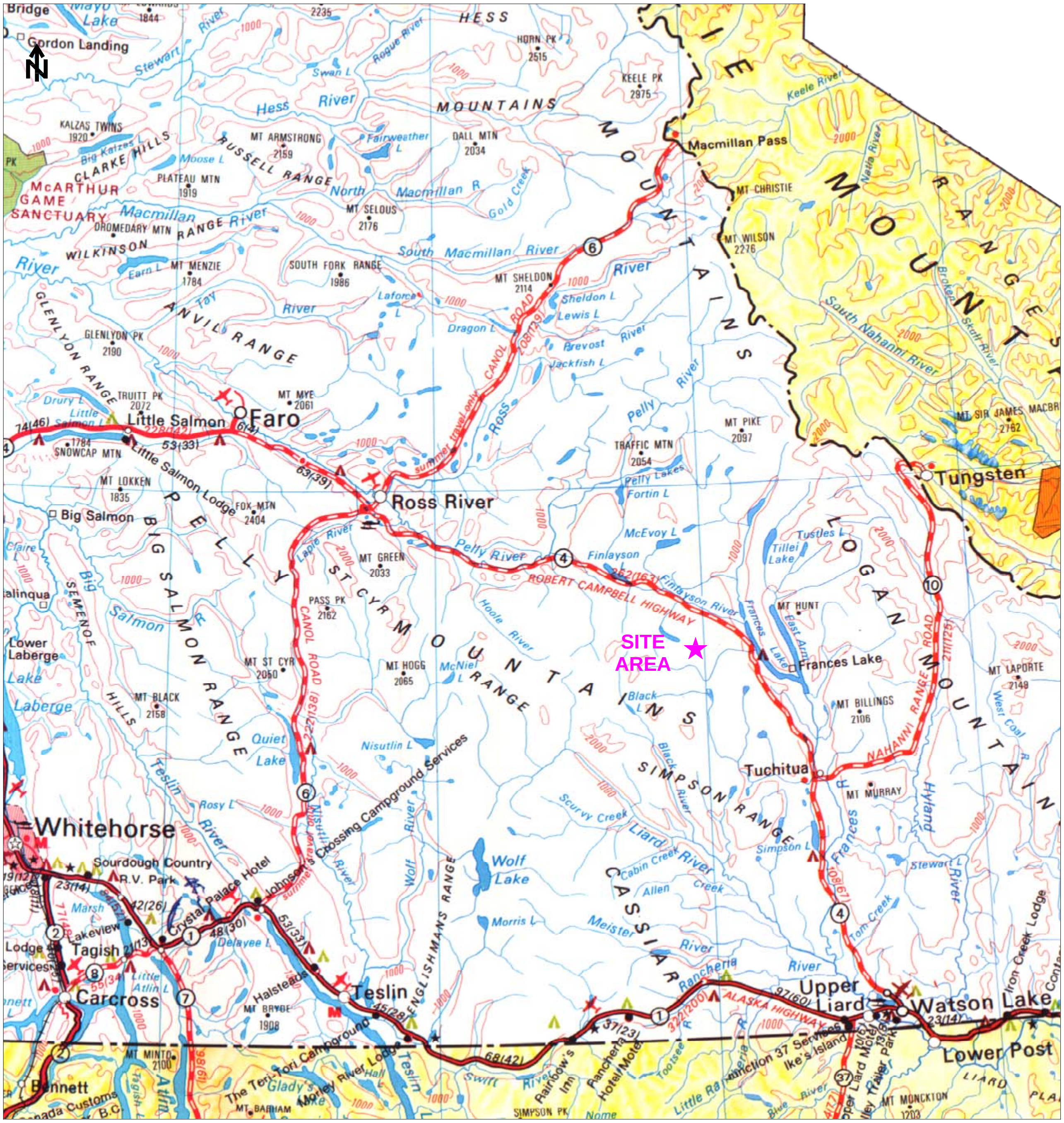
CONTENTS

ILLUSTRATIONS

1. INTRODUCTION

During the period of July 27th to Aug. 6th, 2004, Frontier Geosciences Inc. carried out a program of multi-electrode resistivity surveying for Klohn Crippen at the Wolverine Project in the Yukon Territory. The Survey Location Plan of the area of investigation is shown at 1:25,000 scale in Figure 1. The purpose of the geophysical investigation was to assist in mapping the subsurface conditions by defining the electrical resistivity and chargeability of the earth materials in the vicinity of the tailings dam and plant site location.

The program consists of a two lines in the location of the proposed tailings dam, and two lines in the proposed plant site location.



KLOHN-CRIPPEN
YUKON TERRITORY
WOLVERINE MINE SITE

RESISTIVITY AND IP SURVEY

SURVEY LOCATION PLAN

FRONTIER GEOSCIENCES INC.

DATE: JULY 2004	SCALE 1:2,500,000	FIG. 1

2. THE MULTI-ELECTRODE RESISTIVITY SURVEY

2.1 Equipment

The multi-electrode resistivity surveying was carried out with a system from Advanced Geosciences Inc. of Austin, Texas. The system consists of a SuperSting resistivity meter, a multiplexer and a 56 electrode cable system.

The multi-electrode resistivity surveying method provides measurements of two parameters of the electrical properties of the earth materials at the survey site. The first of these is the measurement of the electrical resistivity. This is a measurement of the capacity of the earth materials to support the flow of electrical current. The properties that affect the resistivity of soil or rock include porosity, water content, composition (clay mineral and metallic mineral content), salinity of the pore water, and grain size distribution.

The second measurement taken in IP surveys is the chargeability. This effect arises when certain layers in the ground become electrically polarized, resulting in a persistence of the measured voltage after the impressed electric current is was turned off. The chargeability parameter expresses the degree to which the ground gradually discharges and returns to equilibrium.

In soils materials, the chargeability response of clay rich horizons may often be elevated as compared to zones of lower clay content. In rock, this measurement indicates the degree to which particular mineral grains are present in the rock. The presence of grains of metallic sulfide, graphite, and sometimes clay disseminated throughout a rock mass results in a increase in chargeability. Both chargeability and resistivity measurements were taken simultaneously during the survey.

2 Survey Procedure

The field procedure consisted of driving 56 metal electrodes into the shallow subsurface at intervals of 6.1 metres along the survey traverse connected to the cable system. The cable system is grouped into four individual cables of 14 electrode take-outs each connected to the multiplexing controller. The controller allows the electrodes to be in either standby, current or measuring potential modes. The SuperSting system is able to make simultaneous measurements on eight electrode pairs, while a given electrode pair are injecting current. The intended procedure was to set an initial run of 56 electrodes and then to advance the array down the line by rolling a 14 electrode cable ahead in sequence. In practice, due to a flaw in the shipped system, the entire array had to be advanced, a more time consuming procedure.

The electrodes were sequenced to measure the dipole-dipole electrode configuration as well as the Schlumberger configuration. The dipole-dipole configuration has the property of good sensitivity to lateral variation, and the Schlumberger configuration provides improved signal to noise ratio with depth.

2.3 Data Processing

The data were downloaded from the instrument and converted to the input file format for the AGI EarthImager package. This package uses a finite difference modelling approach to calculate the resistivity values that best fit the observed data. An iterative least-squares method progressively increases the fit for each run of the forward code. The elevation of each electrode is input, and included in the inversion process. The resulting section is the best estimate of the resistivity and chargeability sections. These sections are displayed in colour contour format for interpretation.

5. GEOPHYSICAL RESULTS

5.1 General

The inverted data was plotted in colour geoelectric section format on Figures 3 - 6. The upper panel shows the resistivity information in ohm-metres, and the lower section shows the chargeability section in milliseconds. The location of the lines are displayed at a scale of 1:20,000 on the Site Plan (Figure 2).

5.2 Discussion

Line 1 follows the proposed alignment of the tailings dam. The resistivity section shows uniformly high resistivities in the southwest segment of the survey line. This is interpreted as a shallow resistive rock area, or resistive dry soils overlying bedrock.

Northeast of 150NE a geoelectric break is interpreted that extends to the northeast across the section. This event is indicated as a black line on the sections. The general configuration of this boundary is consistent with the base of, or horizon within, the valley filling sediments. The thickness of the material overlying the break tends to be thickest in the central valley areas thinning towards the valley walls.

The slightly elevated terrain between 550NE and 800NE exhibits a resistive layer of up to 10 metres thickness. This is likely related to higher resistivity materials above the water table in this location.

Line 2 is located in the central valley perpendicular to Line 1 and shows relatively uniform resistivity layering structure. The data shows a shallow layer of approximately 8 to 10 metres thickness and 300 ohm-metres resistivity, underlain by a thin resistive layer. This layer is fairly uniformly present over the section, and attains resistivities of 900 ohm-metres. These two layers show low chargeability response and thus are less likely to be clay rich.

On Line 2, at a depth of approximately 25 metres, the major geoelectric break is indicated. Beneath this level an increase in chargeability variation is noted. This can be interpreted to represent the approximate depth to bedrock, although the corresponding resistivities are somewhat low. A possible explanation is that strongly conductive layer exists at this depth, possibly just above bedrock, and the conductive response of this layer dominates the section to depth.

Lines 3 and 4 are located in the proposed plant site location (Figure 2). These show similar characteristics to Lines 1 and 2, although with the geoelectric break interpreted slightly shallower. Line 2, which runs parallel to the valley walls, shows a strongly defined shallow resistive layer of up to eight metres thickness. The decrease in resistivities below this depth is interpreted to be associated with the water table in this location.

4. LIMITATIONS

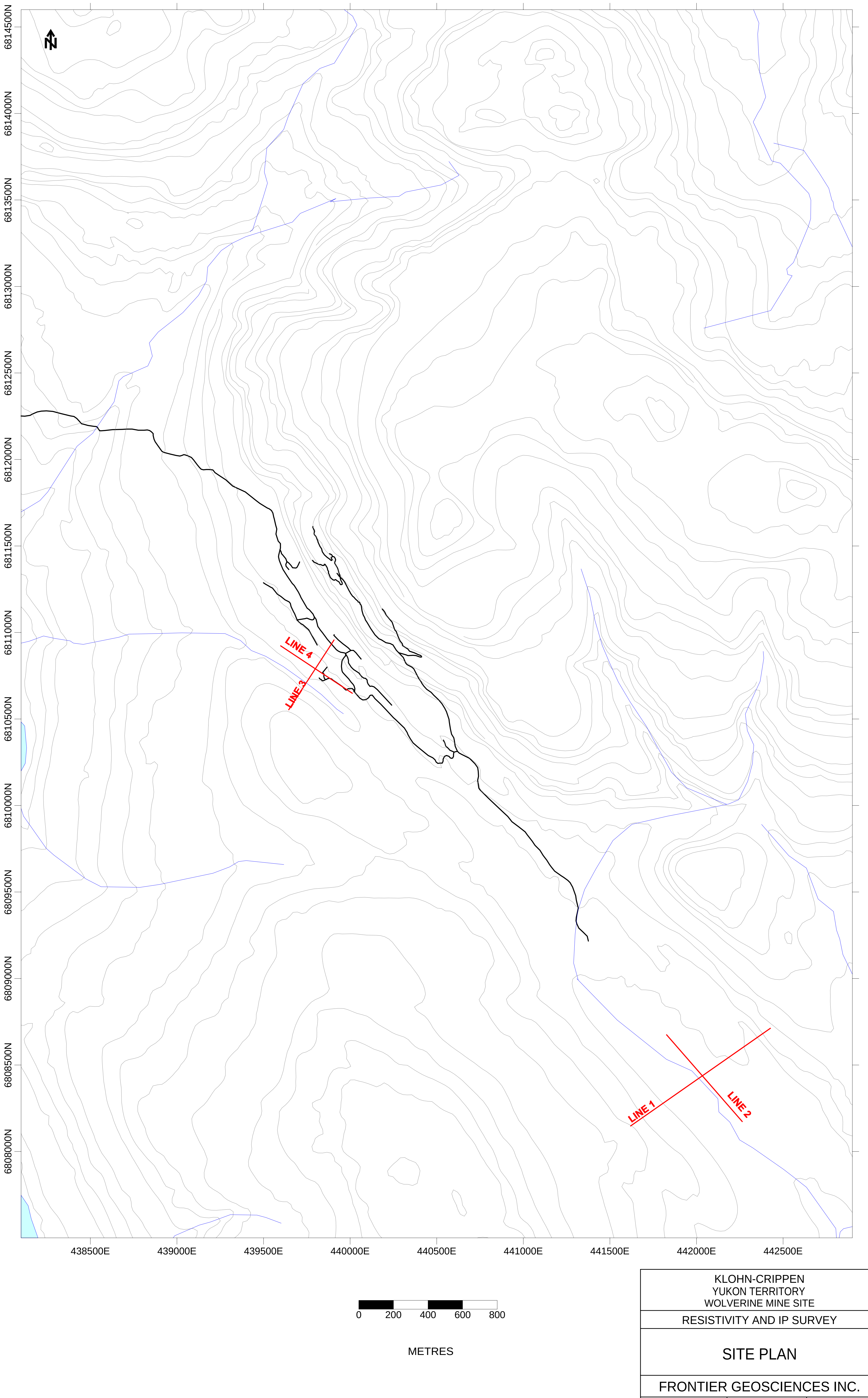
The multi-electrode resistivity method results in repeatable measurement of geoelectric section information in a wide variety of environments. Limitations are present due to variation in electrode coupling, presence of cultural noise or buried services, etc. As well, limitations are imposed by the modelling software in terms of maximum gradients allowed, data density, etc. The geological information is based upon our estimate of subsurface conditions considering the resistivity data and all other information available to us. While the some aspects of the soils types can be classified, the geology of horizons identified in a multi-electrode resistivity investigation would have to be established by borehole intersections.

The results are interpretive in nature and are considered to be a reasonably accurate representation of existing subsurface conditions within the limitations of the multi-electrode resistivity method.

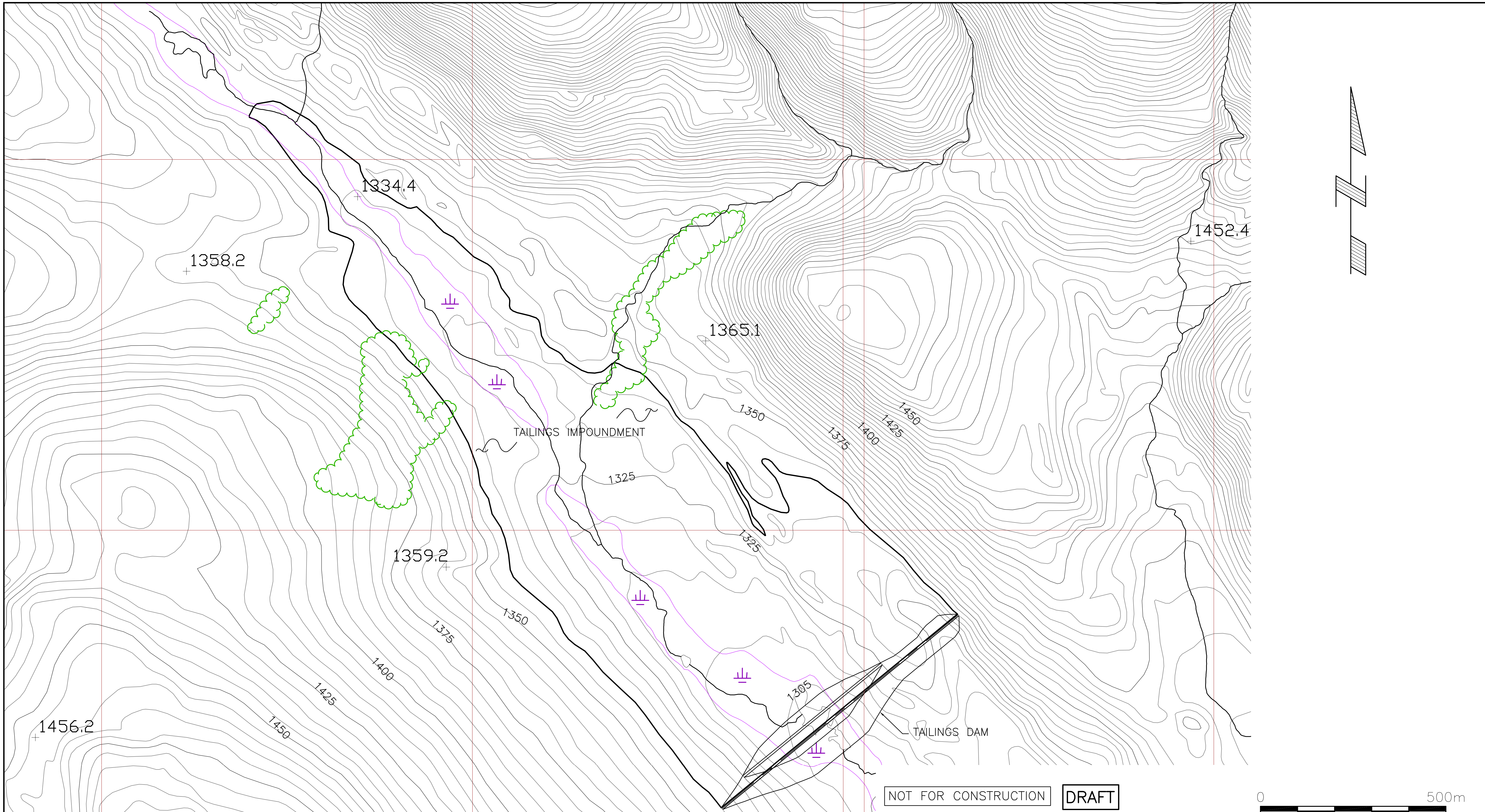
For: Frontier Geosciences Inc.

Ian Campbell, B.Sc.

Cliff Candy, P.Geo.



KLOHN-CRIPPEN YUKON TERRITORY WOLVERINE MINE SITE
RESISTIVITY AND IP SURVEY
SITE PLAN
FRONTIER GEOSCIENCES INC.
DATE: JULY 2004 · SCALE 1:20,000 · FIG. 1



NOT FOR CONSTRUCTION

DRAFT

TO BE READ WITH KLOHN CRIPPEN REPORT DATED ________

SCALE

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CLIENT	PROJECT
EXPATRIATE RESOURCES LTD.	WOLVERINE TAILINGS IMPOUNDMENT
KLOHN CRIPPEN	TITLE: TAILINGS IMPOUNDMENT – PLAN VIEW
PROJECT No. M09234A01 01	FIG. No. FIGURE 1

KCR-BM

Date: 7/29/2004
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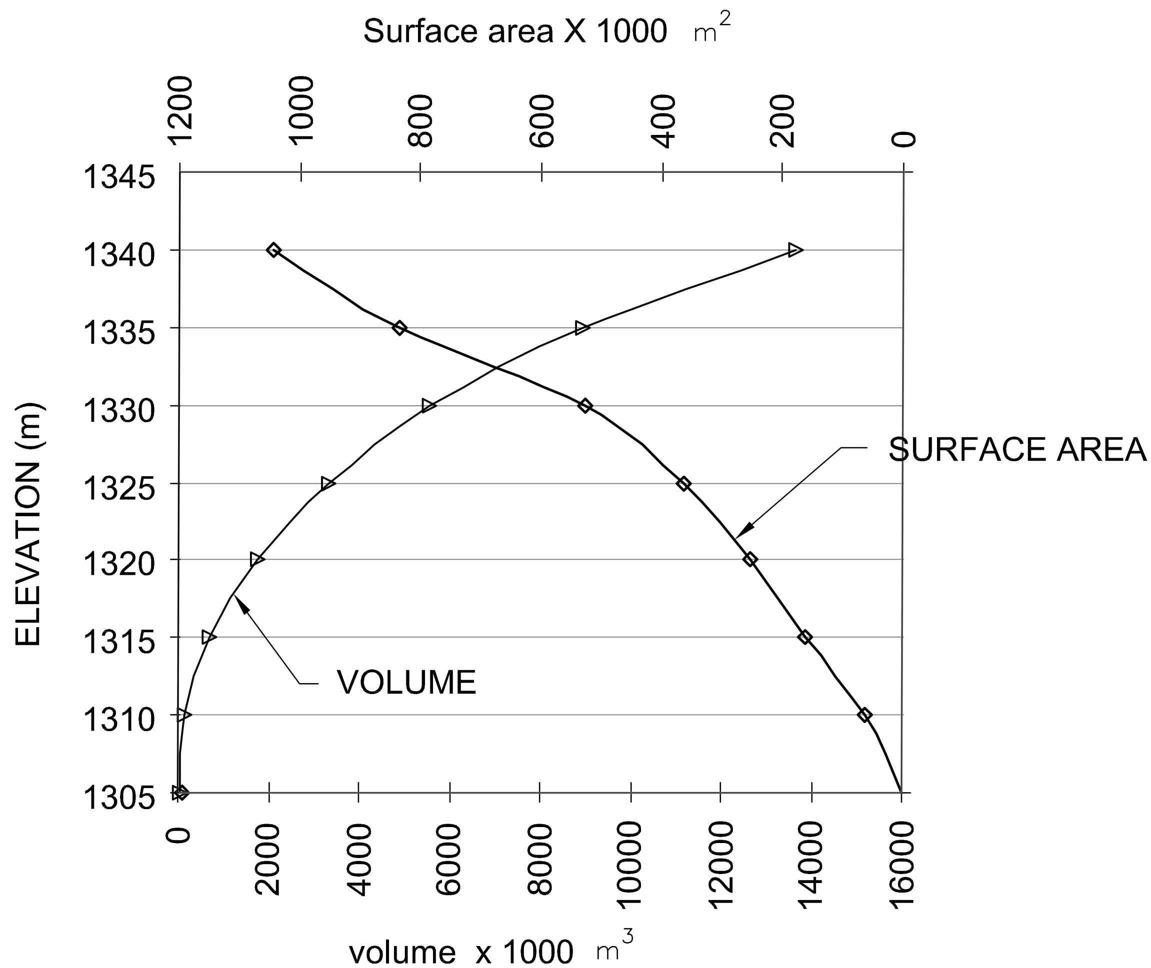
Drawing File: M:\M09234A01 – Wolverine Project\400 Design\410 Drawings\base.dwg (Cwong)



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TO BE READ WITH KLOHN-CRIPPEN REPORT DATED ____________

SCALE

CLIENT EXPATRIATE RESOURCES LTD.	PROJECT WOLVERINE TAILINGS IMPOUNDMENT
KLOHN CRIPPEN	TITLE STORAGE VOLUME VERSUS ELEVATION CURVE
	PROJECT No. M09234A01 01 — FIG. No. FIGURE 2

KCR-AM

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Date: 7/29/2004
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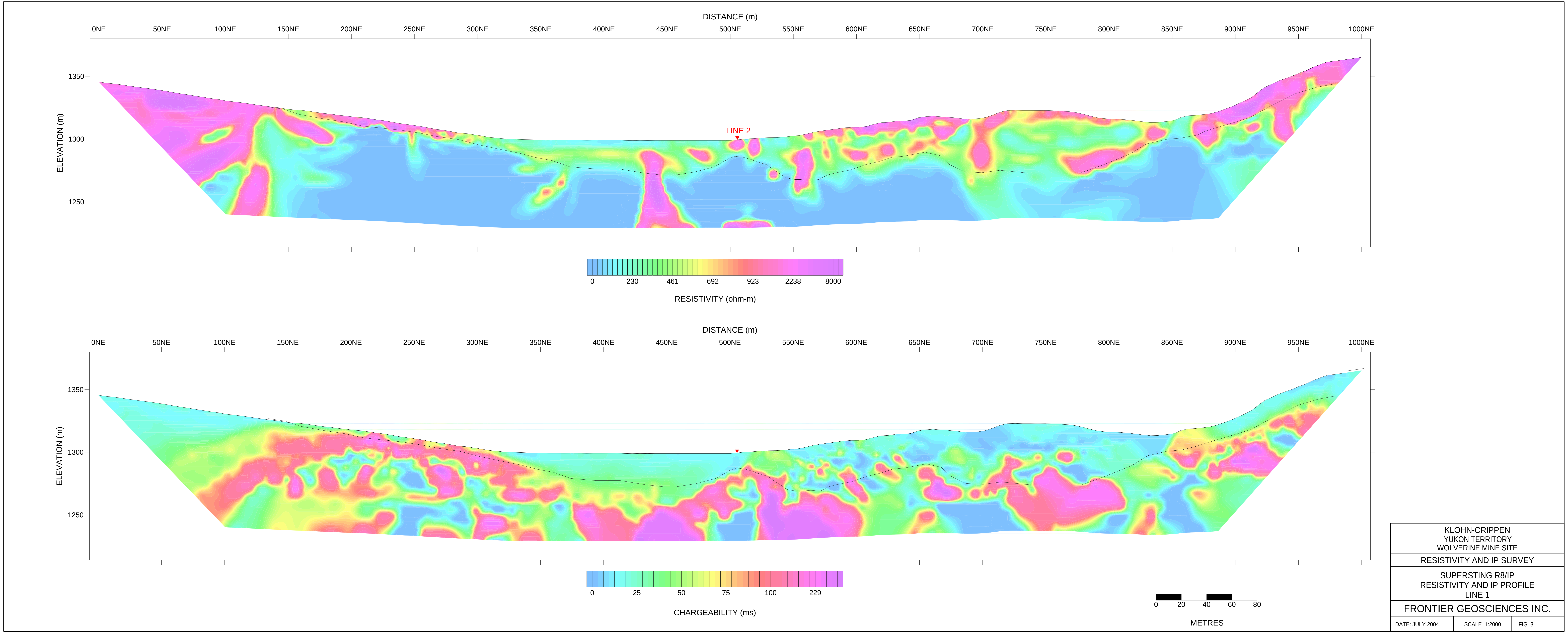
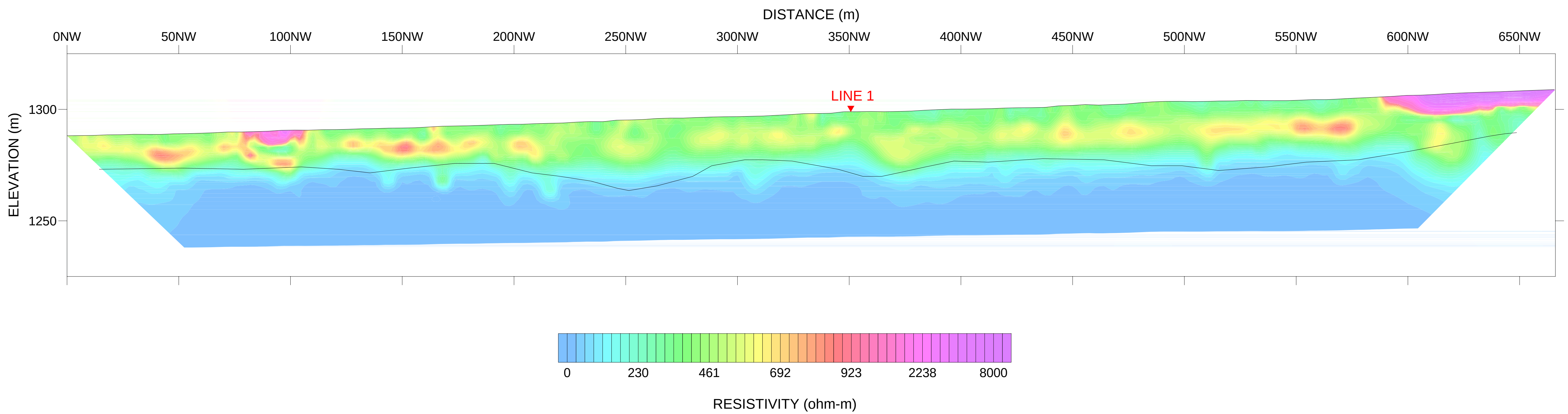
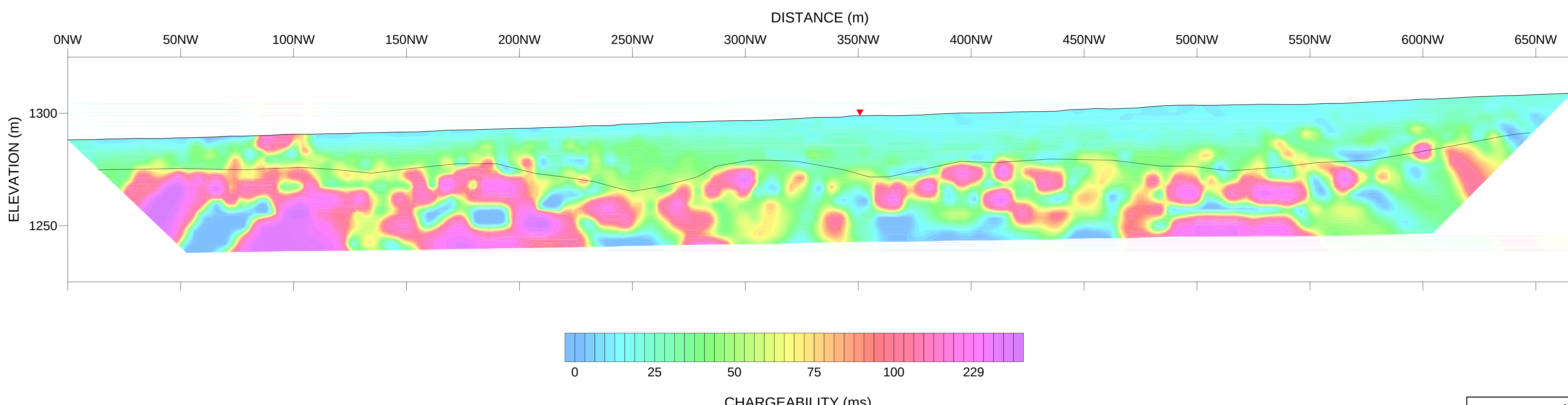

DISTANCE (m)
0NE 50NE 100NE 150NE 200NE 250NE 300NE 350NE 400NE 450NE 500NE 550NE 600NE 650NE 700NE 750NE 800NE 850NE 900NE 950NE 1000NE
ELEVATION (m)
1350
1300
1250
LINE 2
0 230 461 692 923 2238 8000
RESISTIVITY (ohm-m)
DISTANCE (m)
0NE 50NE 100NE 150NE 200NE 250NE 300NE 350NE 400NE 450NE 500NE 550NE 600NE 650NE 700NE 750NE 800NE 850NE 900NE 950NE 1000NE
ELEVATION (m)
1350
1300
1250
0 25 50 75 100 229
CHARGEABILITY (ms)
0 20 40 60 80
METRES
KLOHN-CRIPPEN
YUKON TERRITORY
WOLVERINE MINE SITE
RESISTIVITY AND IP SURVEY
SUPERSTING R8/IP
RESISTIVITY AND IP PROFILE
LINE 1
FRONTIER GEOSCIENCES INC.
DATE: JULY 2004
SCALE 1:2000
FIG. 3





0 20 40 60 80

METRES

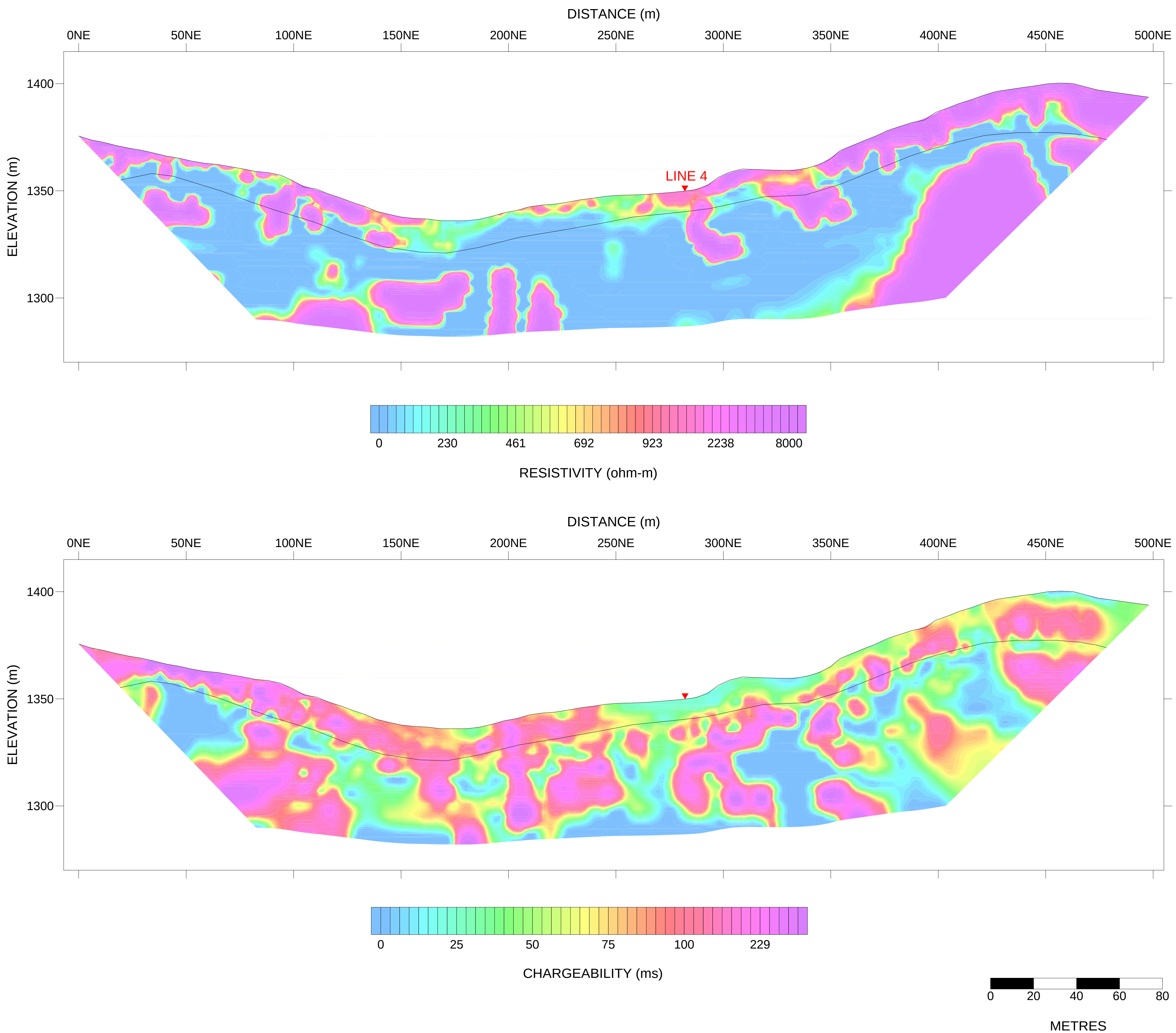
KLOHN-CRIPPEN
YUKON TERRITORY
WOLVERINE MINE SITE

RESISTIVITY AND IP SURVEY

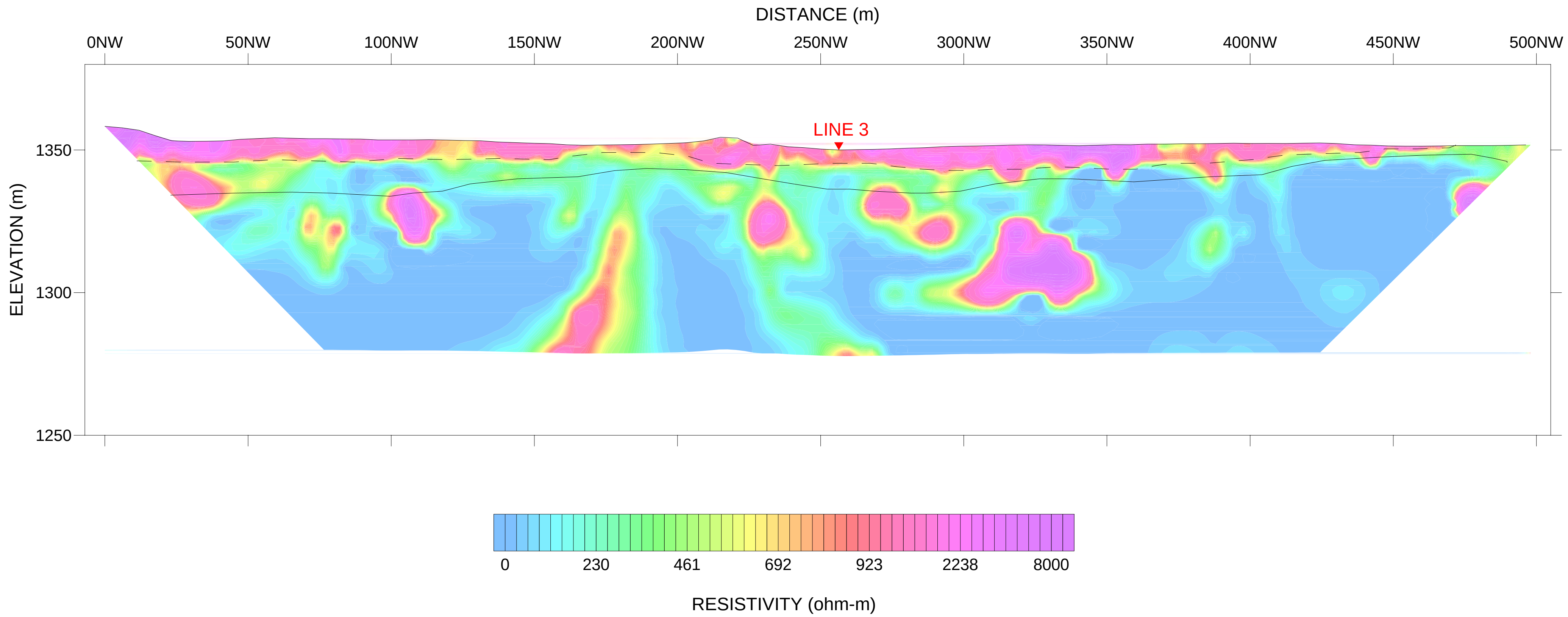
SUPERSTING R8/IP
RESISTIVITY AND IP PROFILE
LINE 2

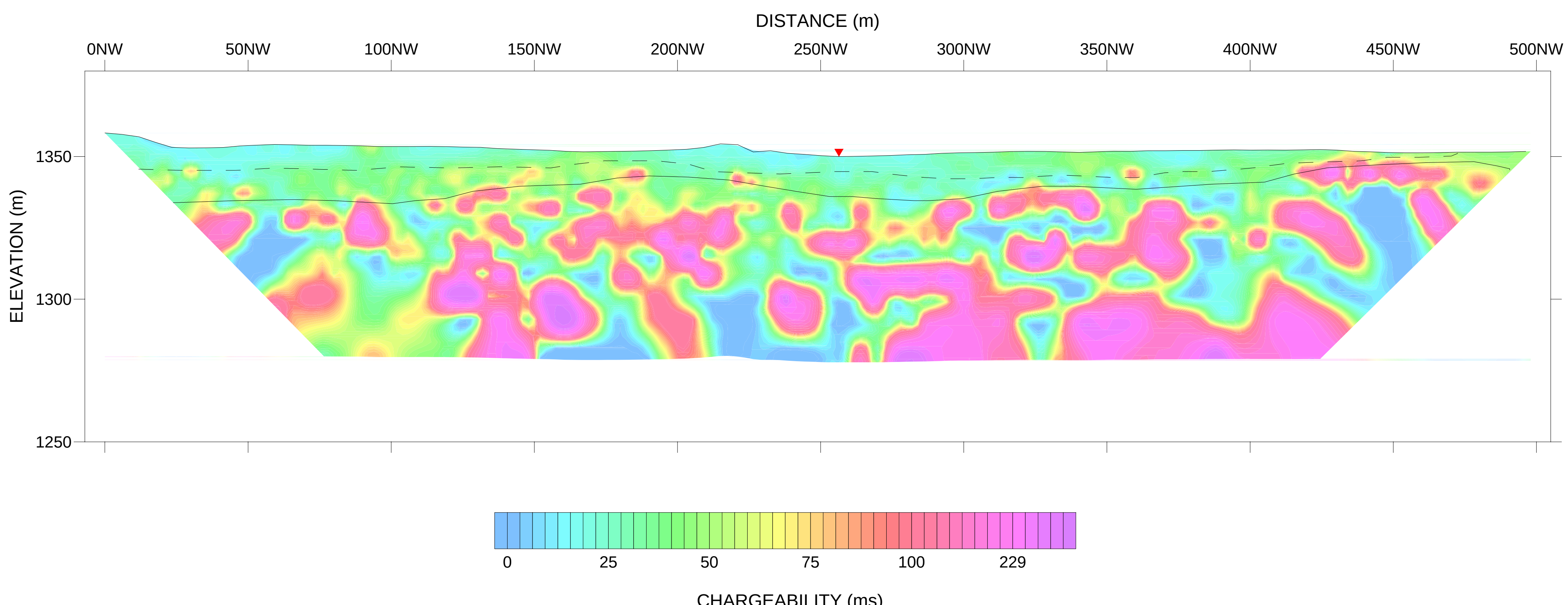
FRONTIER GEOSCIENCES INC.

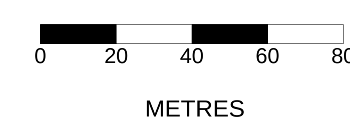
DATE: JULY 2004	SCALE 1:2000	FIG. 4



KLOHN-CRIPPEN YUKON TERRITORY WOLVERINE MINE SITE		
RESISTIVITY AND IP SURVEY		
SUPERSTING R8/IP RESISTIVITY AND IP PROFILE LINE 3		
FRONTIER GEOSCIENCES INC.		
DATE: JULY 2004	SCALE 1:2000	FIG. 5







KLOHN-CRIPPEN
YUKON TERRITORY
WOLVERINE MINE SITE

RESISTIVITY AND IP SURVEY

SUPERSTING R8/IP
RESISTIVITY AND IP PROFILE
LINE 4

FRONTIER GEOSCIENCES INC.

DATE: JULY 2004	SCALE 1:2000	FIG. 6

Appendix 3A

Regional Climate and Hydrology Analysis

November 1, 2004 GLL 20-918-11

Expatriate Resources Ltd.
#701 – 405 Howe Street
Vancouver, BC
V6C 2B3

Attn: Justin Himmelright, Manager of Environment

Dear Mr. Himmelright:

Re: Letter Report #1 - Regional Climatic Analysis for the Finlayson Project Site

The Finlayson Project is a major mining project composed of the Kudz Ze Kayah and Wolverine sites. The project is located between Ross River and Watson Lake in the South East Yukon. Previous studies have been done to estimate the climatic characteristics of the Kudz Ze Kayah site. Expatriate Resources Ltd has asked Gartner Lee Limited to update the previous analysis and extend the results to the Wolverine Site. Gartner Lee Limited is pleased to provide this Regional Climatic Analysis letter report for the Finlayson Project.

Selection of Regional Climatic Stations

The previous climatic analysis used a very large geographical area of the South East Yukon to select the climatic stations with which to complete the analysis. In the hydrologic analysis completed for the Finlayson Project area (Gartner Lee Letter Report, February 2001), an in depth analysis was conducted to determine which hydrometric stations were applicable to the project area. The stations that were found to have the best fit to the Finlayson site were all contained within the Liard Basin Ecoregion. Therefore, the same approach was adopted for the climatic stations and the three stations selected are all within the Liard Basin Ecoregion.

Regional Climate Analysis

Three Environment Canada AES (Atmospheric and Environmental Services) climate stations within the Liard Basin Ecoregion were selected to determine the estimated mean annual precipitation and the estimated extreme annual precipitation values. These stations are: Watson Lake Airport (2101200), Hour Lake (2100 FCG) and Tuchitua (2101135). The mean annual precipitation is estimated to be 478.7 mm/year (Table 1). Mean monthy precipitation is shown in Figure 1.

An annual precipitation frequency analysis was carried out based on annual precipitation totals for the selected regional stations. Given that the length of record for many of the stations is short, a theoretical distribution must be used to predict the annual frequency analysis. The British Columbia Ministry of Lands, Environment and Parks (MELP) Flood Frequency Analysis Program called Ffame (Version 1.1) was used for this purpose. This program uses four different theoretical distributions: Log-Normal, Gumbel, Pearson Type III, and Log-Pearson Type III. The Log-Normal Distribution was found to provide the best fit to the data as it had the lowest Klomogorov-Smirnov statistic. Since the Hour Lake station had less than the required 10 years of data required for frequency analysis, it was dropped from further analysis, and the Watson Lake and Tuchitua stations used to determine the extreme events. The results of the frequency analysis are shown in Table 2.

Once you have had an opportunity to review the results presented in this Report, we would welcome the opportunity to discuss any questions or comments you might have. Please do not hesitate to contact myself or Don McCallum at 867-633-6474.

Yours truly,
GARTNER LEE LIMITED

Sarah Aho, B.Sc.
Environmental Scientist

November 1, 2004 GLL 20-918-11

Expatriate Resources Ltd.
#701 – 405 Howe Street
Vancouver, BC
V6C 2B3

Attn: Justin Himmelright, Manager of Environment

Dear Mr. Himmelright:

Re: Letter Report #2 - Regional Hydrologic Analysis for the Finlayson Project Site

The Finlayson Project is a major mining project composed of the Kudz Ze Kayah and Wolverine sites. The project is located between Ross River and Watson Lake in the South East Yukon. Previous studies have been done to estimate the hydrologic characteristics of the Kudz Ze Kayah site. Expatriate Resources Ltd has asked Gartner Lee Limited to update the previous analysis and extend the results to the Wolverine Site.

Gartner Lee Limited is pleased to provide the Regional Hydrologic Analysis letter report for the Finlayson Project. This report includes the following analysis for the Kudz Ze Kayah and Wolverine properties:

1. Runoff Characterization
2. Low Flow Analysis
3. Flood Frequency Analysis

Selection of Regional Hydrometric Stations

The previous hydrologic analysis used a very large geographical area of the South East Yukon to select the hydrometric stations with which to complete the analysis. With the availability of hydrometric data from the Kudz Ze Kayah and Wolverine sites, a more in depth analysis was undertaken to determine which stations best represented the Finlayson Project site.

The Finlayson Project sits at the junction of three ecoregions; the Yukon Plateau North, the Pelly Mountains and the Liard Basin (Figure 1). Streamflow data obtained from the Kudz Ze Kayah site at Fault Creek (1995) and from the Wolverine site at Go Creek (1996-7) were compared using a linear regression and visual comparison of unit hydrographs to streamflow data from 14 Water Survey of Canada stations and three Department of Indian and Northern Affairs seasonal stations. Appendix A goes into further detail about the selection process for the stations used in this report. From this analysis it was determined that stations in the Liard Basin ecoregion had the best fit in both the linear regression and visual observation in comparison to the Finlayson Project stream data. The following Water Survey of Canada stations are used in all subsequent analysis:

- 10AB003: King Creek at km 20.9 Nahanni Range Road
- 10AA005: Big Creek at km 1084.8 Alaska Highway
- 10AA004: Rancheria near the Mouth
- 10AB001: Frances River near Watson Lake
- 10AA001: Liard River at Upper Crossing

Runoff Characterization

Mean Annual Runoff Analysis

Using the mean monthly flows from the selected regional stations in the Liard Basin Ecoregion, mean annual runoff for the project area was determined to be 335 mm/yr (Table 1), much lower than the previous estimate of 414 mm/yr. Runoff distribution was also calculated as a percentage per month (Figure 2). The stations were divided into small basins (<1000 km^2) and large basins (>1000 km^2) in order to observe the difference in runoff. In the early part of the year from January to April the large basins experience approximately 0.5 percent more runoff than the smaller basins. In May the difference increases to over five percent, but in from June until October the smaller basins experience about two percent more runoff than the larger basins. In November and December, the two basins experience about the same percentage of the yearly runoff.

Estimated Runoff From Mine Sub-Catchment Areas

Using the runoff distribution calculated in the mean annual runoff analysis, mean monthly and annual runoffs were calculated for each of the mine sub-catchment areas (Table 2).

Annual Runoff Frequency Analysis

An annual runoff frequency analysis was carried out based on annual runoff totals for the selected regional stations. Given that the length of record for many of the streams is short, a theoretical distribution must be used to predict the annual frequency analysis. The British Columbia Ministry of Lands, Environment and Parks (MELP) Flood Frequency Analysis Program called Ffame (Version 1.1) was used for this purpose. This program uses four different theoretical distributions: Log-Normal, Gumbel, Pearson Type III, and Log-Pearson Type III. The Log-Normal Distribution was found to provide the best fit to the data as it had the lowest Klomogorov-Smirnov statistic. Annual runoff values for return periods showing low flow and high flow events were extracted from Ffame (Table 3). The ratio of the frequency estimates to the mean annual flow was calculated and applied to the mean annual runoff to determine the frequency of mean annual runoff for the project area. Due to the use of a smaller mean annual runoff estimate (335 mm/yr.), the annual runoff frequency estimates are lower than the previous estimates.

Low Flow Analysis

Annual 10-Year 7-Day Low Flows

A low flow frequency analysis was conducted based on the 7-day average annual low flows for the selected streams using the BC MELP Flood Frequency Analysis program low flow option. Again, the Log-Normal distribution was found to provide the best fit for the available data. The frequency estimates generated by this program are presented in Table 4. The frequency estimates were then plotted on a log-log scale (Figure 3) to allow for the interpretation of regional trendlines (Table 4). Big Creek was eliminated from further low flow analysis due to the anomalous results generated by the frequency analysis for this station. The regional trendline equations allow for the estimation of low flow events at the mine sub-catchment areas (Table 5).

Monthly 10-Year 7-Day Low Flows

The low flow frequency analysis was repeated on a monthly basis to determine the 10-year 7-day monthly low flows. The frequency estimates are presented in Table 6. The frequency estimates were then plotted on a log-log scale (Figure 4) to interpolate 10-year monthly low flow trendlines. The regional trendline equations (Table 7) allow for the estimation of low flow events at the mine sub-catchment areas shown in Table 8.

Normal Variations in Monthly Flows

Flow data from the selected streams were analyzed to determine the average ratio between the minimum flow in a month and the mean monthly flow. Results are summarized in Table 9. Figure 5 depicts the monthly variations in flow.

Flood Frequency Analysis

A flood frequency analysis was carried out based on maximum values as well as instantaneous maximums for the selected regional stations. Given that the length of record for many of the streams is short, a theoretical distribution must be used to predict the annual frequency analysis. The BC MELP Flood Frequency Analysis Program (Ffame) was used for this purpose. This program uses four different theoretical distributions: Log-Normal, Gumbel, Pearson Type III, and Log-Pearson Type III. The Log-Normal Distribution was found to provide the best fit to the data and was used to obtain values for flood estimates from 2 to 1000 year return periods. Maximum instantaneous flood estimates are presented in Table 10 and maximum daily flood estimates are shown in Table 11. The flood frequency estimates were then plotted on a log-log scale to interpolate regional trends. Figure 6 graphically presents the maximum instantaneous flood estimates and maximum daily flood estimates are shown in Figure 7. The trendline equations (Table 12) were then used to estimate mean, 10-year, 100-year and 1000-year floods for the mine sub-catchment areas (Table 13).

Once you have had an opportunity to review the results presented in this Report, we would welcome the opportunity to discuss any questions or comments you might have. Please do not hesitate to contact myself or Don McCallum at 867-633-6474.

Yours truly,
GARTNER LEE LIMITED

Sarah Aho, B.Sc.
Environmental Scientist

Introduction

In previous regional hydrological analysis of the Kudz Ze Kayah site, stations to be used in the analysis were picked on the basis of their proximity to the site in a broad area between 60-63°N Latitude and 128-134°W Longitude. With the availability of site hydrometric data, a more rigorous test was used to find out which stations best defined the project area. The first area looked at was which ecoregion the station belonged to and then a comparison was undertaken between each station and the site hydrometric data.

Description of the Ecozone and Ecoregions

(From the Environment Canada site: www.ecoinfo.com)

Ecozone

The Finlayson Project is located in the Boreal Cordillera Ecozone. An ecozone is at the top of the hierarchy as it defines the ecological mozaic of Canada on a sub-continental scale. Ecozones represent an area of the earth's surface representative of large and very generalized ecological units characterized by interactive and adjusting abiotic and biotic factors. Canada is divided into 15 terrestrial ecozones.

Characteristics of the Boreal Cordillera Ecozone

Climate: The climate ranges from cold, subhumid to semiarid. It is marked by long, cold winters and short, warm summers and modified by vertical zonation and aspect. Mean annual temperatures range from 1°C to 5.5°C. The coldest mean annual temperatures occur in the Yukon Plateau region. The mean summer temperatures range from 9.5°C to 11.5°C. Mean winter temperatures range from -13°C to -23°C. The pacific maritime influence moderates temperatures over most of the ecozone. Mean annual precipitation is lowest in valleys within the rain shadow of the coastal ranges (<300 mm) and increases in the interior ranges farther east, where up to 1500 mm of precipitation is received at higher elevations. Precipitation in the intermontane plateau areas ranges 300–600 mm annually.

Vegetation: In some parts of this ecozone (British Columbia), there are grasslands on south-facing slopes with boreal forest vegetation on the north-facing slopes, a feature unique within the boreal forests of Canada. The vegetative cover ranges from closed to open canopies over much of the plateaus and valleys. Tree species include white and black spruce, alpine fir, lodgepole pine, trembling aspen, balsam poplar, and white birch. In the northwest, the stands are generally open, and lodgepole pine and alpine fir are usually absent. At higher elevations, there are extensive areas of rolling alpine tundra characterized by sedge-dominated meadows, and lichen-colonized rock fields are common.

Landforms and Soils: This ecozone is characterized by mountain ranges that contain numerous high peaks and extensive plateaus, and are separated by wide valleys and lowlands. These have been modified as a result of glaciation, erosion, solifluction, and eolian and volcanic ash deposition. Glacial drift, colluvium, and outcrops constitute the main surface materials. Only a small portion of this ecozone in the northwest was unglaciated. Permafrost and associated landscape features tend to be widespread in the more northerly areas and at higher elevations; soils are Cryosolic in these regions. In the warmer, lower elevations in the southern half, Brunisols, Podzols, and Luvisols are common.

Wildlife: Characteristic mammals of the Boreal Cordillera ecozone include woodland caribou, moose, Dall's sheep, mountain goat, black and grizzly bear, marten, lynx, American pika, hoary marmot, and arctic ground squirrel. Representative bird species include willow, rock and white-tailed ptarmigan, and spruce grouse, along with a range of migratory songbirds and waterfowl.

Human Activities: The zone is rich in mineral resources, and in addition to mining, the large river systems that drain this ecozone have fostered forestry, tourism, hydroelectric development, and some localized agriculture. The total population of the ecozone is approximately 30 800, and the major communities include Whitehorse, Dawson, Faro, Haines Junction, and Mayo. Between 1951–1991, Whitehorse's population increased 29–54% of the total population.

Ecoregions

The Finlayson Project is at the junction of three ecoregions that are part of the Boreal Cordillera ecozone; the Liard Basin, the Yukon North Plateau and the Pelly Mountains. An ecoregion is defined as a subdivision of an ecozone, characterized by distinctive regional ecological factors, including climate, physiography, vegetation, soil, water, and fauna. The distinctive characteristics of each ecoregion are as follows:

181. LIARD BASIN

The Liard Basin ecoregion spans the British Columbia–Yukon boundary to incorporate the Liard Plain, a broad, rolling, low-lying area mantled with glacial drift and outwash deposits in which the Liard River is entrenched. The mean annual temperature for the area is approximately -3°C with a summer mean of 11°C and a winter mean of -18.5°C. Annual precipitation is 350–450 mm. The ecoregion is characterized by extensive stands of boreal forest composed of lodgepole pine, white and black spruce, and aspen. Dry sites support lodgepole pine; moist sites have black spruce and larch with Labrador tea, horsetail, and moss. The ecoregion is underlain by Carboniferous Palaeozoic limestone and Cretaceous shale and lies 620–930 m asl. Luvisolic soils are associated with the productive upland boreal forests of the region. Cumulic Regosols support productive stands of white spruce along the floodplain of the Liard River and its larger tributaries. Eutric and Dystric Brunisols exist on coarse-textured fluvioglacial deposits. Permafrost is scattered, confined mainly to lower north-facing slopes and sphagnum bogs. Big game hunting, outfitting, and trapping are other uses of land in this region. Characteristic wildlife includes moose, black bear, wood bison, wolf, beaver, muskrat, snowshoe hare, waterfowl, crane, ruffed grouse, and other birds. Local sawlog forestry and mining are main industrial land uses. There is some recreational use of the major lakes and rivers in the ecoregion. Watson Lake is the main community. The population of the ecoregion is approximately 1400.

178. PELLY MOUNTAINS

This ecoregion encompasses the Pelly and northern Cassiar Mountains spanning the British Columbia–Yukon border. The mean annual temperature for the area is approximately -3°C with a summer mean of 10.5°C and a winter mean of -17.5°C. Mean annual precipitation is 500–1000 mm, varying with elevation. Boreal forests of white spruce, black spruce, lodgepole pine and aspen cover the lower-elevation valley bottoms. Much of the ecoregion lies above the treeline and is characterized by alpine tundra communities of lichens, dwarf ericaceous shrubs, birch, and willows. Grasses, sedges, cottongrass, and some mosses occupy wet sites. Open-growing black and white spruce, and alpine fir are prevalent in the subalpine region. Some aspen and scrub birch occur in valleys and on lower, warmer slopes of the subalpine sections. Lodgepole pine is common following fires. The Pelly and Cassiar Mountains, composed of crystalline Mesozoic and Palaeozoic strata, are of moderately high relief, ranging from generally over 1500 m asl to the highest peak at 2404 m asl. Relief is greater in the Pelly Mountains than in the Cassiar Mountains. Permafrost is sporadically distributed. Dystric and Eutric Brunisols are codominant in the ecoregion. Dystric Brunisols are associated with coarse igneous rocks at higher elevation. Plateau areas with sandy loam morainal parent materials are associated with Eutric Brunisols. Turbic Cryosolic soils are found in alpine areas and in some imperfectly to poorly drained sites. Representative wildlife includes moose, wolverine, snowshoe hare, black and grizzly bear, Stone's and Dall's sheep, ptarmigan, ground squirrel, and caribou. Land use reflects hunting, trapping, and recreation values as well as mining and mineral exploration activities in both the alpine and subalpine regions. Swift River is the only settlement in the ecoregion. The population of the ecoregion is approximately 30.

176. YUKON PLATEAU-NORTH

This ecoregion lies within the Stewart, MacMillan, and Pelly plateaus and the southern foothills of the Selwyn Mountains. The terrain includes rolling uplands, small mountain groups, and nearly level tablelands dissected by deeply cut, generally broad, U-shaped valleys. The Tintina Trench, a straight, steep-sided valley 5–22 km wide, traverses the ecoregion from southeast to northwest. The mean annual temperature for the area is approximately -4°C with a summer mean of 10.5°C and a winter mean of -20°C. Mean annual precipitation ranges from 300 mm in the major valleys up to 600 in the mountains to the northeast. Northern boreal forests exist at elevations up to 1500 m asl. White spruce in a matrix of dwarf willow, birch, ericaceous shrubs, and, occasionally, lodgepole pine forms extensive open forests, particularly in the northwestern portion of the ecoregion. Black spruce, scrub willow, birch, and mosses are found on poorly drained sites. Alpine fir and lodgepole pine occur in higher subalpine sections, whereas alpine vegetation consists of mountain avens, dwarf willow, birch, ericaceous shrubs, graminoid species, and mosses. Extensive discontinuous permafrost with a medium ice content is widespread decreasing to sporadic discontinuous permafrost along the southwestern edge of the region. Turbic Cryosolic and Eutric Brunisolic soils predominate, and occasional pockets of Dystric Brunisols occur on coarse-textured morainal and fluvioglacial materials. Characteristic wildlife includes caribou, grizzly and black bear, Dall's sheep, moose, beaver, fox, wolf, hare, raven, rock and willow ptarmigan, and golden eagle. Land uses reflect mining, recreation, hunting, and trapping values. Major communities in the area are Keno Hill, Mayo, and Ross River. The population of the ecoregion is approximately 2100.

Selection of Regional Hydrometric Stations

Each of the stations detailed in previous hydrological analysis at Kudz Ze Kayah looked at to determine if they were valid to define the regional hydrology at the Finlayson Project site. Table.A.1 shows the updated results of the mean monthly runoff depth analysis from streamflow records compared with previous results. Streamflow data obtained from the Kudz Ze Kayah site at Fault Creek (1995) and from the Wolverine site at Go Creek (1996-7) were compared using a linear regression and visual comparison of unit hydrographs (using the 1988 year for those stations with no data for the years of 1995-7), to the streamflow data from the stations included in the Kudz Ze Kayah report. The following table gives the results and reasoning for the inclusion or exclusion of the stations in this report.

Stream	Ecozone	Ecoregion	Correlation with Unit Hydrograph	Included in Analysis
Partridge Creek	Boreal	Boreal Mountain		No
180 Mile Creek	Boreal	Yukon Plateau North	No	No
Vangorda Creek	Boreal	Yukon Plateau North	No	No
South MacMillian River	Tagia			No
Pelly River below Fortin Creek	Boreal	Yukon Plateau North	No	No
Pelly River at Ross River	Boreal	Yukon Plateau North	No	No
Nisutlin River	Boreal	Yukon Southern Lakes		No
Sidney Creek	Boreal	Yukon Southern Lakes		No
Teslin River	Boreal	Yukon Southern Lakes		No
Tom Creek	Boreal	Liard Basin	No	No
Hyland River	Boreal	Hyland Highland		No
Ross River	Boreal	Yukon Plateau North	No	No
King Creek	Boreal	Liard Basin	Yes	Yes
Liard River	Boreal	Liard Basin	Yes	Yes
Rancheria River	Boreal	Liard Basin	Yes	Yes
Big Creek	Boreal	Liard Basin	Yes	Yes
Frances River	Boreal	Liard Basin	Yes	Yes

The five stations chosen are all within the Liard Basin ecoregion and a part of the Liard River system.

February 19, 2001

Expatriate Resources Ltd.
#701 – 475 Howe Street
Vancouver, BC
V6C 2B3

Attention: Mr. Justin Himmelright

RE: Letter Report #3 – Hydrological Analysis Peer Review
Finlayson Project #20-918-11

Dear Mr. Himmelright

The following are my comments regarding the Regional Hydrologic Analysis for the Finlayson Project site (Gartner Lee Ltd. Letter Report #2, Feb. 19, 2001). I have also included comments regarding the Hay and Company report, since the differences between their report and ours is part of the reason for undertaking this peer review.

Hay and Company Hydrologic Report

Table 3.2A.1 provides the mean monthly runoff depths and total annual runoff from streamflow records for various watercourses in the vicinity of the site. The mean annual runoff (totals) for both Rose Creek and the Pelly River at Ross River appear to have been totaled incorrectly, as written in the margins. For all other WSC stations listed in Table 3.2A.1, the differences between what is written in the margins and mean annual runoff given by Hay and Company appears to be the result of rounding error.

Also provided is seasonal data and an estimate of the total annual runoff at the two DIAND monitoring sites (Partridge Creek and 180 Mile Creek). It has been assumed that one of the two bottom rows in this table (average monthly runoff for all stations, and average monthly runoff for stations <1000 km^2) were used to extrapolate the data for the DIAND sites for the winter months. If this is the case, the total mean annual runoff for Partridge Creek should be 539 mm or 540 mm, depending upon which of the bottom two rows of the Table is used to extrapolate the data. This is considerably less than the mean annual runoff estimate of 573 mm given by Hay and Company. Similarly, and extrapolation of the data for 180 Mile Creek results in an estimate of 436 mm or 437 mm in mean annual runoff. This is slightly less than the mean annual runoff value of 443 mm given by Hay and Company.

Using these revised numbers would result in an estimate of the mean annual runoff of 399 mm, not 414 mm, for the Kudz Ze Kayah site.

<u>Gartner Lee Hydrologic Analysis for Finlayson Project</u>

Selection of Regional Hydrometric Stations

The first difference between the Hay and Company report and the Gartner Lee (GLL) report is the choice of hydrometric stations that were used to estimate the mean annual runoff at the site. The Hay and Company selection of the King Creek, Sidney Creek and Rose Creek stations was based solely on the small size of the upstream catchment areas for these stations. Their selection of the Frances River and Pelly River below Fortin Creek stations was based on the proximity of these gauges to the proposed mine site.

The GLL report has based the selection of hydrometric stations on a comparison of data from each of 15 Water Survey of Canada stations with the streamflow data obtained from the Kudz Ze Kayah site at Fault Creek and the Wolverine site at Go Creek. The comparison was based on both linear regression and visual comparison of unit hydrographs in an effort to select hydrometric stations whose data is well correlated with both Fault Creek and Go Creek. In addition to the above, an analysis was undertaken to determine whether each hydrometric monitoring site under consideration is located in the same ecoregion as the proposed mine site. Based on this approach, five Water Survey of Canada stations were selected for use in estimating the mean monthly runoff and mean annual runoff for the proposed mine sub-catchment areas.

The approach that was used in the GLL report to select hydrometric monitoring stations is more rigorous than the approach taken by Hay and Company. Using only data that is well correlated with data from the proposed mine site should result in a better estimate of mean monthly and mean annual runoff.

Runoff Characterization

The estimate of mean annual runoff provided in the GLL report (335.23 mm) is considerably lower than the estimate given in the Hay and Company report (414 mm). There are three reasons for this change. First, the approach used by GLL to select Hydrometric stations on which to base an estimate of mean annual runoff was quite different from the approach used by Hay and Company, as described above. Second, the streamflow records given in Table 1 of the GLL report include streamflow data that were collected subsequent to the completion of the Hay and Company report. These data indicate that the interceding years were relatively dry, resulting in a decrease in the estimate of mean annual runoff at each station. Third, the estimate of mean annual runoff given in the Hay and Company report was determined using mean annual runoff values from seven gauge locations. As discussed above, it appears that three of these (Rose Creek, Partridge Creek and 180 Mile Creek) were calculated incorrectly.

Low Flow Analysis
The low flow analysis conducted by GLL is somewhat different than the analysis undertaken by Hay and Company. The Hay and Company analysis based the low flow analysis on streamflow data from a different group of hydrometric stations than they used to arrive at their estimate of mean annual runoff. Gartner Lee's low flow analysis uses data from the same hydrometric stations that were used to estimate the mean annual runoff. Since the GLL approach to selecting hydrometric monitoring stations takes into account both linear regression and visual comparison of unit hydrographs, it is more likely that their low flow analysis will yield good results.

The Gartner Lee approach to the low flow analysis also takes into account the effect of the size of the upstream catchment on the low flow results. The approach presented in the Hay and Company report considered an average low flow contribution per km^2 of catchment area for the stations being considered. This value was used to determine the low flow contribution ($l/s/km^2$) for each sub-catchment for the proposed mine site. The GLL report included an analysis of how the low flow contribution changes with drainage area (Figures 3 & 4, and Tables 4 & 7). This approach should lead to better low flow results than the approach used by Hay and Company.

The Monthly 10-Year 7-Day Low Flow results given in Table 6 include data for the King Creek station at km 20.9, Nahanni Range Road. These results differ from the data provided for the other three stations under consideration in this Table. For each of the other three stations the 10-year 7-day low flow for June is an order of magnitude greater than 10-year 7-day low flow for May. The King Creek gauge shows only a marginal increase from May to June. Similarly, the other three gauges show a maximum 10-year 7-day monthly low flow in June before the values begin to decrease in each subsequent month, as shown graphically in Figure 5. The King Creek gauge data show an increase in the 10-year 7-day low flow from June to July and July to August prior to showing a decrease similar to the other gauges. The reasons for this anomaly should be investigated.

Flood Frequency Analysis
The flood frequency analysis presented in the GLL report uses streamflow data from the same five regional hydrometric stations as were used in the previous analyses, to determine the likely magnitude of flood events for each sub-catchment for the proposed mine site. This is consistent with the approach used throughout the report.

Tables 10, 11, 12 and 13 along with Figures 6 and 7 present the results of the flood frequency analysis. Estimates are provided for both instantaneous and daily maximum flood events of return periods from 2 years to 1000 years. The techniques used to estimate the magnitude of each return period event are appropriate, however the period of record for the regional hydrometric stations used in this analysis are relatively short. The period of record that is used to estimate the magnitude of flood events has a direct bearing on the level of confidence of the results. In particular, estimates of flood events in excess of the 100 year event should be used with caution. The scatter that is evident in the 100 year and 1000 year data shown on Figures 6 and 7 is indicative of the difficulty in estimating extreme events using a short period of record.

Conclusion

The differences between the Hay and Company report and the GLL report may be attributed primarily to different approaches to selecting regional hydrometric stations for use in the analyses. The approach that was used in the GLL report in the selection of hydrometric monitoring stations is more rigorous than the approach taken by Hay and Company. Using only data that is well correlated with data from the proposed mine site should result in a better estimates of mean monthly runoff, mean annual runoff, extreme low flows and extreme high flows.

I trust that this is satisfactory. If you have any questions please do not hesitate to call.

Yours very truly,
GARTNER LEE LIMITED

Douglas G. Jones, M.E.Sc.,P.Eng.
Senior Water Resources Engineer

November 1, 2004 GLL 20-918-11

Expatriate Resources Ltd.
#701 – 405 Howe Street
Vancouver, BC
V6C 2B3

Attn: Justin Himmelright, Manager of Environment

Dear Mr. Himmelright:

Re: Letter Report #4 - Report of the January 13-14 Field Trip to the Wolverine Site of the Finlayson Project

On the weekend of January 13-14, 2001 a field trip was taken to the Wolverine site of the Finlayson Project to obtain winter low flow measurements of several streams within the project area. In flying to the project site, it was noted that most of the streams had areas of open water, possibly due to the warmer temperatures experienced in the Yukon this winter. As well, while preparing to do flow measurements at the sites, the observation was made that the ice was very thin and not strong enough to stand on. This made manual flow measurements very difficult. Therefore, the salt slug dilution method was chosen as the best method to measure flow under the difficult circumstances.

The salt slug dilution method uses a known mass of salt (NaCl), injected into the stream and then measures the conductivity at a downstream point (Kite, Geoff. "Computerized Streamflow Measurement Using Slug Injection", Hydrological Processes, Volume 7, pp. 227-233, 1993.). The discharge of the stream can then be calculated as:

$$Q=\frac{1000M_sT_{g,25}}{t\sum(L_r-L_o)}$$

Where:

Q	discharge in m^3/s
M_s	mass of salt in kg
$T_{g,25}$	gram conductivity at 25°C
t	time interval in seconds
L_r	recorded conductivity in μS/cm
L_o	background conductivity in μS/cm

A correction was also made for background conductivity:

$$T_{g,25}=2.14-0.0003C_o$$

Where: C_o background conductivity in the stream in µS/cm

Manual measurements using a Swifter current meter were also undertaken at two of the smaller streams on site. The accuracy of the measurements was affected by snow and ice in the stream channel creating a backwater condition, and by not being able to stand on the ice surface. Wolverine Creek flow was measured using a V-notch weir that was already in place. Table 1 below summarizes the results of the flow measurements taken during the field trip to the Wolverine Site.

Table 1. Stream Flow Measurements, January 13-14, 2001 (L/s)

Site ID	Name	Salt Slug	Manual	Weir	Gartner Lee Mean January Estimates
W12	Go Creek above Pup Creek	76			107
W14	Money Creek below Go Creek	475			703
W9	Wolverine Creek			7.7	10
W15	Hawkowl Creek near the Mouth	19	13		29
W16	Go Creek upstream of Hawkowl Creek	28	16		33

Once you have had an opportunity to review the results presented in this Report, we would welcome the opportunity to discuss any questions or comments you might have. Please do not hesitate to contact myself or Don McCallum at 867-633-6474.

Yours truly,
GARTNER LEE LIMITED

Sarah Aho, B.Sc.
Environmental Scientist

Table 1. Mean Annual Precipitation (mm)

Source: Environment Canada , AES Precipitation Records

Station ID	AES Station	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2101200	Watson Lake Airport	1938-99	31.1	24.6	19.5	15.7	31.6	51.4	55.6	44.3	42.4	35.0	32.3	34.8	418.3
2101135	Tuchitua	1971-99	40.7	30.1	20.7	16.5	42.2	55.9	72.2	50.6	47.2	40.7	41.5	44.8	503.1
2100 FCG	Hour Lake	1982-99	36.1	30.3	25.2	16.6	40.4	58.1	68.0	55.8	47.2	52.2	43.2	41.8	514.6
	mean		36.0	28.3	21.8	16.3	38.1	55.2	65.3	50.2	45.6	42.7	39.0	40.4	478.7

Figure 1. Mean Monthy Precipitation Estimates

Source: Environment Canada, AES Precipitation Records

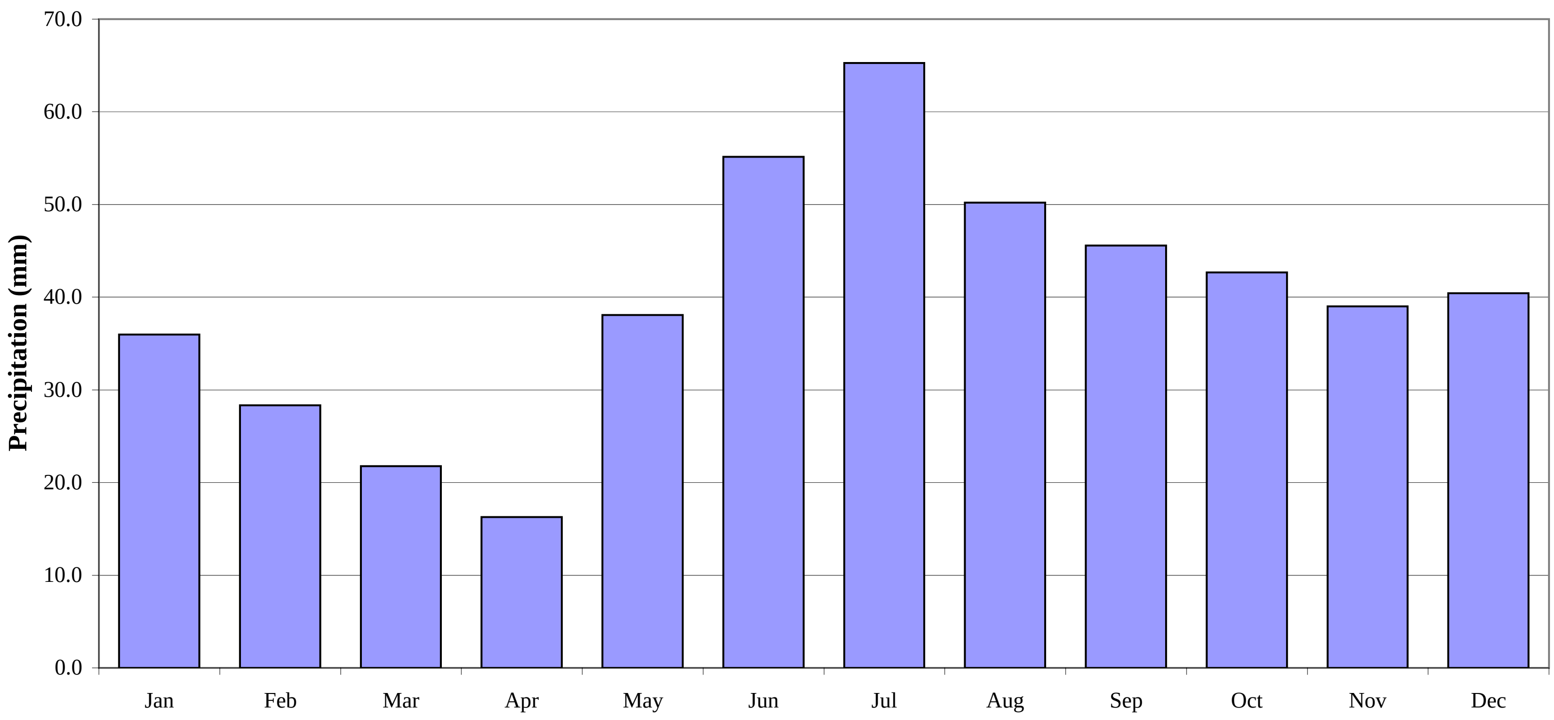


Figure 2. Runoff Comparison Between Small and Large Basins

Source: Table 1. Mean Monthly Runoff

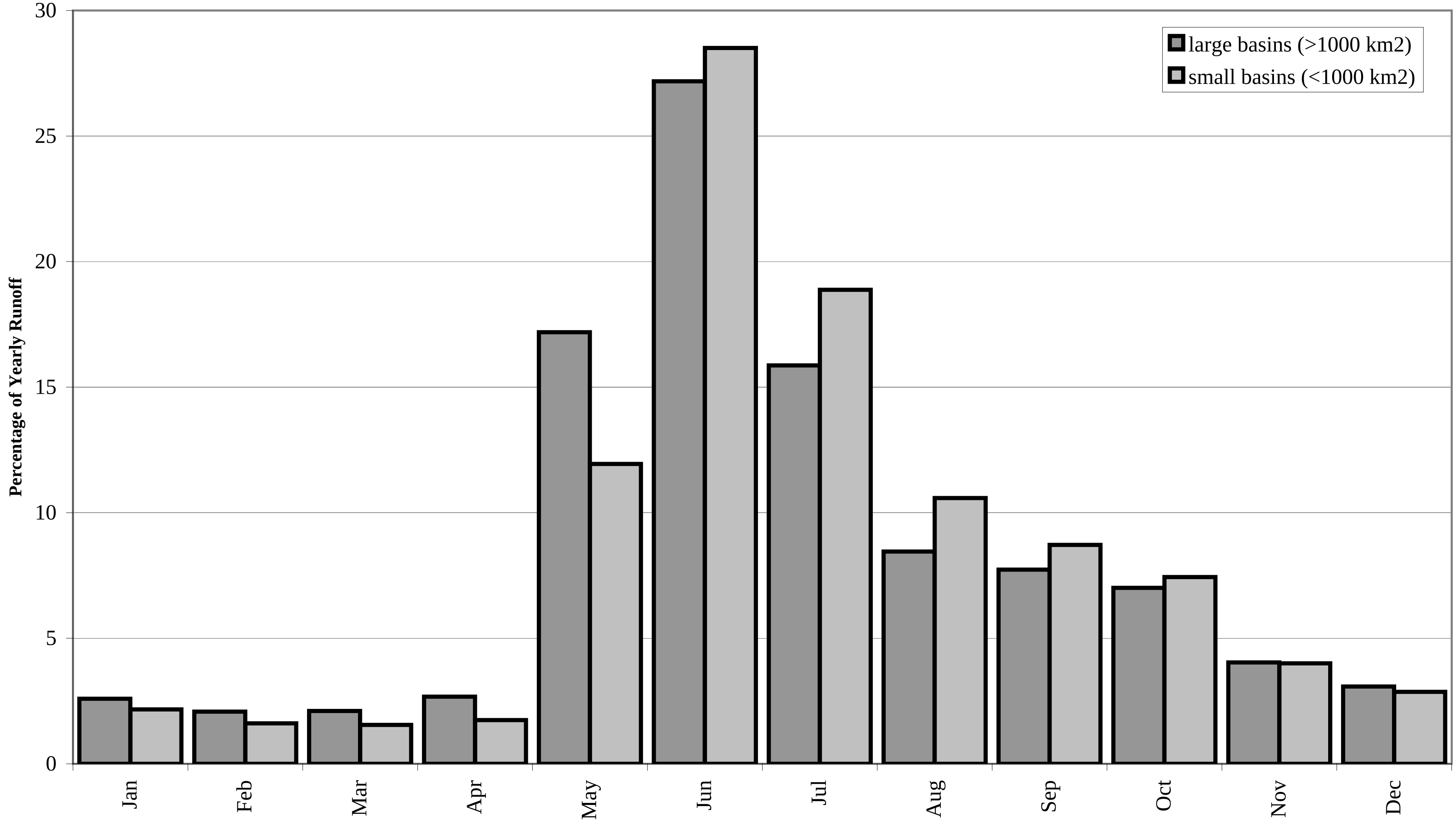


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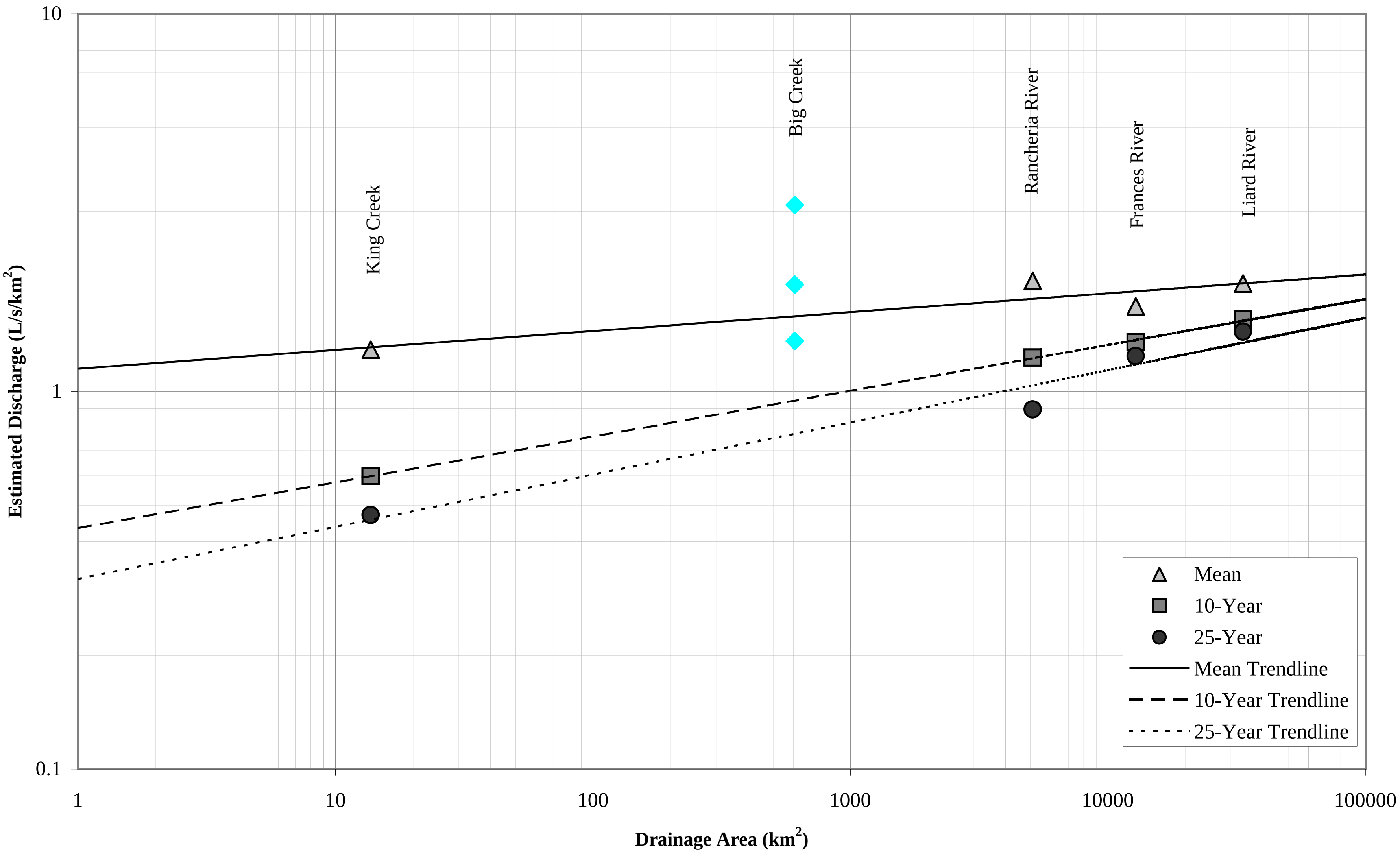
Figure 3. Annual 7-Day 10-Year Low Flow Analysis

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program



annual 10yr low flow.xls 01/09/2001 20-918-11 SA

Figure 4. Monthly 10-Year 7-Day Low Flow Estimates
Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

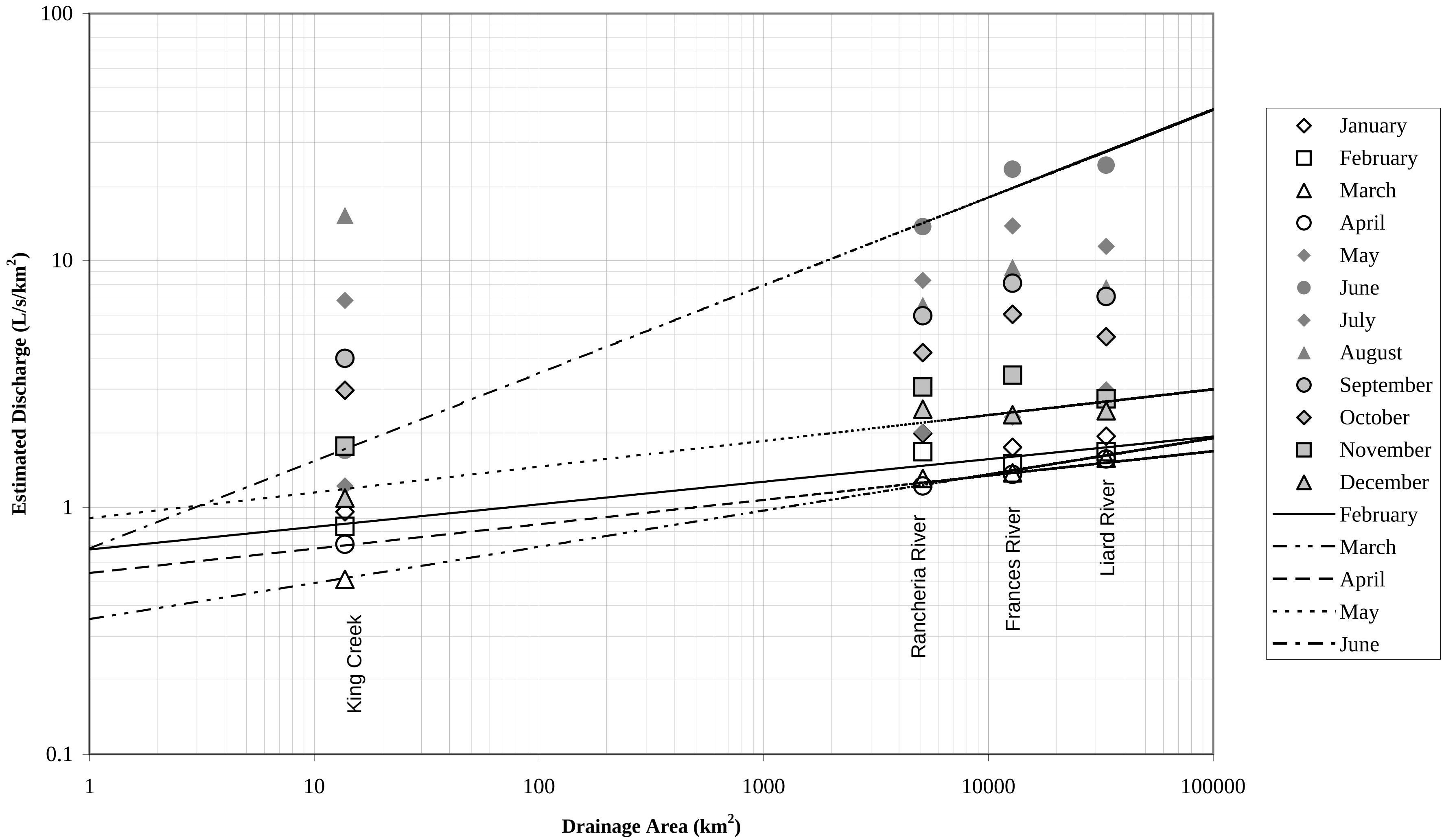


Table 9. Normal Variations in Monthly Flows

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10AA004	Rancheria River near the Mouth	5100	13--15	0.903	0.926	0.916	0.844	0.257	0.632	0.662	0.781	0.838	0.664	0.772	0.862
10AA001	Liard River at Upper Crossing	33400	34	0.877	0.928	0.949	0.799	0.277	0.699	0.706	0.804	0.845	0.691	0.78	0.852
10AB001	Frances River near Watson Lake	12800	33	0.872	0.92	0.952	0.851	0.237	0.719	0.708	0.793	0.846	0.741	0.755	0.835
10AB003	King Creek at km 20.9 Nahanni Range Road	13.7	11--14	0.897	0.889	0.831	0.831	0.165	0.539	0.562	0.699	0.771	0.764	0.777	0.799
	Mean			0.887	0.916	0.912	0.831	0.234	0.647	0.660	0.769	0.825	0.715	0.771	0.837

Figure 5. Normal Variations in Mean Monthly Flows

Source: Table 9. Normal Variations in Monthly Flows

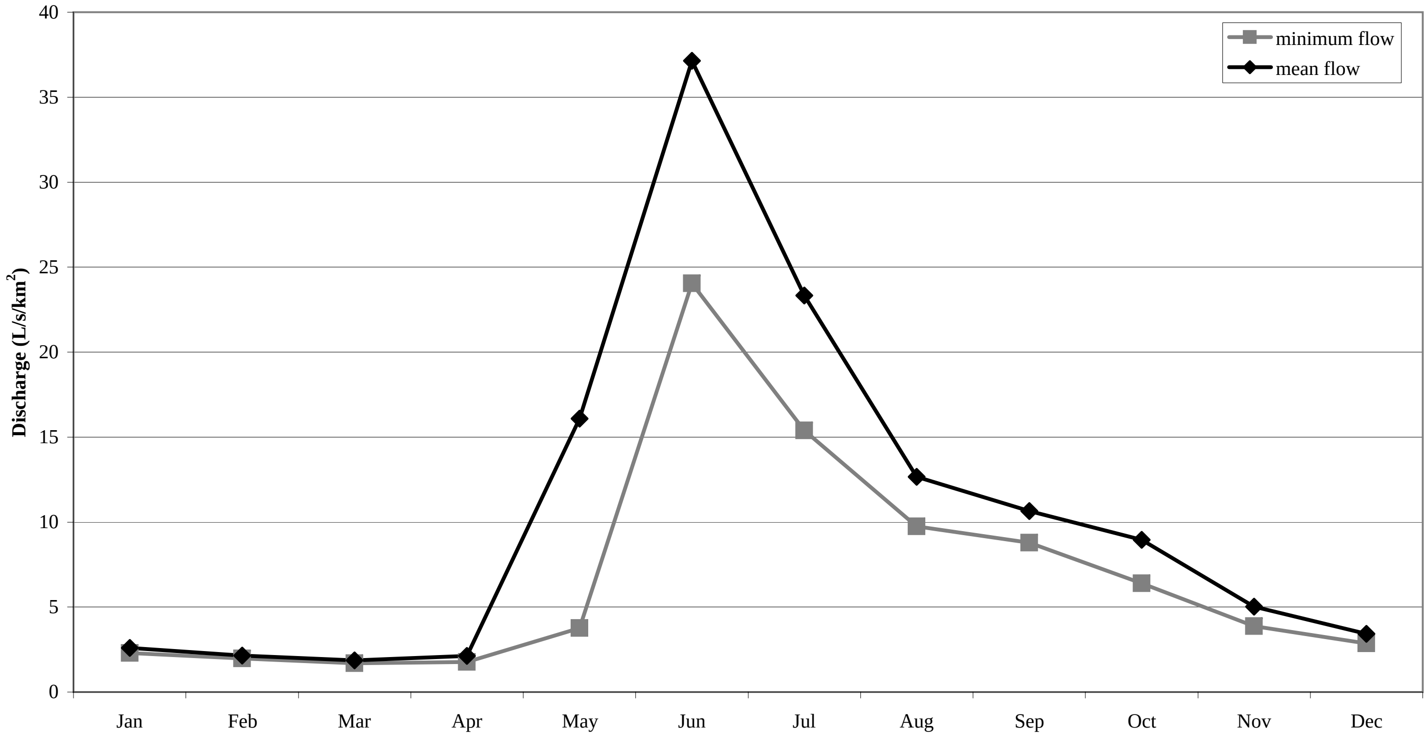


Figure 6. Maximum Instantaneous Flood
Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

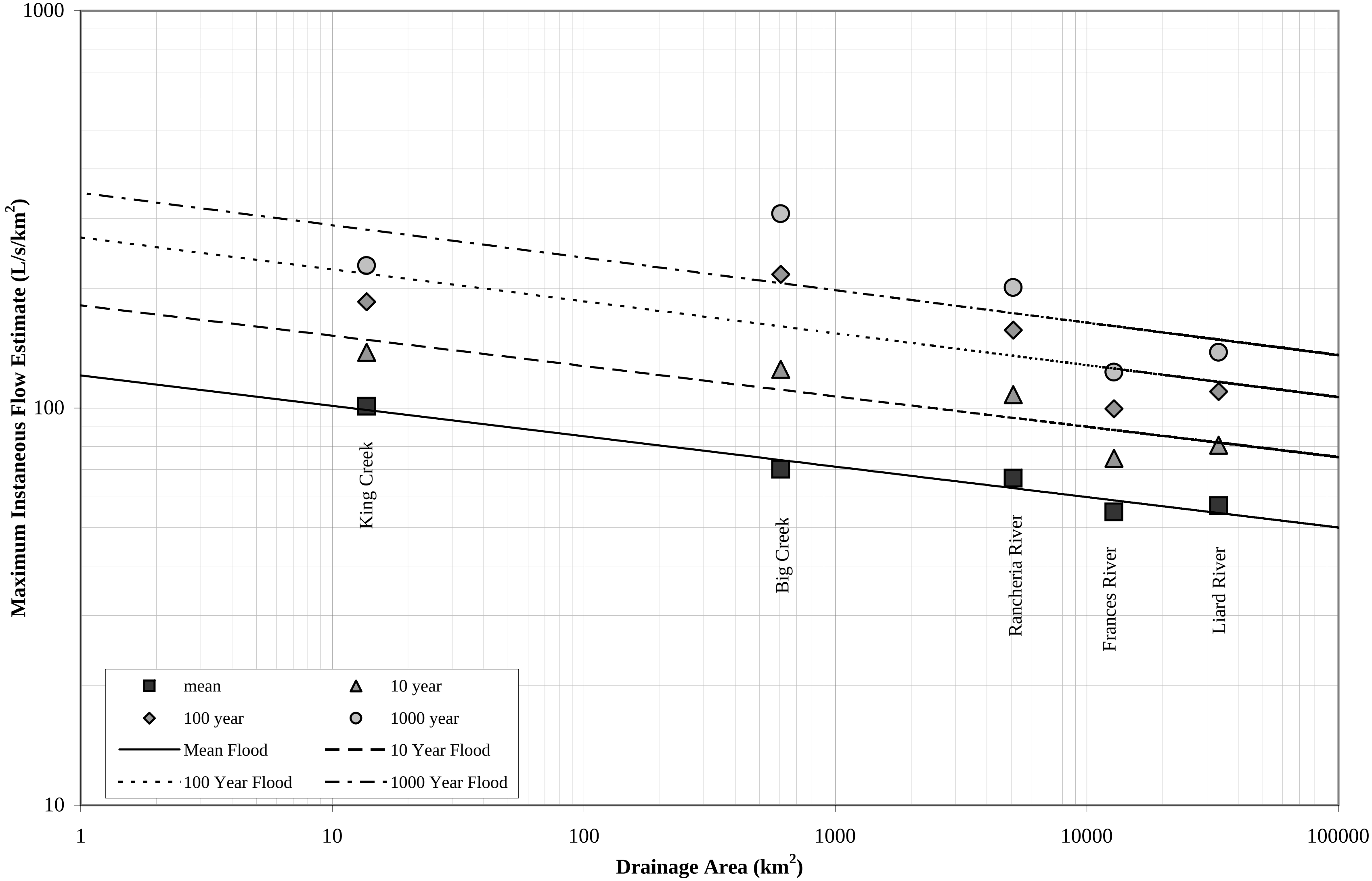


Figure 7. Daily Maximum Flood Estimates

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

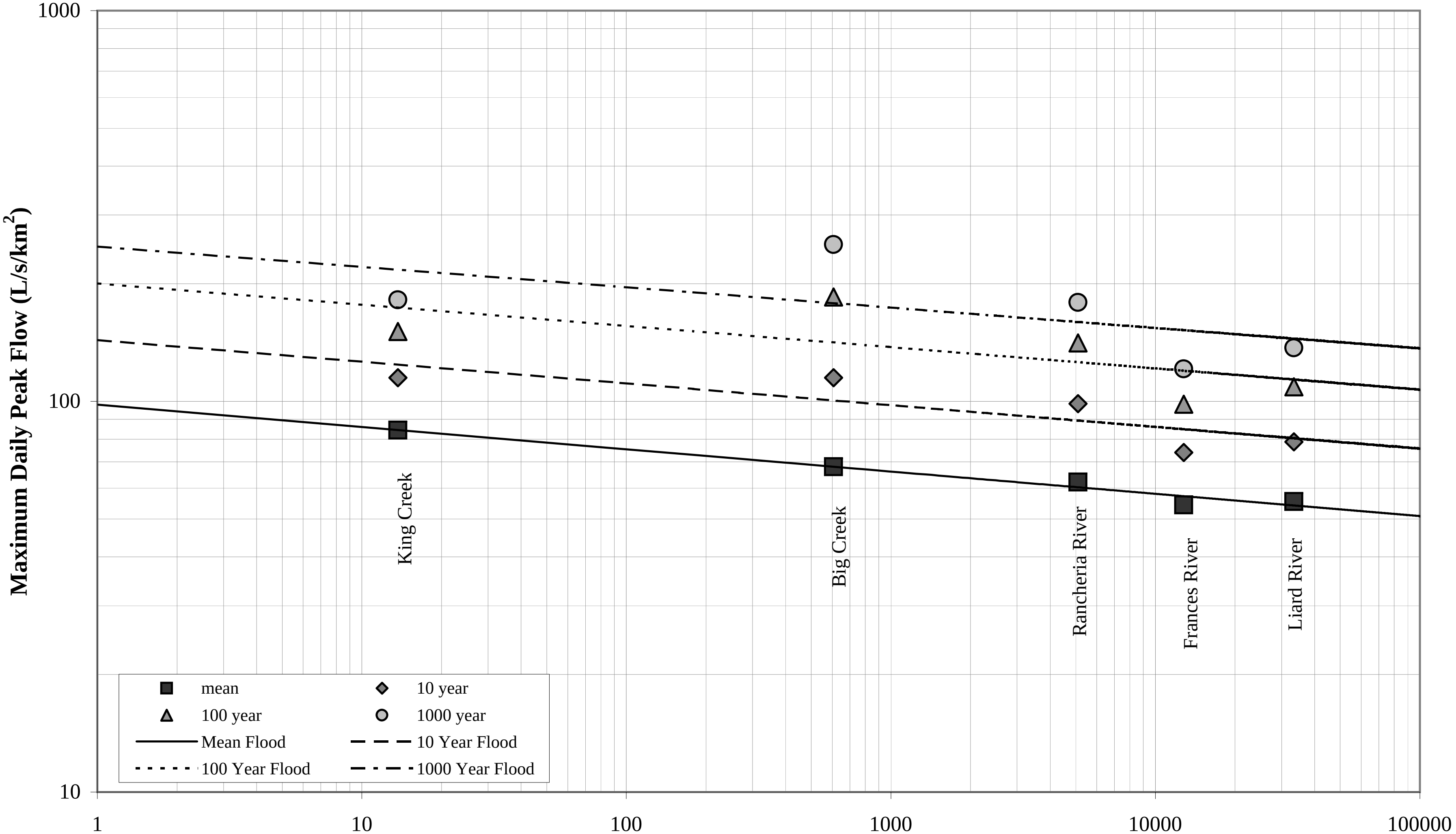


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Table 1. Mean Monthly Runoff (mm)

Source: Water Survey of Canada Streamflow Records

Station ID	Station Name	Period of Record	Drainage Area (km^2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
10AB003	King Creek at km 20.9 Nahanni Range Road	1975-88	13.7	5.22	4.23	3.88	3.91	48.09	88.40	53.60	25.56	19.78	18.51	10.54	6.81	288.55
10AA005	Big Creek at km 1084.8 Alaska Highway	1978-99	607	11.65	9.30	9.84	13.50	63.78	88.54	49.67	29.45	30.58	27.12	15.76	13.24	362.44
10AA004	Rancheria River near the Mouth	1984-99	5100	7.83	5.98	5.74	6.40	40.31	84.74	54.96	28.28	25.00	22.54	13.07	9.92	304.78
10AB001	Frances River near Watson Lake	1962-99	12800	6.94	5.04	4.83	5.23	39.09	111.13	77.67	45.71	35.28	29.08	15.32	9.83	385.15
10AA001	Liard River at Upper Crossing	1960-99	33400	7.75	5.74	5.55	6.50	44.87	100.79	63.80	36.12	30.44	25.78	13.24	10.09	350.66
	Mean All Stations		4630	7.91	6.14	6.07	7.26	47.82	93.20	58.97	32.25	27.66	24.31	13.67	9.95	335.23
	Runoff Distribution (%)			2.36	1.83	1.81	2.17	14.26	27.80	17.59	9.62	8.25	7.25	4.08	2.97	100.00
	Mean Small Basins (<1000 km^2)		310	8.43	6.77	6.86	8.71	55.94	88.47	51.64	27.51	25.18	22.82	13.15	10.03	325.49
	Runoff Distribution (%)			2.59	2.08	2.11	2.68	17.19	27.18	15.86	8.45	7.74	7.01	4.04	3.08	100.00
	Mean Large Basins (>1000 km^2)		17100	7.51	5.59	5.37	6.04	41.42	98.89	65.48	36.70	30.24	25.80	13.88	9.95	346.86
	Runoff Distribution (%)			2.16	1.61	1.55	1.74	11.94	28.51	18.88	10.58	8.72	7.44	4.00	2.87	100.00
	% Difference in Runoff Between Small and Large Basins			-0.43	-0.47	-0.56	-0.93	-5.24	1.33	3.01	2.13	0.98	0.43	-0.04	-0.21	

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Table 2. Estimated Mean Monthly Runoff From Mine Sub-Catchment Areas (m^3/s)

Source: Table 1: Monthly Runoff Distribution, Mean All Stations

Station ID	Station Name	Drainage Area (km^2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Mean
Wolverine															
W8	Campbell Creek near the Mouth	7.2	0.021	0.018	0.016	0.020	0.129	0.259	0.159	0.087	0.077	0.065	0.038	0.027	0.076
W9	Wolverine Creek	3.3	0.010	0.008	0.007	0.009	0.059	0.119	0.073	0.040	0.035	0.030	0.017	0.012	0.035
W12	Go Creek above Pup Creek	36.4	0.107	0.092	0.083	0.102	0.650	1.309	0.801	0.438	0.388	0.330	1.920	0.135	0.530
W14	Money Creek below Go Creek	238	0.703	0.599	0.540	0.667	4.249	8.558	5.240	2.866	2.540	2.160	1.255	0.884	2.522
W15	Hawkowl Creek near the Mouth	9.8	0.029	0.025	0.022	0.027	0.175	0.352	0.216	0.118	0.105	0.089	0.052	0.036	0.104
W21	Nougha Creek at Robert Campbell Highway	287	0.848	0.722	0.651	0.804	5.124	10.320	6.319	3.456	3.062	2.605	1.514	1.066	3.041
W16	Go Creek above Hawkowl	10.16	0.033	0.026	0.027	0.034	0.218	0.472	0.243	0.131	0.135	0.089	0.051	0.039	0.125
Kudz Ze Kayah															
	South Creek	9.82	0.029	0.025	0.022	0.028	0.175	0.353	0.216	0.118	0.105	0.089	0.052	0.036	0.104
	Fault Creek	1.94	0.006	0.005	0.004	0.005	0.035	0.070	0.043	0.023	0.021	0.018	0.010	0.007	0.021
	Geona Creek	26.2	0.077	0.066	0.059	0.073	0.468	0.942	0.577	0.315	0.280	0.238	0.138	0.097	0.278
	East Creek	73.4	0.217	0.185	0.166	0.206	1.310	2.639	1.616	0.884	0.783	0.666	0.387	0.273	0.778
	Upper Finlayson Creek	153	0.452	0.385	0.347	0.429	2.732	5.502	3.369	1.842	1.633	1.389	0.807	0.569	1.621
	Lower Finlayson Creek	191	0.564	0.480	0.433	0.535	3.410	6.868	4.206	2.300	2.038	1.734	1.007	0.710	2.024

Gartner Lee

Table 3. Frequency Analysis of Annual Runoff

Return Period (years)	Exceedance Probability	Ratio to Mean						Annual Runoff Estimates (mm)
		Big Creek (10)*	Frances River (34)	Rancheria River (13)	King Creek (12)	Liard River (39)	Mean Runoff Ratio	
1.001	0.999	0.595	0.553	0.568	0.497	0.555	0.554	185.60
1.002	0.998	0.620	0.582	0.588	0.514	0.582	0.577	193.54
1.005	0.995	0.655	0.623	0.619	0.541	0.620	0.611	204.98
1.01 (extreme dry year)	0.99	0.685	0.658	0.645	0.566	0.652	0.641	214.95
1.020	0.98	0.718	0.697	0.675	0.595	0.687	0.675	226.14
1.042	0.96	0.756	0.735	0.712	0.632	0.730	0.713	239.07
1.053	0.95	0.756	0.755	0.726	0.646	0.744	0.725	243.18
1.111 (dry year)	0.9	0.816	0.806	0.775	0.699	0.798	0.779	261.13
1.25	0.8	0.876	0.871	0.838	0.774	0.863	0.844	282.97
2	0.5	0.994	0.994	0.980	0.960	0.992	0.984	329.83
5	0.2	1.121	1.129	1.152	1.208	1.135	1.149	385.20
10 (wet year)	0.1	1.192	1.194	1.256	1.384	1.213	1.248	418.25
20	0.05	1.251	1.252	1.351	1.544	1.280	1.336	447.75
25	0.04	1.270	1.271	1.379	1.600	1.299	1.364	457.23
50	0.02	1.322	1.323	1.465	1.760	1.358	1.446	484.60
100 (extreme wet year)	0.01	1.370	1.368	1.548	1.920	1.412	1.524	510.74
200	0.005	1.415	1.406	1.629	2.088	1.461	1.600	536.29
500	0.002	1.474	1.458	1.732	2.312	1.523	1.700	569.84
1000	0.001	1.503	1.497	1.809	2.488	1.569	1.773	594.41

**Number in brackets indicates the number of years of record used in the analysis*

Table 4. Annual 10-Year 7-Day Low Flows

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

Station ID	Station Name	Years of Record	Drainage Area (km^2)	Mean Low Flow Date	Record Low ($L/s/km^2$)	Mean 7-Day Low Flow ($l/s/km^2$)	10-Year 7-Day Low Flow ($L/s/km^2$)	25-Year 7-Day Low Flow ($L/s/km^2$)
10AA004	Rancheria River near the Mouth	15	5100	25-Mar	0.629	1.96	1.23	0.896
10AA001	Liard River at Upper Crossing	39	33400	8-Apr	0.958	1.93	1.55	1.44
10AB001	Frances River near Watson Lake	35	12800	31-Mar	1.078	1.68	1.35	1.24
10AB003	King Creek at km 20.9 Nahanni Range Road	11	13.7	2-Apr	0	1.29	0.597	0.471
		Equation of the Trendline*				**$y=1.1487x^{0.0499}$**	**$y=0.4343x^{0.1214}$**	**$y=0.3184x^{0.1384}$**
		Confidence Level (R^2)				0.82	0.99	0.96

y=Discharge ($L/s/km^2$) x=Drainage Area (km^2)

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Table 5. Estimated Low Flow From Mine Sub-Catchment Areas

Source: Table 4. Annual 10-Year 7-Day Low Flows, Trendline Equations

Station ID	Station Name	Drainage Area (km^2)	Mean 7-Day Low Flow ($l/s/km^2$)	Mean 7-Day Low Flow (m^3/s)	10-Year 7-Day Low Flow ($L/s/km^2$)	10-Year 7-Day Low Flow (m^3/s)	25-Year 7-Day Low Flow ($L/s/km^2$)	25-Year 7-Day Low Flow (m^3/s)
Wolverine								
W8	Campbell Creek near the Mouth	7.2	1.268	0.009	0.552	0.004	0.418	0.003
W9	Wolverine Creek	3.3	1.219	0.004	0.502	0.002	0.376	0.001
W12	Go Creek above Pup Creek	36.4	1.374	0.050	0.672	0.024	0.524	0.019
W14	Money Creek below Go Creek	238	1.509	0.359	0.844	0.201	0.679	0.162
W15	Hawkowl Creek near the Mouth	9.8	1.287	0.013	0.573	0.006	0.437	0.004
W21	Nougha Creek at Robert Campbell Highway	287	1.524	0.437	0.863	0.248	0.697	0.200
W16	Go Creek above Hawkowl Creek	10.16	1.290	0.013	0.575	0.006	0.439	0.004
Kudz Ze Kayah								
	South Creek	9.82	1.287	0.013	0.573	0.006	0.437	0.004
	Fault Creek	1.94	1.187	0.002	0.471	0.001	0.349	0.001
	Geona Creek	26.2	1.352	0.035	0.646	0.017	0.500	0.013
	East Creek	73.4	1.423	0.104	0.732	0.054	0.577	0.042
	Upper Finlayson Creek	153	1.476	0.226	0.800	0.122	0.639	0.098
	Lower Finlayson Creek	191	1.493	0.285	0.822	0.157	0.659	0.126

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Table 6. Monthly 10 Year 7 Day Low Flows ($L/s/km^2$)

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

Station ID	Station Name	Drainage Area (km2)	Years of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10AA004	Rancheria River near the Mouth	5100	13 to 15*	1.99	1.68	1.31	1.22	2.01	13.7	8.3	6.58	5.97	4.23	3.07	2.5
10AA001	Liard River at Upper Crossing	33400	34	1.94	1.68	1.58	1.57	2.99	24.3	11.4	7.75	7.14	4.91	2.75	2.46
10AB001	Frances River near Watson Lake	12800	33	1.75	1.5	1.38	1.36	2.32	23.4	13.8	9.36	8.09	6.05	3.43	2.37
10AB003	King Creek at km 20.9 Nahanni Range Road	13.7	11 to 14*	0.96	0.838	0.511	0.708	1.22	1.7	6.89	15.2	4.01	2.98	1.77	1.09

some missing data

Table 7. Monthly 10 Year 7 Day Low Flows Trendline Equations

Source: Figure 4. Trendlines

Month	Equation of the Trendline*	Confidence Level (R^2)
January	$y = 0.7724x^{0.0936}$	0.9154
February	$y = 0.6752x^{0.0914}$	0.9286
March	$y = 0.3523x^{0.1467}$	0.9936
April	$y = 0.5418x^{0.0987}$	0.9931
May	$y = 0.9027x^{0.1045}$	0.9461
June	$y = 0.6791x^{0.3558}$	0.9898
July	$y = 5.5688x^{0.0721}$	0.6587
August	$y = 18.318x^{-0.0884}$	0.733
September	$y = 3.2247x^{0.0821}$	0.8882
October	$y = 2.4426x^{0.0758}$	0.7973
November	$y = 1.5105x^{0.0737}$	0.7971
December	$y = 0.8392x^{0.1117}$	0.9427

**y=Discharge (l/s/km^2) x=Drainage Area (km^2)*

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Table 8. Estimated Monthly 10 Year 7-Day Low Flow From Mine Sub-catchment Areas (L/s/km^2)

Source: Table 7. Monthly 10 Year 7 Day Low Flows Trendline Equations

Station ID	Station Name	Drainage Area (km^2)	Jan	Feb	Mar	Apr	May	Jun	*Jul**	*Aug**	*Sep**	*Oct**	*Nov**	Dec
Wolverine														
W8	Campbell Creek near the Mouth	7.2	0.929	0.809	0.471	0.658	1.086	1.371	*6.421*	*0.154*	*3.837*	*2.837*	*0.175*	1.046
W9	Wolverine Creek	3.3	0.864	0.753	0.420	0.610	1.009	1.039	*6.069*	*0.165*	*3.582*	*2.674*	*0.165*	0.959
W12	Go Creek above Pup Creek	36.4	1.081	0.938	0.597	0.773	1.264	2.440	*7.216*	*0.133*	*4.426*	*3.208*	*0.197*	1.254
W14	Money Creek below Go Creek	238	1.289	1.113	0.786	0.930	1.507	4.759	*8.263*	*0.113*	*5.222*	*3.698*	*0.226*	1.546
W15	Hawkowl Creek near the Mouth	9.8	0.956	0.832	0.492	0.679	1.118	1.530	*6.565*	*0.150*	*3.943*	*2.904*	*0.179*	1.083
W21	Nougha Creek at Robert Campbell Highway	287	1.312	1.133	0.808	0.947	1.533	5.087	*8.375*	*0.111*	*5.309*	*3.751*	*0.229*	1.579
W16	Go Creek above Hawkowl Creek	10.16	0.960	0.835	0.495	0.681	1.121	1.549	*6.582*	*0.149*	*3.955*	*2.912*	*0.179*	1.087
Kudz Ze Kayah														
	South Creek	9.82	0.957	0.832	0.493	0.679	1.118	1.531	*6.566*	*0.150*	*3.944*	*2.904*	*0.179*	1.083
	Fault Creek	1.94	0.822	0.717	0.388	0.578	0.960	0.860	*5.841*	*0.173*	*3.419*	*2.568*	*0.159*	0.904
	Geona Creek	26.2	1.049	0.910	0.569	0.748	1.225	2.171	*7.047*	*0.137*	*4.300*	*3.129*	*0.192*	1.209
	East Creek	73.4	1.155	1.000	0.662	0.828	1.349	3.131	*7.591*	*0.125*	*4.708*	*3.383*	*0.207*	1.356
	Upper Finlayson Creek	153	1.237	1.069	0.737	0.890	1.446	4.067	*8.003*	*0.117*	*5.023*	*3.576*	*0.219*	1.472
	Lower Finlayson Creek	191	1.263	1.091	0.761	0.910	1.476	4.401	*8.133*	*0.115*	*5.122*	*3.637*	*0.222*	1.509

**use with caution, low confidence levels*

Table 9. Normal Variations in Monthly Flows

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10AA004	Rancheria River near the Mouth	5100	13--15	0.903	0.926	0.916	0.844	0.257	0.632	0.662	0.781	0.838	0.664	0.772	0.862
10AA001	Liard River at Upper Crossing	33400	34	0.877	0.928	0.949	0.799	0.277	0.699	0.706	0.804	0.845	0.691	0.78	0.852
10AB001	Frances River near Watson Lake	12800	33	0.872	0.92	0.952	0.851	0.237	0.719	0.708	0.793	0.846	0.741	0.755	0.835
10AB003	King Creek at km 20.9 Nahanni Range Road	13.7	11--14	0.897	0.889	0.831	0.831	0.165	0.539	0.562	0.699	0.771	0.764	0.777	0.799
	Mean			0.887	0.916	0.912	0.831	0.234	0.647	0.660	0.769	0.825	0.715	0.771	0.837

Figure 5. Normal Variations in Mean Monthly Flows

Source: Table 9. Normal Variations in Monthly Flows

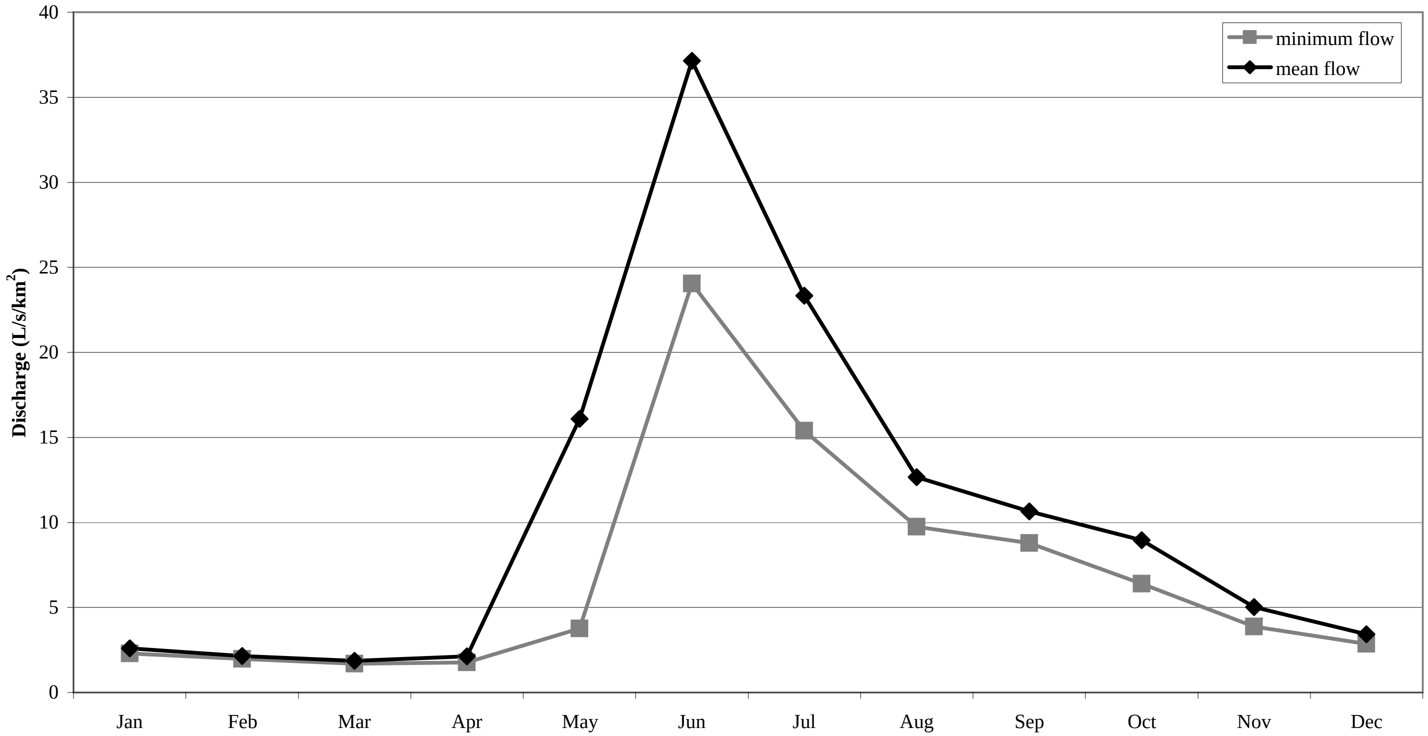

Table 10. Maximum Instantaneous Flood Estimates (L/s/km^2)

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

Station ID	Station Name	Years of Record	Drainage Area (km^2)	mean	2 year	5 year	10 year	20 year	25 year	50 year	100 year	200 year	500 year	1000 year
10AB003	King Creek at km 20.9 Nahanni Range Road	12	13.7	101.0	97.2	123	138	153	158	171	185	198	215	228
10AA001	Liard River at Upper Crossing	21	33400	56.7	54.3	70.5	80.6	90	92.9	102	110	119	130	138
10AB001	Frances River near Watson Lake	37	12800	54.7	52.7	66.1	74.6	82.4	84.9	92.3	99.5	107	116	123
10AA004	Rancheria River near the Mouth	13	5100	66.5	62.0	90.2	108	124	129	143	157	171	189	201
10AA005	Big Creek at km 1084.8 Alaska Highway	10	607	70.1	58.2	96.8	125	153	162	190	217	244	281	308

Table 11. Maximum Daily Flood Estimates (L/s/km^2)

Source: Water Survey of Canada Data Input to Ffame Flood Frequency Analysis Program

Station ID	Station Name	Years of Record	Drainage Area (km^2)	mean	2 year	5 year	10 year	20 year	25 year	50 year	100 year	200 year	500 year	1000 year
10AA001	Liard River at Upper Crossing	40	33400	55.4	52.9	68.8	78.8	88.2	91.1	100	109	117	129	137
10AB003	King Creek at km 20.9 Nahanni Range Road	12	13.7	84.4	82.1	103	115	127	130	141	151	160	173	182
10AB001	Frances River near Watson Lake	37	12800	54.3	52.4	65.6	74	81.6	84.0	91.3	98.3	105	114	121
10AA004	Rancheria River near the Mouth	13	5100	62.1	58.4	83.3	99	112	117	129	141	153	168	179
10AA005	Big Creek at km 1084.8 Alaska Highway	11	607	68	59.6	92.3	115	137	143	164	185	205	232	252

Table 12. Flood Frequency Trendline Equations

Source: Figure 6,7. Trendlines

Return Period	Equation of the Trendline*	Confidence Level (R^2)
Maximum Instantaneos		
mean	y = 120.75x-0.0766	0.946
10 year	y = 181.27x-0.0764	0.776
50 year	y = 181.27x-0.0764	0.557
1000 year	y = 181.27x-0.0764	0.458
Maximum Daily		
mean	$y = 98.034x^{-0.057}$	0.968
10 year	$y = 143.55x^{-0.0556}$	0.692
50 year	$y = 200.43x^{-0.0544}$	y = 200.43x-0.0544
1000 year	$y = 200.43x^{-0.0544}$	0.439

**y=Discharge (l/s/km^2)   x=Drainage Area (km^2)*

Table 13. Flood Frequency Estimates for Mine Sub-Catchment Areas (L/s/km^2)

Source: Table 12. Flood Frequency Trendline Equations

Station ID	Station Name	Drainage Area (km^2)	Instantaneous Maximum				Daily Maximum			
			mean	10 year	100 year	1000 year	mean	10 year	100 year	1000 year
Wolverine										
W8	Campbell Creek near the Mouth	7.2	103.80	155.89	229.14	296.24	87.60	128.63	180.02	224.73
W9	Wolverine Creek	3.3	110.20	165.47	243.97	315.76	91.58	134.33	187.83	234.05
W12	Go Creek above Pup Creek	36.4	91.69	137.74	201.15	259.46	79.87	117.55	164.83	206.53
W14	Money Creek below Go Creek	238	79.40	119.33	172.96	222.52	71.76	105.89	148.83	187.28
W15	Hawkowl Creek near the Mouth	9.8	101.38	152.26	223.53	288.86	86.07	126.44	177.03	221.15
W21	Nougha Creek at Robert Campbell Highway	287	78.27	117.64	170.38	219.13	71.00	104.80	147.32	185.47
W16	Go Creek above Hawkowl Creek	10.16	101.10	151.84	222.88	288.01	85.90	126.19	176.68	220.73
Kudz Ze Kayah										
	South Creek	9.82	101.37	152.24	223.49	288.81	86.06	126.43	177.01	221.12
	Fault Creek	1.94	114.77	172.32	254.62	329.78	94.40	138.36	193.33	240.62
	Geona Creek	26.2	94.03	141.24	206.54	266.53	81.38	119.71	167.81	210.10
	East Creek	73.4	86.89	130.55	190.12	244.99	76.74	113.05	158.66	199.12
	Upper Finlayson Creek	153	82.14	123.43	179.22	230.71	73.60	108.53	152.45	191.65
	Lower Finlayson Creek	191	80.75	121.35	176.05	226.56	72.67	107.20	150.62	189.44

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Table.A.1 Mean Monthly Runoff (mm) From Streamflow Records

Station ID	Name	Period of Record	Drainage Area (km²)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Hay and Co. Annual Total
DIAND																	
29AE003	Partridge Creek	1978-94	63.7						187.08	83.75	45.79	53.66				E 530.69	E 573
29BA002	180 Mile Creek	1983-93	83.1						123.83	61.47	39.66	37.86				E 391.81	E 443
29BC003	Vangorda Creek at Faro Townsite Road	1977-85, 1989-97	91.2					56.36	52.26	30.75	20.97	25.47				E 219.04	
WSC																	
Inactive																	
09BA002	Pelly River below Fortin Creek	1986-94	5020	5.50	3.66	3.42	4.20	95.88	143.66	75.67	45.09	45.12	36.32	12.76	9.00	480.28	487.92
09BC002	Pelly River at Ross River	1954-77	18400	3.37	2.47	2.47	2.73	51.66	101.24	51.32	33.81	27.76	18.82	7.81	5.30	308.76	308.61
09AD001	Nisutlin River above Wolf River	1979-95	8030	6.88	4.87	4.92	7.09	58.49	107.28	58.29	29.33	27.38	28.21	15.41	10.02	358.18	361.81
09AD002	Sidney Creek at km 40 South Canol Road	1982-94	372	7.72	5.74	5.56	7.32	68.25	117.48	53.95	26.82	26.06	24.63	13.00	10.28	366.81	358.16
09AE001	Teslin River near Teslin	1944-94	30300	8.85	6.88	6.94	6.38	22.47	76.14	64.21	36.73	27.94	27.41	18.05	11.97	313.99	313.49
09BC001	South MacMillan River at km 407 Canol Road	1974-96	997	6.22	3.92	3.66	4.46	82.68	203.87	133.10	78.46	57.70	35.35	14.76	9.10	633.28	637.33
10AB003	King Creek	1975-88	13.7	5.22	4.23	3.88	3.91	48.09	88.40	53.60	25.56	19.78	18.51	10.54	6.81	288.55	288.45
10AD002	Hyland River	1976-94	2150	8.04	6.07	5.70	5.81	61.38	206.86	153.82	81.02	55.00	37.55	16.86	11.48	649.59	647.57
Active																	
09BA001	Ross River at Ross River	1958-99	7250	3.39	2.41	2.36	3.34	61.01	85.92	44.19	29.83	25.63	18.66	7.20	5.02	288.97	296.16
09BC004	Pelly River below Vangorda Creek	1970-99	22100	3.73	2.71	2.59	3.28	54.64	80.44	45.52	30.29	27.17	20.00	8.28	5.30	283.95	291.02
10AA001	Liard River at Upper Crossing	1960-99	33400	7.75	5.74	5.55	6.50	44.87	100.79	63.80	36.12	30.44	25.78	13.24	10.09	350.66	359.73
10AA002	Tom Creek at km 34 Robert Campbell Highway	1974-93, 99-2000*	435	3.48	2.62	2.71	4.77	54.75	52.78	35.08	16.55	14.91	14.53	7.42	4.75	214.34	216.59
10AA004	Rancheria River near the Mouth	1984-99	5100	7.83	5.98	5.74	6.40	40.31	84.74	54.96	28.28	25.00	22.54	13.07	9.92	304.78	329.19
10AA005	Big Creek at km 1084.8 Alaska Highway	1978-99	607	11.65	9.30	9.84	13.50	63.78	88.54	49.67	29.45	30.58	27.12	15.76	13.24	362.44	378.10
10AB001	Frances River near Watson Lake	1962-99	12800	6.94	5.04	4.83	5.23	39.09	111.13	77.67	45.71	35.28	29.08	15.32	9.83	385.15	393.90
Mean all Stations			8178.48	6.44	4.78	4.68	5.66	56.48	111.80	66.16	37.75	32.93	25.63	12.63	8.81	379.55	377.87
Mean Stations <1000 km²			332.84	6.86	5.16	5.13	6.79	62.32	114.28	62.67	35.41	33.25	24.03	12.30	8.84	375.87	375.73

**Tom Creek Re-opened as a DIAND station in 1999*

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Table 2. Frequency Analysis of Annual Precipitation

Source: Environment Canada , AES Precipitation Records

Return Period (years)	Exceedance Probability	Ratio to Mean			Annual Precipitation Estimates (mm)
		Watson Lake Airport (55)*	Tuchitua (13)	Mean Precipitation Ratio	
1.001	0.999	0.187	0.467	0.327	156.68
1.002	0.998	0.258	0.499	0.379	181.31
1.005	0.995	0.357	0.544	0.451	215.79
1.01 (extreme dry year)	0.99	0.435	0.583	0.509	243.72
1.020	0.98	0.514	0.629	0.572	273.58
1.042	0.96	0.601	0.677	0.639	306.07
1.053	0.95	0.628	0.694	0.661	316.47
1.111 (dry year)	0.9	0.725	0.756	0.740	354.41
1.25	0.8	0.833	0.835	0.834	399.29
2	0.5	1.017	0.991	1.004	480.50
5	0.2	1.179	1.159	1.169	559.65
10 (wet year)	0.1	1.256	1.253	1.255	600.61
20	0.05	1.314	1.347	1.331	636.93
25	0.04	1.331	1.356	1.344	643.23
50	0.02	1.374	1.426	1.400	670.25
100 (extreme wet year)	0.01	1.413	1.490	1.451	694.77
200	0.005	1.449	1.548	1.499	717.36
500	0.002	1.488	1.623	1.555	744.57
1000	0.001	1.514	1.675	1.595	763.51

**Number in brackets indicates the number of years of record used in the analysis*

Appendix 3B

Wolverine Area – Water Quality by Station

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W9 - Wolverine Creek 50 m U/S mouth

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	244	25	271	221	3	3
Total Dissolved Solids	143	27	229	97	20	20
Hardness CaCO3	110.2	28.7	143.0	8.5	19	19
pH	7.82	0.30	8.33	7.38	20	20
Total Suspended Solids	2	1	6	1	14	6
Turbidity (NTU)	1.2	3.0	13.5	0.1	19	18
Alkalinity-Total CaCO3	94	13	113	56	20	20
Chloride Cl	0.5	0.1	1.0	0.5	18	2
Fluoride F	0.16	0.21	1.00	0.09	18	17
Sulphate SO4	27	4	35	16	19	19
Acidity (to pH 8.3) CaCO3	13	#DIV/0!	13	13	1	1
Ammonia Nitrogen N	0.015	0.018	0.050	0.005	6	0
Nitrate Nitrogen N	0.119	0.066	0.300	0.046	19	18
Nitrite Nitrogen N	0.032	0.115	0.500	0.001	19	5
Nitrite/Nitrate Nitrogen N	0.085	0.040	0.153	0.047	9	9
Dissolved ortho-Phosphate P	0.005	0.003	0.008	0.003	3	3
Total Dissolved Phosphate P	0.007	0.001	0.007	0.006	3	3
Total Phosphate P	0.009	0.003	0.012	0.006	3	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.019	0.016	0.060	0.002	19	17
Antimony T-Sb	0.05484	0.08933	0.20000	0.00010	19	12
Arsenic T-As	0.00223	0.00608	0.02000	0.00018	20	17
Barium T-Ba	0.1162	0.0127	0.1330	0.0800	20	20
Beryllium T-Be	0.0021	0.0022	0.0050	0.0002	20	0
Bismuth T-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron T-B	0.062	0.050	0.100	0.001	18	1
Cadmium T-Cd	0.00133	0.00021	0.00184	0.00085	20	20
Calcium T-Ca	34.8	4.5	43.8	21.3	20	20
Chromium T-Cr	0.0010	0.0022	0.0100	0.0001	20	8
Cobalt T-Co	0.0042	0.0067	0.0200	0.0001	20	0
Copper T-Cu	0.002	0.001	0.006	0.001	20	18
Iron T-Fe	0.05	0.07	0.29	0.01	20	14
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	18	8
Lithium T-Li	0.007	0.007	0.020	0.001	16	1
Magnesium T-Mg	7.43	1.22	9.74	4.64	20	20
Manganese T-Mn	0.00671	0.00939	0.04200	0.00011	20	14
Mercury T-Hg	0.00010	0.00022	0.00100	0.00002	19	1
Molybdenum T-Mo	0.01580	0.01462	0.03000	0.00062	20	7
Nickel T-Ni	0.0085	0.0078	0.0200	0.0020	20	13
Phosphorus T-P	0.3	0.1	0.3	0.1	15	0
Potassium T-K	2	0	2	1	19	3
Selenium T-Se	0.0032	0.0006	0.0040	0.0020	18	18
Silicon T-Si	3.03	0.37	3.75	2.11	16	16
Silver T-Ag	0.00007	0.00023	0.00100	0.00001	19	2
Sodium T-Na	2	0	2	1	20	3
Strontium T-Sr	0.1051	0.0165	0.1320	0.0680	16	16
Thallium T-Tl	0.0281	0.0459	0.1000	0.0001	18	0
Tin T-Sn	0.0127	0.0147	0.0300	0.0001	15	0
Titanium T-Ti	0.01	0.00	0.01	0.00	19	0
Uranium T-U	0.0085	0.0201	0.0600	0.0005	16	14
Vanadium T-V	0.017	0.015	0.030	0.001	20	1
Zinc T-Zn	0.135	0.030	0.198	0.055	20	19

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.019	0.045	0.200	0.001	19	13
Antimony D-Sb	0.05486	0.08932	0.20000	0.00010	19	12
Arsenic D-As	0.00219	0.00609	0.02000	0.00010	20	17
Barium D-Ba	0.1172	0.0118	0.1320	0.0800	20	20
Beryllium D-Be	0.0022	0.0022	0.0050	0.0002	19	0
Bismuth D-Bi	0.0429	0.0487	0.1000	0.0005	15	0
Boron D-B	0.062	0.047	0.100	0.001	17	4
Cadmium D-Cd	0.00120	0.00014	0.00144	0.00082	20	19
Calcium D-Ca	34.7	4.3	42.9	21.3	20	20
Chromium D-Cr	0.0010	0.0022	0.0100	0.0001	19	7
Cobalt D-Co	0.0044	0.0068	0.0200	0.0001	19	0
Copper D-Cu	0.002	0.001	0.004	0.001	20	18
Iron D-Fe	0.03	0.03	0.12	0.00	19	4
Lead D-Pb	0.0007	0.0015	0.0050	0.0001	19	5
Lithium D-Li	0.006	0.007	0.020	0.001	16	0
Magnesium D-Mg	7.46	1.19	9.68	4.61	20	20
Manganese D-Mn	0.00337	0.00297	0.00900	0.00009	19	12
Mercury D-Hg	0.00004	0.00001	0.00005	0.00002	17	0
Molybdenum D-Mo	0.01504	0.01464	0.03000	0.00050	19	7
Nickel D-Ni	0.0082	0.0080	0.0200	0.0020	20	13
Phosphorus D-P	0.3	0.1	0.3	0.1	15	0
Potassium D-K	2	0	2	1	18	3
Selenium D-Se	0.0033	0.0007	0.0040	0.0020	18	18
Silicon D-Si	2.99	0.33	3.65	2.06	16	16
Silver D-Ag	0.00060	0.00229	0.01000	0.00001	19	0
Sodium D-Na	2	0	2	1	19	3
Strontium D-Sr	0.1035	0.0171	0.1280	0.0680	16	16
Thallium D-Tl	0.0297	0.0468	0.1000	0.0001	17	0
Tin D-Sn	0.0127	0.0147	0.0300	0.0001	15	2
Titanium D-Ti	0.01	0.00	0.01	0.00	18	0
Uranium D-U	0.0084	0.0201	0.0600	0.0006	16	14
Vanadium D-V	0.016	0.015	0.030	0.001	19	0
Zinc D-Zn	0.126	0.027	0.175	0.054	20	20
Total Organic Carbon C	2.633	0.764	3.300	1.800	3	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W2

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	278	72	379	159	6	6
Hardness CaCO3	223.3	58.8	277.0	113.0	6	6
pH	7.73	0.27	8.10	7.42	6	6
Total Suspended Solids	7	8	16	1	3	2
Turbidity (NTU)	1.6	2.2	6.0	0.3	6	6
Alkalinity-Total CaCO3	160	38	195	87	6	6
Chloride Cl	0.6	0.2	1.0	0.5	5	1
Fluoride F	0.47	0.09	0.53	0.32	5	5
Sulphate SO4	70	24	97	28	6	6
Ammonia Nitrogen N	0.042	0.033	0.070	0.005	3	1
Nitrate Nitrogen N	0.101	0.196	0.500	0.005	6	4
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	3
Nitrite/Nitrate Nitrogen N	0.022	0.011	0.031	0.005	5	4
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.052	0.057	0.161	0.014	6	6
Antimony T-Sb	0.04410	0.08757	0.20000	0.00013	5	3
Arsenic T-As	0.00457	0.00757	0.02000	0.00111	6	5
Barium T-Ba	0.1008	0.1580	0.4230	0.0243	6	6
Beryllium T-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	3
Cadmium T-Cd	0.00019	0.00017	0.00050	0.00006	6	4
Calcium T-Ca	50.3	13.1	64.6	26.8	6	6
Chromium T-Cr	0.0006	0.0004	0.0010	0.0001	6	3
Cobalt T-Co	0.0053	0.0082	0.0200	0.0001	6	1
Copper T-Cu	0.003	0.003	0.009	0.001	6	6
Iron T-Fe	0.19	0.17	0.54	0.09	6	6
Lead T-Pb	0.0003	0.0004	0.0010	0.0001	5	2
Lithium T-Li	0.007	0.007	0.020	0.002	6	3
Magnesium T-Mg	22.58	6.39	30.40	11.80	6	6
Manganese T-Mn	0.07228	0.03051	0.11900	0.03800	6	6
Mercury T-Hg	0.00021	0.00039	0.00100	0.00005	6	0
Molybdenum T-Mo	0.01130	0.01458	0.03000	0.00058	6	3
Nickel T-Ni	0.0107	0.0074	0.0200	0.0040	6	4
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	0	2	2	5	1
Selenium T-Se	0.0016	0.0005	0.0020	0.0010	5	5
Silicon T-Si	5.20	1.02	6.50	3.69	5	5
Silver T-Ag	0.00019	0.00040	0.00100	0.00001	6	0
Sodium T-Na	2	0	2	1	6	1
Strontium T-Sr	0.1970	0.0517	0.2440	0.1110	5	5
Thallium T-Tl	0.0011	0.0022	0.0050	0.0001	5	1
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	5	2
Uranium T-U	0.0140	0.0257	0.0600	0.0008	5	4
Vanadium T-V	0.011	0.015	0.030	0.001	6	1
Zinc T-Zn	0.031	0.044	0.120	0.006	6	6

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.014	0.009	0.030	0.005	6	6
Antimony D-Sb	0.04409	0.08758	0.20000	0.00013	5	3
Arsenic D-As	0.00440	0.00764	0.02000	0.00103	6	5
Barium D-Ba	0.0392	0.0083	0.0489	0.0237	6	6
Beryllium D-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.043	0.052	0.100	0.001	5	3
Cadmium D-Cd	0.00016	0.00017	0.00050	0.00005	6	3
Calcium D-Ca	51.4	13.1	62.4	26.3	6	6
Chromium D-Cr	0.0006	0.0004	0.0010	0.0001	6	3
Cobalt D-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper D-Cu	0.002	0.003	0.008	0.001	6	6
Iron D-Fe	0.07	0.03	0.10	0.01	6	6
Lead D-Pb	0.0010	0.0020	0.0050	0.0001	6	1
Lithium D-Li	0.007	0.007	0.020	0.002	6	3
Magnesium D-Mg	23.07	6.31	29.40	11.60	6	6
Manganese D-Mn	0.05993	0.02254	0.09370	0.04000	6	6
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.01129	0.01458	0.03000	0.00057	6	3
Nickel D-Ni	0.0098	0.0080	0.0200	0.0020	6	4
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	0	2	1	5	1
Selenium D-Se	0.0018	0.0004	0.0020	0.0010	5	5
Silicon D-Si	5.13	0.99	6.32	3.61	5	5
Silver D-Ag	0.00019	0.00040	0.00100	0.00001	6	0
Sodium D-Na	2	0	2	1	6	1
Strontium D-Sr	0.2016	0.0531	0.2380	0.1100	5	5
Thallium D-Tl	0.0011	0.0022	0.0050	0.0001	5	1
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	5	0
Uranium D-U	0.0140	0.0257	0.0600	0.0009	5	4
Vanadium D-V	0.011	0.015	0.030	0.001	6	1
Zinc D-Zn	0.010	0.003	0.014	0.006	6	6

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W3

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	75	10	88	64	4	4
Hardness CaCO3	54.5	3.3	56.9	49.5	4	4
pH	7.80	0.31	8.05	7.34	4	4
Total Suspended Solids	2	0	2	2	2	2
Turbidity (NTU)	0.5	0.4	1.0	0.2	4	4
Alkalinity-Total CaCO3	49	3	54	47	4	4
Chloride Cl	0.5	0.0	0.5	0.5	3	0
Fluoride F	0.11	0.01	0.12	0.10	3	3
Sulphate SO4	10	1	10	9	4	4
Ammonia Nitrogen N	0.045	0.007	0.050	0.040	2	1
Nitrate Nitrogen N	0.029	0.048	0.100	0.005	4	0
Nitrite Nitrogen N	0.002	0.001	0.003	0.001	4	1
Nitrite/Nitrate Nitrogen N	0.005	0.000	0.005	0.005	3	0
Total Cyanide CN	0.005	#DIV/0!	0.005	0.005	1	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.015	0.011	0.030	0.005	4	4
Antimony T-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic T-As	0.00561	0.00959	0.02000	0.00080	4	3
Barium T-Ba	0.0306	0.0010	0.0317	0.0296	4	4
Beryllium T-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth T-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron T-B	0.034	0.057	0.100	0.001	3	1
Cadmium T-Cd	0.00020	0.00021	0.00050	0.00005	4	0
Calcium T-Ca	15.4	0.4	15.7	14.8	4	4
Chromium T-Cr	0.0007	0.0004	0.0010	0.0002	4	2
Cobalt T-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper T-Cu	0.002	0.002	0.004	0.001	4	3
Iron T-Fe	0.05	0.07	0.15	0.01	4	2
Lead T-Pb	0.0004	0.0005	0.0010	0.0001	3	0
Lithium T-Li	0.006	0.009	0.020	0.001	4	1
Magnesium T-Mg	4.32	0.21	4.53	4.04	4	4
Manganese T-Mn	5.50191	10.99873	22.00000	0.00021	4	3
Mercury T-Hg	0.00029	0.00048	0.00100	0.00005	4	0
Molybdenum T-Mo	0.00919	0.01401	0.03000	0.00074	4	2
Nickel T-Ni	0.0060	0.0093	0.0200	0.0010	4	2
Phosphorus T-P	0.2	0.1	0.3	0.1	3	0
Potassium T-K	2	1	2	1	3	1
Selenium T-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon T-Si	1.76	0.30	2.10	1.55	3	3
Silver T-Ag	0.00028	0.00048	0.00100	0.00001	4	0
Sodium T-Na	2	1	2	1	4	1
Strontium T-Sr	0.0461	0.0010	0.0469	0.0450	3	3
Thallium T-Tl	0.0017	0.0028	0.0050	0.0001	3	1
Tin T-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium T-Ti	0.01	0.01	0.01	0.00	3	0
Uranium T-U	0.0203	0.0344	0.0600	0.0003	3	2
Vanadium T-V	0.009	0.014	0.030	0.001	4	0
Zinc T-Zn	0.004	0.003	0.008	0.001	4	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.010	0.006	0.019	0.006	4	3
Antimony D-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic D-As	0.00558	0.00962	0.02000	0.00075	4	3
Barium D-Ba	0.0321	0.0033	0.0368	0.0298	4	4
Beryllium D-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth D-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron D-B	0.037	0.055	0.100	0.001	3	1
Cadmium D-Cd	0.00020	0.00021	0.00050	0.00005	4	0
Calcium D-Ca	14.9	0.8	15.3	13.7	4	4
Chromium D-Cr	0.0006	0.0005	0.0010	0.0001	4	2
Cobalt D-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper D-Cu	0.002	0.002	0.004	0.001	4	3
Iron D-Fe	0.01	0.01	0.03	0.00	4	0
Lead D-Pb	0.0015	0.0024	0.0050	0.0001	4	0
Lithium D-Li	0.006	0.009	0.020	0.001	4	1
Magnesium D-Mg	4.19	0.33	4.50	3.73	4	4
Manganese D-Mn	0.00162	0.00225	0.00500	0.00034	4	3
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	3	0
Molybdenum D-Mo	0.00916	0.01403	0.03000	0.00080	4	2
Nickel D-Ni	0.0060	0.0093	0.0200	0.0010	4	2
Phosphorus D-P	0.2	0.1	0.3	0.1	3	0
Potassium D-K	2	1	2	1	3	1
Selenium D-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon D-Si	1.68	0.30	2.03	1.48	3	3
Silver D-Ag	0.00028	0.00048	0.00100	0.00001	4	0
Sodium D-Na	2	1	2	1	4	1
Strontium D-Sr	0.0444	0.0030	0.0463	0.0410	3	3
Thallium D-Tl	0.0017	0.0028	0.0050	0.0001	3	1
Tin D-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium D-Ti	0.01	0.01	0.01	0.00	3	0
Uranium D-U	0.0204	0.0343	0.0600	0.0005	3	2
Vanadium D-V	0.009	0.014	0.030	0.001	4	0
Zinc D-Zn	0.004	0.002	0.007	0.002	4	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W11- Money Creek u/s Go Creek

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	97	35	134	65	3	3
Total Dissolved Solids	61	16	105	34	21	21
Hardness CaCO3	41.9	12.1	66.7	20.7	20	20
pH	7.52	0.31	8.00	7.03	21	21
Total Suspended Solids	3	2	8	1	14	9
Turbidity (NTU)	0.7	0.4	1.4	0.2	20	19
Alkalinity-Total CaCO3	35	12	59	17	21	21
Chloride Cl	0.5	0.1	0.8	0.5	18	3
Fluoride F	0.13	0.21	1.00	0.05	19	18
Sulphate SO4	11	3	17	5	20	20
Acidity (to pH 8.3) CaCO3	5	#DIV/0!	5	5	1	1
Ammonia Nitrogen N	0.017	0.020	0.050	0.005	5	0
Nitrate Nitrogen N	0.056	0.078	0.258	0.005	20	15
Nitrite Nitrogen N	0.028	0.114	0.500	0.001	19	7
Nitrite/Nitrate Nitrogen N	0.033	0.076	0.261	0.005	11	9
Dissolved ortho-Phosphate P	0.001	0.000	0.001	0.001	3	2
Total Dissolved Phosphate P	0.002	0.001	0.003	0.002	3	3
Total Phosphate P	0.004	0.001	0.005	0.003	3	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.041	0.022	0.100	0.010	19	19
Antimony T-Sb	0.06530	0.09421	0.20000	0.00005	19	0
Arsenic T-As	0.00206	0.00597	0.02000	0.00005	21	15
Barium T-Ba	0.0315	0.0137	0.0700	0.0200	21	21
Beryllium T-Be	0.0023	0.0022	0.0050	0.0002	20	0
Bismuth T-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron T-B	0.062	0.050	0.100	0.001	18	2
Cadmium T-Cd	0.00011	0.00014	0.00050	0.00005	20	0
Calcium T-Ca	11.5	3.5	18.4	5.6	21	21
Chromium T-Cr	0.0015	0.0029	0.0100	0.0002	20	9
Cobalt T-Co	0.0047	0.0067	0.0200	0.0001	20	0
Copper T-Cu	0.001	0.001	0.004	0.000	21	18
Iron T-Fe	0.13	0.10	0.42	0.03	21	21
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	18	6
Lithium T-Li	0.007	0.006	0.020	0.001	17	8
Magnesium T-Mg	3.50	1.04	5.53	1.73	21	21
Manganese T-Mn	0.01516	0.01661	0.07480	0.00500	21	21
Mercury T-Hg	0.00010	0.00022	0.00100	0.00002	19	1
Molybdenum T-Mo	0.01566	0.01478	0.03000	0.00026	20	7
Nickel T-Ni	0.0078	0.0092	0.0200	0.0007	20	7
Phosphorus T-P	0.3	0.1	0.3	0.1	16	0
Potassium T-K	2	0	2	1	19	3
Selenium T-Se	0.0009	0.0002	0.0011	0.0005	18	2
Silicon T-Si	3.32	1.10	5.73	1.90	17	17
Silver T-Ag	0.00007	0.00023	0.00100	0.00001	19	0
Sodium T-Na	2	0	2	1	20	4
Strontium T-Sr	0.0407	0.0101	0.0590	0.0230	17	17
Thallium T-Tl	0.0281	0.0459	0.1000	0.0001	18	0
Tin T-Sn	0.0138	0.0148	0.0300	0.0001	16	0
Titanium T-Ti	0.01	0.00	0.01	0.00	19	0
Uranium T-U	0.0087	0.0208	0.0600	0.0005	15	13
Vanadium T-V	0.017	0.015	0.030	0.001	20	0
Zinc T-Zn	0.004	0.003	0.012	0.001	20	8

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.037	0.055	0.200	0.005	21	15
Antimony D-Sb	0.06532	0.09421	0.20000	0.00005	19	3
Arsenic D-As	0.00205	0.00597	0.02000	0.00005	21	15
Barium D-Ba	0.0355	0.0184	0.0729	0.0100	21	21
Beryllium D-Be	0.0023	0.0022	0.0050	0.0002	20	0
Bismuth D-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron D-B	0.064	0.046	0.100	0.001	18	4
Cadmium D-Cd	0.00011	0.00014	0.00050	0.00005	20	2
Calcium D-Ca	11.5	3.5	18.4	5.5	21	21
Chromium D-Cr	0.0015	0.0029	0.0100	0.0001	20	8
Cobalt D-Co	0.0047	0.0067	0.0200	0.0001	20	0
Copper D-Cu	0.001	0.001	0.002	0.000	21	17
Iron D-Fe	0.06	0.04	0.19	0.01	20	18
Lead D-Pb	0.0007	0.0015	0.0050	0.0001	20	5
Lithium D-Li	0.007	0.006	0.020	0.001	17	7
Magnesium D-Mg	3.51	1.05	5.60	1.68	21	21
Manganese D-Mn	0.00664	0.00294	0.01500	0.00249	21	17
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	18	0
Molybdenum D-Mo	0.01565	0.01479	0.03000	0.00024	20	7
Nickel D-Ni	0.0077	0.0093	0.0200	0.0005	20	7
Phosphorus D-P	0.3	0.1	0.3	0.1	16	0
Potassium D-K	2	1	2	1	19	3
Selenium D-Se	0.0008	0.0002	0.0010	0.0005	18	0
Silicon D-Si	3.33	1.12	5.68	1.82	17	17
Silver D-Ag	0.00057	0.00223	0.01000	0.00001	20	0
Sodium D-Na	2	0	2	1	20	4
Strontium D-Sr	0.0403	0.0100	0.0590	0.0230	17	17
Thallium D-Tl	0.0281	0.0459	0.1000	0.0001	18	0
Tin D-Sn	0.0138	0.0148	0.0300	0.0001	16	2
Titanium D-Ti	0.01	0.00	0.01	0.00	19	0
Uranium D-U	0.0087	0.0208	0.0600	0.0005	15	13
Vanadium D-V	0.017	0.015	0.030	0.001	20	0
Zinc D-Zn	0.007	0.007	0.026	0.001	20	9

Total Organic Carbon C	3.333	0.907	4.000	2.300	3	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W12 - Go Creek 20 m U/S of Pup Creek

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	130	36	166	94	3	3
Total Dissolved Solids	79	16	111	51	21	21
Hardness CaCO3	60.5	13.2	84.3	36.1	20	20
pH	7.70	0.27	8.11	7.28	21	21
Total Suspended Solids	3	2	10	1	15	10
Turbidity (NTU)	0.9	0.8	3.4	0.2	20	19
Alkalinity-Total CaCO3	54	12	73	28	21	21
Chloride Cl	0.6	0.3	1.7	0.5	19	2
Fluoride F	0.10	0.22	1.00	0.03	19	18
Sulphate SO4	11	3	15	6	20	20
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.015	0.018	0.050	0.005	6	0
Nitrate Nitrogen N	0.030	0.043	0.148	0.005	20	9
Nitrite Nitrogen N	0.026	0.112	0.500	0.001	20	5
Nitrite/Nitrate Nitrogen N	0.020	0.043	0.150	0.005	11	3
Dissolved ortho-Phosphate P	0.002	0.001	0.003	0.001	3	2
Total Dissolved Phosphate P	0.003	0.001	0.004	0.003	3	3
Total Phosphate P	0.005	0.001	0.006	0.004	3	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.023	0.015	0.050	0.005	19	16
Antimony T-Sb	0.06205	0.09285	0.20000	0.00005	20	5
Arsenic T-As	0.00213	0.00594	0.02000	0.00014	21	18
Barium T-Ba	0.0576	0.0133	0.0800	0.0300	21	21
Beryllium T-Be	0.0023	0.0022	0.0050	0.0002	21	0
Bismuth T-Bi	0.0496	0.0493	0.1000	0.0005	17	0
Boron T-B	0.064	0.049	0.100	0.001	19	1
Cadmium T-Cd	0.00011	0.00014	0.00050	0.00005	21	0
Calcium T-Ca	19.2	4.2	26.1	11.7	21	21
Chromium T-Cr	0.0014	0.0029	0.0100	0.0001	21	7
Cobalt T-Co	0.0045	0.0066	0.0200	0.0001	21	1
Copper T-Cu	0.001	0.001	0.004	0.000	21	18
Iron T-Fe	0.07	0.04	0.22	0.03	21	20
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	19	9
Lithium T-Li	0.007	0.007	0.020	0.001	17	0
Magnesium T-Mg	3.33	0.96	5.20	1.90	21	21
Manganese T-Mn	0.01203	0.00642	0.02700	0.00590	21	21
Mercury T-Hg	0.00009	0.00021	0.00100	0.00002	20	0
Molybdenum T-Mo	0.01636	0.01471	0.03000	0.00035	21	7
Nickel T-Ni	0.0072	0.0093	0.0200	0.0001	21	5
Phosphorus T-P	0.3	0.1	0.3	0.1	16	0
Potassium T-K	2	0	2	1	20	3
Selenium T-Se	0.0009	0.0002	0.0012	0.0005	19	5
Silicon T-Si	2.93	0.66	4.49	1.96	17	17
Silver T-Ag	0.00007	0.00022	0.00100	0.00001	20	2
Sodium T-Na	2	0	2	1	21	3
Strontium T-Sr	0.0412	0.0090	0.0560	0.0270	17	17
Thallium T-Tl	0.0266	0.0451	0.1000	0.0001	19	0
Tin T-Sn	0.0138	0.0148	0.0300	0.0001	16	0
Titanium T-Ti	0.01	0.00	0.01	0.00	20	0
Uranium T-U	0.0081	0.0211	0.0600	0.0001	15	12
Vanadium T-V	0.018	0.015	0.030	0.001	21	1
Zinc T-Zn	0.004	0.002	0.005	0.001	21	5

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.030	0.058	0.200	0.004	21	14
Antimony D-Sb	0.06207	0.09284	0.20000	0.00005	20	6
Arsenic D-As	0.00211	0.00595	0.02000	0.00010	21	18
Barium D-Ba	0.0614	0.0191	0.0955	0.0300	21	21
Beryllium D-Be	0.0023	0.0022	0.0050	0.0002	21	0
Bismuth D-Bi	0.0496	0.0493	0.1000	0.0005	17	0
Boron D-B	0.066	0.046	0.100	0.001	19	4
Cadmium D-Cd	0.00018	0.00035	0.00157	0.00005	21	4
Calcium D-Ca	19.1	4.0	26.0	11.4	21	21
Chromium D-Cr	0.0014	0.0029	0.0100	0.0001	21	7
Cobalt D-Co	0.0045	0.0066	0.0200	0.0001	21	0
Copper D-Cu	0.001	0.001	0.003	0.000	21	17
Iron D-Fe	0.04	0.02	0.10	0.01	21	15
Lead D-Pb	0.0007	0.0015	0.0050	0.0001	21	6
Lithium D-Li	0.007	0.007	0.020	0.001	17	0
Magnesium D-Mg	3.35	0.92	5.09	1.86	21	21
Manganese D-Mn	0.00565	0.00368	0.02000	0.00180	21	15
Mercury D-Hg	0.00004	0.00001	0.00005	0.00002	19	0
Molybdenum D-Mo	0.01636	0.01472	0.03000	0.00031	21	7
Nickel D-Ni	0.0072	0.0093	0.0200	0.0001	21	5
Phosphorus D-P	0.3	0.1	0.3	0.1	16	0
Potassium D-K	2	1	2	0	20	3
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	19	2
Silicon D-Si	2.92	0.65	4.39	1.85	17	17
Silver D-Ag	0.00054	0.00218	0.01000	0.00001	21	2
Sodium D-Na	2	0	2	1	21	3
Strontium D-Sr	0.0410	0.0089	0.0550	0.0250	17	17
Thallium D-Tl	0.0266	0.0451	0.1000	0.0001	19	0
Tin D-Sn	0.0138	0.0148	0.0300	0.0001	16	1
Titanium D-Ti	0.01	0.00	0.01	0.00	20	0
Uranium D-U	0.0081	0.0211	0.0600	0.0001	15	11
Vanadium D-V	0.018	0.015	0.030	0.001	21	0
Zinc D-Zn	0.008	0.008	0.026	0.001	21	10
Total Organic Carbon C	2.700	0.721	3.300	1.900	3	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W13

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	74	8	88	62	6	6
Hardness CaCO3	60.4	6.9	65.6	46.5	6	6
pH	7.65	0.31	8.10	7.33	6	6
Total Suspended Solids	2	1	3	1	3	2
Turbidity (NTU)	0.4	0.4	1.0	0.1	6	5
Alkalinity-Total CaCO3	60	7	66	47	6	6
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.04	0.01	0.06	0.02	5	5
Sulphate SO4	4	1	5	3	6	6
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	0
Nitrate Nitrogen N	0.090	0.016	0.113	0.068	6	5
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	4
Nitrite/Nitrate Nitrogen N	0.089	0.017	0.114	0.069	5	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.029	0.032	0.070	0.004	5	4
Antimony T-Sb	0.04403	0.08762	0.20000	0.00005	5	0
Arsenic T-As	0.00345	0.00811	0.02000	0.00005	6	4
Barium T-Ba	0.0680	0.0155	0.0856	0.0438	6	6
Beryllium T-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	0
Cadmium T-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium T-Ca	18.5	2.2	20.3	14.2	6	6
Chromium T-Cr	0.0021	0.0039	0.0100	0.0002	6	3
Cobalt T-Co	0.0054	0.0081	0.0200	0.0001	6	1
Copper T-Cu	0.001	0.001	0.004	0.001	6	5
Iron T-Fe	0.02	0.01	0.03	0.01	6	2
Lead T-Pb	0.0002	0.0004	0.0010	0.0001	5	0
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	3.40	0.35	3.63	2.73	6	6
Manganese T-Mn	0.00246	0.00239	0.00500	0.00020	6	4
Mercury T-Hg	0.00021	0.00039	0.00100	0.00005	6	0
Molybdenum T-Mo	0.01097	0.01486	0.03000	0.00020	6	3
Nickel T-Ni	0.0072	0.0099	0.0200	0.0003	6	3
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	5	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	5	0
Silicon T-Si	4.03	0.42	4.76	3.72	5	5
Silver T-Ag	0.00003	0.00004	0.00010	0.00001	5	0
Sodium T-Na	2	0	2	1	6	1
Strontium T-Sr	0.0275	0.0061	0.0320	0.0172	5	5
Thallium T-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	5	0
Uranium T-U	0.0151	0.0299	0.0600	0.0001	4	3
Vanadium T-V	0.011	0.015	0.030	0.001	6	1
Zinc T-Zn	0.003	0.002	0.005	0.001	6	2

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.051	0.076	0.200	0.002	6	5
Antimony D-Sb	0.04403	0.08762	0.20000	0.00005	5	0
Arsenic D-As	0.00345	0.00811	0.02000	0.00005	6	4
Barium D-Ba	0.0688	0.0150	0.0859	0.0450	6	6
Beryllium D-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.041	0.054	0.100	0.001	5	1
Cadmium D-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium D-Ca	18.4	2.2	19.9	14.1	6	6
Chromium D-Cr	0.0021	0.0039	0.0100	0.0002	6	3
Cobalt D-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper D-Cu	0.001	0.001	0.002	0.000	6	4
Iron D-Fe	0.04	0.05	0.13	0.01	6	2
Lead D-Pb	0.0010	0.0020	0.0050	0.0001	6	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	3.45	0.39	3.84	2.72	6	6
Manganese D-Mn	0.00195	0.00241	0.00500	0.00006	6	4
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.01097	0.01486	0.03000	0.00020	6	3
Nickel D-Ni	0.0072	0.0099	0.0200	0.0003	6	3
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	5	1
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	5	0
Silicon D-Si	4.01	0.36	4.62	3.70	5	5
Silver D-Ag	0.00169	0.00407	0.01000	0.00001	6	0
Sodium D-Na	2	0	2	1	6	1
Strontium D-Sr	0.0280	0.0067	0.0350	0.0171	5	5
Thallium D-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	5	0
Uranium D-U	0.0151	0.0299	0.0600	0.0001	4	3
Vanadium D-V	0.011	0.015	0.030	0.001	6	1
Zinc D-Zn	0.003	0.002	0.005	0.001	6	2

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W14 - Money Creek 100 m D/S Go Creek

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	118	26	138	88	3	3
Total Dissolved Solids	71	16	102	48	21	21
Hardness CaCO3	49.5	12.4	72.1	25.7	20	20
pH	7.59	0.33	8.17	7.06	21	21
Total Suspended Solids	2	1	5	1	15	7
Turbidity (NTU)	0.6	0.3	1.3	0.2	20	20
Alkalinity-Total CaCO3	42	10	63	22	21	21
Chloride Cl	0.5	0.1	0.8	0.5	19	4
Fluoride F	0.12	0.22	1.00	0.02	19	17
Sulphate SO4	11	3	15	5	20	20
Acidity (to pH 8.3) CaCO3	11	#DIV/0!	11	11	1	1
Ammonia Nitrogen N	0.015	0.018	0.050	0.005	6	0
Nitrate Nitrogen N	0.054	0.080	0.300	0.005	20	17
Nitrite Nitrogen N	0.026	0.112	0.500	0.001	20	8
Nitrite/Nitrate Nitrogen N	0.028	0.055	0.191	0.005	11	9
Dissolved ortho-Phosphate P	0.001	0.001	0.002	0.001	3	2
Total Dissolved Phosphate P	0.003	0.001	0.004	0.002	3	2
Total Phosphate P	0.005	0.002	0.007	0.003	3	3
Total Cyanide CN	0.005	#DIV/0!	0.005	0.005	1	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.028	0.015	0.060	0.005	19	17
Antimony T-Sb	0.06205	0.09285	0.20000	0.00005	20	2
Arsenic T-As	0.00207	0.00596	0.02000	0.00007	21	18
Barium T-Ba	0.0420	0.0141	0.0800	0.0200	21	21
Beryllium T-Be	0.0023	0.0022	0.0050	0.0002	21	0
Bismuth T-Bi	0.0496	0.0493	0.1000	0.0005	17	0
Boron T-B	0.064	0.049	0.100	0.001	19	2
Cadmium T-Cd	0.00011	0.00014	0.00050	0.00005	21	0
Calcium T-Ca	14.4	3.8	20.7	7.6	21	21
Chromium T-Cr	0.0014	0.0029	0.0100	0.0001	21	8
Cobalt T-Co	0.0045	0.0066	0.0200	0.0001	21	0
Copper T-Cu	0.001	0.001	0.005	0.000	21	18
Iron T-Fe	0.09	0.05	0.26	0.03	21	20
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	19	4
Lithium T-Li	0.134	0.541	2.300	0.001	18	9
Magnesium T-Mg	3.30	1.21	5.10	0.01	21	21
Manganese T-Mn	0.01016	0.00490	0.02180	0.00002	21	19
Mercury T-Hg	0.00159	0.00669	0.03000	0.00002	20	1
Molybdenum T-Mo	0.01496	0.01475	0.03000	0.00026	21	7
Nickel T-Ni	0.1031	0.4347	2.0000	0.0004	21	8
Phosphorus T-P	0.3	0.1	0.3	0.1	16	0
Potassium T-K	2	1	2	0	20	3
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	18	3
Silicon T-Si	3.25	0.96	5.51	1.96	17	17
Silver T-Ag	0.00007	0.00022	0.00100	0.00001	20	2
Sodium T-Na	2	0	2	1	21	3
Strontium T-Sr	0.0398	0.0097	0.0550	0.0230	17	17
Thallium T-Tl	0.0266	0.0451	0.1000	0.0001	19	0
Tin T-Sn	0.0138	0.0148	0.0300	0.0001	16	0
Titanium T-Ti	0.01	0.00	0.01	0.00	20	1
Uranium T-U	0.0085	0.0209	0.0600	0.0002	15	13
Vanadium T-V	0.018	0.015	0.030	0.001	21	1
Zinc T-Zn	0.004	0.002	0.008	0.001	21	9

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.035	0.056	0.200	0.005	21	15
Antimony D-Sb	0.06206	0.09284	0.20000	0.00005	20	3
Arsenic D-As	0.00207	0.00596	0.02000	0.00005	21	18
Barium D-Ba	0.0475	0.0181	0.0800	0.0200	21	21
Beryllium D-Be	0.0023	0.0022	0.0050	0.0002	21	0
Bismuth D-Bi	0.0496	0.0493	0.1000	0.0005	17	0
Boron D-B	0.066	0.046	0.100	0.001	19	4
Cadmium D-Cd	0.00011	0.00014	0.00050	0.00005	21	2
Calcium D-Ca	14.5	3.7	20.6	7.5	21	21
Chromium D-Cr	0.0014	0.0029	0.0100	0.0001	21	10
Cobalt D-Co	0.0045	0.0066	0.0200	0.0001	21	1
Copper D-Cu	0.001	0.001	0.003	0.000	21	17
Iron D-Fe	0.05	0.03	0.14	0.01	21	15
Lead D-Pb	0.0007	0.0015	0.0050	0.0001	21	4
Lithium D-Li	0.145	0.588	2.500	0.001	18	8
Magnesium D-Mg	3.31	1.17	5.05	0.01	21	20
Manganese D-Mn	0.00543	0.00254	0.01300	0.00002	21	15
Mercury D-Hg	0.00162	0.00687	0.03000	0.00002	19	0
Molybdenum D-Mo	0.01496	0.01476	0.03000	0.00024	21	7
Nickel D-Ni	0.1025	0.4349	2.0000	0.0004	21	7
Phosphorus D-P	0.3	0.1	0.3	0.1	16	0
Potassium D-K	2	1	2	0	20	3
Selenium D-Se	0.0008	0.0002	0.0010	0.0005	18	1
Silicon D-Si	3.25	0.95	5.51	1.87	17	17
Silver D-Ag	0.00054	0.00218	0.01000	0.00001	21	2
Sodium D-Na	2	0	2	1	21	4
Strontium D-Sr	0.0396	0.0094	0.0540	0.0230	17	17
Thallium D-Tl	0.0266	0.0451	0.1000	0.0001	19	0
Tin D-Sn	0.0138	0.0148	0.0300	0.0001	16	1
Titanium D-Ti	0.01	0.00	0.01	0.00	20	0
Uranium D-U	0.0085	0.0209	0.0600	0.0001	15	13
Vanadium D-V	0.018	0.015	0.030	0.001	21	0
Zinc D-Zn	0.008	0.008	0.026	0.001	21	8
Total Organic Carbon C	2.933	0.709	3.700	2.300	3	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W15 - Hawkowl Creek above Go Creek

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	96	25	119	69	3	3
Total Dissolved Solids	63	12	89	37	15	15
Hardness CaCO3	46.3	8.2	62.0	28.1	15	15
pH	7.61	0.35	8.08	6.92	15	15
Total Suspended Solids	5	7	24	1	11	4
Turbidity (NTU)	0.9	1.8	7.4	0.1	15	12
Alkalinity-Total CaCO3	41	7	48	25	15	15
Chloride Cl	0.5	0.0	0.5	0.5	13	0
Fluoride F	0.04	0.02	0.07	0.02	13	8
Sulphate SO4	7	1	9	4	14	14
Acidity (to pH 8.3) CaCO3	5	#DIV/0!	5	5	1	1
Ammonia Nitrogen N	0.008	0.006	0.020	0.005	6	0
Nitrate Nitrogen N	0.060	0.051	0.173	0.018	14	13
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	14	6
Nitrite/Nitrate Nitrogen N	0.052	0.052	0.173	0.018	9	9
Dissolved ortho-Phosphate P	0.001	0.000	0.001	0.001	3	2
Total Dissolved Phosphate P	0.003	0.001	0.004	0.002	3	2
Total Phosphate P	0.003	0.001	0.004	0.002	3	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.016	0.010	0.040	0.005	13	13
Antimony T-Sb	0.03006	0.07219	0.20000	0.00005	14	1
Arsenic T-As	0.00153	0.00512	0.02000	0.00010	15	10
Barium T-Ba	0.0205	0.0248	0.1090	0.0100	15	14
Beryllium T-Be	0.0015	0.0018	0.0050	0.0002	15	0
Bismuth T-Bi	0.0294	0.0457	0.1000	0.0005	11	0
Boron T-B	0.051	0.051	0.100	0.001	14	0
Cadmium T-Cd	0.00010	0.00012	0.00050	0.00005	15	1
Calcium T-Ca	16.6	3.1	22.5	9.9	15	15
Chromium T-Cr	0.0011	0.0025	0.0100	0.0001	15	6
Cobalt T-Co	0.0028	0.0059	0.0200	0.0001	15	2
Copper T-Cu	0.001	0.001	0.004	0.000	15	14
Iron T-Fe	0.06	0.13	0.52	0.01	15	6
Lead T-Pb	0.0001	0.0003	0.0010	0.0001	13	2
Lithium T-Li	0.004	0.006	0.020	0.001	11	0
Magnesium T-Mg	1.10	0.30	1.94	0.60	15	15
Manganese T-Mn	0.00768	0.01863	0.07460	0.00036	15	8
Mercury T-Hg	0.00011	0.00025	0.00100	0.00002	15	1
Molybdenum T-Mo	0.01444	0.01512	0.03000	0.00014	15	7
Nickel T-Ni	0.0045	0.0080	0.0200	0.0001	15	2
Phosphorus T-P	0.3	0.1	0.3	0.1	10	0
Potassium T-K	2	0	2	1	14	1
Selenium T-Se	0.0010	0.0002	0.0012	0.0005	13	2
Silicon T-Si	2.56	0.50	3.73	2.01	11	11
Silver T-Ag	0.00002	0.00002	0.00010	0.00001	14	0
Sodium T-Na	2	0	2	1	15	1
Strontium T-Sr	0.0282	0.0048	0.0377	0.0220	11	11
Thallium T-Tl	0.0075	0.0266	0.1000	0.0001	14	0
Tin T-Sn	0.0066	0.0124	0.0300	0.0001	10	0
Titanium T-Ti	0.01	0.00	0.01	0.00	14	0
Uranium T-U	0.0047	0.0166	0.0600	0.0000	13	8
Vanadium T-V	0.015	0.015	0.030	0.001	15	1
Zinc T-Zn	0.004	0.003	0.013	0.001	15	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.023	0.049	0.200	0.005	15	13
Antimony D-Sb	0.03008	0.07218	0.20000	0.00005	14	4
Arsenic D-As	0.00148	0.00512	0.02000	0.00009	15	11
Barium D-Ba	0.0278	0.0254	0.0843	0.0100	15	14
Beryllium D-Be	0.0015	0.0018	0.0050	0.0002	15	0
Bismuth D-Bi	0.0294	0.0457	0.1000	0.0005	11	0
Boron D-B	0.054	0.048	0.100	0.001	14	4
Cadmium D-Cd	0.00009	0.00012	0.00050	0.00005	15	0
Calcium D-Ca	16.6	3.0	22.6	10.2	15	15
Chromium D-Cr	0.0012	0.0025	0.0100	0.0001	15	7
Cobalt D-Co	0.0028	0.0059	0.0200	0.0001	15	0
Copper D-Cu	0.001	0.001	0.003	0.000	15	13
Iron D-Fe	0.02	0.01	0.05	0.00	15	2
Lead D-Pb	0.0011	0.0026	0.0092	0.0001	15	3
Lithium D-Li	0.004	0.006	0.020	0.001	11	0
Magnesium D-Mg	1.15	0.28	1.84	0.70	15	15
Manganese D-Mn	0.00358	0.00409	0.01580	0.00012	15	8
Mercury D-Hg	0.00004	0.00001	0.00005	0.00002	14	0
Molybdenum D-Mo	0.01444	0.01511	0.03000	0.00016	15	7
Nickel D-Ni	0.0045	0.0080	0.0200	0.0001	15	2
Phosphorus D-P	0.3	0.1	0.3	0.1	10	0
Potassium D-K	2	0	2	0	14	0
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	13	0
Silicon D-Si	2.53	0.41	3.52	2.01	11	11
Silver D-Ag	0.00068	0.00258	0.01000	0.00001	15	0
Sodium D-Na	2	0	2	1	15	1
Strontium D-Sr	0.0286	0.0049	0.0363	0.0220	11	11
Thallium D-Tl	0.0075	0.0266	0.1000	0.0001	14	0
Tin D-Sn	0.0066	0.0124	0.0300	0.0001	10	1
Titanium D-Ti	0.01	0.00	0.01	0.00	14	0
Uranium D-U	0.0047	0.0166	0.0600	0.0000	13	8
Vanadium D-V	0.015	0.015	0.030	0.001	15	0
Zinc D-Zn	0.008	0.008	0.025	0.001	15	7
Total Organic Carbon C	2.233	0.808	3.100	1.500	3	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W16 - Go Creek 15 m U/S Hawkowl Creek

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	120	28	139	87	3	3
Total Dissolved Solids	77	14	96	48	10	10
Hardness CaCO3	59.9	12.1	75.9	37.7	10	10
pH	7.68	0.33	8.14	7.15	10	10
Total Suspended Solids	10	18	50	1	7	1
Turbidity (NTU)	0.5	0.4	1.0	0.1	10	9
Alkalinity-Total CaCO3	54	11	68	35	10	10
Chloride Cl	0.5	0.0	0.6	0.5	8	1
Fluoride F	0.03	0.01	0.05	0.02	8	8
Sulphate SO4	7	2	9	4	9	9
Acidity (to pH 8.3) CaCO3	3	#DIV/0!	3	3	1	1
Ammonia Nitrogen N	0.015	0.018	0.050	0.005	6	0
Nitrate Nitrogen N	0.042	0.042	0.127	0.005	9	7
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	9	3
Nitrite/Nitrate Nitrogen N	0.026	0.005	0.032	0.019	5	5
Dissolved ortho-Phosphate P	0.002	0.002	0.004	0.001	3	2
Total Dissolved Phosphate P	0.004	0.001	0.005	0.003	3	3
Total Phosphate P	0.004	0.002	0.006	0.002	3	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.017	0.010	0.040	0.009	10	10
Antimony T-Sb	0.02451	0.06614	0.20000	0.00005	9	0
Arsenic T-As	0.00214	0.00628	0.02000	0.00010	10	8
Barium T-Ba	0.0559	0.0129	0.0700	0.0300	10	10
Beryllium T-Be	0.0016	0.0018	0.0050	0.0002	10	0
Bismuth T-Bi	0.0369	0.0494	0.1000	0.0005	6	0
Boron T-B	0.067	0.050	0.100	0.001	9	0
Cadmium T-Cd	0.00011	0.00014	0.00050	0.00005	10	0
Calcium T-Ca	19.9	4.2	26.1	12.6	10	10
Chromium T-Cr	0.0005	0.0003	0.0010	0.0001	10	3
Cobalt T-Co	0.0032	0.0067	0.0200	0.0001	10	0
Copper T-Cu	0.001	0.001	0.004	0.000	10	9
Iron T-Fe	0.03	0.01	0.05	0.00	10	6
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	9	0
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	2.40	0.54	2.90	1.30	10	10
Manganese T-Mn	0.00933	0.00556	0.02200	0.00353	10	9
Mercury T-Hg	0.00013	0.00030	0.00100	0.00002	10	0
Molybdenum T-Mo	0.01860	0.01478	0.03000	0.00030	10	3
Nickel T-Ni	0.0047	0.0081	0.0200	0.0002	10	3
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	0	2	1	9	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	9	1
Silicon T-Si	2.78	0.39	3.25	2.22	6	6
Silver T-Ag	0.00002	0.00003	0.00010	0.00001	9	0
Sodium T-Na	2	0	2	1	10	1
Strontium T-Sr	0.0396	0.0072	0.0470	0.0260	6	6
Thallium T-Tl	0.0006	0.0017	0.0050	0.0001	9	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	9	0
Uranium T-U	0.0068	0.0200	0.0600	0.0001	9	5
Vanadium T-V	0.019	0.015	0.030	0.001	10	1
Zinc T-Zn	0.004	0.001	0.005	0.002	10	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.011	0.006	0.021	0.005	10	9
Antimony D-Sb	0.02451	0.06614	0.20000	0.00005	9	0
Arsenic D-As	0.00213	0.00628	0.02000	0.00008	10	6
Barium D-Ba	0.0564	0.0095	0.0700	0.0400	10	10
Beryllium D-Be	0.0016	0.0018	0.0050	0.0002	10	0
Bismuth D-Bi	0.0369	0.0494	0.1000	0.0005	6	0
Boron D-B	0.068	0.048	0.100	0.001	9	1
Cadmium D-Cd	0.00011	0.00014	0.00050	0.00005	10	0
Calcium D-Ca	19.9	4.0	26.1	12.8	10	10
Chromium D-Cr	0.0005	0.0003	0.0010	0.0001	10	2
Cobalt D-Co	0.0032	0.0067	0.0200	0.0001	10	0
Copper D-Cu	0.001	0.000	0.002	0.001	10	8
Iron D-Fe	0.02	0.01	0.03	0.00	10	2
Lead D-Pb	0.0006	0.0016	0.0050	0.0001	10	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	2.45	0.55	3.08	1.40	10	10
Manganese D-Mn	0.00648	0.00412	0.01600	0.00244	10	8
Mercury D-Hg	0.00004	0.00002	0.00005	0.00002	9	0
Molybdenum D-Mo	0.01860	0.01478	0.03000	0.00032	10	3
Nickel D-Ni	0.0047	0.0081	0.0200	0.0002	10	3
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	9	1
Selenium D-Se	0.0008	0.0002	0.0010	0.0005	9	0
Silicon D-Si	2.77	0.34	3.21	2.29	6	6
Silver D-Ag	0.00102	0.00316	0.01000	0.00001	10	0
Sodium D-Na	2	0	2	1	10	1
Strontium D-Sr	0.0397	0.0087	0.0520	0.0258	6	6
Thallium D-Tl	0.0006	0.0017	0.0050	0.0001	9	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	9	0
Uranium D-U	0.0068	0.0200	0.0600	0.0001	9	5
Vanadium D-V	0.019	0.015	0.030	0.001	10	0
Zinc D-Zn	0.005	0.002	0.008	0.001	10	5
Total Organic Carbon C	2.867	0.950	3.800	1.900	3	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W10

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	71	16	93	56	4	4
Hardness CaCO3	51.4	5.4	55.7	43.6	4	4
pH	7.63	0.27	7.88	7.28	4	4
Total Suspended Solids	2	0	2	2	2	2
Turbidity (NTU)	0.8	0.2	1.0	0.5	4	4
Alkalinity-Total CaCO3	45	3	48	41	4	4
Chloride Cl	0.5	0.0	0.5	0.5	3	0
Fluoride F	0.08	0.01	0.08	0.07	3	3
Sulphate SO4	9	1	10	7	4	4
Ammonia Nitrogen N	0.040	0.014	0.050	0.030	2	1
Nitrate Nitrogen N	0.006	0.003	0.010	0.005	4	0
Nitrite Nitrogen N	0.008	0.015	0.030	0.001	4	0
Nitrite/Nitrate Nitrogen N	0.005	0.000	0.005	0.005	3	0
Total Cyanide CN	0.005	#DIV/0!	0.005	0.005	1	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.021	0.013	0.040	0.011	4	4
Antimony T-Sb	0.00670	0.01152	0.02000	0.00005	3	1
Arsenic T-As	0.00589	0.00941	0.02000	0.00113	4	3
Barium T-Ba	0.0456	0.0058	0.0500	0.0372	4	4
Beryllium T-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth T-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron T-B	0.034	0.057	0.100	0.001	3	0
Cadmium T-Cd	0.00020	0.00021	0.00050	0.00005	4	0
Calcium T-Ca	15.7	1.7	16.8	13.2	4	4
Chromium T-Cr	0.0006	0.0005	0.0010	0.0001	4	1
Cobalt T-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper T-Cu	0.002	0.002	0.005	0.001	4	3
Iron T-Fe	0.04	0.02	0.07	0.03	4	4
Lead T-Pb	0.0004	0.0005	0.0010	0.0001	3	0
Lithium T-Li	0.006	0.009	0.020	0.001	4	0
Magnesium T-Mg	3.27	0.32	3.52	2.79	4	4
Manganese T-Mn	0.01440	0.00836	0.02650	0.00741	4	4
Mercury T-Hg	0.00029	0.00048	0.00100	0.00005	4	0
Molybdenum T-Mo	0.00921	0.01399	0.03000	0.00089	4	2
Nickel T-Ni	0.0058	0.0095	0.0200	0.0005	4	2
Phosphorus T-P	0.2	0.1	0.3	0.1	3	0
Potassium T-K	2	1	2	1	3	1
Selenium T-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon T-Si	2.63	0.37	3.05	2.34	3	3
Silver T-Ag	0.00004	0.00005	0.00010	0.00001	3	0
Sodium T-Na	2	1	2	1	4	1
Strontium T-Sr	0.0388	0.0058	0.0430	0.0321	3	3
Thallium T-Tl	0.0017	0.0029	0.0050	0.0001	3	0
Tin T-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium T-Ti	0.01	0.01	0.01	0.00	3	0
Uranium T-U	0.0203	0.0344	0.0600	0.0004	3	2
Vanadium T-V	0.009	0.014	0.030	0.001	4	0
Zinc T-Zn	0.005	0.000	0.005	0.005	4	3

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.011	0.004	0.017	0.007	4	3
Antimony D-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic D-As	0.00584	0.00944	0.02000	0.00110	4	3
Barium D-Ba	0.0474	0.0077	0.0580	0.0400	4	4
Beryllium D-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth D-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron D-B	0.038	0.054	0.100	0.001	3	1
Cadmium D-Cd	0.00020	0.00021	0.00050	0.00005	4	0
Calcium D-Ca	15.3	1.6	16.4	12.9	4	4
Chromium D-Cr	0.0006	0.0005	0.0010	0.0001	4	1
Cobalt D-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper D-Cu	0.001	0.001	0.002	0.001	4	3
Iron D-Fe	0.02	0.01	0.03	0.01	4	1
Lead D-Pb	0.0015	0.0024	0.0050	0.0001	4	0
Lithium D-Li	0.006	0.009	0.020	0.001	4	0
Magnesium D-Mg	3.22	0.35	3.57	2.75	4	4
Manganese D-Mn	0.00238	0.00189	0.00500	0.00062	4	3
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	3	0
Molybdenum D-Mo	0.00921	0.01400	0.03000	0.00090	4	2
Nickel D-Ni	0.0057	0.0096	0.0200	0.0004	4	2
Phosphorus D-P	0.2	0.1	0.3	0.1	3	0
Potassium D-K	2	1	2	1	3	1
Selenium D-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon D-Si	2.59	0.33	2.96	2.31	3	3
Silver D-Ag	0.00253	0.00498	0.01000	0.00001	4	0
Sodium D-Na	2	1	2	1	4	1
Strontium D-Sr	0.0383	0.0036	0.0407	0.0341	3	3
Thallium D-Tl	0.0017	0.0029	0.0050	0.0001	3	0
Tin D-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium D-Ti	0.01	0.01	0.01	0.00	3	0
Uranium D-U	0.0203	0.0344	0.0600	0.0004	3	2
Vanadium D-V	0.009	0.014	0.030	0.001	4	0
Zinc D-Zn	0.007	0.007	0.017	0.001	4	2

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W17

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	74	13	99	58	7	7
Hardness CaCO3	53.6	13.1	68.1	33.0	7	7
pH	7.77	0.29	8.09	7.30	7	7
Total Suspended Solids	2	1	3	1	4	0
Turbidity (NTU)	0.4	0.4	1.0	0.1	7	4
Alkalinity-Total CaCO3	49	12	61	29	7	7
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.03	0.01	0.03	0.02	5	4
Sulphate SO4	8	3	11	5	6	6
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	0
Nitrate Nitrogen N	0.027	0.035	0.097	0.008	6	5
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	3
Nitrite/Nitrate Nitrogen N	0.030	0.038	0.098	0.008	5	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.039	0.018	0.073	0.017	7	7
Antimony T-Sb	0.03671	0.08039	0.20000	0.00005	6	1
Arsenic T-As	0.00303	0.00748	0.02000	0.00013	7	5
Barium T-Ba	0.0104	0.0010	0.0125	0.0098	7	4
Beryllium T-Be	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.051	0.054	0.100	0.001	6	0
Cadmium T-Cd	0.00014	0.00017	0.00050	0.00005	7	0
Calcium T-Ca	19.6	5.0	26.3	11.9	7	7
Chromium T-Cr	0.0005	0.0004	0.0010	0.0001	7	3
Cobalt T-Co	0.0045	0.0077	0.0200	0.0001	7	0
Copper T-Cu	0.003	0.001	0.005	0.001	7	7
Iron T-Fe	0.02	0.01	0.03	0.01	7	2
Lead T-Pb	0.0002	0.0004	0.0010	0.0001	6	0
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	1.23	0.32	1.66	0.70	7	7
Manganese T-Mn	0.00241	0.00244	0.00500	0.00006	7	4
Mercury T-Hg	0.00018	0.00036	0.00100	0.00002	7	0
Molybdenum T-Mo	0.01367	0.01537	0.03000	0.00019	7	3
Nickel T-Ni	0.0062	0.0094	0.0200	0.0001	7	2
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	6	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	6	0
Silicon T-Si	2.54	0.37	3.18	2.24	5	5
Silver T-Ag	0.00003	0.00004	0.00010	0.00001	6	0
Sodium T-Na	2	0	2	1	7	1
Strontium T-Sr	0.0145	0.0038	0.0200	0.0098	5	5
Thallium T-Tl	0.0009	0.0020	0.0050	0.0001	6	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	6	0
Uranium T-U	0.0100	0.0245	0.0600	0.0000	6	2
Vanadium T-V	0.014	0.015	0.030	0.001	7	1
Zinc T-Zn	0.003	0.002	0.005	0.001	7	3

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.032	0.019	0.070	0.015	7	7
Antimony D-Sb	0.03671	0.08039	0.20000	0.00005	6	0
Arsenic D-As	0.00302	0.00749	0.02000	0.00012	7	5
Barium D-Ba	0.0132	0.0055	0.0240	0.0096	7	4
Beryllium D-Be	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.052	0.053	0.100	0.001	6	2
Cadmium D-Cd	0.00014	0.00017	0.00050	0.00005	7	0
Calcium D-Ca	19.3	4.7	24.7	12.0	7	7
Chromium D-Cr	0.0005	0.0004	0.0010	0.0001	7	2
Cobalt D-Co	0.0045	0.0077	0.0200	0.0001	7	0
Copper D-Cu	0.003	0.001	0.004	0.001	6	6
Iron D-Fe	0.02	0.01	0.03	0.01	7	2
Lead D-Pb	0.0009	0.0018	0.0050	0.0001	7	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	1.29	0.38	1.70	0.70	7	7
Manganese D-Mn	0.00236	0.00248	0.00500	0.00005	7	2
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	6	0
Molybdenum D-Mo	0.01366	0.01537	0.03000	0.00018	7	3
Nickel D-Ni	0.0062	0.0094	0.0200	0.0001	7	1
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	6	1
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	6	0
Silicon D-Si	2.46	0.21	2.75	2.24	5	5
Silver D-Ag	0.00145	0.00377	0.01000	0.00001	7	1
Sodium D-Na	2	1	2	0	7	1
Strontium D-Sr	0.0131	0.0070	0.0240	0.0050	5	4
Thallium D-Tl	0.0009	0.0020	0.0050	0.0001	6	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	6	0
Uranium D-U	0.0100	0.0245	0.0600	0.0000	6	2
Vanadium D-V	0.014	0.015	0.030	0.001	7	0
Zinc D-Zn	0.005	0.002	0.008	0.001	7	3

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WATER QUALITY AT STATION W18

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	72	14	97	58	6	6
Hardness CaCO3	56.5	7.6	67.6	47.6	6	6
pH	7.75	0.31	8.10	7.37	6	6
Total Suspended Solids	2	1	2	1	3	2
Turbidity (NTU)	0.4	0.4	1.0	0.1	6	4
Alkalinity-Total CaCO3	52	5	58	46	6	6
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.02	0.00	0.02	0.02	5	1
Sulphate SO4	8	2	11	6	6	6
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	0
Nitrate Nitrogen N	0.084	0.061	0.200	0.032	6	6
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	3
Nitrite/Nitrate Nitrogen N	0.081	0.068	0.201	0.033	5	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.024	0.021	0.060	0.008	6	6
Antimony T-Sb	0.04403	0.08762	0.20000	0.00005	5	1
Arsenic T-As	0.00351	0.00808	0.02000	0.00018	6	5
Barium T-Ba	0.0122	0.0022	0.0158	0.0100	6	4
Beryllium T-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	0
Cadmium T-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium T-Ca	21.3	2.9	26.2	17.9	6	6
Chromium T-Cr	0.0006	0.0004	0.0010	0.0002	6	3
Cobalt T-Co	0.0052	0.0082	0.0200	0.0001	6	1
Copper T-Cu	0.002	0.002	0.006	0.001	6	5
Iron T-Fe	0.02	0.01	0.03	0.01	6	2
Lead T-Pb	0.0002	0.0004	0.0010	0.0001	5	1
Lithium T-Li	0.006	0.008	0.020	0.001	6	1
Magnesium T-Mg	0.93	0.12	1.14	0.79	6	6
Manganese T-Mn	0.00215	0.00229	0.00500	0.00005	6	3
Mercury T-Hg	0.00021	0.00039	0.00100	0.00005	6	0
Molybdenum T-Mo	0.01098	0.01484	0.03000	0.00026	6	3
Nickel T-Ni	0.0071	0.0101	0.0200	0.0001	6	1
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	5	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	5	0
Silicon T-Si	2.32	0.28	2.80	2.06	5	5
Silver T-Ag	0.00003	0.00004	0.00010	0.00001	5	0
Sodium T-Na	2	0	2	1	6	1
Strontium T-Sr	0.0177	0.0031	0.0210	0.0145	5	5
Thallium T-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	5	0
Uranium T-U	0.0120	0.0268	0.0600	0.0000	5	4
Vanadium T-V	0.011	0.015	0.030	0.001	6	1
Zinc T-Zn	0.003	0.002	0.005	0.001	6	1

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.017	0.009	0.034	0.008	6	6
Antimony D-Sb	0.04403	0.08762	0.20000	0.00005	5	0
Arsenic D-As	0.00351	0.00808	0.02000	0.00019	6	5
Barium D-Ba	0.0126	0.0029	0.0170	0.0100	5	4
Beryllium D-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.041	0.054	0.100	0.001	5	1
Cadmium D-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium D-Ca	21.0	2.8	25.3	17.7	6	6
Chromium D-Cr	0.0005	0.0004	0.0010	0.0002	6	3
Cobalt D-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper D-Cu	0.002	0.001	0.003	0.001	6	5
Iron D-Fe	0.02	0.01	0.03	0.00	6	0
Lead D-Pb	0.0010	0.0020	0.0050	0.0001	6	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	1.01	0.18	1.22	0.78	6	6
Manganese D-Mn	0.00197	0.00238	0.00500	0.00005	6	2
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.01099	0.01484	0.03000	0.00027	6	3
Nickel D-Ni	0.0071	0.0100	0.0200	0.0001	6	1
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	5	1
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	5	0
Silicon D-Si	2.31	0.26	2.75	2.12	5	5
Silver D-Ag	0.00169	0.00407	0.01000	0.00001	6	0
Sodium D-Na	2	0	2	1	6	1
Strontium D-Sr	0.0173	0.0044	0.0250	0.0148	5	5
Thallium D-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	5	0
Uranium D-U	0.0120	0.0268	0.0600	0.0000	5	4
Vanadium D-V	0.011	0.015	0.030	0.001	6	0
Zinc D-Zn	0.004	0.002	0.006	0.001	6	2

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WATER QUALITY AT STATION W19

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	67	8	80	57	6	6
Hardness CaCO3	55.0	7.3	62.8	42.0	6	6
pH	7.68	0.27	8.00	7.36	6	6
Total Suspended Solids	1	1	2	1	3	1
Turbidity (NTU)	0.3	0.3	1.0	0.1	6	4
Alkalinity-Total CaCO3	50	5	56	43	6	6
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.02	0.00	0.03	0.02	5	1
Sulphate SO4	8	2	11	5	6	6
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	1
Nitrate Nitrogen N	0.070	0.030	0.115	0.042	6	6
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	3
Nitrite/Nitrate Nitrogen N	0.065	0.030	0.116	0.043	5	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.017	0.013	0.040	0.005	6	6
Antimony T-Sb	0.04403	0.08762	0.20000	0.00005	5	1
Arsenic T-As	0.00343	0.00812	0.02000	0.00010	6	5
Barium T-Ba	0.0113	0.0012	0.0131	0.0100	6	5
Beryllium T-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	0
Cadmium T-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium T-Ca	20.1	2.7	23.2	15.5	6	6
Chromium T-Cr	0.0005	0.0004	0.0010	0.0001	6	3
Cobalt T-Co	0.0053	0.0082	0.0200	0.0001	6	1
Copper T-Cu	0.002	0.002	0.006	0.001	6	5
Iron T-Fe	0.23	0.53	1.31	0.01	6	2
Lead T-Pb	0.0002	0.0004	0.0010	0.0001	5	0
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	1.14	0.12	1.30	0.97	6	6
Manganese T-Mn	0.00407	0.00506	0.01330	0.00030	6	4
Mercury T-Hg	0.00021	0.00039	0.00100	0.00005	6	0
Molybdenum T-Mo	0.01094	0.01488	0.03000	0.00019	6	3
Nickel T-Ni	0.0071	0.0101	0.0200	0.0001	6	1
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	5	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	5	0
Silicon T-Si	2.39	0.29	2.86	2.12	5	5
Silver T-Ag	0.00003	0.00004	0.00010	0.00001	5	0
Sodium T-Na	2	0	2	1	6	1
Strontium T-Sr	0.0207	0.0038	0.0250	0.0145	5	5
Thallium T-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	5	0
Uranium T-U	0.0120	0.0268	0.0600	0.0000	5	4
Vanadium T-V	0.011	0.015	0.030	0.001	6	1
Zinc T-Zn	0.003	0.002	0.005	0.001	6	2

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.011	0.007	0.024	0.005	6	6
Antimony D-Sb	0.04403	0.08762	0.20000	0.00005	5	0
Arsenic D-As	0.00343	0.00812	0.02000	0.00010	6	5
Barium D-Ba	0.0124	0.0032	0.0184	0.0100	6	5
Beryllium D-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.041	0.054	0.100	0.001	5	1
Cadmium D-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium D-Ca	20.0	2.7	23.1	15.3	6	6
Chromium D-Cr	0.0005	0.0004	0.0010	0.0002	6	3
Cobalt D-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper D-Cu	0.001	0.001	0.002	0.001	6	4
Iron D-Fe	0.02	0.01	0.03	0.00	6	0
Lead D-Pb	0.0010	0.0020	0.0050	0.0001	6	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	1.21	0.19	1.45	0.93	6	6
Manganese D-Mn	0.00188	0.00242	0.00500	0.00010	6	3
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.01094	0.01488	0.03000	0.00018	6	3
Nickel D-Ni	0.0071	0.0101	0.0200	0.0001	6	1
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	5	0
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	5	0
Silicon D-Si	2.42	0.30	2.93	2.17	5	5
Silver D-Ag	0.00169	0.00407	0.01000	0.00001	6	0
Sodium D-Na	2	0	2	1	6	1
Strontium D-Sr	0.0206	0.0049	0.0280	0.0147	5	5
Thallium D-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	5	0
Uranium D-U	0.0120	0.0268	0.0600	0.0000	5	4
Vanadium D-V	0.011	0.015	0.030	0.001	6	0
Zinc D-Zn	0.004	0.003	0.008	0.001	6	3

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WATER QUALITY AT STATION W20

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	97	17	126	77	6	6
Hardness CaCO3	75.4	15.1	95.6	50.8	6	6
pH	7.73	0.29	8.10	7.37	6	6
Total Suspended Solids	2	2	4	1	3	2
Turbidity (NTU)	0.7	0.5	1.3	0.1	6	5
Alkalinity-Total CaCO3	64	10	75	48	6	6
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.07	0.01	0.08	0.06	5	5
Sulphate SO4	10	3	14	5	6	6
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	1
Nitrate Nitrogen N	0.042	0.032	0.100	0.005	6	4
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	4
Nitrite/Nitrate Nitrogen N	0.027	0.016	0.044	0.005	4	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.037	0.019	0.060	0.015	6	6
Antimony T-Sb	0.04404	0.08761	0.20000	0.00006	5	3
Arsenic T-As	0.00348	0.00809	0.02000	0.00017	6	5
Barium T-Ba	0.0396	0.0084	0.0508	0.0278	6	6
Beryllium T-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	0
Cadmium T-Cd	0.00015	0.00018	0.00050	0.00005	6	2
Calcium T-Ca	19.8	4.1	25.8	13.2	6	6
Chromium T-Cr	0.0005	0.0004	0.0010	0.0001	6	4
Cobalt T-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper T-Cu	0.002	0.001	0.003	0.001	6	5
Iron T-Fe	0.03	0.01	0.05	0.02	6	4
Lead T-Pb	0.0002	0.0004	0.0010	0.0001	5	2
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	6.36	1.29	8.24	4.33	6	6
Manganese T-Mn	0.00229	0.00217	0.00500	0.00019	6	4
Mercury T-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum T-Mo	0.01124	0.01462	0.03000	0.00075	6	3
Nickel T-Ni	0.0075	0.0097	0.0200	0.0009	6	3
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	0	2	1	5	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0006	5	2
Silicon T-Si	3.71	0.74	4.70	2.66	5	5
Silver T-Ag	0.00169	0.00407	0.01000	0.00001	6	1
Sodium T-Na	2	0	2	1	6	1
Strontium T-Sr	0.0616	0.0141	0.0780	0.0416	5	5
Thallium T-Tl	0.0210	0.0442	0.1000	0.0001	5	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	5	0
Uranium T-U	0.0131	0.0262	0.0600	0.0010	5	4
Vanadium T-V	0.011	0.015	0.030	0.001	6	1
Zinc T-Zn	0.004	0.001	0.005	0.002	6	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.027	0.014	0.052	0.015	6	6
Antimony D-Sb	0.04404	0.08761	0.20000	0.00005	5	3
Arsenic D-As	0.00347	0.00810	0.02000	0.00013	6	5
Barium D-Ba	0.0402	0.0072	0.0493	0.0276	6	6
Beryllium D-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.041	0.054	0.100	0.001	5	1
Cadmium D-Cd	0.00015	0.00018	0.00050	0.00005	6	0
Calcium D-Ca	19.7	4.0	25.1	13.2	6	6
Chromium D-Cr	0.0005	0.0004	0.0010	0.0001	6	4
Cobalt D-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper D-Cu	0.001	0.000	0.002	0.001	6	5
Iron D-Fe	0.02	0.01	0.03	0.01	6	4
Lead D-Pb	0.0010	0.0020	0.0050	0.0001	6	1
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	6.35	1.26	7.97	4.30	6	6
Manganese D-Mn	0.00192	0.00240	0.00500	0.00012	6	4
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.01126	0.01461	0.03000	0.00080	6	3
Nickel D-Ni	0.0075	0.0097	0.0200	0.0007	6	3
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	5	1
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	5	1
Silicon D-Si	3.67	0.71	4.58	2.63	5	5
Silver D-Ag	0.00169	0.00407	0.01000	0.00001	6	0
Sodium D-Na	2	0	2	1	6	1
Strontium D-Sr	0.0610	0.0127	0.0710	0.0418	5	5
Thallium D-Tl	0.0210	0.0442	0.1000	0.0001	5	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	5	0
Uranium D-U	0.0131	0.0262	0.0600	0.0010	5	4
Vanadium D-V	0.011	0.015	0.030	0.001	6	0
Zinc D-Zn	0.004	0.002	0.005	0.001	6	3

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	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	115	25	160	79	18	18
Hardness CaCO3	87.5	18.6	132.0	59.1	17	17
pH	7.82	0.23	8.30	7.42	18	18
Total Suspended Solids	5	5	20	1	12	11
Turbidity (NTU)	1.7	1.3	5.7	0.6	17	17
Alkalinity-Total CaCO3	80	16	115	55	18	18
Chloride Cl	0.5	0.1	0.8	0.5	16	5
Fluoride F	0.18	0.22	1.00	0.08	16	15
Sulphate SO4	16	6	31	8	17	17
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	2
Nitrate Nitrogen N	0.027	0.040	0.121	0.005	17	6
Nitrite Nitrogen N	0.031	0.121	0.500	0.001	17	9
Nitrite/Nitrate Nitrogen N	0.018	0.037	0.123	0.005	10	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	1
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.036	0.036	0.158	0.009	17	16
Antimony T-Sb	0.07299	0.09690	0.20000	0.00007	17	8
Arsenic T-As	0.00354	0.00599	0.02000	0.00100	18	16
Barium T-Ba	0.0465	0.0154	0.1000	0.0300	18	18
Beryllium T-Be	0.0025	0.0023	0.0050	0.0002	18	0
Bismuth T-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron T-B	0.058	0.049	0.100	0.003	16	7
Cadmium T-Cd	0.00013	0.00015	0.00050	0.00005	18	2
Calcium T-Ca	23.5	5.2	32.4	15.6	18	18
Chromium T-Cr	0.0011	0.0022	0.0100	0.0002	18	11
Cobalt T-Co	0.0052	0.0069	0.0200	0.0001	18	1
Copper T-Cu	0.002	0.001	0.004	0.001	18	15
Iron T-Fe	0.15	0.09	0.42	0.06	18	18
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	16	12
Lithium T-Li	0.007	0.006	0.020	0.001	17	8
Magnesium T-Mg	8.16	2.15	12.20	5.25	18	18
Manganese T-Mn	0.02683	0.01397	0.06100	0.00820	18	18
Mercury T-Hg	0.00011	0.00023	0.00100	0.00002	17	1
Molybdenum T-Mo	0.01436	0.01445	0.03000	0.00085	18	8
Nickel T-Ni	0.0091	0.0089	0.0200	0.0018	18	9
Phosphorus T-P	0.3	0.1	0.3	0.1	16	0
Potassium T-K	2	0	2	1	17	3
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	16	2
Silicon T-Si	2.60	0.62	4.26	1.95	16	16
Silver T-Ag	0.00008	0.00024	0.00100	0.00001	17	2
Sodium T-Na	2	0	2	2	18	4
Strontium T-Sr	0.0889	0.0251	0.1500	0.0595	16	16
Thallium T-Tl	0.0378	0.0497	0.1000	0.0001	16	0
Tin T-Sn	0.0138	0.0148	0.0300	0.0001	16	0
Titanium T-Ti	0.01	0.00	0.01	0.00	17	0
Uranium T-U	0.0098	0.0223	0.0600	0.0006	13	11
Vanadium T-V	0.016	0.015	0.030	0.001	18	1
Zinc T-Zn	0.005	0.006	0.028	0.002	18	12

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.023	0.046	0.200	0.004	18	14
Antimony D-Sb	0.07302	0.09688	0.20000	0.00007	17	8
Arsenic D-As	0.00339	0.00605	0.02000	0.00070	18	16
Barium D-Ba	0.0485	0.0156	0.0787	0.0300	18	18
Beryllium D-Be	0.0025	0.0023	0.0050	0.0002	18	0
Bismuth D-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron D-B	0.062	0.044	0.100	0.003	16	7
Cadmium D-Cd	0.00012	0.00015	0.00050	0.00005	18	1
Calcium D-Ca	22.6	4.5	33.2	15.2	18	18
Chromium D-Cr	0.0011	0.0022	0.0100	0.0001	18	11
Cobalt D-Co	0.0052	0.0069	0.0200	0.0001	18	1
Copper D-Cu	0.001	0.001	0.003	0.001	18	15
Iron D-Fe	0.06	0.04	0.18	0.01	18	15
Lead D-Pb	0.0008	0.0016	0.0050	0.0001	18	5
Lithium D-Li	0.007	0.007	0.020	0.001	17	7
Magnesium D-Mg	7.80	1.84	12.00	5.13	18	18
Manganese D-Mn	0.00809	0.00745	0.03200	0.00250	18	15
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	16	0
Molybdenum D-Mo	0.01436	0.01445	0.03000	0.00090	18	8
Nickel D-Ni	0.0090	0.0091	0.0200	0.0015	18	9
Phosphorus D-P	0.3	0.1	0.3	0.1	16	0
Potassium D-K	2	0	2	1	17	3
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	16	0
Silicon D-Si	2.55	0.60	4.13	1.98	16	16
Silver D-Ag	0.00063	0.00235	0.01000	0.00001	18	0
Sodium D-Na	2	0	2	2	18	4
Strontium D-Sr	0.0832	0.0176	0.1230	0.0589	16	16
Thallium D-Tl	0.0378	0.0497	0.1000	0.0001	16	0
Tin D-Sn	0.0138	0.0148	0.0300	0.0001	16	1
Titanium D-Ti	0.01	0.00	0.01	0.00	17	0
Uranium D-U	0.0098	0.0223	0.0600	0.0005	13	11
Vanadium D-V	0.016	0.015	0.030	0.001	18	0
Zinc D-Zn	0.007	0.005	0.020	0.001	18	12

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WATER QUALITY AT STATION W22

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	106	40	187	57	17	17
Hardness CaCO3	82.3	32.2	173.0	42.6	16	16
pH	7.81	0.27	8.31	7.40	17	17
Total Suspended Solids	2	2	6	1	11	6
Turbidity (NTU)	0.9	1.0	4.4	0.1	16	16
Alkalinity-Total CaCO3	72	27	142	35	17	17
Chloride Cl	0.5	0.1	1.0	0.5	16	4
Fluoride F	0.15	0.23	1.00	0.06	16	15
Sulphate SO4	17	7	32	9	17	17
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	1
Nitrate Nitrogen N	0.059	0.077	0.228	0.005	17	15
Nitrite Nitrogen N	0.031	0.121	0.500	0.001	17	11
Nitrite/Nitrate Nitrogen N	0.039	0.064	0.230	0.005	11	10
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.024	0.012	0.040	0.005	16	14
Antimony T-Sb	0.07754	0.09818	0.20000	0.00005	16	7
Arsenic T-As	0.00256	0.00656	0.02000	0.00018	17	15
Barium T-Ba	0.0548	0.0156	0.0900	0.0344	17	17
Beryllium T-Be	0.0026	0.0024	0.0050	0.0002	17	0
Bismuth T-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron T-B	0.055	0.050	0.100	0.002	15	7
Cadmium T-Cd	0.00012	0.00015	0.00050	0.00005	17	0
Calcium T-Ca	22.8	8.8	43.9	11.5	17	17
Chromium T-Cr	0.0011	0.0023	0.0100	0.0002	17	9
Cobalt T-Co	0.0055	0.0070	0.0200	0.0001	17	1
Copper T-Cu	0.0013	0.001	0.004	0.0003	17	14
Iron T-Fe	0.07	0.06	0.27	0.00	17	14
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	15	7
Lithium T-Li	0.007	0.006	0.020	0.001	17	8
Magnesium T-Mg	7.13	3.11	15.10	3.49	17	17
Manganese T-Mn	0.00775	0.00532	0.02400	0.00230	17	13
Mercury T-Hg	0.00011	0.00024	0.00100	0.00005	16	0
Molybdenum T-Mo	0.01319	0.01457	0.03000	0.00043	17	7
Nickel T-Ni	0.0090	0.0095	0.0200	0.0008	17	7
Phosphorus T-P	0.3	0.1	0.3	0.1	16	0
Potassium T-K	2	0	2	1	16	3
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	15	2
Silicon T-Si	3.42	0.88	5.31	2.37	16	16
Silver T-Ag	0.00008	0.00025	0.00100	0.00001	16	1
Sodium T-Na	2	0	3	2	17	4
Strontium T-Sr	0.0958	0.0456	0.2060	0.0480	16	16
Thallium T-Tl	0.0337	0.0485	0.1000	0.0001	15	0
Tin T-Sn	0.0138	0.0148	0.0300	0.0001	16	0
Titanium T-Ti	0.01	0.00	0.01	0.00	16	0
Uranium T-U	0.0105	0.0231	0.0600	0.0005	12	10
Vanadium T-V	0.015	0.015	0.030	0.001	17	1
Zinc T-Zn	0.008	0.017	0.073	0.001	17	10

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.025	0.047	0.200	0.005	17	13
Antimony D-Sb	0.07756	0.09817	0.20000	0.00005	16	6
Arsenic D-As	0.00254	0.00657	0.02000	0.00016	17	15
Barium D-Ba	0.0589	0.0201	0.0962	0.0300	17	17
Beryllium D-Be	0.0026	0.0024	0.0050	0.0002	17	0
Bismuth D-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron D-B	0.058	0.046	0.100	0.002	15	7
Cadmium D-Cd	0.00012	0.00015	0.00050	0.00005	17	0
Calcium D-Ca	22.5	8.5	44.5	11.4	17	17
Chromium D-Cr	0.0012	0.0023	0.0100	0.0002	17	11
Cobalt D-Co	0.0055	0.0070	0.0200	0.0001	17	2
Copper D-Cu	0.001	0.000	0.002	0.000	17	13
Iron D-Fe	0.03	0.03	0.12	0.00	17	12
Lead D-Pb	0.0008	0.0016	0.0050	0.0001	17	4
Lithium D-Li	0.007	0.006	0.020	0.001	17	7
Magnesium D-Mg	7.05	2.97	15.10	3.45	17	17
Manganese D-Mn	0.00334	0.00252	0.00800	0.00073	17	11
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	15	0
Molybdenum D-Mo	0.01319	0.01457	0.03000	0.00038	17	7
Nickel D-Ni	0.0089	0.0096	0.0200	0.0007	17	7
Phosphorus D-P	0.3	0.1	0.3	0.1	16	0
Potassium D-K	2	0	2	1	16	3
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	15	1
Silicon D-Si	3.45	0.96	5.74	2.27	16	16
Silver D-Ag	0.00067	0.00242	0.01000	0.00001	17	1
Sodium D-Na	2	0	3	2	17	5
Strontium D-Sr	0.0940	0.0445	0.2080	0.0470	16	16
Thallium D-Tl	0.0337	0.0485	0.1000	0.0001	15	0
Tin D-Sn	0.0138	0.0148	0.0300	0.0001	16	0
Titanium D-Ti	0.01	0.00	0.01	0.00	16	0
Uranium D-U	0.0105	0.0231	0.0600	0.0005	12	10
Vanadium D-V	0.015	0.015	0.030	0.001	17	0
Zinc D-Zn	0.007	0.006	0.021	0.001	17	7

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WATER QUALITY AT STATION W23

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	61	15	104	42	16	16
Hardness CaCO3	40.2	9.2	55.2	21.0	15	15
pH	7.48	0.30	7.99	7.07	16	16
Total Suspended Solids	1	1	4	1	11	1
Turbidity (NTU)	0.6	0.3	1.0	0.2	15	15
Alkalinity-Total CaCO3	33	9	53	16	16	16
Chloride Cl	0.5	0.0	0.6	0.5	16	2
Fluoride F	0.14	0.23	1.00	0.06	16	15
Sulphate SO4	12	4	20	5	16	16
Ammonia Nitrogen N	0.013	0.011	0.020	0.005	2	0
Nitrate Nitrogen N	0.056	0.091	0.300	0.005	16	15
Nitrite Nitrogen N	0.033	0.125	0.500	0.001	16	8
Nitrite/Nitrate Nitrogen N	0.030	0.062	0.215	0.005	11	10
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.033	0.014	0.070	0.010	14	14
Antimony T-Sb	0.08136	0.10039	0.20000	0.00005	15	0
Arsenic T-As	0.00132	0.00498	0.02000	0.00005	16	11
Barium T-Ba	0.0229	0.0048	0.0319	0.0178	16	16
Beryllium T-Be	0.0027	0.0023	0.0050	0.0002	16	0
Bismuth T-Bi	0.0482	0.0504	0.1000	0.0005	15	0
Boron T-B	0.054	0.051	0.100	0.001	15	3
Cadmium T-Cd	0.00010	0.00012	0.00050	0.00005	16	0
Calcium T-Ca	11.0	2.9	17.2	5.6	16	16
Chromium T-Cr	0.0016	0.0033	0.0100	0.0001	16	9
Cobalt T-Co	0.0058	0.0071	0.0200	0.0001	16	1
Copper T-Cu	0.001	0.001	0.003	0.001	16	13
Iron T-Fe	0.10	0.05	0.22	0.04	16	16
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	15	4
Lithium T-Li	0.007	0.006	0.020	0.001	16	8
Magnesium T-Mg	3.44	0.96	5.53	1.73	16	16
Manganese T-Mn	0.00751	0.00389	0.02000	0.00485	16	12
Mercury T-Hg	0.00005	0.00000	0.00006	0.00005	15	1
Molybdenum T-Mo	0.01359	0.01499	0.03000	0.00018	16	7
Nickel T-Ni	0.0094	0.0097	0.0200	0.0008	16	7
Phosphorus T-P	0.3	0.1	0.3	0.1	15	0
Potassium T-K	2	0	2	1	15	2
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	14	1
Silicon T-Si	3.19	1.02	5.67	1.94	15	15
Silver T-Ag	0.00008	0.00025	0.00100	0.00001	16	1
Sodium T-Na	2	0	2	2	16	2
Strontium T-Sr	0.0395	0.0107	0.0650	0.0240	15	15
Thallium T-Tl	0.0357	0.0497	0.1000	0.0001	14	0
Tin T-Sn	0.0144	0.0152	0.0300	0.0001	15	1
Titanium T-Ti	0.01	0.00	0.01	0.00	15	0
Uranium T-U	0.0068	0.0187	0.0600	0.0007	10	9
Vanadium T-V	0.016	0.015	0.030	0.001	16	0
Zinc T-Zn	0.004	0.003	0.012	0.001	16	5

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.045	0.062	0.200	0.006	16	13
Antimony D-Sb	0.08139	0.10037	0.20000	0.00005	15	3
Arsenic D-As	0.00132	0.00498	0.02000	0.00005	16	10
Barium D-Ba	0.0331	0.0194	0.0753	0.0175	16	16
Beryllium D-Be	0.0027	0.0023	0.0050	0.0002	16	0
Bismuth D-Bi	0.0482	0.0504	0.1000	0.0005	15	0
Boron D-B	0.058	0.047	0.100	0.001	15	4
Cadmium D-Cd	0.00010	0.00012	0.00050	0.00005	16	0
Calcium D-Ca	11.0	2.8	17.1	5.6	16	16
Chromium D-Cr	0.0017	0.0033	0.0100	0.0001	16	10
Cobalt D-Co	0.0058	0.0071	0.0200	0.0001	16	0
Copper D-Cu	0.001	0.000	0.002	0.000	16	13
Iron D-Fe	0.06	0.04	0.16	0.01	16	15
Lead D-Pb	0.0005	0.0012	0.0050	0.0001	16	4
Lithium D-Li	0.007	0.006	0.020	0.001	16	7
Magnesium D-Mg	3.45	0.93	5.42	1.72	16	16
Manganese D-Mn	0.00553	0.00324	0.01700	0.00210	16	11
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	15	1
Molybdenum D-Mo	0.01359	0.01499	0.03000	0.00019	16	7
Nickel D-Ni	0.0094	0.0097	0.0200	0.0007	16	7
Phosphorus D-P	0.3	0.1	0.3	0.1	15	0
Potassium D-K	2	0	2	1	15	2
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	14	0
Silicon D-Si	3.17	0.99	5.61	1.89	15	15
Silver D-Ag	0.00008	0.00025	0.00100	0.00001	16	0
Sodium D-Na	2	0	2	2	16	2
Strontium D-Sr	0.0399	0.0106	0.0640	0.0240	15	15
Thallium D-Tl	0.0357	0.0497	0.1000	0.0001	14	0
Tin D-Sn	0.0144	0.0152	0.0300	0.0001	15	2
Titanium D-Ti	0.01	0.00	0.01	0.00	15	0
Uranium D-U	0.0068	0.0187	0.0600	0.0007	10	9
Vanadium D-V	0.016	0.015	0.030	0.001	16	0
Zinc D-Zn	0.008	0.008	0.025	0.001	16	8

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WATER QUALITY AT STATION W24

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	227	80	444	133	16	16
Hardness CaCO3	199.8	84.2	428.0	98.2	16	16
pH	7.66	0.39	8.06	6.68	16	16
Total Suspended Solids	12	25	89	1	12	11
Turbidity (NTU)	4.7	9.6	40.2	0.7	16	16
Alkalinity-Total CaCO3	185	85	411	87	15	15
Chloride Cl	0.6	0.1	0.9	0.5	15	5
Fluoride F	0.18	0.05	0.31	0.10	15	15
Sulphate SO4	28	9	43	13	15	15
Acidity (to pH 8.3) CaCO3	1	#DIV/0!	1	1	1	1
Alkalinity-Total CaCO3	127	#DIV/0!	127	127	1	1
Ammonia Nitrogen N	0.013	0.011	0.020	0.005	2	1
Nitrate Nitrogen N	0.028	0.061	0.203	0.005	15	4
Nitrite Nitrogen N	0.001	0.000	0.002	0.001	15	8
Nitrite/Nitrate Nitrogen N	0.025	0.063	0.205	0.005	10	2
Total Cyanide CN	0.007	0.002	0.008	0.005	2	1
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.088	0.193	0.790	0.005	16	14
Antimony T-Sb	0.08010	0.10134	0.20000	0.00010	15	8
Arsenic T-As	0.00248	0.00104	0.00500	0.00080	16	16
Barium T-Ba	0.0554	0.0143	0.0900	0.0300	16	16
Beryllium T-Be	0.0028	0.0023	0.0050	0.0005	16	0
Bismuth T-Bi	0.0503	0.0516	0.1000	0.0005	14	0
Boron T-B	0.057	0.050	0.100	0.001	16	7
Cadmium T-Cd	0.00008	0.00005	0.00020	0.00005	16	2
Calcium T-Ca	50.6	20.8	107.0	25.3	16	16
Chromium T-Cr	0.0013	0.0024	0.0100	0.0002	16	10
Cobalt T-Co	0.0058	0.0071	0.0200	0.0001	16	3
Copper T-Cu	0.001	0.001	0.006	0.001	16	14
Iron T-Fe	0.56	0.51	2.35	0.09	16	16
Lead T-Pb	0.0003	0.0005	0.0019	0.0001	16	9
Lithium T-Li	0.010	0.007	0.020	0.003	15	9
Magnesium T-Mg	18.09	8.47	42.40	8.96	16	16
Manganese T-Mn	0.07328	0.06355	0.28100	0.02860	16	16
Mercury T-Hg	0.00005	0.00001	0.00006	0.00002	16	1
Molybdenum T-Mo	0.01563	0.01484	0.03000	0.00066	16	8
Nickel T-Ni	0.0107	0.0087	0.0200	0.0020	16	9
Phosphorus T-P	0.3	0.0	0.3	0.3	14	0
Potassium T-K	2	0	3	2	15	2
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	15	2
Silicon T-Si	4.12	1.48	7.91	2.57	14	14
Silver T-Ag	0.00002	0.00003	0.00010	0.00001	16	1
Sodium T-Na	2	1	4	2	16	2
Strontium T-Sr	0.1570	0.0709	0.3410	0.0790	14	14
Thallium T-Tl	0.0400	0.0507	0.1000	0.0001	15	0
Tin T-Sn	0.0151	0.0155	0.0300	0.0001	14	1
Titanium T-Ti	0.01	0.00	0.02	0.01	15	1
Uranium T-U	0.0018	0.0005	0.0028	0.0013	11	11
Vanadium T-V	0.017	0.015	0.030	0.001	16	1
Zinc T-Zn	0.006	0.005	0.018	0.002	16	10

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.024	0.048	0.200	0.003	16	13
Antimony D-Sb	0.08013	0.10131	0.20000	0.00010	15	8
Arsenic D-As	0.00172	0.00072	0.00320	0.00029	16	16
Barium D-Ba	0.0599	0.0179	0.0917	0.0300	16	16
Beryllium D-Be	0.0028	0.0023	0.0050	0.0005	16	0
Bismuth D-Bi	0.0503	0.0516	0.1000	0.0005	14	0
Boron D-B	0.061	0.046	0.100	0.001	16	7
Cadmium D-Cd	0.00007	0.00005	0.00020	0.00005	16	2
Calcium D-Ca	50.3	20.3	104.0	24.9	16	16
Chromium D-Cr	0.0012	0.0024	0.0100	0.0002	16	11
Cobalt D-Co	0.0057	0.0072	0.0200	0.0001	16	1
Copper D-Cu	0.001	0.000	0.002	0.000	16	14
Iron D-Fe	0.21	0.11	0.41	0.02	16	15
Lead D-Pb	0.0002	0.0003	0.0010	0.0001	16	5
Lithium D-Li	0.010	0.007	0.020	0.002	15	9
Magnesium D-Mg	18.00	8.24	41.10	8.78	16	16
Manganese D-Mn	0.04686	0.06327	0.27100	0.01660	16	16
Mercury D-Hg	0.00005	0.00001	0.00006	0.00002	16	1
Molybdenum D-Mo	0.01567	0.01480	0.03000	0.00100	16	8
Nickel D-Ni	0.0102	0.0090	0.0200	0.0010	16	8
Phosphorus D-P	0.3	0.0	0.3	0.3	14	0
Potassium D-K	2	0	3	2	15	3
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	15	1
Silicon D-Si	4.03	1.45	7.60	2.46	14	14
Silver D-Ag	0.00002	0.00003	0.00010	0.00001	16	0
Sodium D-Na	2	1	4	2	16	2
Strontium D-Sr	0.1549	0.0683	0.3260	0.0770	14	14
Thallium D-Tl	0.0400	0.0507	0.1000	0.0001	15	0
Tin D-Sn	0.0151	0.0155	0.0300	0.0001	14	1
Titanium D-Ti	0.01	0.00	0.01	0.01	15	0
Uranium D-U	0.0017	0.0004	0.0025	0.0010	11	11
Vanadium D-V	0.017	0.015	0.030	0.001	16	0
Zinc D-Zn	0.010	0.009	0.037	0.002	16	11

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WATER QUALITY AT STATION W25

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	49	10	70	38	12	12
Hardness CaCO3	33.4	7.7	51.4	26.2	11	11
pH	7.30	0.30	7.80	6.65	12	12
Total Suspended Solids	4	6	20	1	8	8
Turbidity (NTU)	1.6	2.1	7.8	0.4	11	11
Alkalinity-Total CaCO3	31	8	46	20	12	12
Chloride Cl	0.5	0.1	0.8	0.5	11	4
Fluoride F	0.17	0.28	1.00	0.07	11	10
Sulphate SO4	7	2	10	4	11	11
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.016	0.006	0.020	0.011	2	2
Nitrate Nitrogen N	0.026	0.031	0.100	0.005	11	7
Nitrite Nitrogen N	0.047	0.150	0.500	0.001	11	6
Nitrite/Nitrate Nitrogen N	0.019	0.023	0.068	0.005	7	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.077	0.148	0.543	0.010	12	11
Antimony T-Sb	0.09276	0.10284	0.20000	0.00005	11	0
Arsenic T-As	0.00261	0.00550	0.02000	0.00050	12	11
Barium T-Ba	0.0469	0.0223	0.1100	0.0300	12	12
Beryllium T-Be	0.0031	0.0023	0.0050	0.0002	12	0
Bismuth T-Bi	0.0622	0.0492	0.1000	0.0005	10	0
Boron T-B	0.073	0.046	0.100	0.001	11	0
Cadmium T-Cd	0.00019	0.00027	0.00092	0.00005	12	1
Calcium T-Ca	10.0	2.3	13.9	7.1	12	12
Chromium T-Cr	0.0005	0.0004	0.0010	0.0001	12	3
Cobalt T-Co	0.0069	0.0076	0.0200	0.0001	12	0
Copper T-Cu	0.001	0.001	0.003	0.000	12	9
Iron T-Fe	0.13	0.24	0.88	0.04	12	12
Lead T-Pb	0.0006	0.0014	0.0050	0.0001	12	3
Lithium T-Li	0.009	0.007	0.020	0.001	11	0
Magnesium T-Mg	2.36	0.53	3.44	1.70	12	12
Manganese T-Mn	0.09408	0.22714	0.81300	0.00800	12	12
Mercury T-Hg	0.00005	0.00001	0.00005	0.00002	11	0
Molybdenum T-Mo	0.01825	0.01456	0.03000	0.00091	12	4
Nickel T-Ni	0.0104	0.0100	0.0200	0.0002	12	3
Phosphorus T-P	0.3	0.1	0.3	0.1	10	0
Potassium T-K	2	0	2	1	11	2
Selenium T-Se	0.0008	0.0003	0.0010	0.0005	11	0
Silicon T-Si	2.86	0.80	4.26	2.23	10	10
Silver T-Ag	0.00011	0.00028	0.00100	0.00001	12	1
Sodium T-Na	2	0	2	1	12	2
Strontium T-Sr	0.0272	0.0060	0.0360	0.0199	10	10
Thallium T-Tl	0.0400	0.0516	0.1000	0.0001	10	0
Tin T-Sn	0.0185	0.0149	0.0300	0.0001	10	0
Titanium T-Ti	0.01	0.00	0.01	0.00	11	0
Uranium T-U	0.0080	0.0210	0.0600	0.0002	8	7
Vanadium T-V	0.020	0.014	0.030	0.001	12	0
Zinc T-Zn	0.009	0.016	0.059	0.002	12	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.026	0.021	0.076	0.005	12	9
Antimony D-Sb	0.09276	0.10284	0.20000	0.00005	11	0
Arsenic D-As	0.00241	0.00554	0.02000	0.00050	12	11
Barium D-Ba	0.0406	0.0128	0.0700	0.0300	12	12
Beryllium D-Be	0.0031	0.0023	0.0050	0.0002	12	0
Bismuth D-Bi	0.0622	0.0492	0.1000	0.0005	10	0
Boron D-B	0.073	0.046	0.100	0.001	11	1
Cadmium D-Cd	0.00011	0.00013	0.00050	0.00005	12	1
Calcium D-Ca	9.9	2.4	14.6	7.5	12	12
Chromium D-Cr	0.0006	0.0004	0.0010	0.0001	12	5
Cobalt D-Co	0.0069	0.0076	0.0200	0.0001	12	0
Copper D-Cu	0.001	0.001	0.002	0.000	12	9
Iron D-Fe	0.04	0.03	0.11	0.01	12	8
Lead D-Pb	0.0007	0.0014	0.0050	0.0001	12	3
Lithium D-Li	0.009	0.007	0.020	0.001	11	0
Magnesium D-Mg	2.41	0.56	3.61	1.80	12	12
Manganese D-Mn	0.01712	0.02101	0.07700	0.00437	12	9
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	11	0
Molybdenum D-Mo	0.01825	0.01457	0.03000	0.00093	12	4
Nickel D-Ni	0.0104	0.0100	0.0200	0.0002	12	3
Phosphorus D-P	0.3	0.1	0.3	0.1	10	0
Potassium D-K	2	0	2	1	11	2
Selenium D-Se	0.0008	0.0003	0.0010	0.0005	11	0
Silicon D-Si	2.87	0.80	4.23	2.22	10	10
Silver D-Ag	0.00011	0.00028	0.00100	0.00001	12	1
Sodium D-Na	2	0	2	1	12	2
Strontium D-Sr	0.0272	0.0067	0.0370	0.0200	10	10
Thallium D-Tl	0.0400	0.0516	0.1000	0.0001	10	0
Tin D-Sn	0.0185	0.0149	0.0300	0.0001	10	0
Titanium D-Ti	0.01	0.00	0.01	0.00	11	0
Uranium D-U	0.0078	0.0211	0.0600	0.0002	8	7
Vanadium D-V	0.020	0.014	0.030	0.001	12	0
Zinc D-Zn	0.008	0.009	0.033	0.002	12	7

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WATER QUALITY AT STATION W26

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	171	32	268	127	17	17
Hardness CaCO3	146.7	18.5	175.0	105.0	16	16
pH	7.83	0.24	8.31	7.48	17	17
Total Suspended Solids	34	94	332	1	12	11
Turbidity (NTU)	7.4	17.1	71.4	1.2	16	16
Alkalinity-Total CaCO3	136	18	161	95	17	17
Chloride Cl	0.6	0.1	0.9	0.5	16	4
Fluoride F	0.25	0.21	1.00	0.02	16	14
Sulphate SO4	17	3	24	12	16	16
Acidity (to pH 8.3) CaCO3	1	#DIV/0!	1	1	1	1
Ammonia Nitrogen N	0.018	0.018	0.030	0.005	2	2
Nitrate Nitrogen N	0.056	0.062	0.198	0.005	16	12
Nitrite Nitrogen N	0.039	0.124	0.500	0.001	16	13
Nitrite/Nitrate Nitrogen N	0.081	0.070	0.206	0.005	10	9
Total Cyanide CN	0.006	0.001	0.007	0.005	2	1
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.040	0.026	0.094	0.005	16	14
Antimony T-Sb	0.07640	0.09900	0.20000	0.00018	16	9
Arsenic T-As	0.00758	0.00392	0.02000	0.00306	17	16
Barium T-Ba	0.0666	0.0157	0.1140	0.0400	17	17
Beryllium T-Be	0.0026	0.0023	0.0050	0.0002	17	0
Bismuth T-Bi	0.0482	0.0504	0.1000	0.0005	15	0
Boron T-B	0.057	0.050	0.100	0.001	16	6
Cadmium T-Cd	0.00009	0.00012	0.00050	0.00005	17	3
Calcium T-Ca	36.6	5.2	45.2	26.0	17	17
Chromium T-Cr	0.0011	0.0023	0.0100	0.0001	17	10
Cobalt T-Co	0.0055	0.0070	0.0200	0.0001	17	1
Copper T-Cu	0.001	0.001	0.003	0.001	17	14
Iron T-Fe	0.30	0.31	1.45	0.04	17	17
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	16	6
Lithium T-Li	0.007	0.006	0.020	0.001	16	7
Magnesium T-Mg	14.06	1.96	17.30	9.95	17	17
Manganese T-Mn	0.09189	0.04054	0.18200	0.02600	17	17
Mercury T-Hg	0.00005	0.00001	0.00007	0.00002	16	1
Molybdenum T-Mo	0.01540	0.01420	0.03000	0.00142	17	8
Nickel T-Ni	0.0099	0.0087	0.0200	0.0024	17	10
Phosphorus T-P	0.3	0.0	0.3	0.2	15	1
Potassium T-K	2	0	2	1	16	2
Selenium T-Se	0.0009	0.0001	0.0010	0.0005	15	3
Silicon T-Si	2.56	0.77	5.08	1.81	15	15
Silver T-Ag	0.00008	0.00024	0.00100	0.00001	17	1
Sodium T-Na	2	0	2	2	17	2
Strontium T-Sr	0.1468	0.0232	0.1830	0.1060	15	15
Thallium T-Tl	0.0400	0.0507	0.1000	0.0001	15	0
Tin T-Sn	0.0144	0.0152	0.0300	0.0001	15	0
Titanium T-Ti	0.01	0.00	0.01	0.00	16	1
Uranium T-U	0.0073	0.0166	0.0600	0.0019	12	11
Vanadium T-V	0.016	0.015	0.030	0.001	17	1
Zinc T-Zn	0.004	0.001	0.006	0.002	17	8

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.027	0.048	0.200	0.004	17	12
Antimony D-Sb	0.07644	0.09897	0.20000	0.00018	16	9
Arsenic D-As	0.00673	0.00404	0.02000	0.00274	17	16
Barium D-Ba	0.0716	0.0159	0.0964	0.0400	17	17
Beryllium D-Be	0.0026	0.0023	0.0050	0.0002	17	0
Bismuth D-Bi	0.0482	0.0504	0.1000	0.0005	15	0
Boron D-B	0.061	0.046	0.100	0.001	16	6
Cadmium D-Cd	0.00010	0.00011	0.00050	0.00005	17	2
Calcium D-Ca	36.2	4.6	42.7	25.8	17	17
Chromium D-Cr	0.0011	0.0023	0.0100	0.0001	17	11
Cobalt D-Co	0.0055	0.0071	0.0200	0.0001	17	0
Copper D-Cu	0.001	0.001	0.003	0.001	17	14
Iron D-Fe	0.11	0.11	0.39	0.01	17	14
Lead D-Pb	0.0005	0.0012	0.0050	0.0001	17	4
Lithium D-Li	0.007	0.006	0.020	0.001	16	7
Magnesium D-Mg	13.94	1.75	16.60	9.91	17	17
Manganese D-Mn	0.04703	0.05011	0.18900	0.00500	17	16
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	16	0
Molybdenum D-Mo	0.01541	0.01420	0.03000	0.00154	17	8
Nickel D-Ni	0.0098	0.0088	0.0200	0.0020	17	9
Phosphorus D-P	0.3	0.0	0.3	0.2	15	1
Potassium D-K	2	0	2	1	16	2
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	15	2
Silicon D-Si	2.50	0.74	4.96	1.80	15	15
Silver D-Ag	0.00008	0.00024	0.00100	0.00001	17	1
Sodium D-Na	2	0	2	2	17	4
Strontium D-Sr	0.1447	0.0196	0.1750	0.1050	15	15
Thallium D-Tl	0.0400	0.0507	0.1000	0.0001	15	0
Tin D-Sn	0.0144	0.0152	0.0300	0.0001	15	2
Titanium D-Ti	0.01	0.00	0.01	0.00	16	0
Uranium D-U	0.0073	0.0166	0.0600	0.0020	12	11
Vanadium D-V	0.016	0.015	0.030	0.001	17	0
Zinc D-Zn	0.007	0.005	0.018	0.002	17	11

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WATER QUALITY AT STATION W27

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	89	42	167	56	6	6
Hardness CaCO3	73.1	43.3	160.0	41.7	6	6
pH	7.58	0.44	8.29	6.99	6	6
Total Suspended Solids	5	5	10	1	3	3
Turbidity (NTU)	1.2	0.6	2.1	0.6	6	6
Alkalinity-Total CaCO3	70	38	145	43	6	6
Chloride Cl	0.5	0.0	0.5	0.5	6	0
Fluoride F	0.13	0.03	0.17	0.10	6	6
Sulphate SO4	10	9	28	5	6	6
Ammonia Nitrogen N	0.013	0.011	0.020	0.005	2	0
Nitrate Nitrogen N	0.023	0.038	0.101	0.005	6	3
Nitrite Nitrogen N	0.001	0.000	0.001	0.001	6	3
Nitrite/Nitrate Nitrogen N	0.008	0.004	0.012	0.005	5	2
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.021	0.008	0.034	0.014	5	5
Antimony T-Sb	0.04009	0.08939	0.20000	0.00005	5	1
Arsenic T-As	0.00138	0.00059	0.00188	0.00030	6	6
Barium T-Ba	0.0846	0.0072	0.0915	0.0733	6	6
Beryllium T-Be	0.0028	0.0025	0.0050	0.0005	6	0
Bismuth T-Bi	0.0403	0.0545	0.1000	0.0005	5	0
Boron T-B	0.051	0.054	0.100	0.001	6	1
Cadmium T-Cd	0.00010	0.00008	0.00020	0.00005	6	0
Calcium T-Ca	19.7	10.2	39.9	11.7	6	6
Chromium T-Cr	0.0021	0.0039	0.0100	0.0002	6	3
Cobalt T-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper T-Cu	0.001	0.000	0.001	0.000	6	4
Iron T-Fe	0.13	0.06	0.18	0.01	6	5
Lead T-Pb	0.0004	0.0005	0.0010	0.0001	6	1
Lithium T-Li	0.007	0.008	0.020	0.001	6	0
Magnesium T-Mg	6.00	4.64	15.40	3.15	6	6
Manganese T-Mn	0.04358	0.02483	0.08280	0.00600	6	6
Mercury T-Hg	0.00005	0.00000	0.00005	0.00005	6	0
Molybdenum T-Mo	0.01101	0.01471	0.03000	0.00115	6	4
Nickel T-Ni	0.0072	0.0099	0.0200	0.0007	6	4
Phosphorus T-P	0.3	0.0	0.3	0.3	5	0
Potassium T-K	2	1	2	0	5	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	6	1
Silicon T-Si	3.09	0.85	4.57	2.52	5	5
Silver T-Ag	0.00004	0.00005	0.00010	0.00001	6	0
Sodium T-Na	2	0	2	2	6	1
Strontium T-Sr	0.0673	0.0588	0.1720	0.0315	5	5
Thallium T-Tl	0.0200	0.0447	0.1000	0.0001	5	0
Tin T-Sn	0.0121	0.0164	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.01	5	0
Uranium T-U	0.0004	0.0002	0.0006	0.0002	3	3
Vanadium T-V	0.016	0.016	0.030	0.001	6	0
Zinc T-Zn	0.003	0.002	0.005	0.001	6	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.041	0.078	0.200	0.005	6	4
Antimony D-Sb	0.04007	0.08940	0.20000	0.00005	5	1
Arsenic D-As	0.00120	0.00053	0.00170	0.00020	6	6
Barium D-Ba	0.0815	0.0088	0.0900	0.0700	6	6
Beryllium D-Be	0.0028	0.0025	0.0050	0.0005	6	0
Bismuth D-Bi	0.0403	0.0545	0.1000	0.0005	5	0
Boron D-B	0.051	0.053	0.100	0.001	6	1
Cadmium D-Cd	0.00010	0.00008	0.00020	0.00005	6	0
Calcium D-Ca	19.4	10.0	39.3	11.5	6	6
Chromium D-Cr	0.0021	0.0039	0.0100	0.0001	6	3
Cobalt D-Co	0.0053	0.0082	0.0200	0.0001	6	1
Copper D-Cu	0.001	0.000	0.001	0.000	6	4
Iron D-Fe	0.08	0.04	0.12	0.01	6	5
Lead D-Pb	0.0004	0.0005	0.0010	0.0001	6	0
Lithium D-Li	0.007	0.008	0.020	0.001	6	0
Magnesium D-Mg	5.96	4.47	15.00	3.14	6	6
Manganese D-Mn	0.01990	0.01156	0.03520	0.00500	6	5
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	6	0
Molybdenum D-Mo	0.01101	0.01471	0.03000	0.00116	6	4
Nickel D-Ni	0.0072	0.0099	0.0200	0.0006	6	4
Phosphorus D-P	0.3	0.0	0.3	0.3	5	0
Potassium D-K	2	1	2	0	5	1
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	6	1
Silicon D-Si	3.00	0.79	4.41	2.55	5	5
Silver D-Ag	0.00004	0.00005	0.00010	0.00001	6	0
Sodium D-Na	2	0	2	2	6	1
Strontium D-Sr	0.0672	0.0563	0.1670	0.0317	5	5
Thallium D-Tl	0.0200	0.0447	0.1000	0.0001	5	0
Tin D-Sn	0.0121	0.0164	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.01	5	0
Uranium D-U	0.0004	0.0002	0.0006	0.0002	3	3
Vanadium D-V	0.016	0.016	0.030	0.001	6	0
Zinc D-Zn	0.004	0.002	0.005	0.001	6	3

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	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	136	96	435	70	14	14
Hardness CaCO3	115.2	91.9	406.0	51.1	13	13
pH	7.76	0.24	8.12	7.37	14	14
Total Suspended Solids	23	29	100	1	10	10
Turbidity (NTU)	3.7	6.9	26.4	0.4	13	13
Alkalinity-Total CaCO3	99	74	340	41	14	14
Chloride Cl	0.5	0.1	0.9	0.5	14	4
Fluoride F	0.17	0.24	1.00	0.06	14	13
Sulphate SO4	20	20	78	6	14	14
Ammonia Nitrogen N	0.013	0.011	0.020	0.005	2	0
Nitrate Nitrogen N	0.033	0.079	0.300	0.005	14	8
Nitrite Nitrogen N	0.037	0.133	0.500	0.001	14	7
Nitrite/Nitrate Nitrogen N	0.014	0.023	0.080	0.005	10	6
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.111	0.123	0.495	0.007	14	12
Antimony T-Sb	0.09391	0.10237	0.20000	0.00011	13	6
Arsenic T-As	0.00204	0.00520	0.02000	0.00020	14	13
Barium T-Ba	0.0778	0.0454	0.2100	0.0400	14	14
Beryllium T-Be	0.0027	0.0024	0.0050	0.0002	14	0
Bismuth T-Bi	0.0479	0.0505	0.1000	0.0005	13	0
Boron T-B	0.055	0.051	0.100	0.002	13	6
Cadmium T-Cd	0.00016	0.00018	0.00061	0.00005	14	9
Calcium T-Ca	28.6	20.2	92.0	13.1	14	14
Chromium T-Cr	0.0016	0.0025	0.0100	0.0005	14	9
Cobalt T-Co	0.0066	0.0073	0.0200	0.0001	14	6
Copper T-Cu	0.003	0.001	0.006	0.001	14	13
Iron T-Fe	0.24	0.37	1.47	0.02	14	13
Lead T-Pb	0.0010	0.0018	0.0053	0.0001	14	12
Lithium T-Li	0.007	0.007	0.020	0.001	14	0
Magnesium T-Mg	11.02	10.09	43.60	4.46	14	14
Manganese T-Mn	0.03138	0.05117	0.19600	0.00500	14	12
Mercury T-Hg	0.00005	0.00000	0.00005	0.00005	13	0
Molybdenum T-Mo	0.01577	0.01481	0.03000	0.00074	14	6
Nickel T-Ni	0.0116	0.0088	0.0200	0.0020	14	6
Phosphorus T-P	0.3	0.1	0.3	0.1	13	0
Potassium T-K	2	0	2	0	13	1
Selenium T-Se	0.0011	0.0004	0.0024	0.0005	12	2
Silicon T-Si	3.86	1.84	9.23	2.19	13	13
Silver T-Ag	0.00009	0.00026	0.00100	0.00001	14	3
Sodium T-Na	2	1	4	2	14	2
Strontium T-Sr	0.1236	0.0920	0.3920	0.0550	13	13
Thallium T-Tl	0.0334	0.0492	0.1000	0.0001	12	0
Tin T-Sn	0.0143	0.0152	0.0300	0.0001	13	0
Titanium T-Ti	0.01	0.00	0.01	0.00	13	0
Uranium T-U	0.0065	0.0188	0.0600	0.0002	10	9
Vanadium T-V	0.016	0.015	0.030	0.001	14	1
Zinc T-Zn	0.012	0.021	0.084	0.003	14	9

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.046	0.062	0.200	0.005	14	11
Antimony D-Sb	0.09395	0.10233	0.20000	0.00010	13	6
Arsenic D-As	0.00186	0.00524	0.02000	0.00019	14	13
Barium D-Ba	0.0818	0.0400	0.2000	0.0357	14	14
Beryllium D-Be	0.0027	0.0024	0.0050	0.0002	14	0
Bismuth D-Bi	0.0479	0.0505	0.1000	0.0005	13	0
Boron D-B	0.060	0.046	0.100	0.002	13	6
Cadmium D-Cd	0.00013	0.00013	0.00050	0.00005	14	4
Calcium D-Ca	29.2	19.9	92.0	13.1	14	14
Chromium D-Cr	0.0014	0.0025	0.0100	0.0003	14	9
Cobalt D-Co	0.0065	0.0073	0.0200	0.0001	14	1
Copper D-Cu	0.002	0.001	0.005	0.001	14	13
Iron D-Fe	0.08	0.12	0.45	0.01	14	10
Lead D-Pb	0.0006	0.0013	0.0050	0.0001	14	7
Lithium D-Li	0.007	0.007	0.020	0.001	14	0
Magnesium D-Mg	11.29	9.74	42.80	4.46	14	14
Manganese D-Mn	0.01770	0.02452	0.07400	0.00262	14	11
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	13	0
Molybdenum D-Mo	0.01578	0.01479	0.03000	0.00076	14	6
Nickel D-Ni	0.0112	0.0092	0.0200	0.0017	14	6
Phosphorus D-P	0.3	0.1	0.3	0.1	13	0
Potassium D-K	2	0	2	0	13	1
Selenium D-Se	0.0011	0.0004	0.0023	0.0005	12	3
Silicon D-Si	3.83	1.78	9.06	2.55	13	13
Silver D-Ag	0.00009	0.00026	0.00100	0.00001	14	1
Sodium D-Na	2	1	4	2	14	2
Strontium D-Sr	0.1272	0.0883	0.3870	0.0547	13	13
Thallium D-Tl	0.0334	0.0492	0.1000	0.0001	12	0
Tin D-Sn	0.0143	0.0151	0.0300	0.0001	13	1
Titanium D-Ti	0.01	0.00	0.01	0.00	13	0
Uranium D-U	0.0065	0.0188	0.0600	0.0002	10	9
Vanadium D-V	0.016	0.015	0.030	0.001	14	0
Zinc D-Zn	0.012	0.008	0.030	0.003	14	11

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	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	136	96	435	70	14	14
Hardness CaCO3	115.2	91.9	406.0	51.1	13	13
pH	7.76	0.24	8.12	7.37	14	14
Total Suspended Solids	23	29	100	1	10	10
Turbidity (NTU)	3.7	6.9	26.4	0.4	13	13
Alkalinity-Total CaCO3	99	74	340	41	14	14
Chloride Cl	0.5	0.1	0.9	0.5	14	4
Fluoride F	0.17	0.24	1.00	0.06	14	13
Sulphate SO4	20	20	78	6	14	14
Ammonia Nitrogen N	0.013	0.011	0.020	0.005	2	0
Nitrate Nitrogen N	0.033	0.079	0.300	0.005	14	8
Nitrite Nitrogen N	0.037	0.133	0.500	0.001	14	7
Nitrite/Nitrate Nitrogen N	0.014	0.023	0.080	0.005	10	6
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.111	0.123	0.495	0.007	14	12
Antimony T-Sb	0.09391	0.10237	0.20000	0.00011	13	6
Arsenic T-As	0.00204	0.00520	0.02000	0.00020	14	13
Barium T-Ba	0.0778	0.0454	0.2100	0.0400	14	14
Beryllium T-Be	0.0027	0.0024	0.0050	0.0002	14	0
Bismuth T-Bi	0.0479	0.0505	0.1000	0.0005	13	0
Boron T-B	0.055	0.051	0.100	0.002	13	6
Cadmium T-Cd	0.00016	0.00018	0.00061	0.00005	14	9
Calcium T-Ca	28.6	20.2	92.0	13.1	14	14
Chromium T-Cr	0.0016	0.0025	0.0100	0.0005	14	9
Cobalt T-Co	0.0066	0.0073	0.0200	0.0001	14	6
Copper T-Cu	0.003	0.001	0.006	0.001	14	13
Iron T-Fe	0.24	0.37	1.47	0.02	14	13
Lead T-Pb	0.0010	0.0018	0.0053	0.0001	14	12
Lithium T-Li	0.007	0.007	0.020	0.001	14	0
Magnesium T-Mg	11.02	10.09	43.60	4.46	14	14
Manganese T-Mn	0.03138	0.05117	0.19600	0.00500	14	12
Mercury T-Hg	0.00005	0.00000	0.00005	0.00005	13	0
Molybdenum T-Mo	0.01577	0.01481	0.03000	0.00074	14	6
Nickel T-Ni	0.0116	0.0088	0.0200	0.0020	14	6
Phosphorus T-P	0.3	0.1	0.3	0.1	13	0
Potassium T-K	2	0	2	0	13	1
Selenium T-Se	0.0011	0.0004	0.0024	0.0005	12	2
Silicon T-Si	3.86	1.84	9.23	2.19	13	13
Silver T-Ag	0.00009	0.00026	0.00100	0.00001	14	3
Sodium T-Na	2	1	4	2	14	2
Strontium T-Sr	0.1236	0.0920	0.3920	0.0550	13	13
Thallium T-Tl	0.0334	0.0492	0.1000	0.0001	12	0
Tin T-Sn	0.0143	0.0152	0.0300	0.0001	13	0
Titanium T-Ti	0.01	0.00	0.01	0.00	13	0
Uranium T-U	0.0065	0.0188	0.0600	0.0002	10	9
Vanadium T-V	0.016	0.015	0.030	0.001	14	1
Zinc T-Zn	0.012	0.021	0.084	0.003	14	9

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.046	0.062	0.200	0.005	14	11
Antimony D-Sb	0.09395	0.10233	0.20000	0.00010	13	6
Arsenic D-As	0.00186	0.00524	0.02000	0.00019	14	13
Barium D-Ba	0.0818	0.0400	0.2000	0.0357	14	14
Beryllium D-Be	0.0027	0.0024	0.0050	0.0002	14	0
Bismuth D-Bi	0.0479	0.0505	0.1000	0.0005	13	0
Boron D-B	0.060	0.046	0.100	0.002	13	6
Cadmium D-Cd	0.00013	0.00013	0.00050	0.00005	14	4
Calcium D-Ca	29.2	19.9	92.0	13.1	14	14
Chromium D-Cr	0.0014	0.0025	0.0100	0.0003	14	9
Cobalt D-Co	0.0065	0.0073	0.0200	0.0001	14	1
Copper D-Cu	0.002	0.001	0.005	0.001	14	13
Iron D-Fe	0.08	0.12	0.45	0.01	14	10
Lead D-Pb	0.0006	0.0013	0.0050	0.0001	14	7
Lithium D-Li	0.007	0.007	0.020	0.001	14	0
Magnesium D-Mg	11.29	9.74	42.80	4.46	14	14
Manganese D-Mn	0.01770	0.02452	0.07400	0.00262	14	11
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	13	0
Molybdenum D-Mo	0.01578	0.01479	0.03000	0.00076	14	6
Nickel D-Ni	0.0112	0.0092	0.0200	0.0017	14	6
Phosphorus D-P	0.3	0.1	0.3	0.1	13	0
Potassium D-K	2	0	2	0	13	1
Selenium D-Se	0.0011	0.0004	0.0023	0.0005	12	3
Silicon D-Si	3.83	1.78	9.06	2.55	13	13
Silver D-Ag	0.00009	0.00026	0.00100	0.00001	14	1
Sodium D-Na	2	1	4	2	14	2
Strontium D-Sr	0.1272	0.0883	0.3870	0.0547	13	13
Thallium D-Tl	0.0334	0.0492	0.1000	0.0001	12	0
Tin D-Sn	0.0143	0.0151	0.0300	0.0001	13	1
Titanium D-Ti	0.01	0.00	0.01	0.00	13	0
Uranium D-U	0.0065	0.0188	0.0600	0.0002	10	9
Vanadium D-V	0.016	0.015	0.030	0.001	14	0
Zinc D-Zn	0.012	0.008	0.030	0.003	14	11

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WATER QUALITY AT STATION W29

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	152	47	198	73	5	5
Hardness CaCO3	137.5	49.5	180.0	52.7	5	5
pH	7.70	0.30	8.14	7.33	5	5
Total Suspended Solids	8	7	15	2	4	4
Turbidity (NTU)	2.4	2.0	5.0	0.7	5	5
Alkalinity-Total CaCO3	127	45	167	50	5	5
Chloride Cl	0.5	0.0	0.6	0.5	5	1
Fluoride F	0.17	0.07	0.24	0.10	5	5
Sulphate SO4	19	7	27	9	5	5
Ammonia Nitrogen N	0.020	#DIV/0!	0.020	0.020	1	1
Nitrate Nitrogen N	0.058	0.078	0.179	0.005	5	2
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	5	3
Nitrite/Nitrate Nitrogen N	0.049	0.089	0.182	0.005	4	1
Total Cyanide CN	0.011	#DIV/0!	0.011	0.011	1	1
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.024	0.026	0.070	0.005	5	4
Antimony T-Sb	0.04019	0.08934	0.20000	0.00013	5	4
Arsenic T-As	0.00447	0.00408	0.00986	0.00030	5	5
Barium T-Ba	0.0677	0.0245	0.1000	0.0338	5	5
Beryllium T-Be	0.0023	0.0025	0.0050	0.0005	5	0
Bismuth T-Bi	0.0403	0.0545	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	2
Cadmium T-Cd	0.00009	0.00007	0.00020	0.00005	5	1
Calcium T-Ca	34.8	11.5	44.5	15.2	5	5
Chromium T-Cr	0.0006	0.0005	0.0012	0.0002	5	4
Cobalt T-Co	0.0023	0.0043	0.0100	0.0001	5	3
Copper T-Cu	0.001	0.000	0.002	0.001	5	4
Iron T-Fe	0.16	0.22	0.53	0.02	5	5
Lead T-Pb	0.0003	0.0004	0.0010	0.0001	5	3
Lithium T-Li	0.005	0.005	0.010	0.001	5	2
Magnesium T-Mg	12.93	5.18	17.20	4.05	5	5
Manganese T-Mn	0.03277	0.03754	0.09010	0.00386	5	5
Mercury T-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum T-Mo	0.00743	0.01263	0.03000	0.00085	5	4
Nickel T-Ni	0.0056	0.0081	0.0200	0.0010	5	4
Phosphorus T-P	0.3	0.0	0.3	0.3	5	0
Potassium T-K	2	1	2	0	5	1
Selenium T-Se	0.0011	0.0002	0.0014	0.0010	5	2
Silicon T-Si	2.75	1.18	4.70	1.69	5	5
Silver T-Ag	0.00003	0.00004	0.00010	0.00001	5	0
Sodium T-Na	2	0	2	2	5	1
Strontium T-Sr	0.1380	0.0549	0.1800	0.0470	5	5
Thallium T-Tl	0.0400	0.0547	0.1000	0.0001	5	0
Tin T-Sn	0.0121	0.0164	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.01	5	0
Uranium T-U	0.0017	0.0011	0.0024	0.0005	3	3
Vanadium T-V	0.013	0.016	0.030	0.001	5	1
Zinc T-Zn	0.006	0.002	0.009	0.003	5	4

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.007	0.006	0.018	0.002	5	3
Antimony D-Sb	0.04017	0.08935	0.20000	0.00007	5	4
Arsenic D-As	0.00381	0.00327	0.00762	0.00020	5	5
Barium D-Ba	0.0682	0.0217	0.0900	0.0327	5	5
Beryllium D-Be	0.0023	0.0025	0.0050	0.0005	5	0
Bismuth D-Bi	0.0403	0.0545	0.1000	0.0005	5	0
Boron D-B	0.044	0.051	0.100	0.001	5	3
Cadmium D-Cd	0.00008	0.00007	0.00020	0.00005	5	0
Calcium D-Ca	34.1	11.4	44.0	14.6	5	5
Chromium D-Cr	0.0005	0.0005	0.0011	0.0001	5	4
Cobalt D-Co	0.0023	0.0043	0.0100	0.0001	5	0
Copper D-Cu	0.001	0.001	0.003	0.001	5	4
Iron D-Fe	0.03	0.01	0.04	0.01	5	3
Lead D-Pb	0.0003	0.0004	0.0010	0.0001	5	1
Lithium D-Li	0.005	0.005	0.010	0.001	5	2
Magnesium D-Mg	12.74	5.13	17.10	3.91	5	5
Manganese D-Mn	0.00783	0.00530	0.01590	0.00287	5	3
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.00742	0.01264	0.03000	0.00082	5	4
Nickel D-Ni	0.0054	0.0082	0.0200	0.0009	5	4
Phosphorus D-P	0.3	0.0	0.3	0.3	5	0
Potassium D-K	2	1	2	0	5	1
Selenium D-Se	0.0011	0.0001	0.0013	0.0010	5	2
Silicon D-Si	2.67	1.13	4.49	1.58	5	5
Silver D-Ag	0.00003	0.00004	0.00010	0.00001	5	0
Sodium D-Na	2	0	2	2	5	1
Strontium D-Sr	0.1355	0.0531	0.1790	0.0455	5	5
Thallium D-Tl	0.0400	0.0547	0.1000	0.0001	5	0
Tin D-Sn	0.0121	0.0164	0.0300	0.0001	5	1
Titanium D-Ti	0.01	0.00	0.01	0.01	5	0
Uranium D-U	0.0018	0.0012	0.0025	0.0005	3	3
Vanadium D-V	0.013	0.016	0.030	0.001	5	0
Zinc D-Zn	0.008	0.006	0.019	0.005	5	4

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W30 - Go Creek below the Airstrip

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	102	28	122	82	2	2
Total Dissolved Solids	59	20	73	45	2	2
Hardness CaCO3	47.8	18.9	61.1	34.4	2	2
pH	8.00	0.13	8.09	7.90	2	2
Total Suspended Solids	3	0	3	3	2	0
Turbidity (NTU)	0.3	0.1	0.3	0.2	2	2
Alkalinity-Total CaCO3	44	15	54	33	2	2
Chloride Cl	0.5	0.0	0.5	0.5	2	0
Fluoride F	0.03	0.01	0.03	0.02	2	1
Sulphate SO4	6	2	7	4	2	2
Ammonia Nitrogen N	0.005	0.000	0.005	0.005	2	0
Nitrate Nitrogen N	0.022	0.008	0.027	0.016	2	2
Nitrite Nitrogen N	0.001	0.000	0.001	0.001	2	0
Nitrite/Nitrate Nitrogen N	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Dissolved ortho-Phosphate P	0.002	0.001	0.003	0.001	2	1
Total Dissolved Phosphate P	0.004	0.001	0.005	0.003	2	2
Total Phosphate P	0.006	0.001	0.007	0.005	2	2
Total Cyanide CN	#DIV/0!	#DIV/0!	0.000	0.000	0	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.022	0.013	0.031	0.012	2	2
Antimony T-Sb	0.00010	0.00000	0.00010	0.00010	2	0
Arsenic T-As	0.00010	0.00000	0.00010	0.00010	2	2
Barium T-Ba	0.0400	0.0283	0.0600	0.0200	2	2
Beryllium T-Be	0.0010	0.0000	0.0010	0.0010	2	0
Bismuth T-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron T-B	0.100	0.000	0.100	0.100	2	0
Cadmium T-Cd	0.00005	0.00000	0.00005	0.00005	2	0
Calcium T-Ca	16.2	5.9	20.4	12.0	2	2
Chromium T-Cr	0.0005	0.0000	0.0005	0.0005	2	0
Cobalt T-Co	0.0001	0.0000	0.0001	0.0001	2	0
Copper T-Cu	0.002	0.001	0.002	0.001	2	2
Iron T-Fe	0.03	0.00	0.03	0.03	2	1
Lead T-Pb	0.0001	0.0000	0.0001	0.0001	2	0
Lithium T-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium T-Mg	1.60	0.85	2.20	1.00	2	2
Manganese T-Mn	0.00550	0.00071	0.00600	0.00500	2	1
Mercury T-Hg	0.00002	0.00000	0.00002	0.00002	2	0
Molybdenum T-Mo	0.03000	0.00000	0.03000	0.03000	2	0
Nickel T-Ni	0.0010	0.0000	0.0010	0.0010	2	0
Phosphorus T-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium T-K	2	0	2	2	2	0
Selenium T-Se	0.0006	0.0001	0.0007	0.0005	2	1
Silicon T-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver T-Ag	0.00001	0.00000	0.00001	0.00001	2	0
Sodium T-Na	2	0	2	2	2	0
Strontium T-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium T-Tl	0.0001	0.0000	0.0001	0.0001	2	0
Tin T-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium T-Ti	0.01	0.00	0.01	0.01	2	0
Uranium T-U	0.0001	0.0000	0.0001	0.0001	2	1
Vanadium T-V	0.030	0.000	0.030	0.030	2	0
Zinc T-Zn	0.005	0.000	0.005	0.005	2	0

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.020	0.013	0.029	0.011	2	2
Antimony D-Sb	0.00010	0.00000	0.00010	0.00010	2	0
Arsenic D-As	0.00010	0.00000	0.00010	0.00010	2	2
Barium D-Ba	0.0400	0.0283	0.0600	0.0200	2	2
Beryllium D-Be	0.0010	0.0000	0.0010	0.0010	2	0
Bismuth D-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron D-B	0.100	0.000	0.100	0.100	2	0
Cadmium D-Cd	0.00005	0.00000	0.00005	0.00005	2	0
Calcium D-Ca	16.4	6.1	20.7	12.1	2	2
Chromium D-Cr	0.0005	0.0000	0.0005	0.0005	2	0
Cobalt D-Co	0.0001	0.0000	0.0001	0.0001	2	0
Copper D-Cu	0.002	0.001	0.002	0.001	2	2
Iron D-Fe	0.03	0.00	0.03	0.03	2	0
Lead D-Pb	0.0001	0.0000	0.0001	0.0001	2	0
Lithium D-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium D-Mg	1.65	0.92	2.30	1.00	2	2
Manganese D-Mn	0.00500	0.00000	0.00500	0.00500	2	1
Mercury D-Hg	0.00002	0.00000	0.00002	0.00002	2	0
Molybdenum D-Mo	0.03000	0.00000	0.03000	0.03000	2	0
Nickel D-Ni	0.0010	0.0000	0.0010	0.0010	2	0
Phosphorus D-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium D-K	2	0	2	2	2	0
Selenium D-Se	0.0006	0.0001	0.0007	0.0005	2	1
Silicon D-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver D-Ag	0.00001	0.00000	0.00001	0.00001	2	0
Sodium D-Na	2	0	2	2	2	0
Strontium D-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium D-Tl	0.0001	0.0000	0.0001	0.0001	2	0
Tin D-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium D-Ti	0.01	0.00	0.01	0.01	2	0
Uranium D-U	0.0001	0.0000	0.0001	0.0001	2	1
Vanadium D-V	0.030	0.000	0.030	0.030	2	0
Zinc D-Zn	0.005	0.000	0.005	0.005	2	0

Total Organic Carbon C	3.600	0.566	4.000	3.200	2	2

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W31 - Go Creek above the Airstrip

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	92	30	113	71	2	2
Total Dissolved Solids	53	19	66	39	2	2
Hardness CaCO3	41.6	18.5	54.7	28.5	2	2
pH	7.99	0.28	8.19	7.79	2	2
Total Suspended Solids	3	0	3	3	2	0
Turbidity (NTU)	0.2	0.0	0.2	0.2	2	2
Alkalinity-Total CaCO3	38	16	49	27	2	2
Chloride Cl	0.5	0.0	0.5	0.5	2	0
Fluoride F	0.02	0.00	0.02	0.02	2	0
Sulphate SO4	5	3	7	3	2	2
Ammonia Nitrogen N	0.005	0.000	0.005	0.005	2	0
Nitrate Nitrogen N	0.018	0.018	0.031	0.005	2	1
Nitrite Nitrogen N	0.001	0.000	0.001	0.001	2	0
Nitrite/Nitrate Nitrogen N	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Dissolved ortho-Phosphate P	0.001	0.000	0.001	0.001	2	0
Total Dissolved Phosphate P	0.005	0.004	0.007	0.002	2	1
Total Phosphate P	0.006	0.003	0.008	0.004	2	2
Total Cyanide CN	#DIV/0!	#DIV/0!	0.000	0.000	0	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.028	0.016	0.039	0.017	2	2
Antimony T-Sb	0.00010	0.00000	0.00010	0.00010	2	0
Arsenic T-As	0.00010	0.00000	0.00010	0.00010	2	2
Barium T-Ba	0.0100	0.0000	0.0100	0.0100	2	1
Beryllium T-Be	0.0010	0.0000	0.0010	0.0010	2	0
Bismuth T-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron T-B	0.100	0.000	0.100	0.100	2	0
Cadmium T-Cd	0.00005	0.00000	0.00005	0.00005	2	0
Calcium T-Ca	15.2	6.9	20.1	10.3	2	2
Chromium T-Cr	0.0005	0.0000	0.0005	0.0005	2	0
Cobalt T-Co	0.0001	0.0000	0.0001	0.0001	2	0
Copper T-Cu	0.002	0.001	0.003	0.002	2	2
Iron T-Fe	0.03	0.00	0.03	0.03	2	0
Lead T-Pb	0.0001	0.0000	0.0001	0.0001	2	0
Lithium T-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium T-Mg	0.85	0.35	1.10	0.60	2	2
Manganese T-Mn	0.00500	0.00000	0.00500	0.00500	2	0
Mercury T-Hg	0.00002	0.00000	0.00002	0.00002	2	0
Molybdenum T-Mo	0.03000	0.00000	0.03000	0.03000	2	0
Nickel T-Ni	0.0010	0.0000	0.0010	0.0010	2	0
Phosphorus T-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium T-K	2	0	2	2	2	0
Selenium T-Se	0.0005	0.0000	0.0005	0.0005	2	1
Silicon T-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver T-Ag	0.00001	0.00000	0.00001	0.00001	2	0
Sodium T-Na	2	0	2	2	2	0
Strontium T-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium T-Tl	0.0001	0.0000	0.0001	0.0001	2	0
Tin T-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium T-Ti	0.01	0.00	0.01	0.01	2	0
Uranium T-U	0.0001	0.0000	0.0001	0.0001	2	0
Vanadium T-V	0.030	0.000	0.030	0.030	2	0
Zinc T-Zn	0.005	0.000	0.005	0.005	2	0

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.026	0.016	0.037	0.015	2	2
Antimony D-Sb	0.00010	0.00000	0.00010	0.00010	2	0
Arsenic D-As	0.00010	0.00000	0.00010	0.00010	2	2
Barium D-Ba	0.0100	0.0000	0.0100	0.0100	2	1
Beryllium D-Be	0.0010	0.0000	0.0010	0.0010	2	0
Bismuth D-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron D-B	0.100	0.000	0.100	0.100	2	0
Cadmium D-Cd	0.00005	0.00000	0.00005	0.00005	2	0
Calcium D-Ca	15.3	6.8	20.1	10.5	2	2
Chromium D-Cr	0.0005	0.0000	0.0005	0.0005	2	0
Cobalt D-Co	0.0001	0.0000	0.0001	0.0001	2	0
Copper D-Cu	0.002	0.001	0.002	0.002	2	2
Iron D-Fe	0.03	0.00	0.03	0.03	2	0
Lead D-Pb	0.0001	0.0000	0.0001	0.0001	2	0
Lithium D-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium D-Mg	0.85	0.35	1.10	0.60	2	2
Manganese D-Mn	0.00500	0.00000	0.00500	0.00500	2	0
Mercury D-Hg	0.00002	0.00000	0.00002	0.00002	2	0
Molybdenum D-Mo	0.03000	0.00000	0.03000	0.03000	2	0
Nickel D-Ni	0.0010	0.0000	0.0010	0.0010	2	0
Phosphorus D-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium D-K	2	0	2	2	2	0
Selenium D-Se	0.0005	0.0000	0.0005	0.0005	2	0
Silicon D-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver D-Ag	0.00001	0.00000	0.00001	0.00001	2	0
Sodium D-Na	2	0	2	2	2	0
Strontium D-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium D-Tl	0.0001	0.0000	0.0001	0.0001	2	0
Tin D-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium D-Ti	0.01	0.00	0.01	0.01	2	0
Uranium D-U	0.0001	0.0000	0.0001	0.0001	2	0
Vanadium D-V	0.030	0.000	0.030	0.030	2	0
Zinc D-Zn	0.005	0.000	0.005	0.005	2	0
Total Organic Carbon C	3.500	0.990	4.200	2.800	2	2

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W32- Little Wolverine Creek above Portal Location

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	173	6	177	169	2	2
Total Dissolved Solids	98	2	99	96	2	2
Hardness CaCO3	82.2	6.3	86.6	77.7	2	2
pH	8.15	0.18	8.27	8.02	2	2
Total Suspended Solids	3	0	3	3	2	1
Turbidity (NTU)	0.5	0.2	0.6	0.3	2	2
Alkalinity-Total CaCO3	64	0	64	64	2	2
Chloride Cl	0.5	0.0	0.5	0.5	2	0
Fluoride F	0.09	0.03	0.11	0.07	2	2
Sulphate SO4	16	0	16	16	2	2
Ammonia Nitrogen N	0.005	0.000	0.005	0.005	2	0
Nitrate Nitrogen N	0.158	0.025	0.175	0.140	2	2
Nitrite Nitrogen N	0.001	0.000	0.001	0.001	2	0
Nitrite/Nitrate Nitrogen N	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Dissolved ortho-Phosphate P	0.004	0.001	0.005	0.003	2	2
Total Dissolved Phosphate P	0.008	0.001	0.009	0.007	2	2
Total Phosphate P	0.011	0.006	0.015	0.007	2	2
Total Cyanide CN	#DIV/0!	#DIV/0!	0.000	0.000	0	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.009	0.002	0.010	0.007	2	2
Antimony T-Sb	0.00010	0.00000	0.00010	0.00010	2	0
Arsenic T-As	0.00010	0.00000	0.00010	0.00010	2	1
Barium T-Ba	0.1500	0.0141	0.1600	0.1400	2	2
Beryllium T-Be	0.0010	0.0000	0.0010	0.0010	2	0
Bismuth T-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron T-B	0.100	0.000	0.100	0.100	2	0
Cadmium T-Cd	0.00049	0.00025	0.00067	0.00031	2	2
Calcium T-Ca	28.2	3.2	30.4	25.9	2	2
Chromium T-Cr	0.0005	0.0000	0.0005	0.0005	2	0
Cobalt T-Co	0.0001	0.0000	0.0001	0.0001	2	0
Copper T-Cu	0.001	0.000	0.001	0.001	2	2
Iron T-Fe	0.14	0.10	0.21	0.07	2	2
Lead T-Pb	0.0001	0.0000	0.0001	0.0001	2	1
Lithium T-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium T-Mg	2.50	0.28	2.70	2.30	2	2
Manganese T-Mn	0.02150	0.01909	0.03500	0.00800	2	2
Mercury T-Hg	0.00002	0.00000	0.00002	0.00002	2	0
Molybdenum T-Mo	0.03000	0.00000	0.03000	0.03000	2	0
Nickel T-Ni	0.0015	0.0007	0.0020	0.0010	2	1
Phosphorus T-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium T-K	2	0	2	2	2	0
Selenium T-Se	0.0021	0.0006	0.0025	0.0016	2	2
Silicon T-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver T-Ag	0.00001	0.00000	0.00001	0.00001	2	0
Sodium T-Na	2	0	2	2	2	0
Strontium T-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium T-Tl	0.0001	0.0000	0.0001	0.0001	2	0
Tin T-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium T-Ti	0.01	0.00	0.01	0.01	2	0
Uranium T-U	0.0002	0.0001	0.0002	0.0001	2	2
Vanadium T-V	0.030	0.000	0.030	0.030	2	0
Zinc T-Zn	0.041	0.019	0.054	0.027	2	2

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.007	0.001	0.007	0.006	2	2
Antimony D-Sb	0.00010	0.00000	0.00010	0.00010	2	0
Arsenic D-As	0.00010	0.00000	0.00010	0.00010	2	0
Barium D-Ba	0.1500	0.0141	0.1600	0.1400	2	2
Beryllium D-Be	0.0010	0.0000	0.0010	0.0010	2	0
Bismuth D-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron D-B	0.100	0.000	0.100	0.100	2	0
Cadmium D-Cd	0.00041	0.00018	0.00054	0.00028	2	2
Calcium D-Ca	28.7	3.0	30.8	26.5	2	2
Chromium D-Cr	0.0005	0.0000	0.0005	0.0005	2	0
Cobalt D-Co	0.0001	0.0000	0.0001	0.0001	2	0
Copper D-Cu	0.001	0.000	0.001	0.001	2	2
Iron D-Fe	0.06	0.04	0.08	0.03	2	1
Lead D-Pb	0.0001	0.0000	0.0001	0.0001	2	0
Lithium D-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium D-Mg	2.60	0.28	2.80	2.40	2	2
Manganese D-Mn	0.01600	0.01556	0.02700	0.00500	2	2
Mercury D-Hg	0.00002	0.00000	0.00002	0.00002	2	0
Molybdenum D-Mo	0.03000	0.00000	0.03000	0.03000	2	0
Nickel D-Ni	0.0015	0.0007	0.0020	0.0010	2	1
Phosphorus D-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium D-K	2	0	2	2	2	0
Selenium D-Se	0.0017	0.0005	0.0020	0.0013	2	2
Silicon D-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver D-Ag	0.00001	0.00000	0.00001	0.00001	2	0
Sodium D-Na	2	0	2	2	2	0
Strontium D-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium D-Tl	0.0001	0.0000	0.0001	0.0001	2	0
Tin D-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium D-Ti	0.01	0.00	0.01	0.01	2	0
Uranium D-U	0.0002	0.0001	0.0002	0.0001	2	2
Vanadium D-V	0.030	0.000	0.030	0.030	2	0
Zinc D-Zn	0.041	0.016	0.052	0.030	2	2

Total Organic Carbon C	2.550	0.778	3.100	2.000	2	2

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W33- Spring Water from Drainage Channel

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Conductivity (umhos/cm)	203	#DIV/0!	203	203	1	1
Total Dissolved Solids	117	#DIV/0!	117	117	1	1
Hardness CaCO3	95.9	#DIV/0!	95.9	95.9	1	1
pH	8.02	#DIV/0!	8.02	8.02	1	1
Total Suspended Solids	3	#DIV/0!	3	3	1	0
Turbidity (NTU)	0.2	#DIV/0!	0.2	0.2	1	1
Alkalinity-Total CaCO3	83	#DIV/0!	83	83	1	1
Chloride Cl	0.5	#DIV/0!	0.5	0.5	1	0
Fluoride F	0.03	#DIV/0!	0.03	0.03	1	1
Sulphate SO4	15	#DIV/0!	15	15	1	1
Ammonia Nitrogen N	0.005	#DIV/0!	0.005	0.005	1	0
Nitrate Nitrogen N	0.532	#DIV/0!	0.532	0.532	1	1
Nitrite Nitrogen N	0.001	#DIV/0!	0.001	0.001	1	0
Nitrite/Nitrate Nitrogen N	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Dissolved ortho-Phosphate P	0.001	#DIV/0!	0.001	0.001	1	0
Total Dissolved Phosphate P	0.002	#DIV/0!	0.002	0.002	1	0
Total Phosphate P	0.002	#DIV/0!	0.002	0.002	1	0
Total Cyanide CN	#DIV/0!	#DIV/0!	0.000	0.000	0	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.048	#DIV/0!	0.048	0.048	1	1
Antimony T-Sb	0.00010	#DIV/0!	0.00010	0.00010	1	0
Arsenic T-As	0.00010	#DIV/0!	0.00010	0.00010	1	0
Barium T-Ba	0.1600	#DIV/0!	0.1600	0.1600	1	1
Beryllium T-Be	0.0010	#DIV/0!	0.0010	0.0010	1	0
Bismuth T-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron T-B	0.100	#DIV/0!	0.100	0.100	1	0
Cadmium T-Cd	0.00005	#DIV/0!	0.00005	0.00005	1	0
Calcium T-Ca	35.1	#DIV/0!	35.1	35.1	1	1
Chromium T-Cr	0.0005	#DIV/0!	0.0005	0.0005	1	0
Cobalt T-Co	0.0001	#DIV/0!	0.0001	0.0001	1	0
Copper T-Cu	0.001	#DIV/0!	0.001	0.001	1	1
Iron T-Fe	0.05	#DIV/0!	0.05	0.05	1	1
Lead T-Pb	0.0001	#DIV/0!	0.0001	0.0001	1	1
Lithium T-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium T-Mg	2.00	#DIV/0!	2.00	2.00	1	1
Manganese T-Mn	0.02900	#DIV/0!	0.02900	0.02900	1	1
Mercury T-Hg	0.00002	#DIV/0!	0.00002	0.00002	1	0
Molybdenum T-Mo	0.03000	#DIV/0!	0.03000	0.03000	1	0
Nickel T-Ni	0.0010	#DIV/0!	0.0010	0.0010	1	0
Phosphorus T-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium T-K	2	#DIV/0!	2	2	1	0
Selenium T-Se	0.0010	#DIV/0!	0.0010	0.0010	1	0
Silicon T-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver T-Ag	0.00001	#DIV/0!	0.00001	0.00001	1	0
Sodium T-Na	2	#DIV/0!	2	2	1	0
Strontium T-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium T-Tl	0.0001	#DIV/0!	0.0001	0.0001	1	0
Tin T-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium T-Ti	0.01	#DIV/0!	0.01	0.01	1	0
Uranium T-U	0.0002	#DIV/0!	0.0002	0.0002	1	1
Vanadium T-V	0.030	#DIV/0!	0.030	0.030	1	0
Zinc T-Zn	0.007	#DIV/0!	0.007	0.007	1	1

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.005	#DIV/0!	0.005	0.005	1	0
Antimony D-Sb	0.00010	#DIV/0!	0.00010	0.00010	1	0
Arsenic D-As	0.00010	#DIV/0!	0.00010	0.00010	1	0
Barium D-Ba	0.1600	#DIV/0!	0.1600	0.1600	1	1
Beryllium D-Be	0.0010	#DIV/0!	0.0010	0.0010	1	0
Bismuth D-Bi	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Boron D-B	0.100	#DIV/0!	0.100	0.100	1	0
Cadmium D-Cd	0.00005	#DIV/0!	0.00005	0.00005	1	0
Calcium D-Ca	35.1	#DIV/0!	35.1	35.1	1	1
Chromium D-Cr	0.0005	#DIV/0!	0.0005	0.0005	1	0
Cobalt D-Co	0.0001	#DIV/0!	0.0001	0.0001	1	0
Copper D-Cu	0.001	#DIV/0!	0.001	0.001	1	1
Iron D-Fe	0.03	#DIV/0!	0.03	0.03	1	0
Lead D-Pb	0.0001	#DIV/0!	0.0001	0.0001	1	0
Lithium D-Li	#DIV/0!	#DIV/0!	0.000	0.000	0	0
Magnesium D-Mg	2.00	#DIV/0!	2.00	2.00	1	1
Manganese D-Mn	0.00500	#DIV/0!	0.00500	0.00500	1	0
Mercury D-Hg	0.00002	#DIV/0!	0.00002	0.00002	1	0
Molybdenum D-Mo	0.03000	#DIV/0!	0.03000	0.03000	1	0
Nickel D-Ni	0.0010	#DIV/0!	0.0010	0.0010	1	0
Phosphorus D-P	#DIV/0!	#DIV/0!	0.0	0.0	0	0
Potassium D-K	2	#DIV/0!	2	2	1	0
Selenium D-Se	0.0010	#DIV/0!	0.0010	0.0010	1	0
Silicon D-Si	#DIV/0!	#DIV/0!	0.00	0.00	0	0
Silver D-Ag	0.00001	#DIV/0!	0.00001	0.00001	1	0
Sodium D-Na	2	#DIV/0!	2	2	1	0
Strontium D-Sr	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Thallium D-Tl	0.0001	#DIV/0!	0.0001	0.0001	1	0
Tin D-Sn	#DIV/0!	#DIV/0!	0.0000	0.0000	0	0
Titanium D-Ti	0.01	#DIV/0!	0.01	0.01	1	0
Uranium D-U	0.0002	#DIV/0!	0.0002	0.0002	1	1
Vanadium D-V	0.030	#DIV/0!	0.030	0.030	1	0
Zinc D-Zn	0.005	#DIV/0!	0.005	0.005	1	0

Total Organic Carbon C	1.300	#DIV/0!	1.300	1.300	1	1

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W4

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	197	27	232	153	6	6
Hardness CaCO3	155.3	15.0	164.0	125.0	6	6
pH	7.90	0.23	8.20	7.63	6	6
Total Suspended Solids	6	4	10	4	3	3
Turbidity (NTU)	1.1	1.1	3.1	0.1	6	5
Alkalinity-Total CaCO3	112	9	124	97	6	6
Chloride Cl	0.5	0.0	0.6	0.5	5	1
Fluoride F	0.27	0.03	0.29	0.23	5	5
Sulphate SO4	49	9	55	30	6	6
Ammonia Nitrogen N	0.028	0.023	0.050	0.005	3	1
Nitrate Nitrogen N	0.066	0.045	0.112	0.005	6	4
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	3
Nitrite/Nitrate Nitrogen N	0.076	0.043	0.113	0.005	5	4
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.041	0.026	0.075	0.013	6	6
Antimony T-Sb	0.04413	0.08756	0.20000	0.00019	5	3
Arsenic T-As	0.00362	0.00803	0.02000	0.00028	6	5
Barium T-Ba	0.1241	0.0244	0.1580	0.0928	6	6
Beryllium T-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.041	0.054	0.100	0.001	5	2
Cadmium T-Cd	0.00024	0.00014	0.00050	0.00009	6	4
Calcium T-Ca	36.6	4.2	40.6	29.2	6	6
Chromium T-Cr	0.0006	0.0004	0.0010	0.0001	6	3
Cobalt T-Co	0.0052	0.0082	0.0200	0.0001	6	0
Copper T-Cu	0.002	0.001	0.003	0.001	6	5
Iron T-Fe	0.09	0.06	0.18	0.03	6	4
Lead T-Pb	0.0003	0.0004	0.0010	0.0001	5	4
Lithium T-Li	0.006	0.008	0.020	0.001	6	1
Magnesium T-Mg	14.77	1.18	16.10	12.70	6	6
Manganese T-Mn	0.00946	0.00480	0.01600	0.00500	6	4
Mercury T-Hg	0.00021	0.00039	0.00100	0.00005	6	0
Molybdenum T-Mo	0.01163	0.01429	0.03000	0.00148	6	3
Nickel T-Ni	0.0088	0.0087	0.0200	0.0020	6	4
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	5	1
Selenium T-Se	0.0029	0.0007	0.0040	0.0020	5	5
Silicon T-Si	4.43	0.61	5.21	3.55	5	5
Silver T-Ag	0.00019	0.00040	0.00100	0.00001	6	0
Sodium T-Na	2	0	2	1	6	1
Strontium T-Sr	0.1274	0.0137	0.1380	0.1040	5	5
Thallium T-Tl	0.0010	0.0022	0.0050	0.0001	5	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	5	0
Uranium T-U	0.0129	0.0263	0.0600	0.0010	5	4
Vanadium T-V	0.011	0.015	0.030	0.001	6	1
Zinc T-Zn	0.017	0.007	0.026	0.009	6	6

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.009	0.006	0.020	0.003	6	6
Antimony D-Sb	0.04412	0.08756	0.20000	0.00019	5	3
Arsenic D-As	0.00356	0.00805	0.02000	0.00020	6	5
Barium D-Ba	0.1212	0.0199	0.1460	0.0882	6	6
Beryllium D-Be	0.0020	0.0024	0.0050	0.0002	6	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.042	0.053	0.100	0.001	5	1
Cadmium D-Cd	0.00021	0.00015	0.00050	0.00006	6	4
Calcium D-Ca	37.5	4.0	39.9	29.4	6	6
Chromium D-Cr	0.0005	0.0004	0.0010	0.0001	6	3
Cobalt D-Co	0.0052	0.0082	0.0200	0.0001	6	1
Copper D-Cu	0.002	0.001	0.003	0.001	6	5
Iron D-Fe	0.02	0.02	0.05	0.00	6	1
Lead D-Pb	0.0010	0.0020	0.0050	0.0001	6	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	1
Magnesium D-Mg	15.03	1.19	16.10	12.70	6	6
Manganese D-Mn	0.00378	0.00387	0.01040	0.00023	6	4
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	5	0
Molybdenum D-Mo	0.01165	0.01427	0.03000	0.00161	6	3
Nickel D-Ni	0.0084	0.0090	0.0200	0.0020	6	3
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	5	1
Selenium D-Se	0.0029	0.0012	0.0040	0.0013	5	5
Silicon D-Si	4.42	0.61	5.17	3.52	5	5
Silver D-Ag	0.00019	0.00040	0.00100	0.00001	6	0
Sodium D-Na	2	0	2	1	6	1
Strontium D-Sr	0.1290	0.0153	0.1440	0.1040	5	5
Thallium D-Tl	0.0010	0.0022	0.0050	0.0001	5	1
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	5	0
Uranium D-U	0.0129	0.0263	0.0600	0.0010	5	4
Vanadium D-V	0.011	0.015	0.030	0.001	6	0
Zinc D-Zn	0.013	0.005	0.021	0.007	6	6

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W5

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	72	9	86	66	4	4
Hardness CaCO3	55.4	1.7	57.7	53.7	4	4
pH	7.81	0.26	8.04	7.45	4	4
Total Suspended Solids	2	0	2	1	2	2
Turbidity (NTU)	0.6	0.4	1.0	0.2	4	4
Alkalinity-Total CaCO3	46	4	49	40	4	4
Chloride Cl	0.5	0.0	0.5	0.5	3	0
Fluoride F	0.13	0.04	0.17	0.10	3	3
Sulphate SO4	9	0	10	9	4	4
Ammonia Nitrogen N	0.035	0.021	0.050	0.020	2	1
Nitrate Nitrogen N	0.029	0.048	0.100	0.005	4	0
Nitrite Nitrogen N	0.002	0.001	0.003	0.001	4	0
Nitrite/Nitrate Nitrogen N	0.005	0.000	0.005	0.005	3	0
Total Cyanide CN	0.005	#DIV/0!	0.005	0.005	1	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.014	0.011	0.030	0.007	4	4
Antimony T-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic T-As	0.00560	0.00960	0.02000	0.00077	4	3
Barium T-Ba	0.0312	0.0017	0.0327	0.0295	4	4
Beryllium T-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth T-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron T-B	0.034	0.057	0.100	0.001	3	1
Cadmium T-Cd	0.00020	0.00021	0.00050	0.00005	4	0
Calcium T-Ca	15.4	0.4	16.0	15.1	4	4
Chromium T-Cr	0.0006	0.0005	0.0010	0.0001	4	2
Cobalt T-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper T-Cu	0.002	0.003	0.007	0.001	4	3
Iron T-Fe	0.02	0.01	0.03	0.01	4	1
Lead T-Pb	0.0004	0.0005	0.0010	0.0001	3	1
Lithium T-Li	0.006	0.009	0.020	0.001	4	1
Magnesium T-Mg	4.26	0.12	4.42	4.13	4	4
Manganese T-Mn	0.00282	0.00146	0.00500	0.00192	4	3
Mercury T-Hg	0.00029	0.00048	0.00100	0.00005	4	0
Molybdenum T-Mo	0.00915	0.01404	0.03000	0.00076	4	2
Nickel T-Ni	0.0060	0.0093	0.0200	0.0010	4	2
Phosphorus T-P	0.2	0.1	0.3	0.1	3	0
Potassium T-K	2	1	2	1	3	1
Selenium T-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon T-Si	1.71	0.42	2.20	1.47	3	3
Silver T-Ag	0.00028	0.00048	0.00100	0.00001	4	0
Sodium T-Na	2	0	2	1	4	1
Strontium T-Sr	0.0469	0.0012	0.0480	0.0457	3	3
Thallium T-Tl	1.0334	1.7898	3.1000	0.0001	3	2
Tin T-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium T-Ti	0.01	0.01	0.01	0.00	3	0
Uranium T-U	0.0204	0.0343	0.0600	0.0005	3	2
Vanadium T-V	0.009	0.014	0.030	0.001	4	0
Zinc T-Zn	0.004	0.002	0.006	0.002	4	3

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.008	0.002	0.010	0.006	4	4
Antimony D-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic D-As	0.00559	0.00961	0.02000	0.00075	4	3
Barium D-Ba	0.0324	0.0025	0.0358	0.0300	4	4
Beryllium D-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth D-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron D-B	0.037	0.055	0.100	0.001	3	1
Cadmium D-Cd	0.00020	0.00021	0.00050	0.00005	4	0
Calcium D-Ca	15.2	0.5	15.9	14.8	4	4
Chromium D-Cr	0.0006	0.0005	0.0010	0.0001	4	2
Cobalt D-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper D-Cu	0.002	0.002	0.005	0.001	4	3
Iron D-Fe	0.01	0.01	0.03	0.00	4	1
Lead D-Pb	0.0015	0.0024	0.0050	0.0001	4	0
Lithium D-Li	0.006	0.009	0.020	0.001	4	1
Magnesium D-Mg	4.24	0.15	4.36	4.05	4	4
Manganese D-Mn	0.00159	0.00228	0.00500	0.00026	4	3
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	3	0
Molybdenum D-Mo	0.00914	0.01405	0.03000	0.00075	4	2
Nickel D-Ni	0.0060	0.0093	0.0200	0.0010	4	2
Phosphorus D-P	0.2	0.1	0.3	0.1	3	0
Potassium D-K	2	1	2	1	3	1
Selenium D-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon D-Si	1.67	0.38	2.11	1.45	3	3
Silver D-Ag	0.00028	0.00048	0.00100	0.00001	4	0
Sodium D-Na	2	0	2	1	4	1
Strontium D-Sr	0.0467	0.0008	0.0472	0.0458	3	3
Thallium D-Tl	0.0017	0.0029	0.0050	0.0001	3	0
Tin D-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium D-Ti	0.01	0.01	0.01	0.00	3	0
Uranium D-U	0.0204	0.0343	0.0600	0.0005	3	2
Vanadium D-V	0.009	0.014	0.030	0.001	4	0
Zinc D-Zn	0.004	0.003	0.007	0.001	4	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W6

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	109	21	139	72	7	7
Hardness CaCO3	83.3	18.2	99.7	52.3	7	7
pH	7.82	0.30	8.21	7.34	7	7
Total Suspended Solids	9	13	28	1	4	3
Turbidity (NTU)	1.1	1.6	4.7	0.1	7	5
Alkalinity-Total CaCO3	71	17	89	48	7	7
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.05	0.02	0.06	0.02	5	5
Sulphate SO4	15	5	20	7	6	6
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.028	0.023	0.050	0.005	3	1
Nitrate Nitrogen N	0.070	0.018	0.100	0.047	6	6
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	2
Nitrite/Nitrate Nitrogen N	0.065	0.012	0.079	0.048	5	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.078	0.110	0.273	0.007	7	6
Antimony T-Sb	0.03672	0.08039	0.20000	0.00005	6	2
Arsenic T-As	0.00304	0.00748	0.02000	0.00005	7	4
Barium T-Ba	0.0781	0.0287	0.1070	0.0200	7	6
Beryllium T-Be	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.051	0.054	0.100	0.001	6	0
Cadmium T-Cd	0.00017	0.00018	0.00050	0.00005	7	1
Calcium T-Ca	27.7	6.0	33.3	18.1	7	7
Chromium T-Cr	0.0019	0.0036	0.0100	0.0002	7	3
Cobalt T-Co	0.0045	0.0077	0.0200	0.0001	7	1
Copper T-Cu	0.002	0.002	0.005	0.001	7	6
Iron T-Fe	0.06	0.12	0.33	0.01	7	2
Lead T-Pb	0.0003	0.0004	0.0010	0.0001	6	1
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	3.55	0.74	4.27	2.33	7	7
Manganese T-Mn	0.01564	0.03252	0.08930	0.00122	7	4
Mercury T-Hg	0.00018	0.00036	0.00100	0.00002	7	0
Molybdenum T-Mo	0.01378	0.01525	0.03000	0.00037	7	3
Nickel T-Ni	0.0068	0.0091	0.0200	0.0003	7	3
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	6	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	6	0
Silicon T-Si	2.69	0.35	3.21	2.30	5	5
Silver T-Ag	0.00016	0.00037	0.00100	0.00001	7	1
Sodium T-Na	2	0	2	1	7	1
Strontium T-Sr	0.0972	0.0217	0.1170	0.0619	5	5
Thallium T-Tl	0.0009	0.0020	0.0050	0.0001	6	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	6	0
Uranium T-U	0.0125	0.0266	0.0600	0.0003	5	4
Vanadium T-V	0.014	0.015	0.030	0.001	7	1
Zinc T-Zn	0.005	0.004	0.014	0.002	7	4

Dissolved	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum	0.039	0.071	0.200	0.005	7	6
Antimony	0.03671	0.08039	0.20000	0.00005	6	2
Arsenic	0.00303	0.00749	0.02000	0.00010	7	5
Barium	0.0857	0.0184	0.1070	0.0531	7	7
Beryllium	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth	0.0243	0.0432	0.1000	0.0005	5	0
Boron	0.052	0.053	0.100	0.001	6	1
Cadmium	0.00014	0.00017	0.00050	0.00005	7	0
Calcium	27.5	6.0	33.1	17.2	7	7
Chromium	0.0019	0.0036	0.0100	0.0001	7	3
Cobalt	0.0045	0.0077	0.0200	0.0001	7	1
Copper	0.002	0.001	0.004	0.001	7	7
Iron	0.02	0.01	0.03	0.00	7	1
Lead	0.0009	0.0018	0.0050	0.0001	7	1
Lithium	0.006	0.008	0.020	0.001	6	0
Magnesiu	3.56	0.76	4.27	2.26	7	7
Manganes	0.00312	0.00195	0.00500	0.00080	7	4
Mercury	0.00005	0.00001	0.00005	0.00002	6	0
Molybden	0.01380	0.01523	0.03000	0.00047	7	3
Nickel	0.0064	0.0093	0.0200	0.0003	7	3
Phosphor	0.3	0.1	0.3	0.1	5	0
Potassium	2	1	2	0	6	1
Selenium	0.0009	0.0002	0.0010	0.0005	6	0
Silicon	2.66	0.34	3.06	2.11	5	5
Silver	0.00145	0.00377	0.01000	0.00001	7	0
Sodium	2	0	2	1	7	1
Strontium	0.0966	0.0215	0.1160	0.0611	5	5
Thallium	0.0009	0.0020	0.0050	0.0001	6	0
Tin	0.0071	0.0130	0.0300	0.0001	5	0
Titanium	0.01	0.00	0.01	0.00	6	0
Uranium	0.0124	0.0266	0.0600	0.0002	5	4
Vanadium	0.014	0.015	0.030	0.001	7	0
Zinc	0.004	0.002	0.008	0.001	7	5

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WATER QUALITY AT STATION W6

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	109	21	139	72	7	7
Hardness CaCO3	83.3	18.2	99.7	52.3	7	7
pH	7.82	0.30	8.21	7.34	7	7
Total Suspended Solids	9	13	28	1	4	3
Turbidity (NTU)	1.1	1.6	4.7	0.1	7	5
Alkalinity-Total CaCO3	71	17	89	48	7	7
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.05	0.02	0.06	0.02	5	5
Sulphate SO4	15	5	20	7	6	6
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.028	0.023	0.050	0.005	3	1
Nitrate Nitrogen N	0.070	0.018	0.100	0.047	6	6
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	2
Nitrite/Nitrate Nitrogen N	0.065	0.012	0.079	0.048	5	5
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	0.01	#DIV/0!	0.01	0.01	1	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.078	0.110	0.273	0.007	7	6
Antimony T-Sb	0.03672	0.08039	0.20000	0.00005	6	2
Arsenic T-As	0.00304	0.00748	0.02000	0.00005	7	4
Barium T-Ba	0.0781	0.0287	0.1070	0.0200	7	6
Beryllium T-Be	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.051	0.054	0.100	0.001	6	0
Cadmium T-Cd	0.00017	0.00018	0.00050	0.00005	7	1
Calcium T-Ca	27.7	6.0	33.3	18.1	7	7
Chromium T-Cr	0.0019	0.0036	0.0100	0.0002	7	3
Cobalt T-Co	0.0045	0.0077	0.0200	0.0001	7	1
Copper T-Cu	0.002	0.002	0.005	0.001	7	6
Iron T-Fe	0.06	0.12	0.33	0.01	7	2
Lead T-Pb	0.0003	0.0004	0.0010	0.0001	6	1
Lithium T-Li	0.006	0.008	0.020	0.001	6	0
Magnesium T-Mg	3.55	0.74	4.27	2.33	7	7
Manganese T-Mn	0.01564	0.03252	0.08930	0.00122	7	4
Mercury T-Hg	0.00018	0.00036	0.00100	0.00002	7	0
Molybdenum T-Mo	0.01378	0.01525	0.03000	0.00037	7	3
Nickel T-Ni	0.0068	0.0091	0.0200	0.0003	7	3
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	1	6	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	6	0
Silicon T-Si	2.69	0.35	3.21	2.30	5	5
Silver T-Ag	0.00016	0.00037	0.00100	0.00001	7	1
Sodium T-Na	2	0	2	1	7	1
Strontium T-Sr	0.0972	0.0217	0.1170	0.0619	5	5
Thallium T-Tl	0.0009	0.0020	0.0050	0.0001	6	0
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	6	0
Uranium T-U	0.0125	0.0266	0.0600	0.0003	5	4
Vanadium T-V	0.014	0.015	0.030	0.001	7	1
Zinc T-Zn	0.005	0.004	0.014	0.002	7	4

Dissolved	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum	0.039	0.071	0.200	0.005	7	6
Antimony	0.03671	0.08039	0.20000	0.00005	6	2
Arsenic	0.00303	0.00749	0.02000	0.00010	7	5
Barium	0.0857	0.0184	0.1070	0.0531	7	7
Beryllium	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth	0.0243	0.0432	0.1000	0.0005	5	0
Boron	0.052	0.053	0.100	0.001	6	1
Cadmium	0.00014	0.00017	0.00050	0.00005	7	0
Calcium	27.5	6.0	33.1	17.2	7	7
Chromium	0.0019	0.0036	0.0100	0.0001	7	3
Cobalt	0.0045	0.0077	0.0200	0.0001	7	1
Copper	0.002	0.001	0.004	0.001	7	7
Iron	0.02	0.01	0.03	0.00	7	1
Lead	0.0009	0.0018	0.0050	0.0001	7	1
Lithium	0.006	0.008	0.020	0.001	6	0
Magnesiu	3.56	0.76	4.27	2.26	7	7
Manganes	0.00312	0.00195	0.00500	0.00080	7	4
Mercury	0.00005	0.00001	0.00005	0.00002	6	0
Molybden	0.01380	0.01523	0.03000	0.00047	7	3
Nickel	0.0064	0.0093	0.0200	0.0003	7	3
Phosphor	0.3	0.1	0.3	0.1	5	0
Potassium	2	1	2	0	6	1
Selenium	0.0009	0.0002	0.0010	0.0005	6	0
Silicon	2.66	0.34	3.06	2.11	5	5
Silver	0.00145	0.00377	0.01000	0.00001	7	0
Sodium	2	0	2	1	7	1
Strontium	0.0966	0.0215	0.1160	0.0611	5	5
Thallium	0.0009	0.0020	0.0050	0.0001	6	0
Tin	0.0071	0.0130	0.0300	0.0001	5	0
Titanium	0.01	0.00	0.01	0.00	6	0
Uranium	0.0124	0.0266	0.0600	0.0002	5	4
Vanadium	0.014	0.015	0.030	0.001	7	0
Zinc	0.004	0.002	0.008	0.001	7	5

EXPATRIATE RESOURCES LTD.
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WATER QUALITY AT STATION W1

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	88	20	135	67	18	18
Hardness CaCO3	66.6	12.1	101.0	51.2	17	17
pH	7.77	0.34	8.57	7.25	18	18
Total Suspended Solids	3	4	16	1	12	9
Turbidity (NTU)	0.9	0.5	2.0	0.4	17	17
Alkalinity-Total CaCO3	61	13	91	45	18	18
Chloride Cl	0.5	0.1	0.9	0.5	16	4
Fluoride F	0.17	0.22	1.00	0.08	16	15
Sulphate SO4	10	2	16	7	17	17
Acidity (to pH 8.3) CaCO3	4	#DIV/0!	4	4	1	1
Ammonia Nitrogen N	0.078	0.082	0.170	0.013	3	2
Nitrate Nitrogen N	0.015	0.026	0.100	0.005	17	5
Nitrite Nitrogen N	0.031	0.121	0.500	0.001	17	8
Nitrite/Nitrate Nitrogen N	0.011	0.018	0.061	0.005	10	3
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.020	0.015	0.057	0.005	17	15
Antimony T-Sb	0.07299	0.09690	0.20000	0.00006	17	7
Arsenic T-As	0.00372	0.00594	0.02000	0.00090	18	16
Barium T-Ba	0.0350	0.0069	0.0500	0.0269	18	18
Beryllium T-Be	0.0025	0.0023	0.0050	0.0002	18	0
Bismuth T-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron T-B	0.057	0.051	0.100	0.001	16	2
Cadmium T-Cd	0.00012	0.00015	0.00050	0.00005	18	0
Calcium T-Ca	17.8	3.6	26.2	13.2	18	18
Chromium T-Cr	0.0010	0.0023	0.0100	0.0001	18	10
Cobalt T-Co	0.0052	0.0069	0.0200	0.0001	18	0
Copper T-Cu	0.001	0.001	0.006	0.001	18	16
Iron T-Fe	0.08	0.05	0.25	0.03	18	18
Lead T-Pb	0.0002	0.0003	0.0010	0.0001	16	4
Lithium T-Li	0.022	0.069	0.290	0.001	17	8
Magnesium T-Mg	5.71	1.28	8.64	4.13	18	18
Manganese T-Mn	0.01518	0.00753	0.03400	0.00700	18	18
Mercury T-Hg	0.00010	0.00023	0.00100	0.00002	17	0
Molybdenum T-Mo	0.01431	0.01449	0.03000	0.00081	18	8
Nickel T-Ni	0.0086	0.0093	0.0200	0.0010	18	9
Phosphorus T-P	0.3	0.1	0.3	0.1	16	0
Potassium T-K	2	0	2	1	17	3
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	16	1
Silicon T-Si	1.98	0.76	3.94	1.23	16	16
Silver T-Ag	0.00013	0.00032	0.00100	0.00001	18	2
Sodium T-Na	2	0	2	1	18	3
Strontium T-Sr	0.0614	0.0148	0.0950	0.0435	16	16
Thallium T-Tl	0.0379	0.0497	0.1000	0.0001	16	1
Tin T-Sn	0.0138	0.0148	0.0300	0.0001	16	1
Titanium T-Ti	0.01	0.00	0.01	0.00	17	0
Uranium T-U	0.0098	0.0223	0.0600	0.0006	13	11
Vanadium T-V	0.016	0.015	0.030	0.001	18	2
Zinc T-Zn	0.004	0.002	0.007	0.001	18	9

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.025	0.045	0.200	0.004	18	14
Antimony D-Sb	0.07301	0.09689	0.20000	0.00006	17	7
Arsenic D-As	0.00362	0.00598	0.02000	0.00080	18	16
Barium D-Ba	0.0402	0.0156	0.0792	0.0200	18	18
Beryllium D-Be	0.0025	0.0023	0.0050	0.0002	18	0
Bismuth D-Bi	0.0465	0.0492	0.1000	0.0005	16	0
Boron D-B	0.060	0.048	0.100	0.001	16	4
Cadmium D-Cd	0.00012	0.00015	0.00050	0.00005	18	1
Calcium D-Ca	17.9	3.5	26.3	13.6	18	18
Chromium D-Cr	0.0010	0.0023	0.0100	0.0001	18	11
Cobalt D-Co	0.0052	0.0069	0.0200	0.0001	18	0
Copper D-Cu	0.001	0.001	0.003	0.001	18	16
Iron D-Fe	0.06	0.09	0.40	0.00	18	15
Lead D-Pb	0.0007	0.0016	0.0050	0.0001	18	3
Lithium D-Li	0.011	0.021	0.090	0.001	17	8
Magnesium D-Mg	5.74	1.21	8.52	4.17	18	18
Manganese D-Mn	0.00955	0.00878	0.03200	0.00060	18	14
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	16	0
Molybdenum D-Mo	0.01431	0.01450	0.03000	0.00081	18	8
Nickel D-Ni	0.0086	0.0094	0.0200	0.0010	18	9
Phosphorus D-P	0.3	0.1	0.3	0.1	16	0
Potassium D-K	2	0	2	1	17	3
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	16	0
Silicon D-Si	1.97	0.73	3.88	1.25	16	16
Silver D-Ag	0.00013	0.00032	0.00100	0.00001	18	1
Sodium D-Na	2	0	2	1	18	3
Strontium D-Sr	0.0610	0.0139	0.0910	0.0437	16	16
Thallium D-Tl	0.0379	0.0497	0.1000	0.0001	16	1
Tin D-Sn	0.0138	0.0148	0.0300	0.0001	16	1
Titanium D-Ti	0.01	0.00	0.01	0.00	17	0
Uranium D-U	0.0098	0.0223	0.0600	0.0005	13	11
Vanadium D-V	0.016	0.015	0.030	0.001	18	0
Zinc D-Zn	0.005	0.004	0.020	0.001	18	9

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WATER QUALITY AT STATION W7

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	73	11	89	65	4	4
Hardness CaCO3	54.9	2.9	57.8	50.9	4	4
pH	7.81	0.26	7.99	7.42	4	4
Total Suspended Solids	2	0	2	2	2	2
Turbidity (NTU)	0.5	0.4	1.0	0.2	4	4
Alkalinity-Total CaCO3	49	3	54	47	4	4
Chloride Cl	0.5	0.0	0.5	0.5	3	0
Fluoride F	0.10	0.02	0.12	0.09	3	3
Sulphate SO4	10	0	10	9	4	4
Ammonia Nitrogen N	0.035	0.021	0.050	0.020	2	1
Nitrate Nitrogen N	0.006	0.003	0.010	0.005	4	0
Nitrite Nitrogen N	0.002	0.001	0.003	0.001	4	0
Nitrite/Nitrate Nitrogen N	0.005	0.000	0.005	0.005	3	0
Total Cyanide CN	0.005	#DIV/0!	0.005	0.005	1	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.009	0.001	0.010	0.007	4	3
Antimony T-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic T-As	0.00562	0.00959	0.02000	0.00077	4	3
Barium T-Ba	0.0311	0.0010	0.0324	0.0300	4	4
Beryllium T-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth T-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron T-B	0.034	0.057	0.100	0.001	3	1
Cadmium T-Cd	0.00010	0.00009	0.00020	0.00005	3	0
Calcium T-Ca	15.5	0.5	16.2	15.2	4	4
Chromium T-Cr	0.0006	0.0005	0.0010	0.0001	4	2
Cobalt T-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper T-Cu	0.002	0.002	0.005	0.001	4	3
Iron T-Fe	0.02	0.01	0.03	0.01	4	1
Lead T-Pb	0.0004	0.0005	0.0010	0.0001	3	0
Lithium T-Li	0.006	0.009	0.020	0.001	4	3
Magnesium T-Mg	4.27	0.12	4.44	4.18	4	4
Manganese T-Mn	0.00282	0.00146	0.00500	0.00186	4	3
Mercury T-Hg	0.00029	0.00048	0.00100	0.00005	4	0
Molybdenum T-Mo	0.00914	0.01405	0.03000	0.00072	4	2
Nickel T-Ni	0.0060	0.0093	0.0200	0.0010	4	2
Phosphorus T-P	0.2	0.1	0.3	0.1	3	0
Potassium T-K	2	1	2	1	3	1
Selenium T-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon T-Si	1.71	0.41	2.19	1.47	3	3
Silver T-Ag	0.00053	0.00098	0.00200	0.00001	4	1
Sodium T-Na	2	0	2	1	4	1
Strontium T-Sr	0.0472	0.0015	0.0487	0.0458	3	3
Thallium T-Tl	0.0017	0.0029	0.0050	0.0001	3	0
Tin T-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium T-Ti	0.01	0.01	0.01	0.00	3	0
Uranium T-U	0.0203	0.0343	0.0600	0.0005	3	2
Vanadium T-V	0.009	0.014	0.030	0.001	4	1
Zinc T-Zn	0.003	0.001	0.005	0.002	4	3

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.007	0.002	0.010	0.005	4	2
Antimony D-Sb	0.00670	0.01152	0.02000	0.00005	3	0
Arsenic D-As	0.00559	0.00961	0.02000	0.00074	4	3
Barium D-Ba	0.0321	0.0027	0.0361	0.0300	4	4
Beryllium D-Be	0.0016	0.0023	0.0050	0.0002	4	0
Bismuth D-Bi	0.0070	0.0113	0.0200	0.0005	3	0
Boron D-B	0.036	0.055	0.100	0.001	3	1
Cadmium D-Cd	0.00133	0.00245	0.00500	0.00005	4	0
Calcium D-Ca	15.1	0.7	15.9	14.1	4	4
Chromium D-Cr	0.0006	0.0005	0.0010	0.0001	4	0
Cobalt D-Co	0.0053	0.0098	0.0200	0.0001	4	0
Copper D-Cu	0.002	0.002	0.004	0.001	4	3
Iron D-Fe	0.01	0.01	0.03	0.00	4	0
Lead D-Pb	0.0015	0.0024	0.0050	0.0001	4	0
Lithium D-Li	0.006	0.009	0.020	0.001	4	2
Magnesium D-Mg	4.20	0.27	4.40	3.82	4	4
Manganese D-Mn	0.00158	0.00228	0.00500	0.00032	4	2
Mercury D-Hg	0.00005	0.00000	0.00005	0.00005	3	0
Molybdenum D-Mo	0.00915	0.01404	0.03000	0.00078	4	2
Nickel D-Ni	0.0060	0.0093	0.0200	0.0010	4	2
Phosphorus D-P	0.2	0.1	0.3	0.1	3	0
Potassium D-K	2	1	2	1	3	1
Selenium D-Se	0.0008	0.0003	0.0010	0.0005	3	0
Silicon D-Si	1.68	0.39	2.13	1.45	3	3
Silver D-Ag	0.00028	0.00048	0.00100	0.00001	4	0
Sodium D-Na	2	1	2	1	4	1
Strontium D-Sr	0.0457	0.0017	0.0473	0.0440	3	3
Thallium D-Tl	0.0017	0.0029	0.0050	0.0001	3	0
Tin D-Sn	0.0017	0.0028	0.0050	0.0001	3	0
Titanium D-Ti	0.01	0.01	0.01	0.00	3	0
Uranium D-U	0.0204	0.0343	0.0600	0.0005	3	2
Vanadium D-V	0.009	0.014	0.030	0.001	4	0
Zinc D-Zn	0.004	0.001	0.005	0.002	4	3

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

WATER QUALITY AT STATION W8

	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Total Dissolved Solids	95	14	121	78	7	7
Hardness CaCO3	74.3	12.5	87.3	48.7	7	7
pH	7.72	0.26	8.00	7.38	7	7
Total Suspended Solids	2	1	3	1	4	0
Turbidity (NTU)	0.5	0.3	1.0	0.1	7	7
Alkalinity-Total CaCO3	62	10	71	42	7	7
Chloride Cl	0.5	0.0	0.5	0.5	5	0
Fluoride F	0.04	0.01	0.05	0.03	5	5
Sulphate SO4	13	3	19	10	6	6
Acidity (to pH 8.3) CaCO3	2	#DIV/0!	2	2	1	1
Ammonia Nitrogen N	0.025	0.023	0.050	0.005	3	0
Nitrate Nitrogen N	0.073	0.026	0.107	0.045	6	6
Nitrite Nitrogen N	0.001	0.001	0.003	0.001	6	2
Nitrite/Nitrate Nitrogen N	0.068	0.029	0.108	0.045	4	4
Total Cyanide CN	0.005	0.000	0.005	0.005	2	0
WAD Cyanide CN	#DIV/0!	#DIV/0!	0.00	0.00	0	0

Total Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum T-Al	0.020	0.015	0.050	0.007	7	7
Antimony T-Sb	0.03672	0.08038	0.20000	0.00005	6	2
Arsenic T-As	0.00304	0.00748	0.02000	0.00012	7	5
Barium T-Ba	0.1027	0.1667	0.4800	0.0200	7	7
Beryllium T-Be	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth T-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron T-B	0.051	0.054	0.100	0.001	6	0
Cadmium T-Cd	0.00008	0.00006	0.00020	0.00005	6	0
Calcium T-Ca	25.1	4.4	29.9	16.0	7	7
Chromium T-Cr	0.0005	0.0004	0.0010	0.0002	7	5
Cobalt T-Co	0.0046	0.0077	0.0200	0.0001	7	1
Copper T-Cu	0.002	0.002	0.007	0.001	7	6
Iron T-Fe	0.03	0.02	0.07	0.01	7	2
Lead T-Pb	0.0002	0.0004	0.0010	0.0001	6	1
Lithium T-Li	0.006	0.008	0.020	0.001	6	1
Magnesium T-Mg	2.94	0.66	3.58	1.60	7	7
Manganese T-Mn	0.00370	0.00226	0.00662	0.00071	7	4
Mercury T-Hg	0.00018	0.00036	0.00100	0.00002	7	0
Molybdenum T-Mo	0.01376	0.01527	0.03000	0.00038	7	3
Nickel T-Ni	0.0066	0.0092	0.0200	0.0007	7	3
Phosphorus T-P	0.3	0.1	0.3	0.1	5	0
Potassium T-K	2	1	2	0	6	1
Selenium T-Se	0.0009	0.0002	0.0010	0.0005	6	0
Silicon T-Si	2.70	0.33	3.26	2.41	5	5
Silver T-Ag	0.00031	0.00075	0.00200	0.00001	7	2
Sodium T-Na	2	0	2	1	7	1
Strontium T-Sr	0.0569	0.0065	0.0650	0.0491	5	5
Thallium T-Tl	0.0177	0.0404	0.1000	0.0001	6	1
Tin T-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium T-Ti	0.01	0.00	0.01	0.00	6	1
Uranium T-U	0.0103	0.0243	0.0600	0.0001	6	5
Vanadium T-V	0.014	0.015	0.030	0.001	7	1
Zinc T-Zn	0.006	0.002	0.010	0.004	7	5

Dissolved Metals	Average	Standard Dev.	Maximum	Minimum	Sample Size	# of Detections
Aluminum D-Al	0.013	0.006	0.022	0.006	7	7
Antimony D-Sb	0.03672	0.08039	0.20000	0.00005	6	3
Arsenic D-As	0.00303	0.00748	0.02000	0.00010	7	5
Barium D-Ba	0.0415	0.0104	0.0502	0.0200	7	7
Beryllium D-Be	0.0018	0.0022	0.0050	0.0002	7	0
Bismuth D-Bi	0.0243	0.0432	0.1000	0.0005	5	0
Boron D-B	0.051	0.054	0.100	0.001	6	1
Cadmium D-Cd	0.00078	0.00186	0.00500	0.00005	7	0
Calcium D-Ca	24.8	4.0	29.2	16.7	7	7
Chromium D-Cr	0.0005	0.0004	0.0010	0.0001	7	4
Cobalt D-Co	0.0045	0.0077	0.0200	0.0001	7	1
Copper D-Cu	0.002	0.002	0.006	0.001	7	7
Iron D-Fe	0.02	0.01	0.03	0.01	7	2
Lead D-Pb	0.0009	0.0018	0.0050	0.0001	7	0
Lithium D-Li	0.006	0.008	0.020	0.001	6	0
Magnesium D-Mg	2.98	0.62	3.46	1.70	7	7
Manganese D-Mn	0.00276	0.00213	0.00500	0.00035	7	4
Mercury D-Hg	0.00005	0.00001	0.00005	0.00002	6	0
Molybdenum D-Mo	0.01377	0.01527	0.03000	0.00040	7	3
Nickel D-Ni	0.0066	0.0092	0.0200	0.0006	7	3
Phosphorus D-P	0.3	0.1	0.3	0.1	5	0
Potassium D-K	2	1	2	0	6	1
Selenium D-Se	0.0009	0.0002	0.0010	0.0005	6	0
Silicon D-Si	2.65	0.29	3.13	2.40	5	5
Silver D-Ag	0.00016	0.00037	0.00100	0.00001	7	3
Sodium D-Na	2	0	2	1	7	1
Strontium D-Sr	0.0562	0.0060	0.0630	0.0488	5	5
Thallium D-Tl	0.0175	0.0404	0.1000	0.0001	6	0
Tin D-Sn	0.0071	0.0130	0.0300	0.0001	5	0
Titanium D-Ti	0.01	0.00	0.01	0.00	6	0
Uranium D-U	0.0103	0.0243	0.0600	0.0001	6	5
Vanadium D-V	0.014	0.015	0.030	0.001	7	0
Zinc D-Zn	0.006	0.001	0.007	0.004	7	7

Appendix 3C

Wolverine Area – Sediment Quality Data

EXPATRIATE RESOURCES LTD.

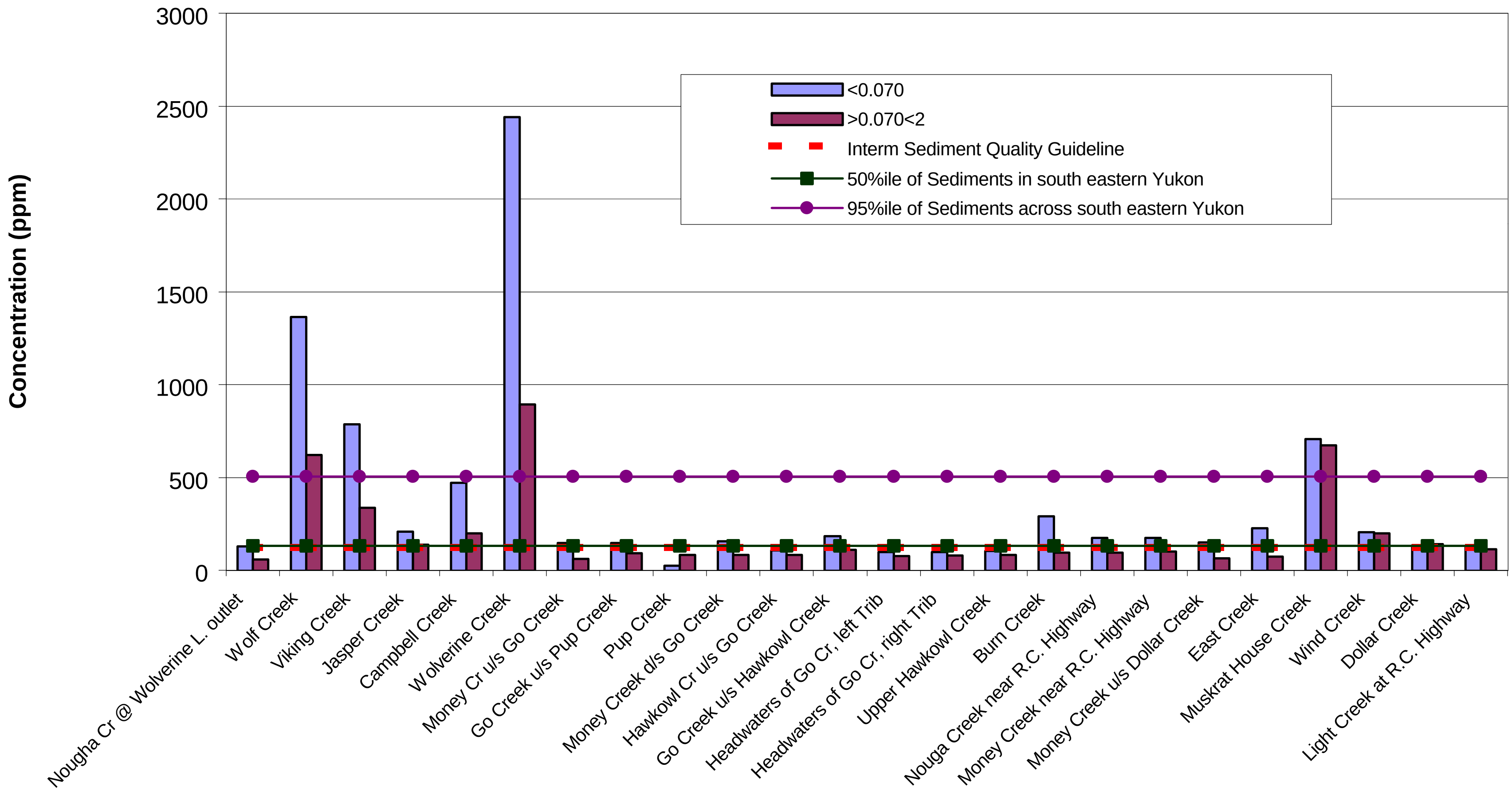
Stream Sediment Quality in the Wolverine Area

SITE	SAMPLE	D.O.C. ppm		Cd ppm		Co ppm		Cr ppm		Cu ppm		Fe %	
#	DESCRIPTION	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2
W-1	Nougha Cr @ Wolverine L. outlet	275	95	<.5	<.5	9	5	147	99	17	7	2.77	1.59
W-2	Wolf Creek	3250	700	9	4	26	14	96	70	40	12	5.67	2.97
W-4	Viking Creek	300	100	7.5	3	15	10	110	112	152	96	3.69	2.46
W-6	Jasper Creek	170	42	1.5	1	17	16	109	88	44	28	3.83	3.33
W-8	Campbell Creek	410	120	2.5	0.5	15	11	108	65	63	22	3.67	2.59
W-9	Wolverine Creek	262	60	11.5	4.5	14	11	98	61	50	20	4.01	2.84
W-11	Money Cr u/s Go Creek	340	95	<.5	<.5	13	7	108	55	17	7	4.33	1.91
W-12	Go Creek u/s Pup Creek	1000	240	1	<.5	18	11	112	132	42	22	4.08	3.44
W-13	Pup Creek	550	90	<.5	<.5	4	15	29	145	8	24	0.84	4
W-14	Money Creek d/s Go Creek	380	130	1.5	<.5	18	9	114	66	36	16	4.11	2.61
W-15	Hawkowl Cr u/s Go Creek	310	87	<.5	<.5	19	15	135	163	70	48	4.23	3.67
W-16	Go Creek u/s Hawkowl Creek	500	160	3.5	0.5	28	23	172	167	53	36	5.61	5.34
W-17	Headwaters of Go Cr, left Trib	400	120	<.5	<.5	39	33	238	327	82	65	6.71	6.82
W-18	Headwaters of Go Cr, right Trib	187	127	<.5	<.5	39	35	220	193	86	64	7.31	7.02
W-19	Upper Hawkowl Creek	220	75	<.5	<.5	36	32	150	130	80	53	6.81	6.7
W-20	Burn Creek	600	70	2	0.5	10	7	79	72	27	9	2.72	1.73
W-21	Nouga Creek near R.C. Highway	650	215	0.5	<.5	13	10	150	142	26	11	2.62	2.15
W-22	Money Creek near R.C. Highway	233	92	0.5	<.5	16	12	139	137	47	31	3.66	2.79
W-23	Money Creek u/s Dollar Creek	937	182	0.5	<.5	21	11	101	56	24	7	5.27	2.35
W-24	East Creek	510	87	1.5	<.5	29	13	116	76	27	11	5.96	2.61
W-25	Muskrat House Creek	2200	487	7	7.5	9	10	28	25	17	16	2.49	2.73
W-26	Wind Creek	1450	1100	3	3	8	9	62	63	40	35	2.09	1.98
W-27	Dollar Creek	5250	4750	2.5	3	5	4	42	42	17	19	2.77	3.17
W-28	Light Creek at R.C. Highway	262	215	0.5	0.5	11	11	60	76	28	19	2.07	1.96

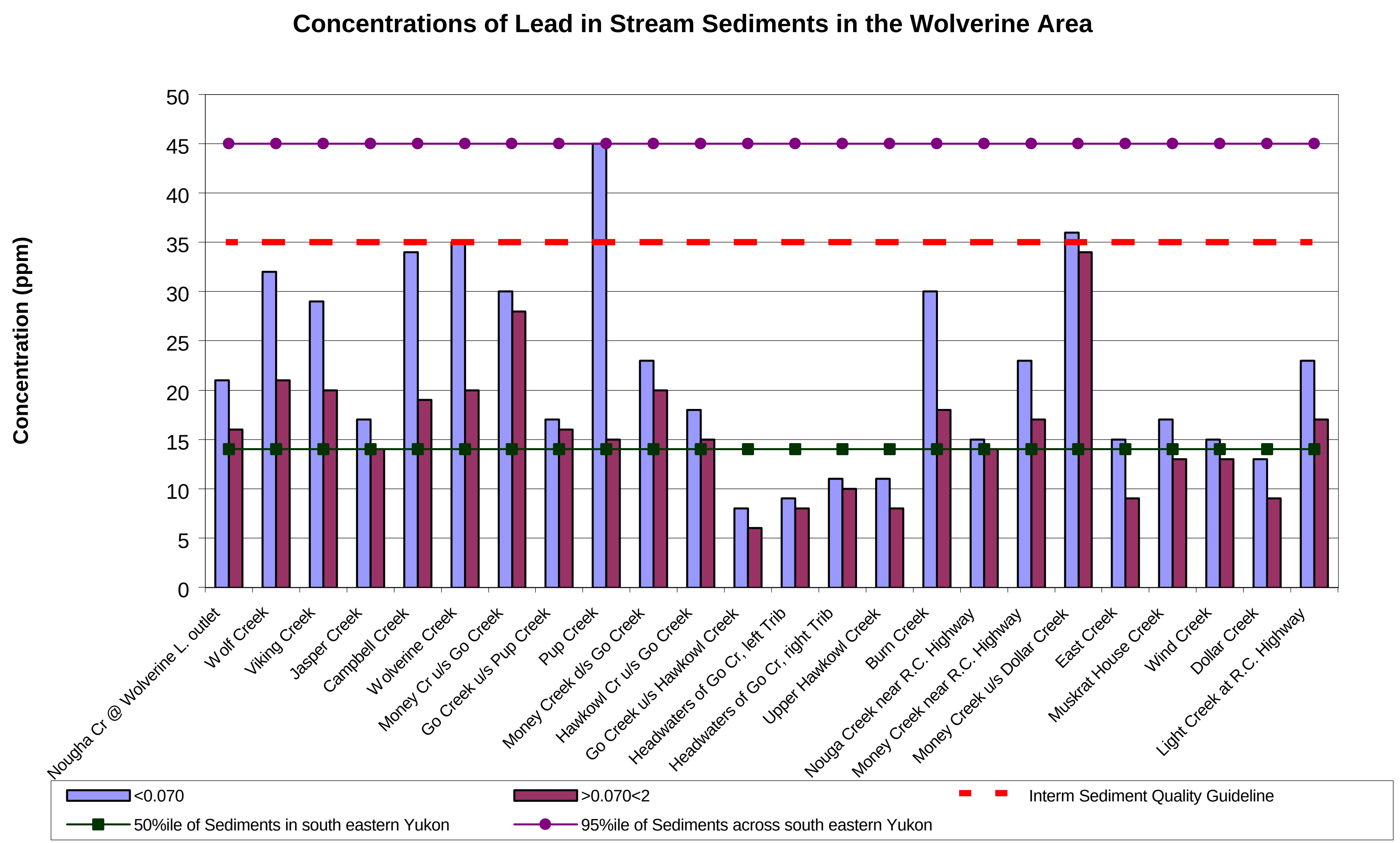
SITE	SAMPLE	Mn ppm		Mo ppm		Ni ppm		Pb ppm		Zn ppm	
#	DESCRIPTION	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2
W-1	Nougha Cr @ Wolverine L. outlet	300	190	3	1	51	42	21	16	128	58
W-2	Wolf Creek	6230	2480	5	1	212	106	32	21	1365	620
W-4	Viking Creek	1265	725	6	3	117	70	29	20	786	336
W-6	Jasper Creek	1225	1560	4	2	57	46	17	14	208	138
W-8	Campbell Creek	815	600	3	1	71	35	34	19	472	198
W-9	Wolverine Creek	935	740	4	3	79	37	35	20	2440	892
W-11	Money Cr u/s Go Creek	1695	600	3	1	58	25	30	28	148	60
W-12	Go Creek u/s Pup Creek	1740	1040	2	1	42	31	17	16	148	92
W-13	Pup Creek	280	985	<1	2	13	42	45	15	24	82
W-14	Money Creek d/s Go Creek	2010	880	3	1	51	28	23	20	156	82
W-15	Hawkowl Cr u/s Go Creek	1100	875	1	<1	60	77	18	15	108	82
W-16	Go Creek u/s Hawkowl Creek	1860	1185	1	1	64	48	8	6	182	110
W-17	Headwaters of Go Cr, left Trib	1205	1145	5	2	89	118	9	8	98	76
W-18	Headwaters of Go Cr, right Trib	1280	1175	2	<1	98	79	11	10	98	78
W-19	Upper Hawkowl Creek	1320	1265	1	2	65	51	11	8	104	82
W-20	Burn Creek	600	495	3	1	46	24	30	18	290	94
W-21	Nouga Creek near R.C. Highway	1405	625	2	2	88	85	15	14	174	94
W-22	Money Creek near R.C. Highway	1015	640	6	3	83	70	23	17	174	102
W-23	Money Creek u/s Dollar Creek	3070	1100	4	1	71	39	36	34	150	64
W-24	East Creek	8550	2230	7	2	123	49	15	9	226	74
W-25	Muskrat House Creek	5310	6060	6	7	29	28	17	13	706	672
W-26	Wind Creek	915	880	3	4	55	63	15	13	206	200
W-27	Dollar Creek	1410	1760	4	4	44	50	13	9	136	140
W-28	Light Creek at R.C. Highway	620	560	4	1	45	55	23	17	124	114

EXPATRIATE RESOURCES LTD.

Concentrations of Zinc in Stream Sediments in the Wolverine Area

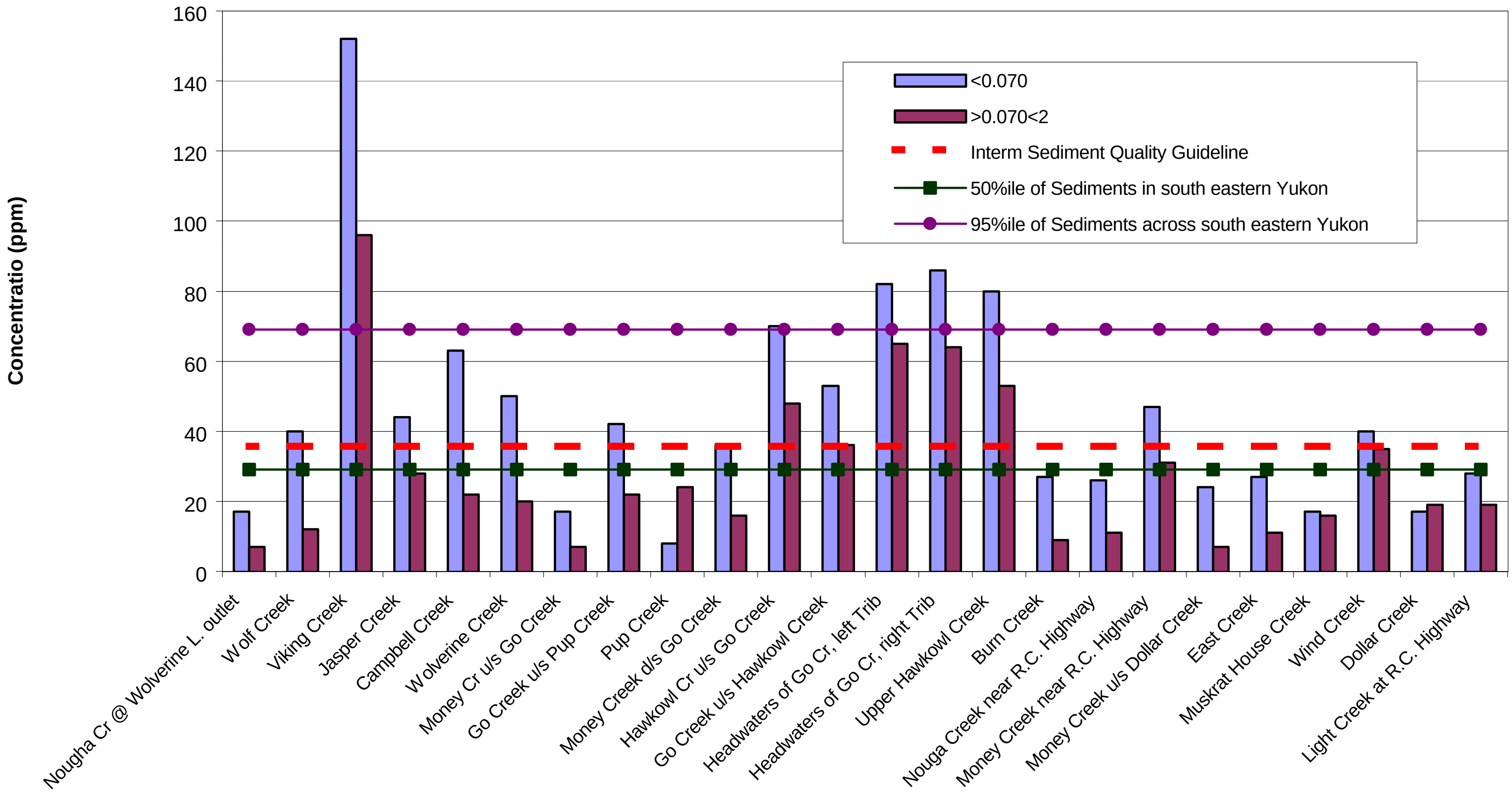


EXPATRIATE RESOURCES LTD.



EXPATRIATE RESOURCES LTD.

Concentrations of Copper in Stream Sediments in the Wolverine Area



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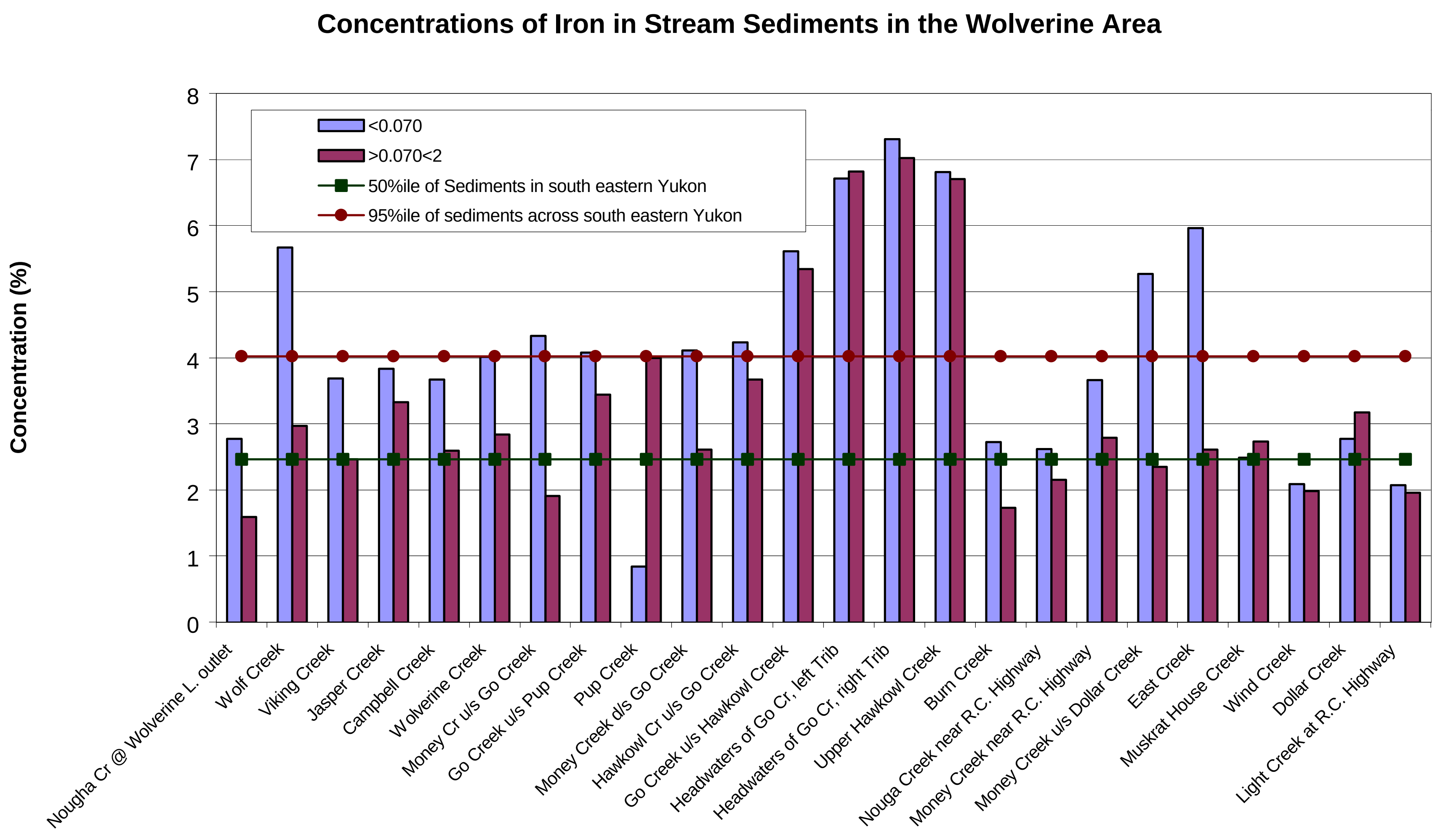

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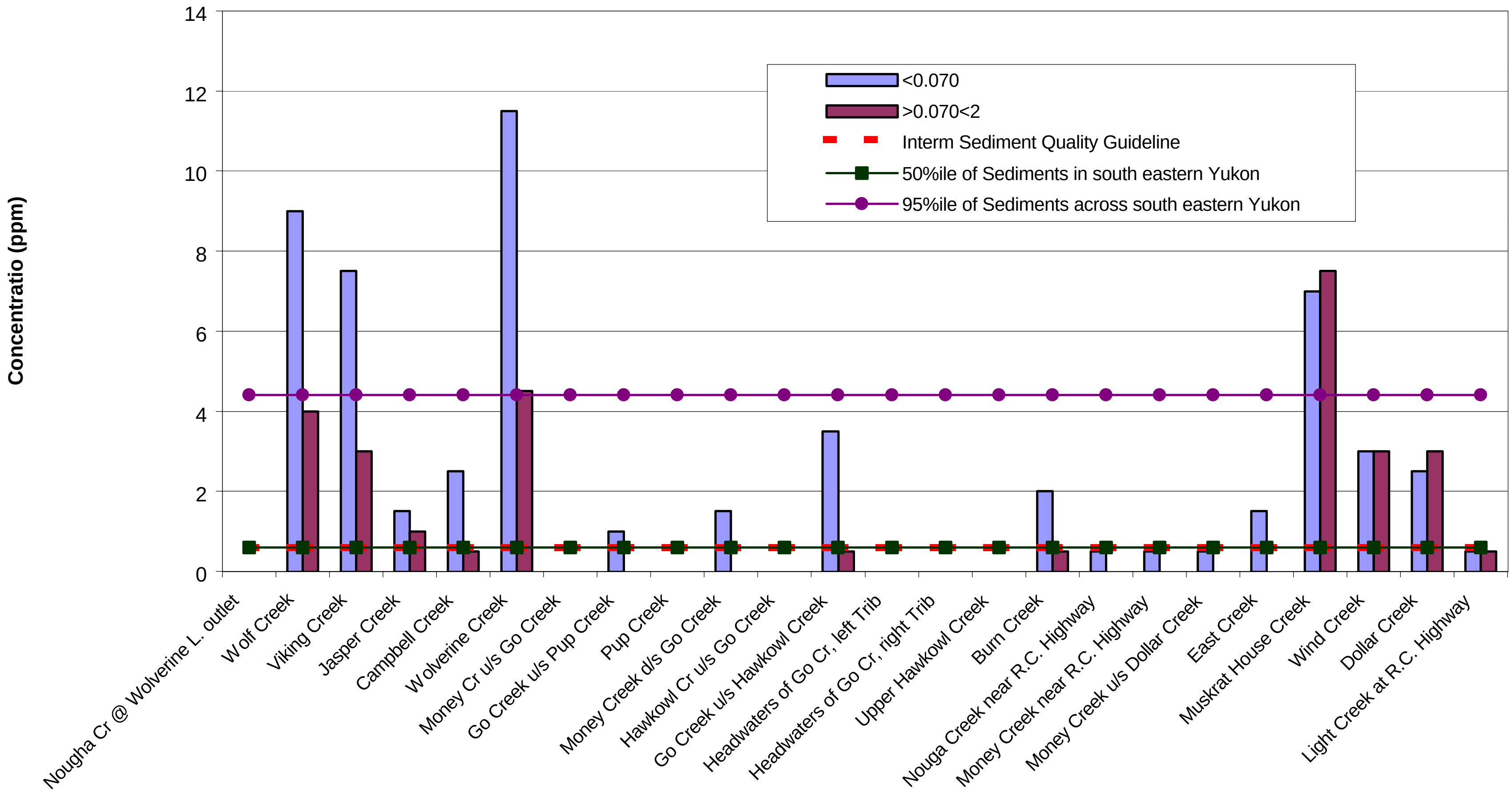
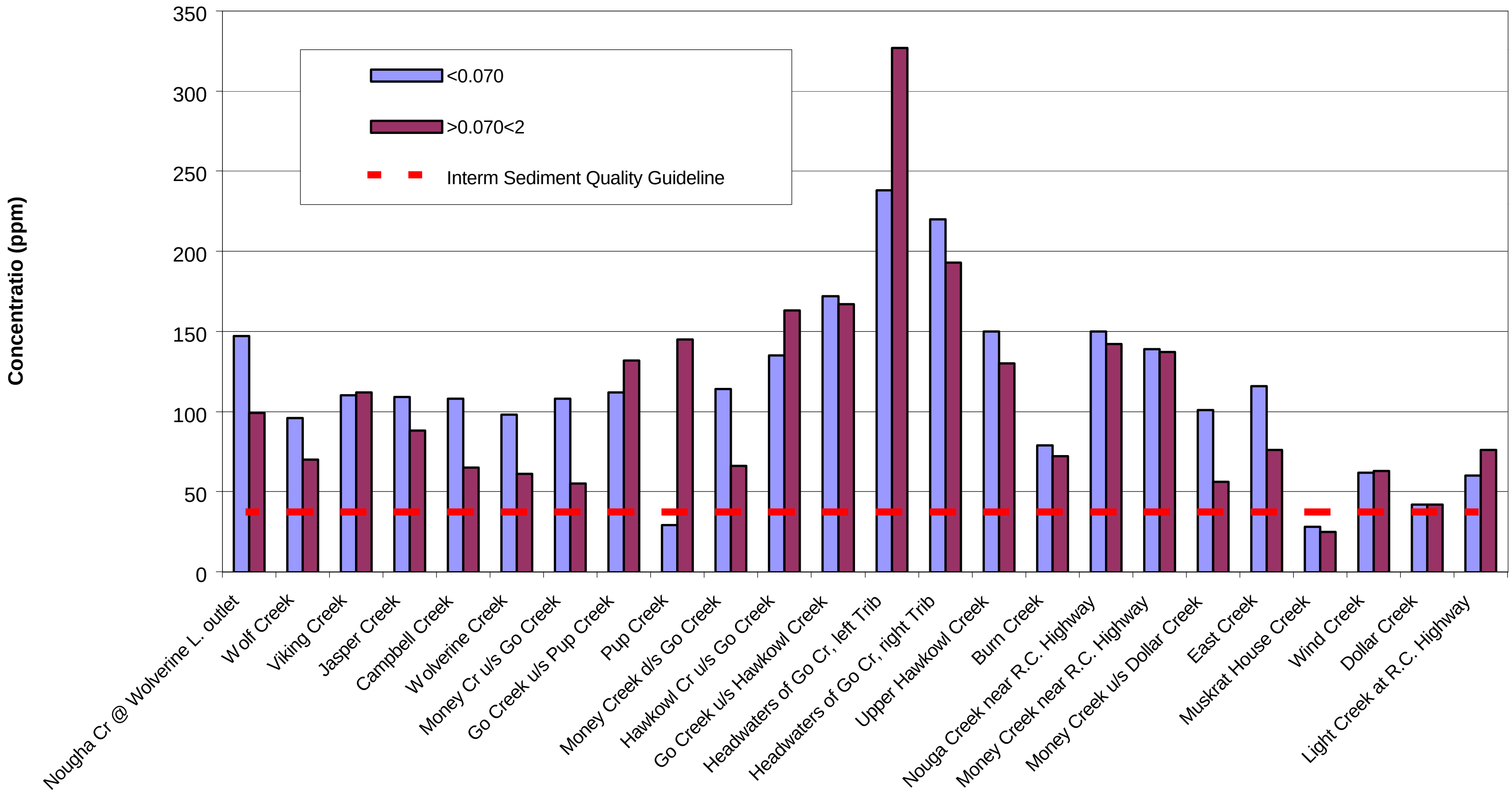
Concentrations of Cadmium in Stream Sediments in the Wolverine Area



EXPATRIATE RESOURCES LTD.

Concentrations of Chromium in Stream Sediments in the Wolverine Area



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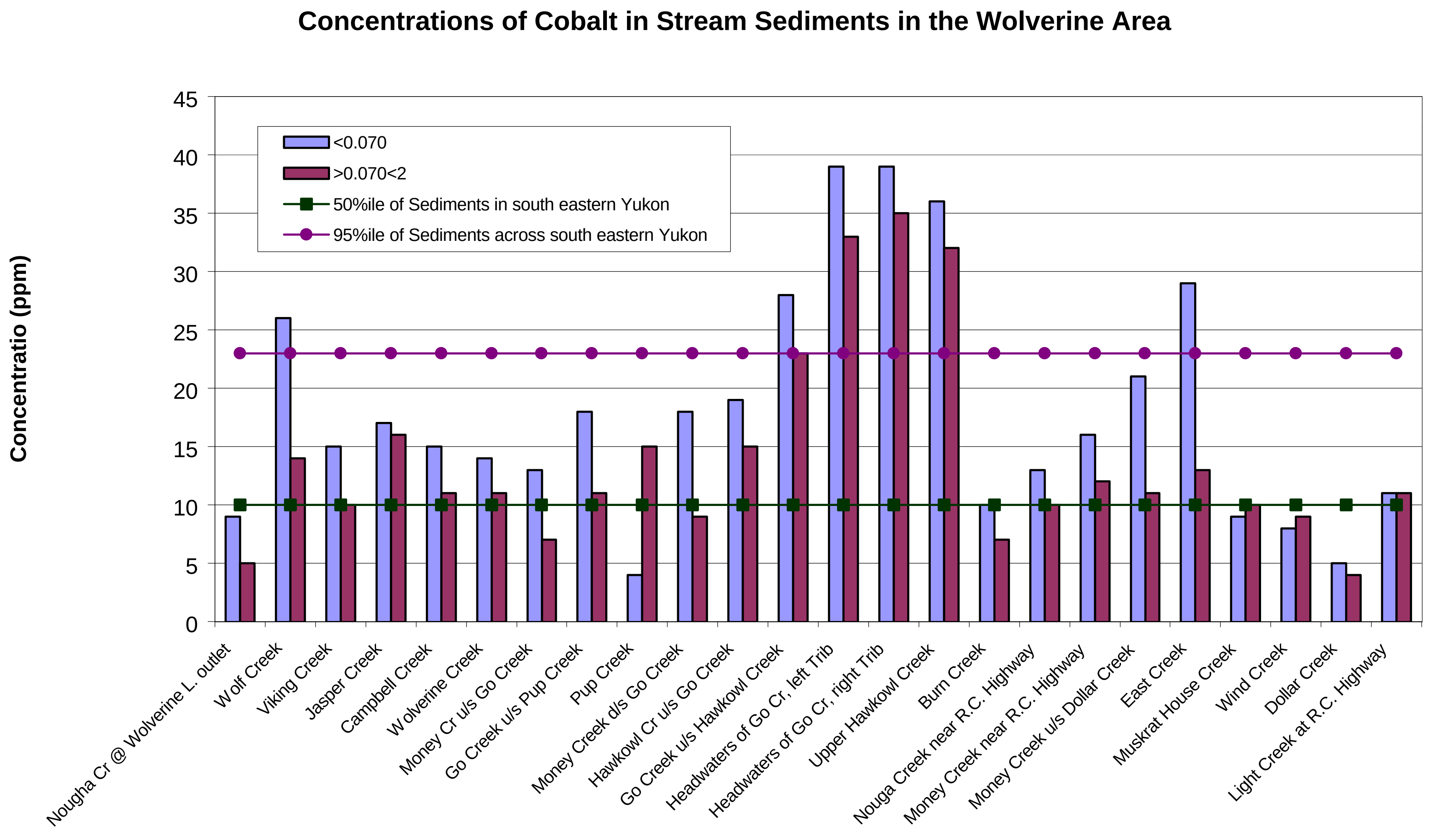

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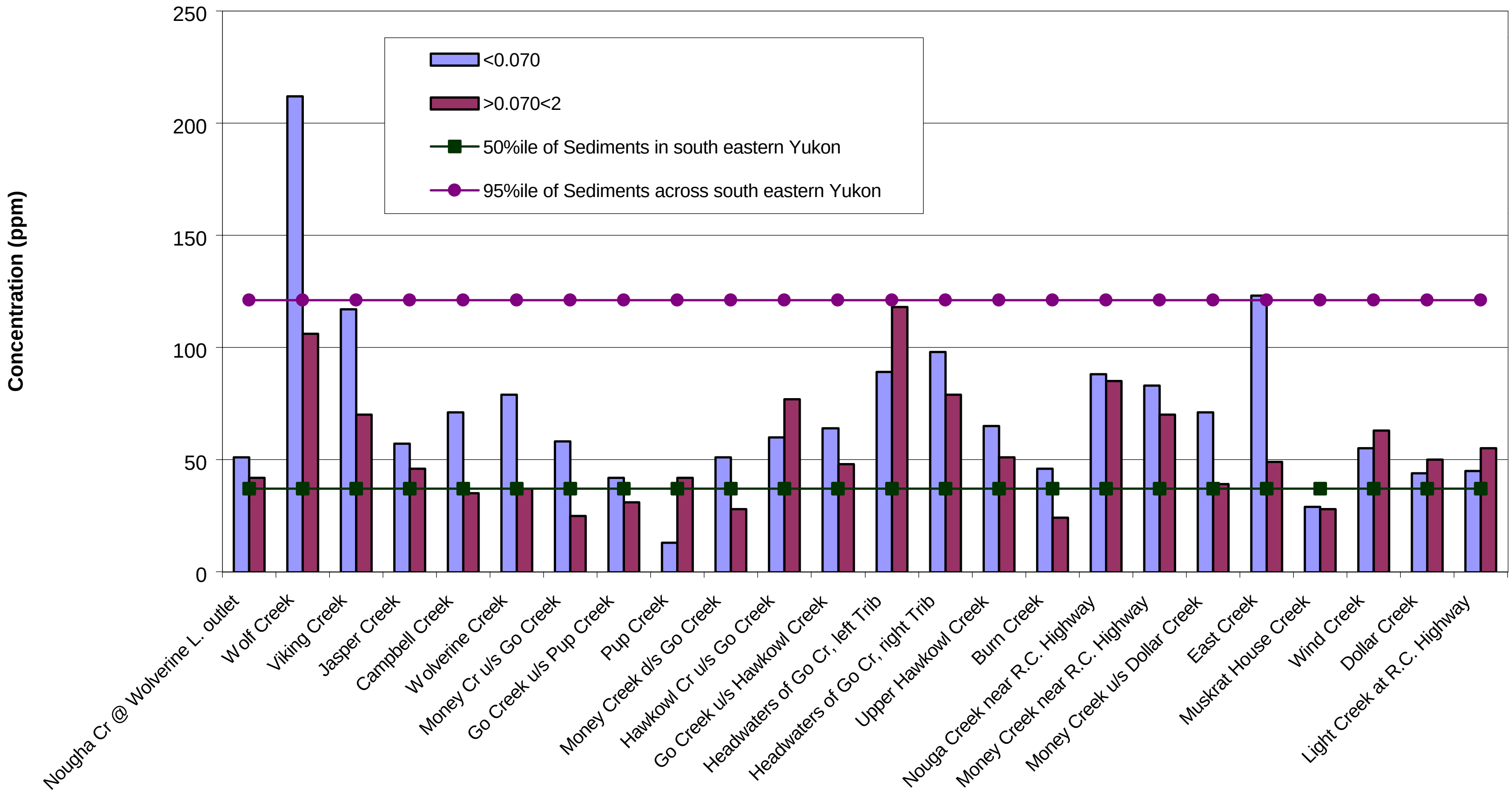
Concentrations of Nickel in Stream Sediments in the Wolverine Area



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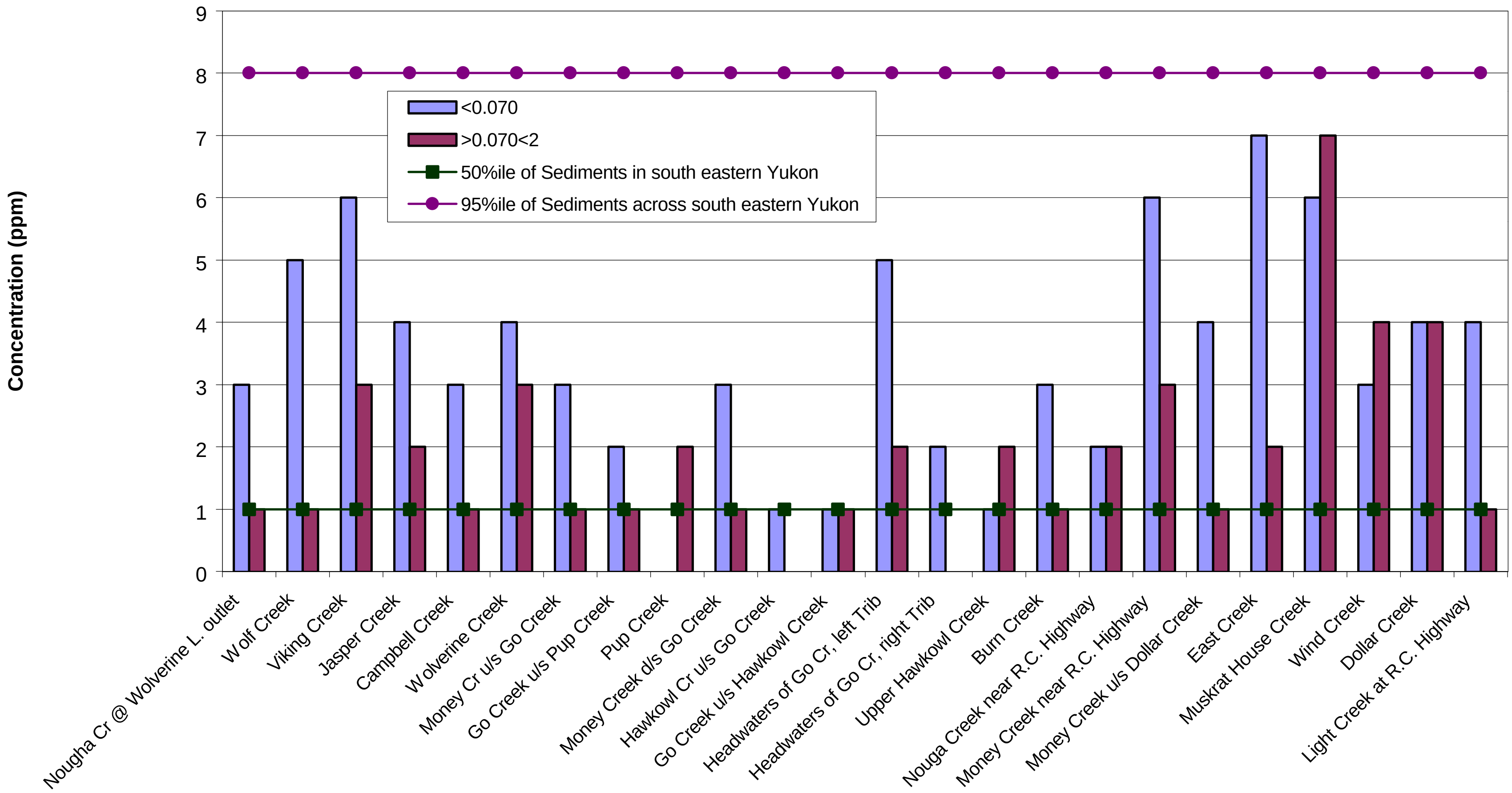
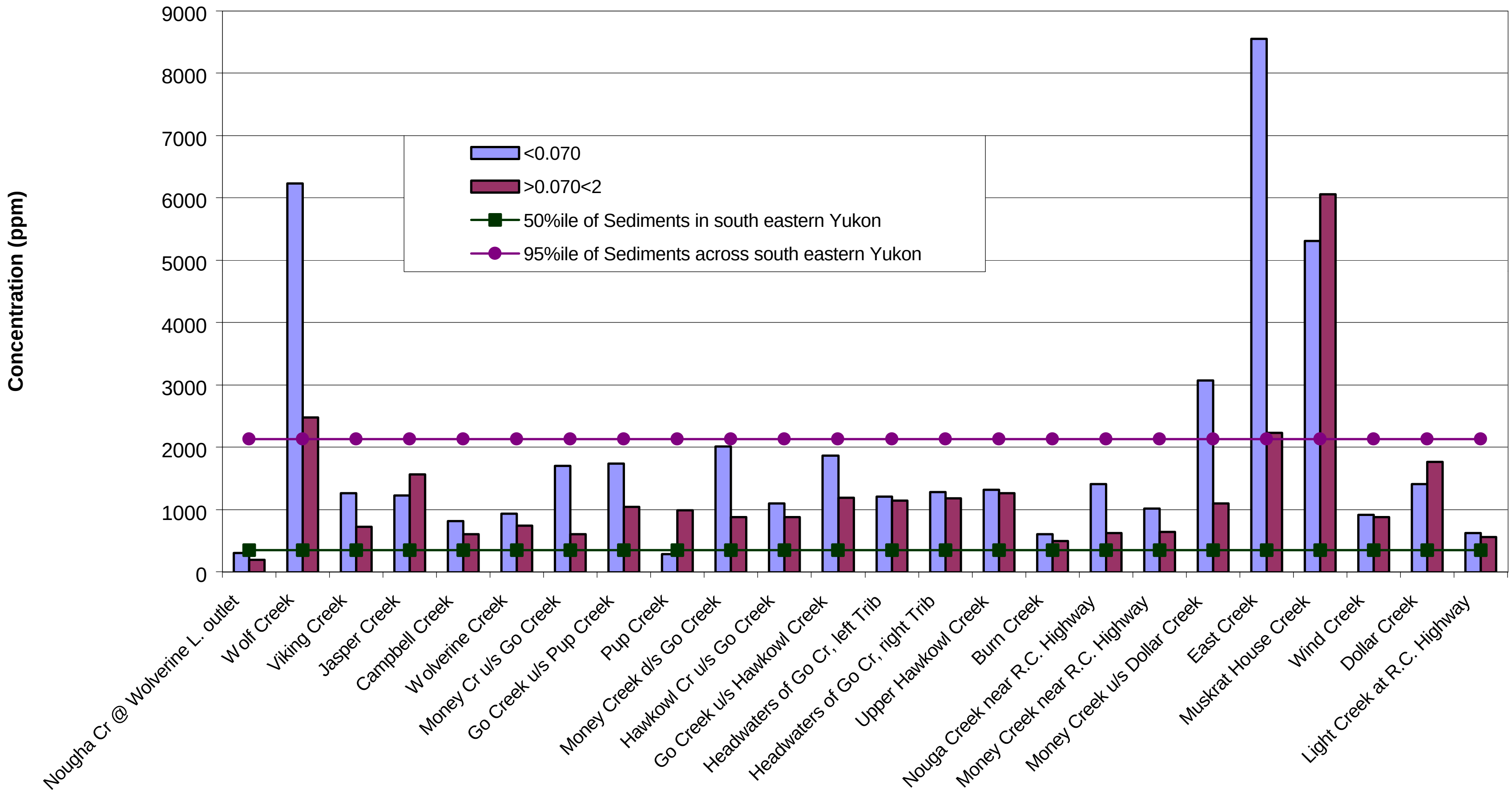
Concentrations of Molybdenum in Stream Sediments in the Wolverine Area



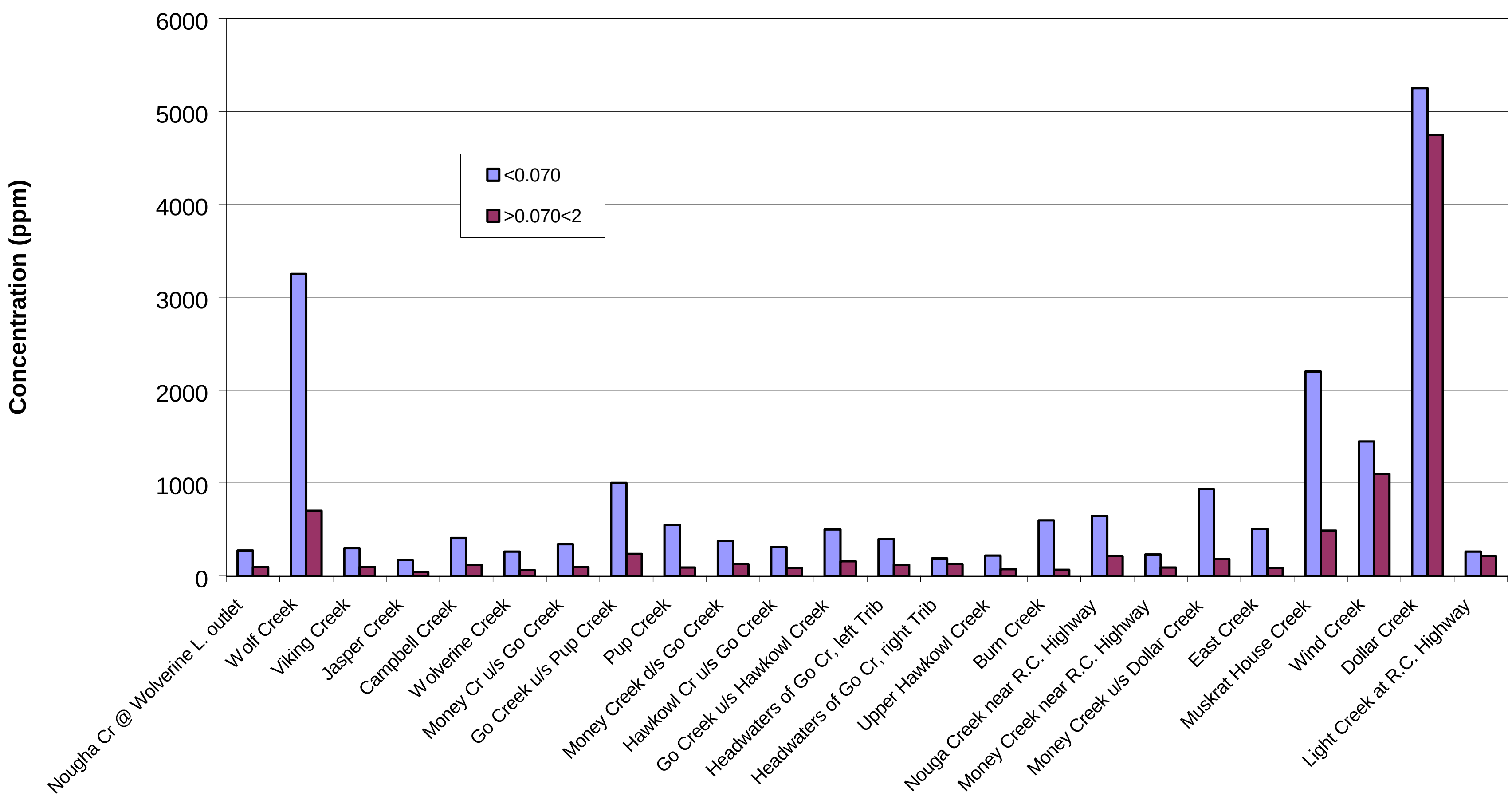
EXPATRIATE RESOURCES LTD.

Concentrations of Manganese in Stream Sediments in the Wolverine Area



EXPATRIATE RESOURCES LTD.

Concentrations of Dissolved Organic Carbon in Stream Sediments in the Wolverine Area



EXPATRIATE RESOURCES LTD.

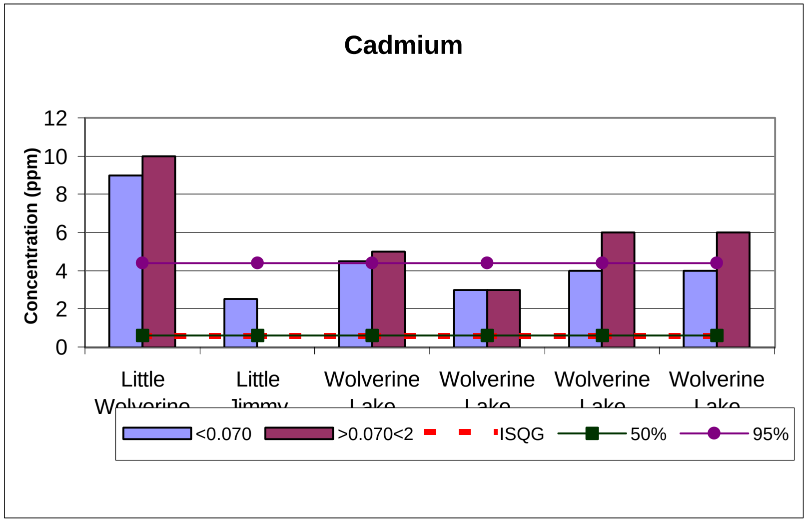
Lake Sediment Quality in the Wolverine Area

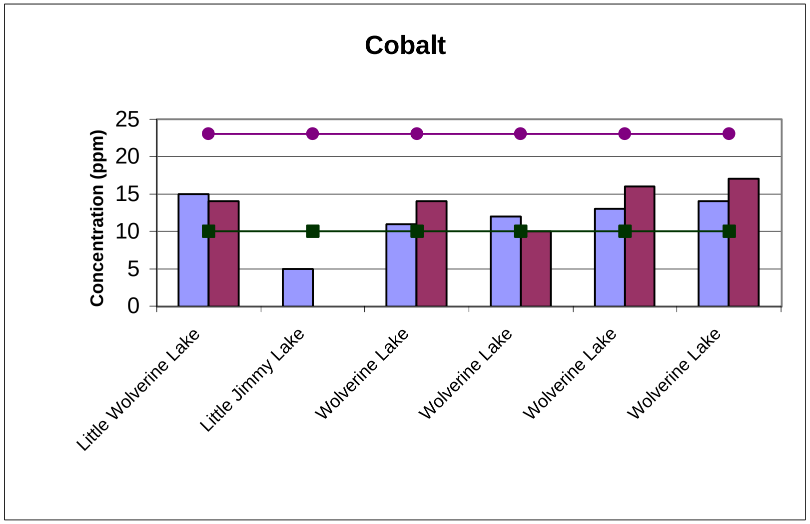
SITE	SAMPLE	D.O.C. ppm		Cd ppm		Co ppm		Cr ppm		Cu ppm		Fe %	
#	DESCRIPTION	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2
L-1 @16m	Little Wolverine Lake	2350	2850	9	10	15	14	81	77	68	71	5.86	5.51
M-1 @13m	Little Jimmy Lake	1150	not/ss	2.5	not/ss	5	not/ss	48	not/ss	23	not/ss	1.45	not/ss
P-1 @21m	Wolverine Lake	1800	1080	4.5	5	11	14	71	77	47	52	4.58	6.07
P-2@35.2m	Wolverine Lake	387	300	3	3	12	10	58	58	37	31	6.38	6.59
P-3 @68m	Wolverine Lake	1250	1050	4	6	13	16	43	49	39	48	3.67	4.25
P-4 @73m	Wolverine Lake	750	625	4	6	14	17	58	58	55	54	3.64	4.38

		Mn ppm		Mo ppm		Ni ppm		Pb ppm		Zn ppm	
		<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2	<0.070	>0.070<2
L-1 @16m	Little Wolverine Lake	2050	1850	4	5	52	54	25	22	860	982
M-1 @13m	Little Jimmy Lake	580	not/ss	9	not/ss	28	not/ss	18	not/ss	142	not/ss
P-1 @21m	Wolverine Lake	2180	2680	5	8	78	97	20	17	446	554
P-2@35.2m	Wolverine Lake	5330	6690	8	9	47	45	18	17	342	292
P-3 @68m	Wolverine Lake	6370	6780	4	4	52	68	20	22	382	496
P-4 @73m	Wolverine Lake	4980	5070	6	5	66	78	16	16	438	556

EXPATRIATE RESOURCES LTD.

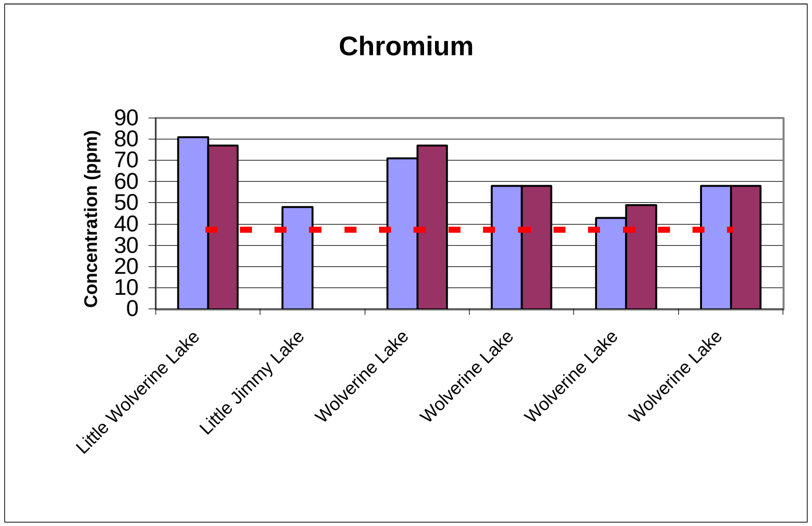
Sediment Quality in Lakes in the Wolverine Area

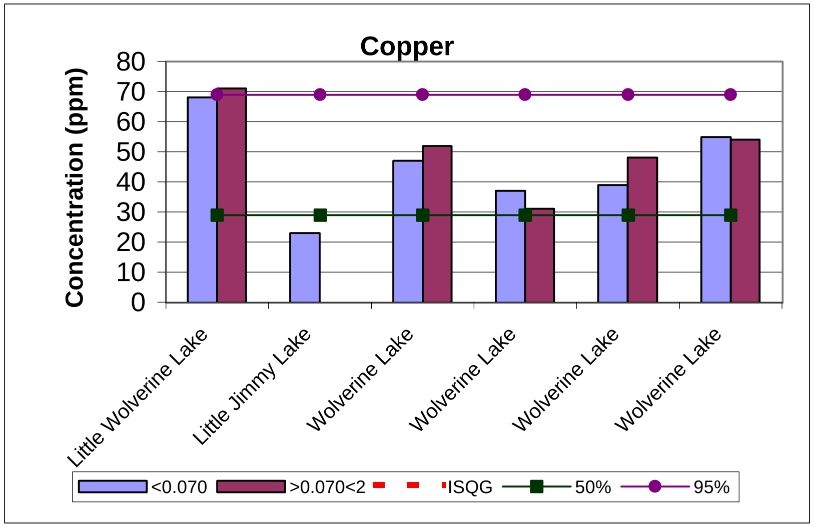




EXPATRIATE RESOURCES LTD.

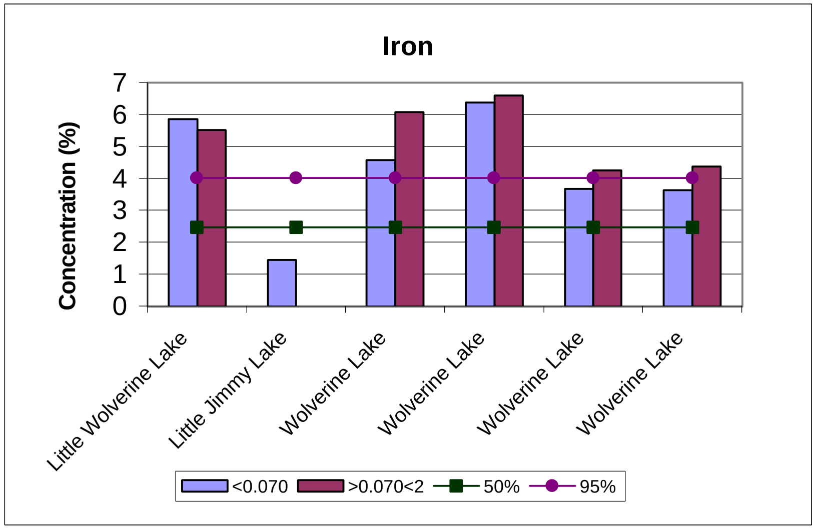
Sediment Quality in Lakes in the Wolverine Area

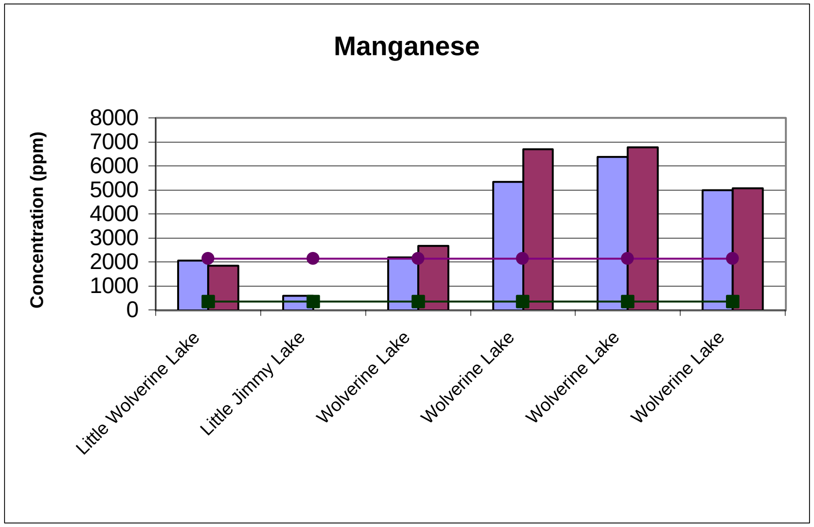




EXPATRIATE RESOURCES LTD.

Sediment Quality in Lakes in the Wolverine Area





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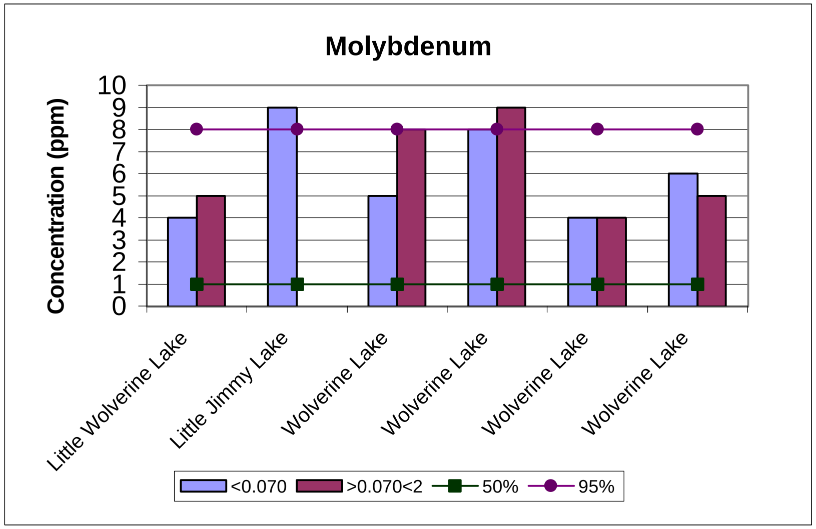
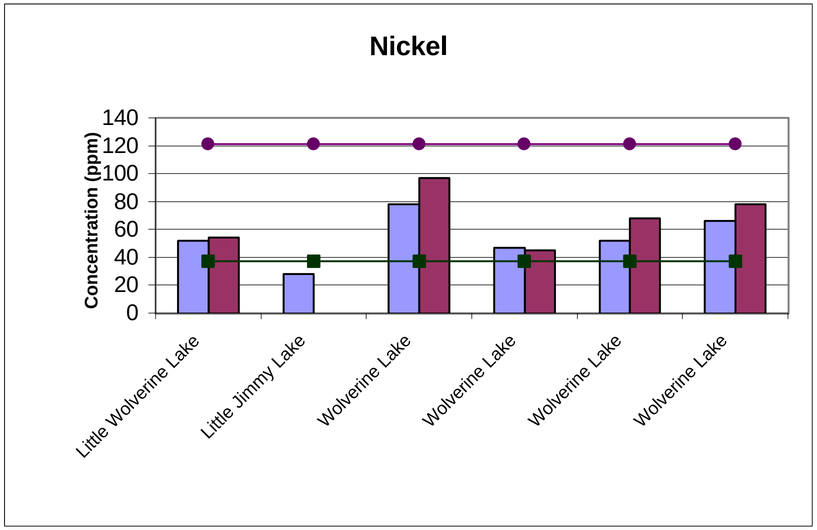
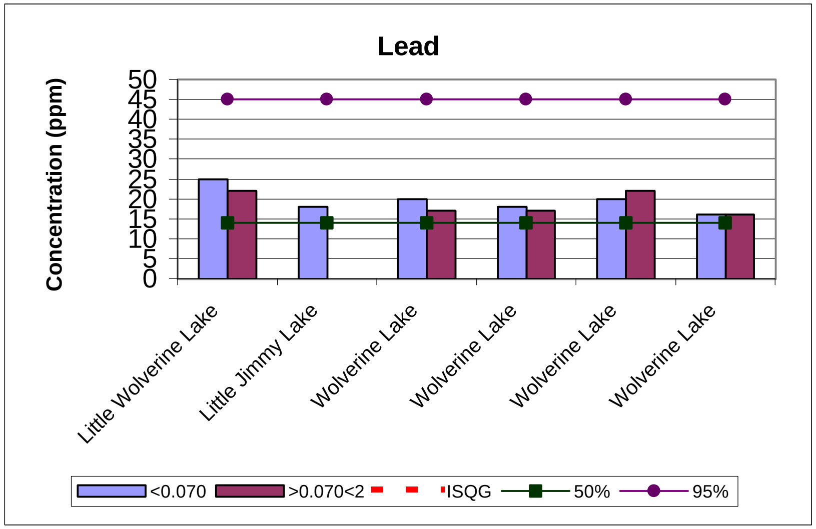
Sediment Quality in Lakes in the Wolverine Area

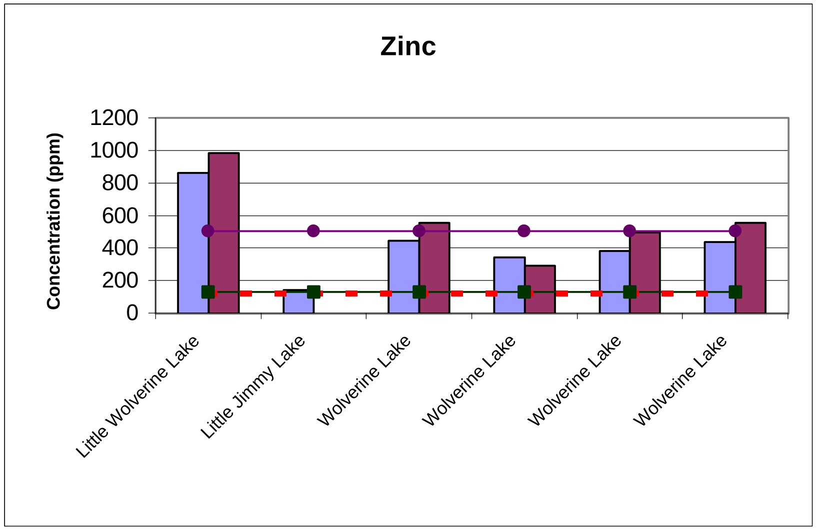




EXPATRIATE RESOURCES LTD.

Sediment Quality in Lakes in the Wolverine Area





Appendix 3D

Wolverine Area – Benthic and Zooplankton Data

EXPATRIATE RESOURCES
WOLVERINE PROJECT

Benthic Invertebrate Data for Streams in the Wolverine Area

Site Location	Nougha Cr @ outlet			Go Creek			Money Cr d/s Go Cr			Nougha Cr @ Hwy			Money Cr u/s Dollar			Wind Cr		
Site Number	W1a	W1b	W1c	W12a	W12b	W12c	W14a	W14b	W14c	W21a	W21b	W21c	W23a	W23b	W23c	W26a	W26b	W26c
Cnidaria																		
Hydra sp	1747	6000	5305															
Bryozoa Unid																P	P	P
Cristatella mucedo																		
Porifera																		
Spongilla lacustris																		
Tardigrada								4	8									
Bivalvia																		
Pisidium sp			3															
Sphaerium sp			18															
Gastropoda																		
Gyraulus parvus			2													13	35	40
Stagnicola arctica																	1	
Valvata sincera	16	96	8					1								24		
Nematoda	33	64	8	34	40	80	72	69	5	63	2	20	56	64	8			
Hirudinea																		
Dina sp (D parva?)																		
Erpobdella sp																		1
Helobdella stagnicola																		
Oligochaeta																		
Chaetogaster sp	176	708	120	1			32	4	96					16	2	9	96	192
Nais sp																40		32
Slavinia appendiculata																		
Enchytraeidae		128	16	2	2	1	8	1										
Lumbriculus variegatus																		
Tubificidae unid J	16		8	1			1						8		1			
Cladocera																		
Alona sp	16				4								8			48		64
Allonella sp															2	16		32
Camptocercus rectirostris																		
Ceriodaphnia reticulata																		
Chydorus sphaericus					2													
Daphnia sp															2			
Eurycercus (Bullatifrons) sp															4	9		
Ilyocryptus sordidus	4																	
Copepoda																		
Calanoida		16	9								2							
Cyclopoida	1	16														2		
Harpacticoida		16		8	2	24		8	48				16	64		2		32
Amphipoda																		
Gammarus lacustris																		
Hyalella azteca	1						9									7		68
Ostracoda Unid																		
Candona sp											2					8		
Cypria sp																8		
Hydracarina, unid J/D	16	64	8	44	32	168	64	36	48	4	4		56	96	42	57	32	192
Arrenurus sp																		
Frontipodia sp																		
Lebertia sp					2		1	4	8				9	32	4		1	
Sperchon sp		136	53		2			1	1				9		2	56	64	64
Torrenticola sp		32	56	92	58	40	16	28	48	32	76	60	80	48	54	88	32	
Oribatei						1												
Plecoptera, Unid J/D						1	10	8			1		24	1	9			
Capnia sp				16	6	9	11	5		4	6		16		20			
Isoperla sp				1									2		1			
Podmosta sp																127	37	
Malenka sp				10	8	8	1	3	12	16	29	14		1		1		1
Megarcys sp										2	3	6	2	3	1			
Skwala curvata			1	1				5	8		7	5		16	2			
Skwala paralella							1			4								
Sweltsa sp gp		1		6	2				1				8	1	1			
Taenionema sp											3	16						
Zapada sp	42	40	1	128	57	214	24	18	113	26	54	51	6	47	7	2		32
Ephemeroptera																		

EXPATRIATE WOLVERINE
WOLVERINE PROJECT

Benthic Invertebrate Data for Streams in the Wolverine Area

Site Location	Nougha Cr @ outlet			Go Creek			Money Cr d/s Go Cr			Nougha Cr @ Hwy			Money Cr u/s Dollar			Wind Cr		
Site Number	W1a	W1b	W1c	W12a	W12b	W12c	W14a	W14b	W14c	W21a	W21b	W21c	W23a	W23b	W23c	W26a	W26b	W26c
Ameletus sp														1	3			
Baetis sp	146	240	60	76	52	169	1082	548	2019	257	219	425	209	1060	63	196	10	179
Cinygmula sp				2	3	2	42	22	5		6							32
Ephemerella coloradensis				5		5			3									
Ephemerella doddsi							20	8	23	3	7	7						
Ephemerella inermis	1	4					12	7	23	4	4			2				
Ephemerella grandis							19	7	14	3	6	5	1	32	2			
Epeorus (Iron) albertae										6	1	7						
Epeorus (Iron)longimanus				4	9	14		1	5	14	4	8		32				
Ephemerella sp							31	5	3	5	22	33	4	1	6	1		
Rhithrogena sp				7	3	17	10	20	39	11	36	15	8	33	19			
Siphlonurus sp																1		
Trichoptera, Unid J				31	14	32							80	160	14	24		64
Trichoptera pupae			1													1	1	
Agraylea sp			1										1					
Agrypnia sp																		
Arctopsyche sp	5			13	12	32		3	8	41	154	105	16	32			33	2
Brachycentrus sp				14	5	6	38	38	78	24	58	65	48	79	6	1	2	
Ceraclea sp			1													4	4	1
Clostoeca sp													1		1			
Dicosmoecus sp				1														
Glossosoma sp		1					8											
Grammotaulius sp																10	15	4
Hydropsychidae unid J							12	49	17									
Hydropsyche sp	452	576	395				11	8										
Hydroptilidae J		81	64															
Hydroptila sp												1	8	32	1	8		
Micrasema sp				13	20	17	3		11	3	7	9	1			1		
Mystacides sp																		
Psychoglypha sp																1		2
Rhyacophila sp juv			8								4							
Rhyacophila acropedes/vao		4	2	2			3	2	3	2	2	11		1	1	2		
Rhyacophila (hyalinata?)										2	2	3						
Diptera, Unid adult											1	2		1			1	
Diptera Unid P																		
													1					
Tipulidae																		
Antocha sp											4							
Dicranota sp	1				4								1			1	4	2
Dolichopeza sp																		
Tipula sp																		
Simulidae																		
Prosimulium sp				1	1													
Simulium sp L	1773	942	434	4	12	16	3	2	9	692	160	211				2701	2282	5399
Simulium sp P	984	1320	100		1				1	153	29	230					2	3
Chironomidae adult																		
Chironomidae pupae	195	584	104	5	20	17	17	20	48	64	40	112	16	33	10	185	369	408
Chironomidae unid J/D	1978	1584	242	432	203	1238	357	347	1715	443	111	76	2808	1452	264	2740	4999	10543
Tanypodinae																1		
Procladius sp					3													
Thienemannimyia sp	781	882	156							2	3	1	26	21	21	78	43	300
Chironomini																		
Chironomus sp																		
Constempelina sp																		
Cryptochironomus sp							1											
Dicrotendipes sp																10	33	257
Endochironomus sp																		
Micropsectra sp							1	4								25		290
Microtendipes sp																		
Pagastiella sp																		
Paracladius sp																		
Paralauterborniella sp																		
Phaenopsectra sp																		
Polypedilum (Polypedilum) sp																		
Rheotanytarsus sp	16									13	10	8	40	16	4	272	449	5344
Stempelina sp																8		
Stichtochironomus sp																		
Tanytarsus sp																		
Orthocladiinae																		
Brillia sp										4	6					1		32
Cardiocladius sp	4	36	9	52	52	59	79	65	199	39	9	133	335	51				
Corynoneura sp				1	4		1			4	6		32		6	48	32	128
Cricotopus sp	192	316	84	110	146	268	230	195	581	117	127	132	420	338	217	760	1171	2996
Eukiefferiella sp	516	968	143	132	61	155	263	128	384	191	122	181	676	329	109	704	1876	
Euryhapsis sp										4	6					1		32

EXPATRIATE RESOURCES
WOLVERINE PROJECT

Benthic Invertebrate Data for Streams in the Wolverine Area

Site Location	Nougha Cr @ outlet			Go Creek			Money Cr d/s Go Cr			Nougha Cr @ Hwy			Money Cr u/s Dollar			Wind Cr		
Site Number	W1a	W1b	W1c	W12a	W12b	W12c	W14a	W14b	W14c	W21a	W21b	W21c	W23a	W23b	W23c	W26a	W26b	W26c
Heterotrissocladius sp																		
Synorthocladius sp	28	96	282		15	42	1	8	16	2	10	9			4	81	64	449
Thienemanniella sp				30	4	16	16	20	66	8	42	20	64	112	20	16		64
Diamesinae																		
Monodiamesa sp																	1	
Blephariceridae																		
Bibiocephala sp										1								
Ceratopogonidae																		
Palpomyia sp																		1
Deuterophlebiidae																		
Deuterophlebia sp										1								
Empididae pupae									1							1		
Chelifera sp				4	7	1	1		4									
Clinocera sp						1			2			4					1	
Weidemannia sp												4						
Psychodidae																		
Pericoma sp				4	2	1				4						2		66
Coleoptera																		
Elmidae, unid J											1							
Optioservus sp												2						
Homoptera																		
Cicadellidae																	1	
Hymenoptera Unid A	1												1				2	
Lepidoptera L													1				2	
Turbellaria unid	7	32	16													48		512

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Benthic Invertebrate Data for Lakes in the Wolverine Area

Site Location	Little Jimmy L.			Wolverine Lake			Wolverine Lake			Wolverine Lake			Little Wolverine L.		
Site Number	M1a	M1b	M1c	W3a	W3b	W3c	W5a	W5b	W5c	W7a	W7b	W7c	W10a	W10b	W10c
Cnidaria															
Hydra sp						2		9							
Bryozoa Unid															
Cristatella mucedo													P	P	P
Porifera															
Spongilla lacustris													P	P	P
Tardigrada															
Bivalvia															
Pisidium sp	70	3	44	12	18	17	25	80	27	64	52	95	107	16	94
Sphaerium sp	6		7			15			1	8	3	5	421	195	93
Gastropoda															
Gyraulus parvus					1								5	1	
Stagnicola arctica				2	1									4	
Valvata sincera			1	3	22	48	3	8	26		1	18	4	4	13
Nematoda	870	65	429	67	61	58	689	865	460	104	311	746	303	62	411
Hirudinea															
Dina sp (D parva?)													10	4	1
Erpobdella sp															
Helobdella stagnicola													2		1
Oligochaeta															
Chaetogaster sp	8	4	14		3	9	48	192	36		112	32	72	28	32
Nais sp								1			1		4	8	
Slavinia appendiculata						1								2	8
Enchytraeidae	8			1	1	4			4			8	72	7	1
Lumbriculus variegatus	3	2	1			3						2	13	9	4
Tubificidae unid J	116	155	194	14	23	151	85	37	65	28	73	46	406	45	178
Cladocera															
Alona sp	3	10	171	2	6	113	249	56	24	32	169	192	352	110	8
Allonella sp															
Camptocercus rectirostris					2	1				4	8	8			
Ceriodaphnia reticulata		3	1	2			2						4	6	1
Chydorus sphaericus				10	2	15	3280	144	36				8		8
Daphnia sp															
Eurycercus (Bullatifrons) sp													14	17	
Ilyocryptus sordidus										4					
Copepoda															
Calanoida	8	6	6	3	2	2		8	8		32			2	
Cyclopoida		2	30	3	3	34	16	72	16	4	32	8		8	17
Harpacticoida	97	38	490	25	49	48	192	240	140	128	456	560	32	22	24
Amphipoda															
Gammarus lacustris					1									2	
Hyalella azteca	26	23	74		1	9			4	6	11	6	108	187	22
Ostracoda Unid		1		20	6	8		184	64	4	56	32	44	2	
Candona sp	14	7	89	14	13	111	33	112	9		16	64	44	22	54
Cypria sp	23	15	177	102	133	263	60	360	56	36	76	32	36	12	16
Hydracarina, unid J/D				2	3	2	1	40	13			8			
Arrenurus sp									1						
Frontipodia sp			4	1				8							
Lebertia sp	1				2	1		1							
Sperchon sp															
Torrenticola sp															

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Benthic Invertebrate Data for Lakes in the Wolverine Area

Site Location	Little Jimmy L.			Wolverine Lake			Wolverine Lake			Wolverine Lake			Little Wolverine L.		
Site Number	M1a	M1b	M1c	W3a	W3b	W3c	W5a	W5b	W5c	W7a	W7b	W7c	W10a	W10b	W10c
Oribatei															
Plecoptera, Unid J/D															
Capnia sp												1			
Isoperla sp															
Podmosta sp															
Malenka sp															
Megarcys sp															
Skwala curvata															
Skwala paralella															
Sweltsa sp gp															
Taenionema sp															
Zapada sp															
Ephemeroptera															
Ameletus sp															
Baetis sp					1										
Cinygmula sp															
Ephemerella coloradensis															
Ephemerella doddsi															
Ephemerella inermis															
Ephemerella grandis															
Epeorus (Iron) albertae															
Epeorus (Iron)longimanus															
Ephemerella sp															
Rhithrogena sp															
Siphlonurus sp															
Trichoptera, Unid J				1	1	3							5		
Trichoptera pupae	1														
Agraylea sp													4		
Agrypnia sp															1
Arctopsyche sp				1											
Brachycentrus sp															
Ceraclea sp					1			1					1	1	
Clostoeca sp	3								1				3		
Dicosmoecus sp															
Glossosoma sp															
Grammotaulius sp															
Hydropsychidae unid J															
Hydropsyche sp															
Hydroptilidae J				24											
Hydroptila sp															
Micrasema sp															
Mystacides sp	2		1					1							4
Psychoglypha sp															
Rhyacophila sp juv															
Rhyacophila acropedes/vao															
Rhyacophila (hyalinata?)															
Diptera, Unid adult															
Diptera Unid P															
Tipulidae															
Antocha sp															
Dicranota sp															
Dolichopeza sp															1
Tipula sp													1		
Simulidae															
Prosimulium sp															
Simulium sp L					1							4			
Simulium sp P															
Chironomidae adult				1											
Chironomidae pupae			1				37	5	2		16	8	8	4	
Chironomidae unid J/D	150	20	239	34	48	34	354	289	412	252	920	1161	450	142	874

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Benthic Invertebrate Data for Lakes in the Wolverine Area

Site Location	Little Jimmy L.			Wolverine Lake			Wolverine Lake			Wolverine Lake			Little Wolverine L.		
Site Number	M1a	M1b	M1c	W3a	W3b	W3c	W5a	W5b	W5c	W7a	W7b	W7c	W10a	W10b	W10c
Tanypodinae															
Procladius sp	23	10	22	10	13	12	13	10	49	40	7	41	23	14	53
Thienemannimyia sp	1		6	1	4	1			9	12	50	66	6	8	11
Chironomini															
Chironomus sp			1												
Constempelina sp			1												
Cryptochironomus sp													9	1	11
Dicrotendipes sp			6			1					2		89	107	190
Endochironomus sp													1	1	
Micropsectra sp		35	69												
Microtendipes sp	349	17	6	5	16	4			117	4	1		79	16	30
Pagastiella sp															16
Paracladius sp				1			1	8	1						
Paralauterborniella sp				1						4	8	1			
Phaenopsectra sp	10	6	21	4	8	4	2	3	33	2	12	1	2	4	
Polypedilum (Polypedilum) sp				1	11	2		8	11	10	10		6		3
Rheotanytarsus sp	8	2	58	14	43	70	336	133	207	49	24	26	10	4	8
Stempelina sp								8							
Stichtochironomus sp										2	10	2	4		
Tanytarsus sp	4			1	2	4	4	8	7	47	106	84	16	8	8
Orthocladiinae															
Brillia sp															
Cardiocladius sp															
Corynoneura sp													12		
Cricotopus sp				1	5	5	2	16					1	3	
Eukiefferiella sp				1	2	1	1	8							1
Euryhapsis sp															
Heterotrissocladius sp							1								
Synorthocladius sp													54	17	
Thienemanniella sp															
Diamesinae															
Monodiamesa sp															
Blephariceridae															
Bibiocephala sp															
Ceratopogonidae															
Palpomyia sp							1						10	2	7
Deuterophlebiidae															
Deuterophlebia sp															
Empididae pupae															
Chelifera sp							1	9	1	1					
Clinocera sp															
Weidemannia sp															
Psychodidae															
Pericoma sp															
Coleoptera															
Elmidae, unid J															
Optioservus sp															
Homoptera															
Cicadellidae															
Hymenoptera Unid A															
Lepidoptera L															
Turbellaria unid	2	3	12	2	1	3	5	79	1	4	97	37	64	66	

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

MEASUREMENTS OF ADULT COPEPODA

LITTLE JIMMY LAKE

Date: 22-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
JIMMY		female	male	female	male
	1	2,693.9	2,734.7	1,326.5	1,163.3
#1	2	2,551.3	2,489.8	1,367.3	1,183.7
VERT HAUL	3	2,734.9	2,428.6	1,265.3	1,285.7
	4	2,816.6	2,816.3	1,306.1	1,142.8
	5	2,857.4	2,653.0	1,326.5	1,183.7
	6	2,837.0	2,591.8	1,265.3	1,183.7
	7	2,837.0	2,734.7	1,326.5	1,122.4
	8	2,571.7	2,755.1	1,285.7	1,163.3
	9	2,877.8	2,836.7	1,367.3	1,183.7
	10	2,796.2	2,775.5	1,408.2	1,244.9
	AVER	**2757.36**	**2681.61**	**1324.48**	**1185.70**

Date: 22-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
JIMMY		female	male	female	male
	1	2,734.7	3,020.4	1,306.1	1,224.5
#2	2	2,816.6	2,653.0	1,224.5	1,183.7
VERT HAUL	3	2,775.8	2,959.2	1,285.7	1,224.5
	4	2,734.9	2,897.9	1,285.7	1,285.7
	5	2,755.4	2,755.1	1,306.1	1,204.1
	6	2,653.3	2,714.3	1,285.7	1,163.3
	7	2,755.4	2,714.3	1,306.1	1,183.7
	8	3,122.7	2,653.0	1,265.3	1,244.9
	9	2,816.6	3,061.2	1,367.3	1,163.3
	10	2,775.8	2,795.9	1,326.5	1,204.1
	AVER	**2794.10**	**2822.43**	**1295.91**	**1208.15**

Date: 22-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
JIMMY		female	male	female	male
	1	2,591.8	2,816.3	1,326.5	1,265.3
#3	2	2,796.2	2,755.1	1,346.9	1,326.5
VERT HAUL	3	2,877.8	2,755.1	1,265.3	1,265.3
	4	2,918.6	2,693.9	1,387.7	1,183.7
	5	2,571.7	3,061.2	1,326.5	1,142.8
	6	2,755.4	2,836.7	1,346.9	1,142.8
	7	2,775.8	2,795.9	1,285.7	1,163.3
	8	3,122.7	2,897.9	1,367.3	1,122.4
	9	2,959.5	3,000.0	1,346.9	1,183.7
	10	2,775.8	2,897.9	1,285.7	1,142.8
	AVER	**2814.51**	**2851.00**	**1328.56**	**1193.87**

Date: 22-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
JIMMY		female	male	female	male
	1	2,918.3	2,653.0	1,367.3	1,224.5
#4	2	2,959.5	2,816.3	1,346.9	1,224.5
VERT HAUL	3	2,755.4	2,734.7	1,326.5	1,163.3
	4	2,959.5	2,755.1	1,265.3	1,142.8
	5	2,796.2	2,755.1	1,265.3	1,183.7
	6	2,714.5	2,714.3	1,367.3	1,244.9
	7	2,734.9	2,795.9	1,387.7	1,224.5
	8	2,694.1	2,795.9	1,346.9	1,183.7
	9	2,979.9	2,857.1	1,265.3	1,224.5
	10	2,755.4	2,755.1	1,265.3	1,224.5
	AVER	**2826.76**	**2763.24**	**1320.40**	**1204.07**

Date: 22-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
JIMMY		female	male	female	male
	1	2,653.0	2,571.4	1,387.7	1,306.1
#5	2	2,714.5	2,755.1	1,408.2	1,244.9
VERT HAUL	3	2,775.8	2,693.9	1,326.5	1,183.7
	4	2,837.0	2,653.0	1,428.6	1,142.8
	5	2,694.1	2,673.4	1,387.7	1,265.3
	6	2,898.2	2,755.1	1,449.0	1,224.5
	7	2,877.8	2,857.1	1,346.9	1,285.7
	8	2,694.1	2,714.3	1,387.7	1,224.5
	9	2,551.3	2,857.1	1,408.2	1,183.7
	10	2,857.4	2,795.9	1,367.3	1,204.1
	AVER	**2755.32**	**2732.63**	**1389.78**	**1226.52**

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

ZOOPLANKTON ANALYSIS

Site: **LITTLE JIMMY LAKE**
Date: 22-Aug-92

Phylum * Subclass ** Order	Suborder	Species	stage	JIMMY 08-22-92 HAUL #1 NR /SAMPLE	JIMMY 08-22-92 HAUL #2 NR /SAMPLE	JIMMY 08-22-92 HAUL #3 NR /SAMPLE	JIMMY 08-22-92 HAUL #4 NR /SAMPLE	JIMMY 08-22-92 HAUL #5 NR /SAMPLE
	CYCLOPOIDA	CYCLOPS scutifer	fem & eggs					
			fem no eggs	112	64	448	576	
			male					
			cop	26,720	22,848	35,328	56,576	22,656
			Total	**26,832**	**22,912**	**35,776**	**57,152**	**22,656**
COPEPODA**	CALANOIDA	HETEROCOPE septentrionalis	female	64	260	236	176	260
			male	68	288	252	156	288
			Total	**132**	**548**	**488**	**332**	**548**
		DIAPTOMUS pribilofensis	fem & eggs	120	128	128	768	384
			fem no eggs	6,080	11,904	18,752	20,736	12,288
			male	3,392	9,536	8,704	12,288	12,928
		DIAPTOMUS ashlandi	fem & eggs					
			fem no eggs					
			male					
		TOTAL DIAPTOMUS copepodites	cop	4,032	2,048	3,584	3,328	2,944
			Total	**13,624**	**23,616**	**31,168**	**37,120**	**28,544**
	Total nauplii		**nauplii**	**25,408**	**23,616**	**50,240**	**62,848**	**20,800**
	TOTAL COPEPODA (excluding nauplii)			**40,588**	**47,076**	**67,432**	**94,604**	**51,748**
ROTIFERA * PLOIMA		KELLICOTTIA		960	1,600	3,712	4,416	896
		POLYARTHRA						
FLOSCULARIACEAE		CONOCHILUS unicornis (colonies)		140	496	128	432	
	TOTAL ROTIFERA(excluding Conochilus colonies)			**960**	**1,600**	**3,712**	**4,416**	**896**
		loose DIAPTOMUS eggs		4,608	9,728	12,480	19,392	11,840

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

MEASUREMENTS AND REPRODUCTIVE CONDITION

LITTLE WOLVERINE LAKE

Date: 19-Aug-92	BOSMINA longispina			
LAKE	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
LITTLE WOLVERINE	32.0	653.1	1	1
#1	34.0	693.9	1	1
VERT HAUL	32.0	653.1	1	1
	36.0	734.7	3	3
	33.0	673.5	1	1
	29.0	591.8	1	1
	33.0	673.5	1	1
	32.5	663.3	1	1
	31.0	632.6	1	1
	32.0	653.1	1	1
		667.63		

Date: 19-Aug-92	BOSMINA longispina			
LAKE	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
LITTLE WOLVERINE	35.0	714.3	1	1
#4	32.0	653.1	1	1
VERT HAUL	33.0	673.5	1	1
	33.0	673.5	1	1
	31.0	632.6	1	1
	32.0	653.1	1	1
	32.0	653.1	1	1
	33.0	673.5	1	1
	29.0	591.8	1	1
	30.0	612.2	1	1
		664.72		

Date: 19-Aug-92	BOSMINA longispina			
LAKE	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
LITTLE WOLVERINE	35.0	714.3	1	1
#2	35.0	714.3	1	1
VERT HAUL	34.0	693.9	1	1
	32.0	653.1	1	1
	32.0	653.1	1	1
	32.0	653.1	1	1
	31.0	632.6	1	1
	33.0	673.5	1	1
	34.0	693.9	1	1
	34.0	693.9	1	1
		673.46		

Date: 19-Aug-92	BOSMINA longispina			
LAKE	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
LITTLE WOLVERINE	32.0	653.1	1	1
#5	32.0	653.1	1	1
VERT HAUL	31.0	632.6	1	1
	30.0	612.2	1	1
	30.0	612.2	1	1
	28.0	571.4	1	1
	31.0	632.6	1	1
	32.0	653.1	1	1
	32.0	653.1	1	1
	31.0	632.6	1	1
		623.90		

Date: 19-Aug-92	BOSMINA longispina			
LAKE	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
LITTLE WOLVERINE	32.5	663.3	1	1
#3	33.0	673.5	1	1
VERT HAUL	30.0	612.2	1	1
	29.5	602.0	1	1
	32.0	653.1	1	1
	30.0	612.2	1	1
	32.0	653.1	1	1
	35.0	714.3	1	1
	33.5	683.7	1	1
	28.0	571.4	1	1
		638.48		

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

ZOOPLANKTON ANALYSIS

Site: **LITTLE WOLVERINE**
Date: 19-Aug-92

Phylum * Subclass ** Order	Suborder	Species	stage	L.WOLVERINE 08-19-92 HAUL #1 NR /SAMPLE	L.WOLVERINE 08-19-92 HAUL #2 NR /SAMPLE	L.WOLVERINE 08-19-92 HAUL #3 NR /SAMPLE	L.WOLVERINE 08-19-92 HAUL #4 NR /SAMPLE	L.WOLVERINE 08-19-92 HAUL #5 NR /SAMPLE
CLADOCERA		EUBOSMINA longispina	fem & eggs	656	348	56	8	12
			fem no eggs	480	124	52	8	8
			small	208	196	28	24	
			male	912	376	80	28	44
			Total	**2,256**	**1,044**	**216**	**68**	**64**
		ACROPERUS harpae			**8**			
		ALONA sp.			**4**			
		CERIODAPHNIA pulchella		**32**	**12**	**24**	**20**	**88**
		CHYDORUS sphaericus			**20**	**12**	**20**	**72**
		EURYCERCUS lamellatus						**12**
		SIMOCEPHALUS vetulus				**1**		**36**
		DAPHNIA pulex	fem & eggs		4	2		
			fem no eggs	16			8	
			small					1
			male					
			Total	**16**	**4**	**2**	**8**	**1**
COPEPODA**	CYCLOPOIDA	CYCLOPS scutifer	fem & eggs	32	8		11	4
			fem no eggs	704	188	240	464	88
			male	576	96	56	320	36
			cop	14,496	4,336	2,220	7,056	680
			Total	**15,808**	**4,628**	**2,516**	**7,851**	**808**
	CALANOIDA	HETEROCOPE septentrionalis	female	34	13	6	3	
			male	35	37	54	1	1
			Total	**69**	**50**	**60**	**4**	**1**
		DIAPTOMUS pribilofensis	fem & eggs	80		4	4	
			fem no eggs	624	84	112	34	28
			male	2,336	380	732	11	16
		TOTAL DIAPTOMUS copepodites	cop	8,480	2,596	936	480	684
			Total	**11,520**	**3,060**	**1,784**	**529**	**728**
	Total nauplii		**nauplii**	**4,432**	**6,688**	**6,992**	**2,896**	**1,320**
TOTAL CLADOCERA and COPEPODA(excluding nauplii)				**29,701**	**8,830**	**4,615**	**8,500**	**1,810**
ROTIFERA *		KERATELLA cochlearis			64	48	16	
PLOIMA		KERATELLA quadrata			64	16		
		KELLICOTTIA		8,672	13,616	12,880	24,224	57,600
		POLYARTHRA		64	144	224	16	
FLOSCULARIACEAE		CONOCHILUS unicornis (colonies)					12	
	TOTAL ROTIFERA (excluding CONOCHILUS colonies)			**8,736**	**13,888**	**13,168**	**24,256**	**57,600**

		#1	#2	#3	#4	#5
BENTHIC ORGANISMS:	loose DIAPTOMUS eggs	496	28	16	26	
(and loose eggs)	CLADOCERA ephippium eggs					5
	CHIRONOMIDAE larvae					262
	HYDRA					14
	MITE					8
	OSTRACODA					8

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

MEASUREMENTS OF ADULT COPEPODA

LITTLE WOLVERINE LAKE

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
L. WOLVERINE		female	male	female	male
	1	3,142.8	3,000.0	1,510.2	1,387.7
#1	2	2,959.5	3,020.4	1,612.2	1,408.2
VERT HAUL	3	3,204.4	3,224.5	1,510.2	1,387.7
	4	3,102.3	2,938.8	1,530.6	1,489.8
	5	3,163.6	3,142.8	1,510.2	1,387.7
	6	3,143.1	3,163.2	1,591.8	1,387.7
	7	3,306.4	2,897.9	1,510.2	1,387.7
	8	3,081.9	2,857.1	1,530.6	1,449.0
	9	2,979.9	3,061.2	1,591.8	1,469.4
	10	3,061.5	3,102.0	1,612.2	1,428.6
	AVER	**3114.54**	**3040.79**	**1551.01**	**1418.36**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
L. WOLVERINE		female	male	female	male
	1	2,857.1	3,142.8	1,510.2	1,489.8
#2	2	3,224.8	2,795.9	1,510.2	1,367.3
VERT HAUL	3	2,918.6	2,857.1	1,428.6	1,408.2
	4	3,143.1	2,714.3	1,489.8	1,449.0
	5	3,081.9	2,857.1	1,530.6	1,326.5
	6	2,796.2	2,857.1	1,530.6	1,326.5
	7	3,041.1	2,775.5	1,428.6	1,326.5
	8	2,857.4	2,897.9	1,510.2	1,306.1
	9	3,143.1	2,979.6	1,449.0	1,326.5
	10	3,020.7	2,693.9	1,428.6	1,408.2
	AVER	**3008.41**	**2857.12**	**1481.62**	**1373.46**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
L.WOLVERINE		female	male	female	male
	1	3,224.5	3,020.4	1,571.4	1,367.3
#3	2	3,102.3	3,040.8	1,489.8	1,428.6
VERT HAUL	3	2,979.9	3,000.0	1,551.0	1,428.6
	4	2,959.5	2,918.3	1,489.8	1,449.0
	5	3,061.5	3,040.8	1,530.6	1,387.7
	6	3,102.3	2,755.1	1,489.8	1,367.3
	7		2,836.7	1,591.8	1,428.6
	8		2,959.2	1,632.6	1,428.6
	9		3,020.4	1,693.9	1,387.7
	10		3,224.5	1,489.8	1,367.3
	AVER	**3071.65**	**2981.61**	**1553.05**	**1404.07**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
L.WOLVERINE		female	male	female	male
	1	3,061.2	2,816.3	1,632.6	1,489.8
#4	2	3,041.1		1,591.8	1,428.6
VERT HAUL	3	2,857.4		1,612.2	1,469.4
	4			1,632.6	1,469.4
	5			1,489.8	1,489.8
	6			1,632.6	1,489.8
	7			1,571.4	1,367.3
	8			1,530.6	1,387.7
	9			1,489.8	1,489.8
	10			1,693.9	1,469.4
	AVER	**2986.56**	**2816.30**	**1587.74**	**1455.09**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns
L.WOLVERINE		female	male	female	male
	1			1,551.0	1,428.6
#5	2			1,551.0	1,326.5
VERT HAUL	3			1,530.6	1,387.7
	4			1,591.8	1,367.3
	5			1,571.4	1,489.8
	6			1,489.8	1,489.8
	7			1,632.6	1,469.4
	8			1,530.6	1,387.7
	9			1,571.4	1,367.3
	10			1,612.2	1,408.2
	AVER			**1563.25**	**1412.23**

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

MEASUREMENTS OF ADULT COPEPODA

WOLVERINE LAKE

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis		DIAPTOMUS ashlandi	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns
WOLVERINE		female	male	female	male	female	male
	1	3,326.5	3,020.4	1,387.7	1,326.5	714.3	836.7
#1	2	3,122.7	2,795.9	1,469.4	1,265.3	775.5	857.1
VERT HAUL	3	3,102.3	3,061.2	1,469.4	1,163.3	816.3	816.3
	4	2,755.4	3,102.0	1,449.0	1,265.3	816.3	816.3
	5	3,306.4	3,020.4	1,469.4	1,244.9	755.1	734.7
	6	3,061.5	3,122.4	1,510.2	1,367.3	775.5	795.9
	7	3,163.6	3,081.6	1,510.2	1,244.9	775.5	816.3
	8	3,306.4	2,816.3	1,346.9	1,265.3	857.1	836.7
	9	3,163.6	3,061.2	1,428.6	1,102.0	836.7	734.7
	10	3,306.4	3,163.2	1,428.6	1,265.3	816.3	816.3
	AVER	**3161.48**	**3024.47**	**1446.93**	**1251.01**	**793.87**	**806.12**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis		DIAPTOMUS ashlandi	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns
WOLVERINE		female	male	female	male	female	male
	1	2,775.5	3,000.0	1,591.8	1,265.3	795.9	857.1
#2	2	3,000.3	2,734.7	1,408.2	1,265.3	836.7	755.1
VERT HAUL	3	3,061.5	2,795.9	1,489.8	1,367.3	775.5	816.3
	4	3,102.3	2,816.3	1,367.3	1,367.3	877.5	734.7
	5	3,000.3	2,897.9	1,449.0	1,326.5	816.3	795.9
	6	2,796.2	3,204.1	1,530.6	1,326.5	795.9	795.9
	7	3,020.7	2,857.1	1,530.6	1,367.3	816.3	816.3
	8	3,163.6	3,000.0	1,469.4	1,285.7	816.3	734.7
	9	2,796.2	3,061.2	1,489.8	1,428.6	836.7	857.1
	10	3,143.1	3,102.0	1,408.2	1,428.6	898.0	755.1
	AVER	**2985.96**	**2946.92**	**1473.46**	**1342.85**	**826.52**	**791.83**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis		DIAPTOMUS ashlandi	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns
WOLVERINE		female	male	female	male	female	male
	1	2,877.5	3,224.5	1,326.5	1,326.5	816.3	775.5
#3	2	3,102.3	2,857.1	1,428.6	1,346.9	836.7	816.3
VERT HAUL	3	3,204.4	2,836.7	1,387.7	1,285.7	775.5	795.9
	4	2,857.4	3,020.4	1,387.7	1,346.9	816.3	734.7
	5		2,877.5	1,387.7	1,326.5	755.1	734.7
	6		2,795.9	1,428.6	1,367.3	755.1	755.1
	7		2,755.1	1,387.7	1,224.5	816.3	816.3
	8		2,857.1	1,428.6	1,183.7	816.3	775.5
	9			1,469.4	1,204.1	755.1	755.1
	10			1,367.3	1,285.7	795.9	755.1
	AVER	**3010.40**	**2903.04**	**1399.99**	**1289.79**	**793.87**	**771.42**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis		DIAPTOMUS ashlandi	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns
WOLVERINE		female	male	female	male	female	male
	1	2,857.1	3,346.9	1,428.6	1,367.3	816.3	816.3
#4	2	3,265.6	3,163.2	1,510.2	1,387.7	775.5	734.7
VERT HAUL	3	2,959.5	2,938.8	1,449.0	1,265.3	836.7	734.7
	4	2,959.5	3,102.0	1,469.4	1,183.7	734.7	775.5
	5	2,939.0	3,163.2	1,489.8	1,163.3	775.5	795.9
	6	3,081.9	3,183.6	1,551.0	1,183.7	775.5	734.7
	7	3,020.7	3,040.8	1,510.2	1,326.5	755.1	795.9
	8	3,020.7	2,897.9	1,469.4	1,367.3	816.3	755.1
	9	3,061.5	3,020.4	1,428.6	1,183.7	755.1	734.7
	10	3,061.5	3,061.2	1,428.6	1,387.7	755.1	775.5
	AVER	**3022.69**	**3091.81**	**1473.46**	**1281.62**	**779.59**	**765.30**

Date: 19-Aug-92		HETEROCOPE septentrionalis		DIAPTOMUS pribilofensis		DIAPTOMUS ashlandi	
LAKE	NO.	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns	SIZE microns
WOLVERINE		female	male	female	male	female	male
	1	3,367.3	3,061.2	1,510.2	1,367.3	898.0	877.5
#5	2	3,000.3	3,142.8	1,408.2	1,346.9	857.1	755.1
VERT HAUL	3	3,449.3	2,938.8	1,387.7	1,285.7	857.1	734.7
	4	3,061.5	2,959.2	1,428.6	1,285.7	755.1	755.1
	5	3,102.3	3,163.2	1,387.7	1,265.3	775.5	775.5
	6	3,143.1	3,142.8	1,428.6	1,387.7	795.9	755.1
	7	3,367.7	3,020.4	1,306.1	1,163.3	775.5	714.3
	8	3,000.3	2,897.9	1,346.9	1,183.7	795.9	755.1
	9	3,204.4	2,959.2	1,367.3	1,204.1	775.5	734.7
	10	3,163.6	2,938.8	1,367.3	1,265.3	816.3	836.7
	AVER	**3185.97**	**3022.42**	**1393.87**	**1275.50**	**810.20**	**769.38**

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

ZOOPLANKTON ANALYSIS

Site: **WOLVERINE lake**
Date: 19-Aug-92

Phylum * Subclass ** Order	Suborder	Species	stage	WOLVERINE 08-19-92 HAUL #1 NR / SAMPLE	WOLVERINE 08-19-92 HAUL #2 NR / SAMPLE	WOLVERINE 08-19-92 HAUL #3 NR / SAMPLE	WOLVERINE 08-19-92 HAUL #4 NR / SAMPLE	WOLVERINE 08-19-92 HAUL #5 NR / SAMPLE
CLADOCERA		EUBOSMINA longispina	fem & eggs	72				
			fem no eggs	84	24			16
			small					
			male	24	8			
			Total	**180**	**32**			**16**
		ALONA sp.						
		CERIODAPHNIA pulchella		32				
		CHYDORUS sphaericus		4		8		
		EURYCERCUS lamellatus						
		SIMOCEPHALUS vetulus						
		DAPHNIA pulex	fem & eggs	2	7			
			fem no eggs	28	4	4	16	21
			small	20	16			12
			male					
			Total	**50**	**27**	**4**	**16**	**33**
COPEPODA**	CYCLOPOIDA	CYCLOPS scutifer	fem & eggs		16		32	
			fem no eggs	112	272	48	272	256
			male			4		
			cop	4,320	6,784	1,392	9,952	4,848
			Total	**4,432**	**7,072**	**1,444**	**10,256**	**5,104**
	CALANOIDA	HETEROCOPE septentrionalis	female	57	26	4	42	67
			male	12	15	8	44	76
			Total	**69**	**41**	**12**	**86**	**143**
		DIAPTOMUS pribilofensis	fem & eggs	32	8	4	16	16
			fem no eggs	976	488	304	1,648	880
			male	592	376	224	608	800
		DIAPTOMUS ashlandi	fem & eggs		4			
			fem no eggs	48	72	96	128	96
			male	448	80	64	96	64
		TOTAL DIAPTOMUS copepodites	cop	8,192	3,920	3,776	29,904	24,816
			Total	**10,288**	**4,948**	**4,468**	**32,400**	**26,672**
	Total nauplii		**nauplii**	**1,472**	**1,840**	**368**	**2,656**	**1,280**
TOTAL CLADOCERA and COPEPODA(excluding nauplii)				**15,055**	**12,120**	**5,936**	**42,758**	**31,968**
ROTIFERA * PLOIMA		KERATELLA cochlearis		80	64	32	240	32
		KELLICOTTIA		18,736	4,112	3,728	15,424	4,464
		POLYARTHRA		16				
FLOSCULARIACEAE		CONOCHILUS unicornis (colonies)		32				48
	TOTAL ROTIFERA (excluding CONOCHILUS colonies)			**18,832**	**4,176**	**3,760**	**15,664**	**4,496**
BENTHIC ORGANISMS:		loose DIAPTOMUS eggs		252	96	60	256	432
		CLADOCERA ephippium eggs				28		
		Chironimidae				144		
		Hydra				299		
		Oligochaeta				90		

EXPATRIATE RESOURCES LTD.
WOLVERINE PROJECT

Zooplankton Data for Lakes in the Wolverine Area

MEASUREMENTS AND REPRODUCTIVE CONDITION

WOLVERINE LAKE

Date: 19-Aug-92	spp.	DAPHNIA pulex				BOSMINA longispina			
LAKE	NO.	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
WOLVERINE	1	95.0	1,938.8	1	2	29.0	591.8	1	1
#1	2	110.0	2,245.1	1	3	30.0	612.2	1	1
VERT HAUL	3					31.0	632.6	1	1
	4					32.0	653.1	1	1
	5					28.0	571.4	1	1
	6					31.0	632.6	1	1
	7					30.0	612.2	1	1
	8					29.0	591.8	1	1
	9					28.0	571.4	1	1
	10					30.0	612.2	1	1
	AVER.		2091.93				615.16		

Date: 19-Aug-92	spp.	DAPHNIA pulex				BOSMINA longispina			
LAKE	NO.	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS	SIZE UNITS	SIZE microns	STAGE (1-5)	NR EGGS
WOLVERINE	1	106.0	2,163.2	1	3				
#2	2	105.0	2,143.1	2	3				
VERT HAUL	3	98.0	2,000.2	3	2				
	4	125.0	2,551.3	3	3				
	5	107.0	2,183.9	1	3				
	6	101.0	2,061.4	3	4				
	7	100.0	2,041.0	1	2				
	8								
	9								
	10								
	AVER.		2163.43						

THERE ARE NO MORE CLADOCERANS WITH EGGS IN THE SAMPLES

Appendix 3E

Wolverine Area – Fisheries Investigations

Fisheries Resource Investigations

Wolverine Lake Property

Westmin Resources Limited

(Spring, Summer and Fall Surveys)

December, 1996

List of Tables and Figures

Note: A summary of the results from these investigations is contained within the Baseline Biophysical Surveys Report produced by Westmin Resources.

ADDENDUM #1

Preliminary Fish Habitat and Utilization Assessments
Wolverine Lake Area
Spring, 1996

White Mountain Environmental Consulting (WMEC) conducted preliminary fisheries investigations in the Wolverine lake area between June 11 and June 16, 1996. During the course of these investigations WMEC undertook the following:

- Conducted small mesh (non-destructive) gillnet surveys on Wolverine Lake, Little Wolverine Lake and Little Jimmy Lake.
- Investigated the inlet and outlet of Wolverine Lake for spawning activity.
- Investigated the lower reaches of Money and Nouga (Wolverine) creeks for spawning activity and conducted general habitat evaluations.
- Initiated a creel census program at the exploration camp on Wolverine lake.
- Collected fish flesh samples for heavy metal analysis.

METHODS

Gillnetting on Wolverine, Little Wolverine and Little Jimmy Lakes was conducted between June 12 and 15, 1996. A total of 35, 1 hour sets using a net gang consisting of 3, 25 meter panels (3.8mm, 6.4mm and 8.9 mm stretch measure) were completed. Surface water temperature, maximum depth of set and catch by mesh size and species was recorded for each net set (refer to Figure 1 for the locations of gillnet sets)

All fish captured were live sampled for fork length, round weight and any external observations were recorded before the fish were released, unharmed back to the waters of origin.

Incidental mortalities that occurred during gillnetting were sampled for round weight, fork length, stomach contents, sex and maturity, and an otilith was taken and stored for age analysis (aging was not completed as a part of this study, although the otoliths have been appropriately stored and age analysis can be conducted as necessary). Six of the lake trout mortalities were also used to provide fish for metal sample analysis. Flesh of these fish suitable for human consumption was given to local residents working at the exploration camp. Refer to Tables 1 to 6 for data on the fish collected or observed during the study.

RESULTS

Gillnetting survey:

Three species of fish were encountered during the index gillnetting, these were; lake trout(*Salvelinus namaycush,* Walbaum*),* Arctic grayling (*Thymallus arcticus),* and longnose sucker*(Catostomus catostomus).* A total of 85 lake trout, 199 Arctic grayling and 5 longnose sucker were captured (refer to Tables A to C).

The capture of grayling releasing eggs implies that at least one area of Wolverine Lake shore is used by spawning grayling (on the mainland directly north-east of the island).
Long nose sucker exuding eggs were captured near the outlet of Little Jimmy Lake indicating that the site may be a spawning area for suckers.

Inlet and Outlet of Wolverine Lake:

Based on the ground and aerial surveys conducted on June 11, 13 and 15 the inlet and outlet of Wolverine Lake is a popular spawning area for Arctic grayling. Large numbers of grayling were observed congregating in the inlet and outlet areas. Subsequent capture of fish in these vicinities showed them to be in spawning condition with some females exuding eggs and some males exuding milt. Grayling eggs were found during seining of the inlet to Wolverine lake as were lake trout fry (refer to Figure 2 for the locations of Lake Tributaries and Lake sample sites).

Lower reaches of Money and Wolverine Creeks:

Cursory assessments were conducted at the mouth of Money creek, where it empties into Francis Lake, on June 11 and 16. Seine netting, electrofishing and angling caught only a small number of slimy sculpin (*Cottus cognatus*). No Arctic grayling were caught or observed at this site during these investigations, although suitable habitat was prevalent.

Cursory assessments of the lower reaches of Nougha creek were undertaken on June 16. Angling, electro-fishing and visual surveys indicated Arctic grayling congregating in the mouth area . Longnose sucker fry and slimy sculpin were also captured in very small numbers at the creek mouth (refer to Figure 3 for the locations of Creek sample sites).

Creel Census

A voluntary creel census was initiated for anglers at the Wolverine lake exploration camp on June 15. An environmental person stationed at the camp will oversee the implementation of this census. A catch and release policy is in effect for personnel associated with the exploration camp.

Metal samples

A total of 6 lake trout were taken for heavy metal contaminant analysis, these fish were incidental mortalities from the index gillnetting. A set of three samples from each fish was obtained, a back flesh sample, a stomach flesh sample, and the liver. The metal samples will be sent to Quanta trace laboratories for analysis at the completion of the field studies program.

ADDENDUM #2

Preliminary Fish Habitat and Utilization Assessments
Wolverine Lake Area
Summer 1996

White Mountain Environmental Consulting (WMEC) conducted preliminary summer fisheries investigations in the Wolverine lake area between July 12 and 17, 1996. These summer investigations consisted of the following:

- preliminary fish habitat and utilization assessments of both Money and Nougha creeks.
- habitat assessments and cursory fish utilization assessments of 36 creek sites within the study area.
- investigating the extent of Dolly Varden trout utilization of Money and Nougha creeks.
- monitoring the creel census program in place at Wolverine lake exploration camp.
- collection of fish flesh samples for heavy metal analysis.

METHODS

Habitat and Fish Utilization Assessments.

A total of 36 creek sites were investigated during the summer assessment. The inlet and outlet of Wolverine Lake were sampled as were any tributaries flowing into the lake. All tributaries flowing into Little Wolverine and Little Jimmy lakes were also sampled.

Aerial surveys of Nougha, Money and Go Creeks were conducted by helicopter to map fish habitats and to note any barriers to fish passage.

Sites where a possible access road may cross small tributary creeks were sampled for fish utilization.

RESULTS

Lake Inlet Creeks

Slimy sculpin were found in most watercourses sampled. Burbot, lake trout fry, Arctic grayling, longnose sucker and/or slimy sculpin were found to utilize the mouths of some tributaries flowing into Wolverine and Little Wolverine Lakes. Lake trout fry and Arctic grayling were found to utilize the inlet and outlet areas of Wolverine Lake (refer to Table 4).

Nougha Creek

An aerial survey of Nougha creek was conducted from its mouth at the Finlayson River to Wolverine lake. At this time, fish habitat was mapped and any barriers to fish passage were noted. Nougha creek was sampled at 4 locations to determine fish utilization.

Arctic grayling was the most abundant species found, followed by slimy sculpin, northern pike and burbot. No Dolly varden were found in Nougha Creek.

Money Creek

An aerial survey of Money Creek was conducted from its mouth at Frances Lake to a point several kilometers above its junction with Go Creek. Fish habitat was mapped and any barriers to fish passage noted. It was also sampled at 7 sites during to determine fish utilization as were 2 tributaries to Money Creek.

Dolly varden trout were present in the upper reaches of Money Creek both above and below its junction with Go Creek. Suitable spawning habitat was observed at various locations throughout Money creek, including above the junction of Money and Go Creeks. Arctic grayling, slimy sculpin and northern pike were the only other species encountered in Money Creek.

Go Creek

An aerial survey of Go Creek was conducted from its mouth at Money creek to just above the site of the airstrip. Fish habitat was mapped and four sites were sampled for fish utilization.

Dolly varden were found in the lower reaches of this creek along with slimy sculpin and adult and sub adult Arctic grayling.

Access Road Creeks

Three creeks that drain into Wind Lake and two creeks draining into Nougha Creek were found to be very poor fish habitat and no fish were found in any of these creeks.

Creel Census

The catch and release policy in place at the exploration camp was generally adhered to. The extent of compliance to the creel census was difficult to assess. It appears that angling pressure from personnel at the exploration camp has been minimal at this time. Angling pressure consisted mostly of angling from shore at camp by camp personnel. An average of 40 minutes angling time per day was observed.

Metal samples

A total of 10 slimy sculpin samples (consisting of 3 to 7 individual fish each)and 4 Arctic grayling samples were taken for heavy metal analysis. The slimy sculpin samples were taken from two tributaries to Little Wolverine Lake, three tributaries to Wolverine Lake, the outlet of Wolverine Lake, and three sites on Money Creek. The Arctic grayling samples were taken from the inlet and outlet of Wolverine Lake (two fish from each site). Arctic grayling samples consisted of both flesh and liver samples.

ADDENDUM #3

Preliminary Fish Habitat and Utilization Assessments
Wolverine Lake Area
FALL 1996

White Mountain Environmental Consulting (WMEC) conducted fall fisheries investigations in the Wolverine lake area between September 22 and 25, 1996. These investigations constituted the third and final field investigation of the 1996 season. The investigations consisted of the following:

- An Aerial survey of Money Creek to detect any congregations of spawning dolly varden or any signs of dolly spawning such as redds. Ground surveys were conducted at the outlet of Go Creek.
- Investigating the lake trout spawning locations on Wolverine, Little Wolverine, Little Jimmy and Francis lakes.
- Monitoring the creel census program in place at Wolverine Lake exploration camp.
- Conducting preliminary fisheries investigations of Wind Lake including using non-destructive small mesh gillnetting.
- Conducting ground investigations of Nougha Creek at the confluence with the Finlayson River, including angling in the Finlayson River downstream of Nougha Creek to detect presence or absence of dolly varden.
- Investigations into fish utilization of Francis Lake near the outlet of Money Creek, including determination of key fish habitats such as lake trout spawning.
- Obtaining fish samples from Wolverine Lake to determine sexual maturity and timing of spawn and for stomach analysis.
- Obtaining fish samples for heavy metal analysis from Little Jimmy Lake.

Refer to Figures 1, 2 and 3 for the locations of sample sites in the study area. Refer to Tables 1 to 6 for information on the fish captured during the study.

RESULTS

Money creek

The aerial survey of Money Creek found no evidence of dolly varden spawning. No aggregations of fish were detected and no obvious signs of redd building were observed.

Ground surveys near the outlet of Go Creek into Money Creek found only slimy sculpin
Dolly varden spawning strategies vary throughout the species range. Little information on spawning strategies for this type (small river) of population in the Liard River drainage has been compiled. It was suspected that that dolly varden spawning occurred prior to our investigation. Thus. the investigations do not provide sufficient information on dolly varden spawning strategies in Money Creek.

Lake Trout Spawning Surveys

The locations of lake trout and Arctic grayling spawning sites is shown on Figure 4. Note: The spawning sites locations are confidential and should not become published information.

Surveys for lake trout spawning areas were conducted in two stages. The first stage was aerial surveys of the lakes, with flights conducted during the evening and early morning. Fish observations were plotted on topographic maps. The second stage of the survey was conducted by boat using sonar and angling to locate and capture fish.

During the aerial survey, fish were observed in the outlet areas of Little Jimmy, Wolverine and Little Wolverine lakes. Fish were also detected at four other locations on Wolverine Lake.

Boat /sonar surveys showed fish were not widely dispersed in the lakes with most of the fish located occurring in a few large aggregations. Angling was used to determine species and spawning condition.

Little Jimmy Lake

Examination of lake trout captured in Little Jimmy Lake showed these fish had spawned several days prior to September 24. Stomach analysis revealed that the trout in this area were cannibalizing there own eggs and indicated that the outlet area is likely a spawning location for lake trout on this lake.

Little Wolverine Lake

Few fish were observed in Little Wolverine Lake. Arctic grayling were observed in the channel between Little Wolverine and Wolverine lakes and the occasional lake trout was observed near the outlet of Little Wolverine Lake. Two lake trout were captured from this area and sacrificed for metals analysis. Both of these trout were resting fish, one a male and the other a female. This survey indicates that Little Wolverine Lake is not likely a spawning location for lake trout, and trout utilizing this lake are of the same population as those in Wolverine Lake.

Wolverine Lake

Ground surveys in Wolverine Lake indicated that most of the Arctic grayling had moved into shallow areas near creeks, particularly in the outlet area at Nougha Creek. Large numbers of “stacked“ lake trout were encountered at two locations in the south east end of the lake, both adjacent to shore in areas with steep drop-offs and water depths in excess off 40 meters within 30 meters of shore. The first of these locations is approximately 1 km north of the exploration camp on the northwest shore. The second location is directly across the lake on the southeast shore. The site on the southeast shore was considerably larger than the site on the northwest shore and fish were stacked in an area approximately 300m long (following the shoreline) and extending 30 meters from shore. Trout were in water depths of 3 to 35 meters.

Trout were easily angled at the site on the southeast shore and several fish were taken for dead samples. Sampling revealed that the fish were close to spawning, skeins in the females had burst, but the eggs had not become loose in the body cavity, indicating that spawning would likely occur during the first few days of October.

Francis Lake

Boat sonar surveys in Francis Lake found significant numbers of fish near the mouth of Money Creek. Based on the number of fish observed, this area appears to be important fish habitat. No fish were captured in the area and the species composition of fish utilizing this area is unknown. Some stacking of fish was found in an area approximately two kilometers north of the mouth of Money Creek. Angling at this site proved unsuccessful and the fish species could not be positively determined, sonar readings did resemble those found at the spawning sites on Wolverine Lake. Because of Francis Lakes lower elevation in comparison to Wolverine Lake it is expected that lake trout spawning would occur at a later date than on Wolverine Lake.

Wind lake

Wind Lake was surveyed on September 23, 1996. A gang of small mesh gillnets consisting of 20 m x 1", 20m x 2" and 25 m x 2.5" was set for 1 hour periods at three different locations on the lake. One large lake trout (5.5kg) was the only trout captured, arctic grayling were numerous as were long nose sucker. The lake has an even bottom with steep drop offs from shore. The maximum depth found was 10 meters (32').

Creel Census

The catch and release policy previously in place at the exploration camp is no longer adhered to, although the high quality waters limit of 1 fish per day has been maintained . The informal creel census was not a camp priority and results were therefore not complete. It appears that angling pressure from personnel at the exploration camp has been minimal and has consisted mostly of angling from shore at the camp.

Metal samples

Samples collected from Muskrat House Lake were used to complete the collection of fish for heavy metal analysis. A composite of livers from 6 trout was taken as was a single flesh sample from one of the trout. Flesh not required for metal analysis was given to local residents working at the exploration camp.

WHITE MOUNTAIN ENVIRONMENTAL CONSULTING

Proposed Access Road Creek Crossings

Fish Habitat Evaluation and Utilization Assessment, 1997

INTRODUCTION

At present two possible access roads to the Wolverine Lake property are being considered to access the property for future development. All creeks crossed by the two proposed routes were investigated by White Mountain Environmental Consulting (WMEC) during the 1997 open water season. Creeks were evaluated at the proposed crossing locations and at their outlets for the presence of both fish and fish habitat. Site investigations were conducted during June, July and September in order to provide an evaluation of spring, summer and fall utilization and account for seasonal movements of fish. The following report documents habitat availability and utilization during all seasons of investigation.

METHODS

A total of fifteen creeks were studied during the proposed access road crossing investigation. The creeks investigated consisted of the following:

- A tributary to East Lake;
- Two tributaries to Wind Lake;
- Seven tributaries of Nougha Creek;
- Nougha Creek;
- Three tributaries to Wolverine Lake, and
- A small headwater feeder creek of Van Bibber Creek.

The titles and descriptions of each of the 1996 and 1997 sample sites are provided on Table 1.

Table 1 Sample Sites

Site	Description
TE	Tributary to East Lake
TW-1	Access Road Crossing Site, a Tributary that Drains into Wind Lake
TW-2	Access Road Crossing Site, a Tributary that Drains into Wind Lake
WO	Outlet of Wolverine Lake
TN-1	Access Road Crossing Site, a Tributary that Drains into Nougha Creek 300 m Downstream of Wolverine Lake Outlet
TN-2	Access Road Crossing Site, a Tributary that Drains into Nougha Creek 350 m Downstream of Wolverine Lake Outlet
TN-3	Tributary of Nougha Creek, 800 m Downstream of Wolverine Lake Outlet
TN3F	Feeder Tributary to TN3
NTN3	Nougha at Mouth of TN3
TN-7	Tributary to Nougha Creek Approximately 8.9 km Downstream of Wolverine Lake
TN-8	Tributary to Nougha Creek Approximately 8.6 km Downstream of Wolverine Lake
TN-9	Tributary to Nougha Creek Approximately 7.6 km Downstream of Wolverine Lake
TN-10	Tributary to Nougha Creek Approximately 6.9 km Downstream of Wolverine Lake
TWV-1	Tributary to Wolverine Lake
TWV-2	Tributary to Wolverine Lake
TWV-3	Tributary to Wolverine Lake
TVB	Tributary to Van Bibber Creek
TVB-1	Tributary to TVB

The location of each of sample sites are presented in Figure 1. Figure 2 shows the two potential access routes to the Wolverine Lake property. A general description of the physical fish habitat for each site investigated is provided in Appendix 1. Results from all fish utilization assessments, including catch and sample records are contained in Appendix 2, Tables 1 to 3. Photos were also taken at each site and are provided in Appendix 3.

Habitat characteristics evaluated at each site included; creek depths and widths, water velocities, pool to riffle ratios, substrates, overhanging and adjacent vegetation and potential fish cover. Methods used to determine fish presence were electro-fishing, seining (where possible), angling and visual observations. Polarized glasses were used at all times to enhance visibility.

Insert Figure 1

Insert Figure 2

With the exception of Nougha Creek, all crossing sites occur in areas where the creek flows in a small draw with dense willow cover over and adjacent to the creeks. These creeks flow through dense tangles of willow in incised channels which are typically deeper than they are wide. These creeks rarely exceed a width of greater than 0.3 m, and have velocities averaging >1 m/sec. This type of creek, generally, does not provide good fish habitat. Aufies noted during spring investigations implies the creeks bottom freeze, a factor that severely limits ability to support over-wintering by fish. Rare and occasional ground water feeds may provide habitats suitable for slimy sculpin over wintering, and Arctic grayling may move into the creeks during summer months. During our investigations no fish were found in any of the creeks above the point where streamflow flowed through dense willows.

TE: The tributary to East Lake, as marked on the map sheet, does not at this time represent an above ground flow. This creek has been denoted as non-fish bearing and as such requires no further fisheries investigations.

TW-1: Tributary to Wind Lake #1 has two distinct reaches, the first being from the outlet to Wind Lake upstream for 400 m through a large wetland area, the second reach is above the first and extends up its valley, as a willow tangled draw, to the headwater area. The lower reach provides critical spawning, rearing and feeding habitat for Arctic grayling, particularly where it is closer to the lake. Long nose sucker and slimy sculpin also utilize this reach. Arctic grayling fry were the only species utilizing this reach during fall investigations. The upper reach is of little value as fish habitat; the proposed access road crosses the upper reach near the headwater area in an area not considered as fish habitat.

TW-2: Tributary to Wind Lake #2 consists of a small creek flowing through a willow draw. This creek does not provide fish habitat in its upper reaches. The only reach of this creek to provide fish habitat is the lowest 35 m, which forms a small bay of the lake. This area has significant influence from the lakes warmer water. The location of the proposed crossing site is approximately 2 km upstream of the lake in non-fish habitats.

WO and N: Nougha Creek near the outlet from Wolverine Lake represents important fish habitat. Utilization of the reach adjacent to the lake was documented as supporting Arctic grayling spawning and rearing, lake trout rearing and adult feeding and long nose sucker, slimy sculpin, and burbot were also present. Large numbers of adult Arctic grayling observed during fall surveys may indicate this is an over-wintering site for grayling. Fish habitats vary seasonally with water levels and velocities.

TN-1: Tributary to Nougha Creek #1 is a small creek (0.35 m wide x 0.05 m depth). The lowest 10 m of the creek consists of a gravel boulder bottomed riffle with velocities >1m/sec. Above this reach, the creek flows through tangled willows alternating between being a narrow incised channel with velocities >1m/sec to areas with little or no defined channel with flows flooding out through the adjacent willows and sedges. Limited fish habitats exist in the creek in the form of eddies and pools below boulders. Two trails cross this creek 35 and 50 m upstream of Nougha Creek. Small pools with gravel substrates have been created by the trails crossing the creek. No fish were found in this creek.

TN-2: Tributary to Nougha Creek #2 does not have a defined channel outlet into Nougha Creek, rather it spills over the bank along a 10 m reach. Above this the creek flows through a tangle of willow and the channel is not well defined in most places. The most defined channel area occurs where the creek has been crossed by two winter trails, 30 and 40 m upstream of Nougha Creek. This creek does not represent fish habitat.

TN-3: Tributary to Nougha Creek #3 has flow and size sufficient to support fish. The outlet into Nougha Creek creates two important eddy pools in Nougha, one upstream and one downstream of the outlet. The first 10 m of the creek upstream of Nougha consist of a shallow glide at the mouth then a fast riffle before narrowing and entering into heavy willow tangles. Substrates in the creek are consistently heavily silted with clay and sand in the lower reach, gravel and cobbles occur occasionally at distances greater than 20 m upstream of Nougha Creek.

This creek is crossed by two winter trails 40 and 50 m upstream of Nougha Creek. Significant ice buildups were observed at the crossing sites during our spring investigations. The creek flows in a gully at the site of crossing with banks rising as much as 2.5 m above the actual flow. Arctic grayling juveniles were recorded in the first 20 m of the creek upstream of Nougha Creek during fall investigations and in the zone of influence during both summer and fall investigations.

TN-7: Tributary to Nougha Creek #7 does not have a discernible flow above ground at the outlet to Nougha Creek. The creek does have a large ponded area adjacent to Nougha Creek but flows from the creek enter this pond as seepage from the surrounding area. The distinct above ground channel that flows into a small alluvial area 50 m up from Nougha quickly dissipates into the wetland area leaving no above ground flow. Flows within the ponded area occur as seepage. The creek proper drains a willow tangled and spruce filled draw. Vegetation adjacent to the channel is alpine shrub.

The creek does not provide fish habitat, nor access to Nougha Creek, however the outlet bay formed by the creeks historic flows does offer a zero velocity area adjacent to Nougha Creek and as such provides some fish habitat.

TN-8: Tributary to Nougha Creek #8 is a small creek (depth was 0.2 m and width was 0.8 m), narrowing to < 0.25 m) which flows as stepped 0.3 m waterfalls interspersed by riffle/rapids (velocity > 2 m/sec) through a dense tangle of willow. The tributary flows directly into Nougha Creek in a narrow, confined and incised channel. There is very little in terms of a zone of influence where the tributary enters Nougha Creek, since it enters on a deep side into velocities >2m/sec. The tributary provides very limited fish habitat, primarily due to steep gradient and high velocities. This creek does not merit further fisheries investigations.

TN-9: Tributary to Nougha Creek #9 enters Nougha Creek as a waterfall approximately 3 m high. A second waterfall occurs within 20 m. The waterfalls cascade over bedrock with boulders. Above the waterfall area the creek channel is narrow and confined with velocities >2 m/sec over predominantly boulder/cobble substrates. The creek is heavily covered with willow and spruce.

The potential for fish utilization of this tributary is extremely limited due to high water velocities. The first 20 m of the creek forms a permanent barrier to fish passage. The creek enters Nougha directly with very little zone of influence. Nougha Creeks flows are fast (>2 m/sec) in this reach with a narrow and confined channel that provides very little low velocity habitats. This tributary creek does not provide fish habitat.

TN-10: Tributary to Nougha Creek #10. The upper reach starts 15 m u/s of Nougha Creek and is narrow and confined in an incised channel. The upper reach is 0.3 m wide and 0.5 m deep, on average, with surface velocities >1 m/sec.

The lower 15 m reach consists of mostly boulder substrates with a wetted width of 2 m, or greater. The lower reach of the creek has potential to support fish. The boulder substrates are clear of any silts or fines, a situation that may indicate ground welling.

This creek enters Nougha Creek were the flows are mostly <1 m/sec and some channel braiding occurs. The zone of influence to Nougha consists of an upstream pool of 2 m by 3 m and a downstream mix trail of approximately 2 m by 8 m, both of these areas have depths >0.5 m. Fish were captured in Nougha Creek adjacent to the tributary, however no fish were captured in the tributary itself. Sculpins and Arctic grayling juveniles were recorded in the zone of influence during summer and fall investigations.

TWV-1 Tributary to Wolverine Lake #1, also known as Jasper Creek, provides very little fish habitat and shows very low utilization. The creek is small with a depth of 0.3 m and a width of 0.6 m and has a high flow (<2 m/sec) through a heavy tangle of willow. The creek does provide an important mix zone as it enters Wolverine Lake. Several slimy sculpin and a single Arctic grayling juvenile were recorded in the creek. Large numbers of lake trout fry and grayling fry were recorded in the mix area of Wolverine Lake. Seines pulled in adjacent areas of Wolverine Lake had very low catches relative to those pulled in area influenced by TWV-1.

TWV-2 Tributary to Wolverine Lake #2 is a very small creek with depths of <0.01 m and width that does not exceed 0.3 m. The Creek does not provide any fish habitat.

TWV-3 Tributary to Wolverine Lake #3 drains a wetland area adjacent to Wolverine Lake. The creek is has a low gradient in its lower reaches and in several locations throughout its length. Numerous species of fish, in limited numbers, were recorded in the creek near the outlet during all seasonal investigations. Available fish habitat occurs predominantly within 150 m of the lake, however small pockets of good habitat occur 500 m upstream of the lake near the confluence of two feeder creeks.

TVB & TVB-1 Tributary to van Bibber Creek, and tributary to this tributary. The site of investigation consisted of the headwater reaches at the confluence of two feeder creeks. The northern most of the feeder creek intersects the proposed access route just upstream of its confluence with the second feeder creek. The creeks both consist of wide, flat, stepped riffles with available structural habitats with very low conductivity (i.e. very pure water) and cold water temperatures. The reaches investigated are above a long reach consisting of high velocity water and a narrow channel with limited fish migration potential. Fish were not recorded in any of the channels of this creek.

Investigations into the outlet areas of these creeks revealed several to have significant fish values. The tributary to Wind Lake, TW-1, has an extended outlet area flowing through small bluffs of willow mixed with dwarf birch. The area is extensively worked by beavers and extends over 300 m from the lake. This area provides spawning and rearing habitat for Arctic grayling. Juvenile long nose sucker and juvenile Arctic grayling utilize the ponds associated with the creek near the lakeshore.

Tributary TWV3, at its outlet to Wolverine Lake, provides rearing habitats for juvenile Arctic grayling, juvenile lake trout, juvenile long nose sucker and juvenile burbot, resident slimy sculpin also utilize this creek. Suitable habitats are located upstream of the lake for a distance of 150 m, aerial assessments showed potential for fish habitat in scattered pockets up to the point of the confluence of two feeder creeks 500 m from the lake.

Most of the tributaries entering Nougha Creek are colder than Nougha throughout the year. Tributaries TN1 and TN3 provide limited fish habitats near the outlets, however utilization was restricted to within 20 m of Nougha Creek. Several of the tributaries create eddying in Nougha Creek at their point of entry creating important habitats in an otherwise fast flowing Nougha Creek.

Although most of the creeks investigated did not provide fish habitat, the outlet areas often enhanced fish habitats by introducing oxygen and nutrient rich waters to the lake and receiver creek. This was especially evident in the lakes where utilization of the waters at the creek outlet was significantly higher than in similar adjacent areas.

WHITE MOUNTAIN ENVIRONMENTAL CONSULTING

Habitat Evaluation of Money Creek

Summary

Aerial assessments of Money Creek were conducted on July 14,1997 in order to provide an evaluation of the creek and it's potential to support fish. The July survey was a continuation of the 1996 investigation which focussed on species utilization along specific sections of Money Creek.

Money Creek flows as a high velocity creek with predominantly cobble substrates interspersed with boulders and sorted gravel. Fish habitats are limited and typically small. Concentrated pockets of key habitats exist along the creek, the most notable being the potential over wintering sites near Reach #7. The creek flows clear and shallow with high velocities that provide poor cover and few resting areas for fish.

The descriptions start at the creeks outlet at Francis Lake and continue upstream in ascending order to a point above Go Creek in the alpine headwaters of Money Creek. Money and Go Creek are shown on Figure 1 of the "Proposed Access Road Creek Crossings – Habitat Evaluation and Utilization Assessment, 1997" report.

Reach #1

Outlet area to Frances Lake 61°24.80 N/ 129°38.30 W.
Some silting of gravel and sand substrates, open area with many exposed gravel bars. Mostly shallow flat glide. Reach extends 150 m from Francis Lake.

Reach #2

Starts 150 m from lake, extends 350 m upstream of the Robert Campbell Highway bridge. Gravel/cobble substrate with some braiding the creek is primarily riffle runs and glides with few pools. This reach is 1.4 km long.

Reach #3

Increasing boulders and riffles begin above the Robert Campbell highway. Rapids begin at the point where the creek becomes confined by a canyon. Rapids interspersed by occasional pools and gravel bars. This reach is 3 km long.

Reach #4

Start at 61°24.00 N/ 129°40.75 W.

Canyon becomes deeper and more abrupt, many cliff areas, rapids at bends of the creek, typically against cliffs. Mostly high velocity riffles over boulder cobble substrates. This reach includes sample site M3. This reach is 1 km long.

Reach #5

Starts at 61°23.85 N/ 129°41.00 W.

Longer glides with fewer pools and riffles, cobble/boulder substrates with very few side pools. The creek velocity has slowed with rare rapid “shoots” occurring in confined areas. Reach is 4 km long.

Reach #6

Starts at 61°23.85 N/ 129°44.00 W.

The creek develops more rapids and deep pools with large boulders becoming more common in boulder cobble substrates. Creek remains confined by canyon Riffle / pool sequences common. The reach is 2.3 km long and flows out across the edge of the Pelly Mountains.

Reach #7

Starts at 61°24.20 N/ 129°46.20 W.

A short reach that consists of a series of deep pools below stepped rapid / small pool sequences. This reach represents the most likely over wintering habitats (deepest and most frequent pools) observed on Money Creek. Reach is 0.8 km long.

Reach #8

Approximately three foot high falls at 61°24.17 N/ 129°46.45 W.

May be an impediment to fish passage at certain flows (high or low). Does not likely form a constant barrier to fish passage but is the most restrictive area in terms of fish passage on Money Creek. Substrates are predominantly bedrock with boulders and areas of sorted gravels. This reach is approximately 150 m long.

Reach #9

Starts at waterfall in Reach #8.

Long flat glide/riffle with high velocities, substrates predominantly boulder with some cobble/ gravel areas. This reach is 2.5 km long.

Reach #10

Starts at 61°24.33 N/ 129°48.50 W.

Large boulders occur commonly in fast flowing riffles, with some corner pools and glide areas. Substrates consist of an even mix of boulder, cobble, gravel substrate. A narrow flood plain exists within the continuing steep sided canyon. Occasional islands occur in braided areas were substrates are composed mainly of gravel and cobble mix (this includes site 10a). This reach is 3.5 km long.

Reach 10a

At 61°24.20 N/ 129°50.00 W.

Island with shallow, low volume channel on north side.

Reach #11

Starts at 61°24.33 N/ 129°52.00 W.

Wide shallow glides, creek channel up to 20 m wide, confined by steep sided valley. Gravel / cobble substrate.

Reach #11a

At 61°24.10 N/ 129°53.20 W.

Boulder strewn riffle area of higher velocity at tight meander scroll, steep sided cliff on north bank.

Reach #12

Starts at Outlet of tributary creek TM4 at sample site M4, located at 61°23.85 N/ 129°53.60 W

Wide flat glides with few smaller boulders dispersed throughout. Several gravel point bars and side channels, occasional small cliff banks with small pools associated at outside corners. Valley broadens to 800m wide flood plain, creek channel confined by banks averaging 2 m in height above water line. Creek becomes more meandering with abandoned channels visible. This reach is 4 km long.

Reach #12a

Large point bar with sorted gravels. Two old channels apparent on downstream side.

Reach #12b

At 61°24.33 N/ 129°48.50 W

Marks the downstream edge of recent burn. This burn extends up the Money Creek valley into the headwater area. Channel is braided in the wide flood plain, with substrates predominantly gravel. Large island (5m x 200m) formed by braided channel, excellent combination of habitat with pools and back eddies.

Reach #13

Starts at 61°22.10 N/ 129°53.70 W.

Finer gravel substrates with few boulders. Mainly glides with few riffles. Moderate velocities. Reach is 1.5 km long.

Reach #14

Starts at 61°21.50 N/ 129°53.90 W.

Creek increases in velocity and becomes more sinuous with increasing numbers of boulders. Few log sweepers with stick and log jams along corner banks, several boulder riffle runs interspersed by gravel bottom glides. The reach is 5.8 km long.

Reach #14a

At 61°21.00 N/ 129°54.80 W.

A potential obstruction created by a log jam backs water levels up to between 0.75 and 1.2 m high along the log jam area. Beaver activity has added to the obstruction. The channel has split as a result of the log jam. The original channel no longer flows through and exists as a pond, the new channel, also obstructed has backed up water so that the creek flows through adjacent vegetated areas to pass the obstruction.

Reach #15

Starts at 61°19.25 N/ 129°57.00 W.

Channel is wide and flat (up to 20 m wide) and boulder filled. Wide flood plain ends and vegetation becomes more dispersed typical of higher altitudes. Creek has predominantly cobble substrates with boulders consistently dispersed throughout; glide areas are short and rare. The reach is 3 km long.

Reach #15a

Ends at 61°18.65 N/ 129°59.00 W.

Large braided channel has shifted main flow into what map shows as side channel, which now has main flow. Old channel has maintained some flow now has limited flow linked by gentle shallow riffles. New channel is 650 m long. The downstream end (junction) of both channels is sample site M5.

Reach #16

Starts at 61°18.45 N/ 129°59.50 W.

Creek becomes noticeably smaller, substrates are boulder strewn cobbles and gravel, with occasional patches (up to 200 m in length) of sorted fine gravel. Creek consists mostly of long riffle areas, few glides or pools, open flood plain, glides with point bars, occasional strip of fine gravel (up to 200 m in length). This reach is 9.4 km long.

Reach #17

Starts at 61°24.33 N/ 129°48.50 W.

Channel narrows with the average width in this reach is 7 m and is as narrow as 3 m. Creek consists of mainly boulder riffles interspersed with gravel bottom glides with some wetland areas nearby. Wide flood plain with willow vegetation (no spruce near channel). Evidence of channel shifting throughout the reach with many abandoned channels visible. This reach includes sample sites M6 and M7 (outlet of Go Creek area) and is approximately 9 km long.

Reach #18

Starts at 61°21.15 N/ 130°04.50 W.

Area above Go Creek confluence. Flood plain narrows, adjacent vegetation remains similar with little streamside vegetation as elevation increases and vegetation becomes alpine with few shrubs and no trees. Approximately 10 km up this reach the creek flows shallow and braided over a glacial feature with angular and fractured cobbles for almost 1 km. This same type of creek structure occurs in several other areas further up the creek. The braided area 10 km up this reach marks the furthest point studied during our investigation.

WHITE MOUNTAIN ENVIRONMENTAL CONSULTING

Habitat Evaluation of Nougha Creek

Summary

The lower reaches may provide habitats for bull trout, although none were recorded during 1996 or 1997 surveys. Nougha Creek provides many good fish habitat areas but fish passage is blocked to upstream movements by waterfalls in Reach # 4. The creek provides many habitats for Arctic grayling.

Aerial assessments of Nougha Creek were conducted on July 16,1997 in order to provide general comments about the creek and it's potential to support fish.

The reaches of Nougha Creek are described below in ascending order, starting at the outlet to Finlayson River and moving upstream to the mouth of the creek at Wolverine Lake. Nougha Creek is shown on Figure 1 of the "Proposed Access Road Creek Crossings – Habitat Evaluation and Utilization Assessment, 1997" report.

Reach #1

Outlet to Finlayson River at 61°36.05 N/ 130°08.04W.
Flat slow glides with deep silts near the outlet and fine gravels becoming more prevalent nearer the Robert Campbell highway. This reach is 1.2 km long.

Reach #2

Starts at bridged crossing of the Robert Campbell highway at 61°35.65 N/ 130°08.04W.
Above the Robert Campbell highway cobble/gravel bottom glides with occasional boulders and deep pools occurring near undercut banks at creek bends. This reach is 2.8 km long.

Reach #2a

At 61°35.10 N/ 130°11.80 W.
A new channel has been cut due to beaver activity, beavers continue to dam in this location on the new channel. This beaver dam (>1 meter height) represents a partial obstruction to fish passage.

Reach #3

This reach starts at 61°35.30 N/ 130°10.75 W.

Boulders become more common, velocity increases causing more riffles with fewer pools, creek flows through a steep sided valley with the channel constricted by bedrock rock in places. This reach is 2.5 km long.

Reach #3a

At 61°35.10 N/ 130°11.80 W.

A small waterfall followed by 100 meter section of deep rapids with pools and many boulders. May limit fish passage during high or low flow periods.

Reach #4

Starts at 61°34.80 N/ 130°11.75 W.

Valley constricts, channel narrows and water velocity increases. Many large boulders with intermittent deep pools. First downstream rapid may present a barrier to fish during low water periods. This reach is 1 km long.

Reach #4a

At 61°34.50 N/ 130°12.85 W.

Area marked “rapids” on 1:50,000 topographic maps. Channel confined by a narrow gorge, mainly boulder rapids interspersed with deep pools. These rapids likely present a barrier to fish passage.

Reach #5

Starts at 61°33.44 N/ 130°13.75 W.

Valley broadens and channel flattens with gravel/cobble/boulder substrates. Long riffles/runs with some pools at stream bends. Riffles have high velocities. Good fish habitats are dispersed throughout the reach. This reach includes the outlets of tributaries TN7 and TN8. This reach is 2 km long.

Reach #6

Starts at 61°33.40 N/ 130°13.75 W.

Stepped rapids 100 meters in length likely present a barrier to fish passage. This reach flows at the point were Nougha Creek exits the Campbell Range of the Pelly Mountains. This reach is 0.8 km long.

Reach #7

Starts at 61°33.20 N/ 130°14.45 W.

Gradient decreases and stepped rapids become more dispersed with good pools between, several long glides exist and side channels are common, large pools have formed at creek bends. Substrates mostly cobble, some gravel patches and a few areas of fine gravel. This reach includes the outlets of tributary creeks TN9 and TN10 and is 2.3 km long.

Reach #8

Starts at 61°32.35 N/ 130°14.45 W.

Channel widens and velocity is significantly reduced. Gentle riffles followed by slow pools. Glide pools and back eddies are common. Aquatic vegetation and siltation occurs in mid channel areas. Above #8A substrates are composed of fine gravels in an area with sharp meander curves and varying velocities, flows still occur as glides with the occasional short riffle. Heavy willow vegetation encloses the creek and several ponds associated with the creek occur near the top of this reach. This reach is 3 km long.

Reach #8a

At 61°31.75'N/ 130°16.15W.

Wide meanders with sluggish flow and silted bottom. Old ox bow lakes connected and likely recharged during high water events. An extensive patch of fine well sorted pea gravels occurs at this site just above the ox bow lakes. Recent beaver activity is in evidence.

Reach #9

Starts at 61°31.08 N/ 130°17.25 W.

Extensive beaver dam area, a series of beaver dams creates wetland over 100 meters wide and presents an obstruction to fish passage. A wide willow flood plain occurs in this area and shows signs of recent and old beaver activities. Substrates are cobble and gravel in flow areas, silt in areas behind beaver dams and other low flow areas. This reach is 1 km long and includes the outlet area of a significant tributary from the South and South East (this tributary was not part of WMEC's investigation).

Reach #10

Starts at 61°30.80 N/ 130°17.90 W.

The creek channel is flat with a mix of substrates, gravel/cobble/boulder riffles occur with few pools interspersed. Good shoreline habitats in the form of side pools and cut banks exist. This reach extends to the mouth of Nougha Creek at the outlet of Wolverine Lake and is 1.6 km long.

WHITE MOUNTAIN ENVIRONMENTAL CONSULTING

Money Creek – Bull Trout Utilization Assessment, 1997

Assessments of Money Creek and two of its tributaries, Go Creek and an unnamed tributary that enters Money Creek from the north approximately 19 km upstream of Francis Lake, were investigated to determine potential spawning and over-wintering areas for bull trout. The assessments were conducted between September 15 and 18, 1997 and consisted of:

- aerial assessments conducted by helicopter to observe any aggregations of fish and map deep pools suitable for over-wintering;
- ground surveys using minnow traps, electro-fisher, seine net, angling and visual observations; and
- Float surveys conducted with dry suits, mask and snorkel to investigate micro-habitats and determine presence of adult fish.

Table 1 provides a description of the sample sites on Money and Go Creek, including tributaries to Go Creek, during 1996 and 1997 investigations.

Table 1 Station Descriptions and Locations

Site	Description
M1	Mouth of Money Creek at Francis Lake
M2	Money Creek - Mouth at Robert Campbell Highway
M3	Money Creek Approximately 3.5 km Upstream of the Outlet to Francis Lake
M4	Money Creek - Mouth Area of Major Tributary to Money Creek Approximately 18 km upstream of the Outlet to Francis Lake
M5	Money Creek Approximately 36 km Upstream of the Outlet to Francis Lake
M6	Money Creek 1 km Downstream of its Junction with Go Creek
M7G	Money Creek at its Junction with Go Creek
M8	Money Creek Downstream of Little Jimmy Valley Tributary
M9	Money Creek at Downstream End of Wide Gravel Area
G1	Go Creek at Junction Area with Money Creek
G2	Go Creek Approximately 2.5 km Upstream of the Mouth of Go Creek
G3	Go Creek Approximately 5.6 km Upstream of the Mouth of Go Creek
G4	Go Creek Approximately 5.9 km Upstream of the Mouth of Go Creek
G5	Go Creek Approximately 7.5 km Upstream of the Mouth of Go Creek
P1	Pup Creek, a Tributary of Go Creek
HO	Hawk Owl Creek, a Tributary of Go Creek

The species of fish in the study belongs to the dolly varden/ bull trout (*Salvelinus malma-confluentus*) complex. To determine the exact species involved, specific genetic tests were undertaken. Three specimens were taken during the field assessment, frozen and later delivered to Yukon Territorial Government Fisheries Department representatives. Genetic testing was done at the University of British Columbia by Eric Taylor, Assistant Professor, Department of Zoology. Growth hormone diagnostic testing was conducted and resulted in a positive identification of the specimens as bull trout *Salvelinus confluentus.* Further testing confirmed the initial result.

Bull trout are a sub-species of the genus *Salvelinus*, which includes Arctic char, lake trout and dolly varden. The species is wide spread throughout western North America and eastern Asia. Within the dolly varden / bull trout complex numerous forms exist, including northern and southern, anadromous and non-anadromous, stream resident and lake resident populations (Armstrong and Morrow, 1980). The different forms have developed varying life history strategies that make it difficult to confidently describe the Money Creek population based on existing models from other areas.

Although a great deal of information has been compiled on the species understanding, references in this specific type of habitat are limited. The similarities between land locked and anadromous individuals are subtle but distinct enough that the species complex has often been subjected to sub-species classifications, (e.g. bull trout/ dolly varden). The life history and habits of the various forms varies greatly depend on the surrounding environment. The fish in Money Creek correspond most closely with the stream resident form of dolly varden/ bulltrout, typically confined to clear water tributaries of major rivers. However, there are similarities with a form described as a stream-lake resident (Morrow and Armstrong, 1980). Genetic analysis, conducted by the Yukon Territorial Government Fisheries Department, in conjunction with the University of British Columbia, on specimens taken from the Liard River drainage in the Yukon has shown all specimens analyzed to be bull trout.

Timing of field investigations was coordinated after assessing several reference sources. The closest (proximity) bull trout population to have existing information is at Shiltsky Lake, Yukon, where spawning occurred between September 16 and 21, consistently over a five year period. Water temperatures at spawning vary with the reference; the 1995 spawn at Shiltsky Lake was recorded at 12°C, in contradiction to other recorded references which suggests spawning occurs between 5 and 7°C (Blackett, 1968) or near 8°C (Scott and Crossman, 1974).

Water temperatures in Money Creek were monitored with a data logger located 500 m downstream of the outlet of Go Creek (site W-14). Temperature data was recorded 20 times per day from August 20 to September 12. During this time period daily temperatures rose to highs of between 9 and 12°C, while night time lows fell as low as 5.7°C. Daily temperatures typically fluctuated between 3 to 5°C.

Thermographic records taken at site W-14 on Money Creek indicate that temperatures were approaching a high of 5 to 7°C on September 12 when the recorder was removed. Temperatures remained at that level until our investigations were conducted. Blackett (1960) reported that anadromous dolly varden in Alaska spawned at temperatures between 5 and 6°C but spawning ceased abruptly after a further 2°C drop in temperature. Temperatures at the time of our field investigations were near 6°C. In light of this, the lack of spawning individuals observed during the surveys may indicate that spawning occurred prior to the investigations.

Spawning did not appear to occur in large aggregations, as few suitable locations were recorded and those investigated showed no signs of a recent spawn. One potential area that large numbers may have spawned in is the gravel shoals located immediately upstream of the outlet of Money Creek to Francis Lake. Alternatively, small pockets of sorted, clean washed gravels were observed under undercut banks during the float surveys. These potential micro-spawning sites were small, usually oblong in shape and less than 0.5 x 0.3 m. Fish of this species complex have been recorded utilizing similar habitats (Armstrong and Morrow,1980, and Blackett 1968).

Money Creek may be used as a spawning and rearing creek for bull trout, with adults utilizing Francis Lake and only entering the creek for spawning. Unpublished data from YTG (Thompson Per. Com, 1997) shows that eleven adult dolly varden / bull trout were captured during index gillnetting surveys of Francis Lake conducted in 1990. Of the eleven fish captured, one was taken in the East arm, one was taken in the small lake at the north end of the West arm, and nine were captured just to the south of the Money Creek outlet. This data suggested that the creek is used for spawning and rearing while the lake is used by adults. This model would explain why extensive effort to capture bull trout produced only randomly scattered immature specimens. Considering this model it seems likely that the spawning locations would be located in the lower reaches of the creek. The steep canyon areas and rapids would present a barrier to adult fish migration during spawning in September when water levels are low. These same rapids become more passable to the fry during high water in the spring, allowing the upstream movement of fry that would rear in the creek for as much as several years, or until they reach sexual maturity.

Given the extended effort into locating bull trout in Money Creek and the low numbers of fish captured or observed, it seems likely that the population density and extent of utilization is quite low. Results of fish sampling from this investigation are provided in Appendix 2 of the Proposed Access Road Creek Crossings – Fish Habitat Evaluation and Utilization Assessment, 1997 report. The locations of the sample sites are shown on Figure 1 within the above noted report.

Potential over wintering sites exist in an area only accessible by helicopter. A very tight canyon starting approximately 8 km upstream of Francis Lake extends for a distance of approximately 2.5 km. The canyon has abrupt valley walls, is 100% confined and flows in a narrow channel interspersed with deep pools below abrupt rapids and steep riffles. This canyon area represents a unique habitat on Money Creek. Pools of the same depth occur rarely elsewhere on the creek and definitely do not occur in such a concentrated cluster. The series of pools starts at a small waterfall at coordinates 61°09’17”N / 129°46’45”W. Float surveys were conducted in the uppermost pool of the reach and Arctic grayling, in an aggregation of 24 adults and sub adults, were observed. One juvenile bull trout was observed below the pool.

References

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Table 1 Index Gillnetting Survey, Catch Record, Wolverine Lake area - 1996

Set #	Date (M/D/YR)	Time set	Time lifted	H2O Temp.(C)	Mesh size (cm)	Max. Depth (ft)	CATCH LT	CATCH AG	CATCH LNS	Comments
WLV1	12/06/96	8:05	9:05	4.5	3.8	74	0	0	0	
					6.4		1	0	0	
					8.9		1	0	0	
WLV2	12/06/96	8:45	9:45	4.4	3.8	96	0	0	0	
					6.4		0	0	0	
					8.9		0	0	0	
WLV3	12/06/96	9:30	10:30	4.5	3.8	101	0	0	0	
					6.4		1	2	0	
					8.9		1	0	0	
WLV4	12/06/96	10:05	11:15	4.4	3.8	130	2	0	0	
					6,4		0	0	0	
					8.9		0	0	0	
WLV5	12/06/96	11:00	12:00	4.8	3.8	75	0	0	0	
					6.4		0	0	0	
					8.9		1	1	0	
WLV7	12/06/96	12:50	13:50	4.3	3.8	34	1	0	0	
					6.4		4	0	0	
					8.9		0	0	0	
WLV8	12/06/96	14:25	15:30	5.1	3.8	34	0	0	0	
					6.4		2	4	0	spawning area ?
					8.9		0	0	0	
WLV9	12/06/96	14:50	15:59	5.1	3.8	40	0	0	0	
					6.4		2	0	0	
					8.9		1	2	0	
WLV10	12/06/96	15:55	16:55	5.3	3.8	30	0	2	0	
					6.4		2	9	0	
					8.9		3	0	0	
WLV11	12/06/96	16:25	17:25	6.8	3,8	7	0	0	0	
					6.4		2	0	0	
					8.9		3	2	0	
WLV12	13/06/96	8:55	9:55	6.8	3.8	6	0	0	0	
					6.4		0	5	0	
					8.9		1	2	0	
WLV13	13/06/96	9:35	10:35	6.4	3.8	6	0	0	0	
					6.4		3	2	0	
					8.9		3	6	0	
WLV14	13/06/96	10:15	11:15	5.8	3.8	8	0	1	0	
					6.4		2	2	0	
					8.9		3	12	0	

Set #	Date (M/D/YR)	Time set	Time lifted	H2O Temp.(C)	Mesh size (cm)	Max. Depth (ft)	LT	AG	LNS	Comments
WLV15	13/06/96	12:00	13:00	5.1	3,8	76	0	0	0	
					6,4		0	0	0	
					8.9		1	0	0	
WLV16	13/06/96	12:45	13:45	4.9	3.8	38	0	0	0	
					6,4		0	0	0	
					8.9		0	7	0	
WLV17	13/06/96	13:35	14:35	4.5	3.8	43	0	0	0	
					6.4		0	2	0	
					8.9		0	0	0	
WLV18	13/06/96	14:15	14:50	4.1	3.8	36	0	0	0	
					6.4		0	0	0	
					8.9		1	1	0	net pulled early - zodiac problems
WLV19	13/06/96	16:27	17:27	4.5	3.8	29	0	0	0	
					6.4		0	1	0	
					8.9		0	0	0	
WLV20	13/06/96	17:00	18:00	4.2	3.8	48	0	0	0	
					6.4		0	0	0	
					8.9		2	1	0	
WLV21	13/06/96	17:43	18:43	3.6	3.8	57	0	0	0	
					6.4		1	0	0	
					8.9		0	0	0	
WLV22	13/06/96	7:20	8:20	3.1	3.8	51	0	0	0	
					6.4		1	0	0	
					8.9		0	0	0	
WLV23	23/09/96	14:10	15:10	4.8	3.8	96	1	0	0	
					6.4		2	0	0	
					8.9		0	0	0	
WLV24	15/06/96	14:40	15:45	4.4	3.8	125	1	0	0	
					6.4		0	0	0	
					8.9		0	0	0	
WLV25	15/06/96	15:27	16:27	4.8	8.9	26	3	0	0	
					3.8		1	0	0	
					6.4		2	1	0	
LWV 1	15/06/96	8:00	9:00	8.9	3.8	4	5	4	0	
					6.4		2	6	0	
					8.9		6	8	4	
LWV 2	15/06/96	8:35	9:50	7.5	3.8	36	0	0	0	
					6.4		5	5	0	
					8.9		0	0	0	
LWV 3	15/06/96	9:46	10:46	7.5	3.8	22	0	1	0	
					6.4		3	9	0	
					8.9		2	12	0	

Set #	Date (M/D/YR)	Time set	Time lifted	H2O Temp.(C)	Mesh size (cm)	Max. Depth (ft)	LT	AG	LNS	Comments
LWV 4	15/06/96	10:28	11:28	7.8	3.8	39	0	0	0	
					6.4		2	12	0	
					8.9		0	0	0	
LJ1	14/06/96	10:05	11:05	5.9	3.8	21	0	1	0	
					6.4		0	12	1	
					8.9		0	0	0	
LJ2	14/06/96	10:38	11:45	5.4	3.8	32	0	1	0	
					6.4		0	7	0	
					8.9		0	4	0	
LJ3	14/06/96	11:40	12:40	5.6	3.8	21	0	0	0	
					6.4		0	5	0	
					8.9		0	0	0	
LJ4	14/06/96	12:15	13:16	6	3.8	26	0	0	0	
					6.4		0	0	0	
					8.9		1	9	0	
LJ5	14/06/96	13:04	14:05	6.2	3.8	31	0	4	0	
					6.4		1	20	0	
					8.9		0	0	0	
LF6	14/06/96	13:35	14:35	5.9	3.8	103	0	1	0	
					6.4		0	1	0	
					8.9		1	15	0	
WND1	23/09/96	12:45	13:45		6.4	24	1	4	3	
					5.1		0	9	0	
					2.5		1	1	0	
WND2	23/09/96	14:15	15:15		6.4	17	0	4	3	
					5.1		0	2	0	
					2.5		0	2	0	
WND3	23/09/96	15:30	16:40		6.4	28	0	0	1	
					5.1		0	4	0	
					2.5		0	0	0	

Table 2. Electro-fishing Results, Wolverine Lake area - 1996

DATE	SITE	EFFORT (sec)	TEMP (c)	CATCH						comments
				AG	LT	SS	BB	LNS	DV	
11/06/96	M1	156		0	0	0	0	0	0	
11/06/96	M1	460		0	0	9	0	0	0	
14/06/96	WC	184	6.9	0	0	2	0	0	0	
14/06/96	WC	57	6.9	1	0	0	0	0	0	
14/06/96	WT1	64		0	0	0	0	0	0	
16/06/96	N1	258	7.7	1	0	12	0	16	0	
12/07/96	TLW1	445	0.9	0	0	13	1	0	0	5 ss taken for metal samples
12/07/96	TLW2	101	4.6	0	0	5	0	0	0	
12/07/96	TLW2	81	4.6	0	0	0	0	0	0	
12/07/96	TLW3	177	1.9	0	0	0	0	0	0	
12/07/96	TLW4	197	2.4	40	1	11	1	0	0	
12/07/96	TLW4	205	2.4	30	5	21	0	0	0	
12/07/96	TLW4	205	2.4	50	0	5	0	0	0	
13/07/96	TWV3	335	2.1	1	0	5	4	0	0	2 ss taken for metal samples
13/07/96	TWV3	279	2.1	0	0	3	0	0	0	3 ss taken for metal samples
13/07/96	TWV4	160	11.8	31	0	0	0	85	0	20 u.i. fry (LNS?)
13/07/96	TWV5	173	10.7	0	8	0	2	0	0	
13/07/96	TWV5	356	10.7	0	1	6	1	0	0	3 ss taken for metal samples
13/07/96	TWV5	340	10.7	0	1	16	0	0	0	5 ss taken for metal samples
13/07/96	TWV6	179	9.2	0	2	33	4	0	0	
13/07/96	TWV6	109	9.2	0	4	21	2	0	0	3 ss taken for metal samples
13/07/96	TWV6	181	5	0	8	10	0	0	0	2 ss taken for metal samples
13/07/96	TWV6	136	4.7	0	0	5	0	0	0	2 ss taken for metal samples
13/07/96	TWV6	46	4.7	0	0	0	0	0	0	
13/07/96	WO	338	12.5	2	19	32	3	0	0	7 ss taken for metal samples
13/07/96	WO	89	12.5	0	2	2	1	0	0	
13/07/96	WO	148	12.5	12	11	25	0	0	0	
13/07/96	WO	158	12.5	30	3	6	1	0	0	
14/07/96	M3	964	7.8	40	0	17	1	0	0	3 ss taken for metal samples
14/07/96	M4	249	7.6	0	0	9	0	0	5	
14/07/96	M4	195	7.6	1	0	20	0	0	5	
14/07/96	M4 (trib)	129	4.6	0	0	7	0	0	0	upper fork

Table 2. Electro-fishing Results, Wolverine Lake area - 1996

DATE	SITE	EFFORT (sec)	TEMP (c)	CATCH						comments
				AG	LT	SS	BB	LNS	DV	
14/07/96	M4 (trib)	122		0	0	0	0	0	2	
14/07/96	M4 (trib)	128	7.6	0	0	0	0	0	1	lower fork
14/07/96	M5	632		4	0	135	0	0	2	4 ss taken for metal samples
14/07/96	M5	117		143	0	26	0	0	0	
14/07/96	TLJ1	102	2.6	0	0	3	1	0	0	
14/07/96	TLJ1	177	2.6	0	1	3	0	0	0	
15/07/96	AR1	147	2.2	0	0	0	0	0	0	
15/07/96	AR1	80	2.2	0	0	0	0	0	0	
15/07/96	G1	80	4.9	0	0	1	0	0	1	
15/07/96	G1	152	4.9	0	0	4	0	0	1	1 ss taken for metal samples
15/07/96	G1	512	4.9	1	0	6	0	0	2	1 ss taken for metal samples
15/07/96	G1	175	4.9	0	0	10	0	0	1	1 ss taken for metal samples
15/07/96	M6	573	6.5	11	0	118	0	0	5	
15/07/96	M6	120	6.5	0	0	18	0	0	1	
15/07/96	M6	149	6.5	0	0	12	0	0	0	
15/07/96	M6	55	6.5	0	0	5	0	0	0	
15/07/96	M6	74	6.5	0	0	3	0	0	0	
15/07/96	M7G	88	5.1	0	0	4	0	0	0	
15/07/96	M7G	154	5.1	0	0	14	0	0	1	
15/07/96	M7G	443	7.2	6	0	59	0	0	2	4 ss taken for metal samples
15/07/96	M8	148		1	0	12	0	0	0	
15/07/96	M8	139		0	0	18	0	0	0	
15/07/96	M9	302	9.3	19	0	21	0	0	0	
15/07/96	M9	164	9.3	0	0	8	0	0	0	
15/07/96	P1	175	2.8	0	0	6	0	0	0	
16/07/96	AR3	83	3.3	0	0	0	0	0	0	
16/07/96	N4	159	8.5	0	0	11	0	0	0	1 u.i. salmonid
16/07/96	N4	214	8.5	10	0	6	0	0	0	
16/07/96	N4	432	8.5	75	0	32	0	0	0	
16/07/96	N5	52	11.9	100	0	0	1	0	0	
16/07/96	N5	213	11.9	88	0	0	1	0	0	
16/07/96	N5	122	11.9	225	0	0	1	0	0	

Table 2. Electro-fishing Results, Wolverine Lake area - 1996

DATE	SITE	EFFORT (sec)	TEMP (c)	CATCH						comments
				AG	LT	SS	BB	LNS	DV	
16/07/96	N5	196	11.9	150	0	0	1	0	0	
16/07/96	N5	297	11.9	83	0	0	2	0	0	
16/07/96	N5	120	11.9	0	0	7	1	0	0	
16/07/96	N5	20	11.9	60	0	0	0	0	0	
16/07/96	N5	112	11.9	6	0	14	3	0	0	
16/07/96	TN1	148	2	0	0	0	0	0	0	
16/07/96	TWV	109	3.4	0	0	0	0	0	0	
16/07/96	WND	163	16.1	91	0	19	0	0	0	
16/07/96	WND	75	16.1	2000	0	0	0	0	0	
17/07/96	G2	447	5.3	3	0	0	0	0	0	
17/07/96	G3	232	4.1	0	0	0	0	0	0	
17/07/96	G4	90	4.7	0	0	0	0	0	0	
17/07/96	G5	209	2.7	0	0	0	0	0	0	
17/07/96	HO1	244	3.6	0	0	0	0	0	0	
25/09/96	G1	89	1.2	0	0	0	0	0	0	
25/09/96	M7G	159	1.1	0	0	25	0	0	0	
25/09/96	M7G	183	1.1	0	0	5	0	0	1	
25/09/96	N2	165	2.5	15	0	0	0	0	0	
25/09/96	N2	371	2.5	19	0	17	0	0	0	
25/09/96	N2	154	2.5	4	0	2	0	0	0	

Table 3. Angling Results, Wolverine Lake area, 1996.

Date (d/m/yr)	Site	Temp (C)	Effort (min)	Catch		Comments
				Arctic grayliing	Lake trout	
13/07/96	WO	12.5	7	2	2	grayling in riffles, trout above riffles
13/07/96	TWV5	10.7	15	4	0	
13/07/96	TWV6	9.2	40	2	4	
13/07/96	TWV3		15	0	3	lake at outlet area
14/07/96	M3	7.8	20	3	0	
14/07/96	LJ		15	1	1	
16/07/96	N4	8.5	15	7	0	
16/07/96	WO		22	3		taken for metal samples
16/07/96	WND	16.1	5	0	0	
16/07/96	WI		60	3	8	2 grayling taken for metal samples
17/07/96	M6		25	4	0	
23/09/96	WO	5	7	2	2	
24/09/96	WO	5	15	10	0	
24/09/96	WI		20	0	0	
24/09/96	LJ	6.4	40	0	16	
24/09/96	LWV		25	0	2	
14/06/96	WC	8.9	52	0	10	
16/06/96	M1	14	50	0	0	
14/06/96	LJ	5.9	3	0	1	
14/06/96	LJ	5.9	1	0	1	
16/06/96	N1	7.7	2	5	0	
23/09/96	WLV		20	0	0	near island
24/09/96	WLV		20	0	0	near island
24/09/96	WLV		20	0	0	spawning site east
24/09/96	WLV		40	0	7	spawning site west
25/09/96	N2		5	2	0	below culverts
25/09/96	Frances Lake		70	0	0	

Table 4. SEINE NETTING RESULTS, WOLVERINE LAKE AREA, 1996.

DATE	SITE	TEMP (c)	EFFORT (m2)	DEPTH (avg.)	CATCH				
(d/m/yr)					AG	LT	SS	BB	DV
11/06/96	M1	6.6	25		0	0	1	0	0
11/06/96	M1	6.4	40		0	0	1	0	0
11/06/96	M1		35		0	0	1	0	0
11/06/96	M1		35		0	0	0	0	0
11/06/96	M1		25		0	0	0	0	0
15/06/96	WO	10.2	20		0	1	1	0	0
15/06/96	WO	10.2	25		0	4	2	0	0
15/06/96	WO	10.2	12		2	0	2	0	0
12/07/96	WI	13.6	50	0.4	114	3	4	0	0
12/07/96	TLW1	3.7	25	0.1	0	0	0	0	0
13/07/96	TWV6	5	42	0.4	0	0	0	0	0
13/07/96	TWV6	5	27	0.4	0	2	1	0	0
13/07/96	TWV6	9.2	84	0.7	4	1	3	0	0
14/07/96	M4 (trib)	7.6	15	0.35	0	0	0	0	0
14/07/96	M4	7.6	30	0.2	0	0	0	0	0
14/07/96	M5		36	0.9	2	0	1	0	0
15/07/96	WI	10.2	20		0	1	0	0	0
15/07/96	WI	10.2	25		0	4	0	0	0
15/07/96	WI	10.2	10		2	0	2	0	0

DATE	SITE	TEMP (c)	EFFORT (m2)	DEPTH (avg.)	CATCH				
(d/m/yr)					AG	LT	SS	BB	DV
16/06/96	N1	8.9	20		0	0	2	0	0
16/06/96	N1	8.9	15		0	0	11	0	0
16/06/96	N2	9.8	32		0	0	0	0	0
16/06/96	N2	9.8	18		0	0	0	0	0
16/06/96	N2	9.8	40		0	0	6	0	0

Table 5. Master Sample Records, Wolverine Lake Area, 1996.

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
WOLVERINE LAKE	**Arctic grayling**	AG	16/07/96	ANG	WI	344	300		mature male	
(includes inlet and outlet)		AG	16/07/96	ANG	WI	321	250		mature male	ants=6
		AG	13/06/96	ANG	WO	394	650			
		AG	13/06/96	ANG	WO	417	800			
		AG	13/06/96	ANG	WO	408	750			
		AG	16/07/96	ANG	WO	384	500		mature male	
		AG	16/07/96	ANG	WO	388	525		mature male	
		AG	16/07/96	ANG	WO	470				
		AG	23/09/96	ANG	WO	350				
		AG	23/09/96	ANG	WO	395				
		AG	14/06/96	ELS	WC	82				
		AG	13/07/96	ELS	WO	23				
		AG	13/07/96	ELS	WO	41				
		AG	13/07/96	ELS	WO	35				
		AG	13/07/96	ELS	WO	34				
		AG	13/07/96	ELS	WO	31				
		AG	13/07/96	ELS	WO	30				
		AG	13/07/96	ELS	WO	125				
		AG	13/07/96	ELS	WO	280				
		AG	12/06/96	GL	WLV10	296	300			
		AG	12/06/96	GL	WLV10	360	650			
		AG	12/06/96	GL	WLV10	399	750			
		AG	12/06/96	GL	WLV10	357	475			
		AG	12/06/96	GL	WLV10	317	325			
		AG	12/06/96	GL	WLV10	272	200			
		AG	12/06/96	GL	WLV10	387	675			
		AG	12/06/96	GL	WLV10	279	275			
		AG	12/06/96	GL	WLV10	342	500			
		AG	12/06/96	GL	WLV10	263	275			
		AG	12/06/96	GL	WLV10	479	650			
		AG	12/06/96	GL	WLV11	378	600			
		AG	12/06/96	GL	WLV11	386	675			
		AG	13/06/96	GL	WLV12	380	675			
		AG	13/06/96	GL	WLV12	405	700			
		AG	13/06/96	GL	WLV12	317	350			
		AG	13/06/96	GL	WLV12	300	250			
		AG	13/06/96	GL	WLV12	290	300			
		AG	13/06/96	GL	WLV12	309	375			
		AG	13/06/96	GL	WLV12	271	200			
		AG	13/06/96	GL	WLV13	366	575			
		AG	13/06/96	GL	WLV13	292	250			
		AG	13/06/96	GL	WLV13	389	650			
		AG	13/06/96	GL	WLV13	334	500			
		AG	13/06/96	GL	WLV13	416	800			
		AG	13/06/96	GL	WLV13	380	600			
		AG	13/06/96	GL	WLV13	382	625			
		AG	13/06/96	GL	WLV13	370	600			
		AG	13/06/96	GL	WLV14	410	700			
		AG	13/06/96	GL	WLV14	410	775			
		AG	13/06/96	GL	WLV14	410	775			
		AG	13/06/96	GL	WLV14	380	700			
		AG	13/06/96	GL	WLV14	389	650			
		AG	13/06/96	GL	WLV14	422	850	growth on side of body taken as sample		
		AG	13/06/96	GL	WLV14	423	800			
		AG	13/06/96	GL	WLV14	391	675	voluntering milt	male	
		AG	13/06/96	GL	WLV14	400	750			
		AG	13/06/96	GL	WLV14	387	700			
		AG	13/06/96	GL	WLV14	401	725			
		AG	13/06/96	GL	WLV14	407	700			

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		AG	13/06/96	GL	WLV14	398	750			
		AG	13/06/96	GL	WLV14	402	750			
		AG	13/06/96	GL	WLV14	372	600			
		AG	13/06/96	GL	WLV16	394	700			
		AG	13/06/96	GL	WLV16	415	850			
		AG	13/06/96	GL	WLV16	355	600			
		AG	13/06/96	GL	WLV16	412	800			
		AG	13/06/96	GL	WLV16	384	700			
		AG	13/06/96	GL	WLV16	368	575			
		AG	13/06/96	GL	WLV16	399	565			
		AG	13/06/96	GL	WLV17	387	750			
		AG	13/06/96	GL	WLV17	366	600			
		AG	13/06/96	GL	WLV18	392	700			
		AG	13/06/96	GL	WLV19	403	825			
		AG	13/06/96	GL	WLV20	380	600			
		AG	15/06/96	GL	WLV25	360	525			
		AG	12/06/96	GL	WLV3	404	700			
		AG	12/06/96	GL	WLV3	389	675			
		AG	12/06/96	GL	WLV5	375	600			
		AG	12/06/96	GL	WLV8	348	575			
		AG	12/06/96	GL	WLV8	368	525	voluntering eggs	female	
		AG	12/06/96	GL	WLV8	367	675			
		AG	12/06/96	GL	WLV8	380	650			
		AG	12/06/96	GL	WLV9	412	825			
		AG	12/06/96	GL	WLV9	351	575	voluntering eggs	female	
		AG	15/06/96	SN	WI	407	700			
		AG	12/07/96	SN	WI	148				
		AG	12/07/96	SN	WI	114				
		AG	12/07/96	SN	WI	93				
		AG	12/07/96	SN	WI	131				
		AG	12/07/96	SN	WI	142				
		AG	12/07/96	SN	WI	114				
		AG	12/07/96	SN	WI	118				
		AG	12/07/96	SN	WI	109				
		AG	12/07/96	SN	WI	141				
		AG	12/07/96	SN	WI	135				
		AG	12/07/96	SN	WI	98				
		AG	12/07/96	SN	WI	138				
		AG	12/07/96	SN	WI	124				
		AG	12/07/96	SN	WI	111				
		AG	12/07/96	SN	WI	118				
		AG	12/07/96	SN	WI	108				
		AG	12/07/96	SN	WI	115				
		AG	12/07/96	SN	WI	125				
		AG	12/07/96	SN	WI	140				
		AG	12/07/96	SN	WI	118				
		AG	12/07/96	SN	WI	121				
		AG	12/07/96	SN	WI	116				
		AG	12/07/96	SN	WI	109				
		AG	12/07/96	SN	WI	94				
		AG	12/07/96	SN	WI	78				
		AG	12/07/96	SN	WI	107				
		AG	12/07/96	SN	WI	118				
		AG	12/07/96	SN	WI	127				
		AG	12/07/96	SN	WI	124				
		AG	12/07/96	SN	WI	114				
		AG	12/07/96	SN	WI	114				
		AG	12/07/96	SN	WI	111				
		AG	12/07/96	SN	WI	109				
		AG	12/07/96	SN	WI	114				
		AG	12/07/96	SN	WI	97				

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		AG	12/07/96	SN	WI	107				
		AG	12/07/96	SN	WI	38				
		AG	12/07/96	SN	WI	132				
		AG	12/07/96	SN	WI	29				
		AG	12/07/96	SN	WI	41				
		AG	12/07/96	SN	WI	26				
		AG	12/07/96	SN	WI	22				
		AG	12/07/96	SN	WI	27				
		AG	12/07/96	SN	WI	23				
		AG	12/07/96	SN	WI	24				
		AG	12/07/96	SN	WI	41				
		AG	12/07/96	SN	WI	23				
		AG	12/07/96	SN	WI	24				
		AG	12/07/96	SN	WI	41				
		AG	12/07/96	SN	WI	23				
		AG	12/07/96	SN	WI	25				
		AG	12/07/96	SN	WI	24				
		AG	12/07/96	SN	WI	22				
		AG	12/07/96	SN	WI	27				
		AG	12/07/96	SN	WI	26				
		AG	12/07/96	SN	WI	26				
		AG	12/07/96	SN	WI	29				
		AG	12/07/96	SN	WI	30				
		AG	12/07/96	SN	WI	31				
		AG	12/07/96	SN	WI	18				
		AG	12/07/96	SN	WI	29				
		AG	12/07/96	SN	WI	39				
WOLVERINE LAKE	**Burbot**	BB	13/07/96	ANG	WO	138				
		BB	13/07/96	ANG	WO	142				
		BB	13/07/96	ELS	WO	245				
		BB	13/07/96	ELS	WO	93				
WOLVERINE LAKE	**Lake trout**	LT	14/06/96	ANG	WC	374	700			
		LT	14/06/96	ANG	WC	405	1000			
		LT	14/06/96	ANG	WC	387	650			
		LT	14/06/96	ANG	WC	400	725			
		LT	23/09/96	ANG	WO	400				
		LT	24/09/96	ANG	WO	428	625	on spawning site	F2	
		LT	24/09/96	ANG	WLV	400	750	on spawning site	M10	shrimp=5
		LT	24/09/96	ANG	WLV	410	925	on spawning site	M9	empty
		LT	24/09/96	ANG	WLV	415	925	on spawning site	F4	shrimp=8,snails=2
		LT	13/07/96	ELS	WO	27				
		LT	13/07/96	ELS	WO	32				
		LT	13/07/96	ELS	WO	34				
		LT	13/07/96	ELS	WO	32				
		LT	13/07/96	ELS	WO	36				
		LT	13/07/96	ELS	WO	39				
		LT	13/07/96	ELS	WO	42				
		LT	13/07/96	ELS	WO	34				
		LT	12/06/96	GL	WLV1	760	5500			
		LT	12/06/96	GL	WLV1	364	675			
		LT	12/06/96	GL	WLV10	770	6450			
		LT	12/06/96	GL	WLV10	846	7500			
		LT	12/06/96	GL	WLV10	802	6400			
		LT	12/06/96	GL	WLV10	424	900			
		LT	12/06/96	GL	WLV10	391	675			
		LT	12/06/96	GL	WLV11	423	800	metal sample #3		
		LT	12/06/96	GL	WLV11	406	825			
		LT	12/06/96	GL	WLV11	407	990			
		LT	12/06/96	GL	WLV11	382	625	metal sample #4		
		LT	12/06/96	GL	WLV11	450	950	metal sample #5		
		LT	13/06/96	GL	WLV12	471	1200			

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		LT	13/06/96	GL	WLV13	405	775			
		LT	13/06/96	GL	WLV13	445	975			
		LT	13/06/96	GL	WLV13	405	800			
		LT	13/06/96	GL	WLV13	440	800			
		LT	13/06/96	GL	WLV13	420	975			
		LT	13/06/96	GL	WLV13	415	800			
		LT	13/06/96	GL	WLV14	389	700			
		LT	13/06/96	GL	WLV14	404	800			
		LT	13/06/96	GL	WLV14	394	800			
		LT	13/06/96	GL	WLV14	436	980			
		LT	13/06/96	GL	WLV14	394	750			
		LT	13/06/96	GL	WLV15	680	4200			
		LT	13/06/96	GL	WLV18	425	950			
		LT	13/06/96	GL	WLV20	388	700			
		LT	13/06/96	GL	WLV20	439	875	Sample #6		
		LT	13/06/96	GL	WLV21	414	775	Sample #7		
		LT	14/06/96	GL	WLV22	424	900			
		LT	15/06/96	GL	WLV23	87				
		LT	15/06/96	GL	WLV23	409	650			
		LT	15/06/96	GL	WLV23	431	1000			
		LT	15/06/96	GL	WLV24	437	750			
		LT	15/06/96	GL	WLV25	421	820			
		LT	15/06/96	GL	WLV25	440	1100			
		LT	15/06/96	GL	WLV25	403	750			
		LT	15/06/96	GL	WLV25	406	750			
		LT	15/06/96	GL	WLV25	417	950			
		LT	15/06/96	GL	WLV25	422	925			
		LT	12/06/96	GL	WLV3	578	2600			
		LT	12/06/96	GL	WLV3	393	800			
		LT	12/06/96	GL	WLV4	273	225	Leeches on tail		
		LT	12/06/96	GL	WLV4	172	50			
		LT	12/06/96	GL	WLV5	396	850			
		LT	12/06/96	GL	WLV7	293	250			
		LT	12/06/96	GL	WLV7	444	1050			
		LT	12/06/96	GL	WLV7	404	800			
		LT	12/06/96	GL	WLV7	411	750			
		LT	12/06/96	GL	WLV7	378	675			
		LT	12/06/96	GL	WLV8	395	675	metal sample #1		
		LT	12/06/96	GL	WLV8	458	1100			
		LT	12/06/96	GL	WLV9	345	480	metal sample #2		
		LT	12/06/96	GL	WLV9	401	725			
		LT	12/06/96	GL	WLV9	408	900			
		LT	15/06/96	SN	WI	30				
		LT	15/06/96	SN	WI	30				
		LT	15/06/96	SN	WI	30				
		LT	15/06/96	SN	WI	30				
		LT	15/06/96	SN	WI	30				
		LT	12/07/96	SN	WI	132				
		LT	12/07/96	SN	WI	41				
		LT	12/07/96	SN	WI	41				
WOLVERINE LAKE	**Slimy sculpin**	SS	13/07/96	ELS	WO	71				
		SS	13/07/96	ELS	WO	68				
		SS	13/07/96	ELS	WO	59				
		SS	13/07/96	ELS	WO	89				
		SS	13/07/96	ELS	WO	55				
		SS	13/07/96	ELS	WO	78				
		SS	13/07/96	ELS	WO	99				
		SS	15/06/96	SN	WI	31				
		SS	12/07/96	SN	WI	32				
		SS	12/07/96	SN	WI	37				
		SS	12/07/96	SN	WI	36				

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
LITTLE WOLVERINE LAKE	**Arctic grayling**	AG	15/06/96	GL	LWV 1	372	500			
		AG	15/06/96	GL	LWV 1	313	350			
		AG	15/06/96	GL	LWV 1	368	475			
		AG	15/06/96	GL	LWV 1	271	175			
		AG	15/06/96	GL	LWV 1	318	350			
		AG	15/06/96	GL	LWV 1	290	200			
		AG	15/06/96	GL	LWV 1	265	190			
		AG	15/06/96	GL	LWV 1	354	500			
		AG	15/06/96	GL	LWV 1	380	550			
		AG	15/06/96	GL	LWV 1	294	300			
		AG	15/06/96	GL	LWV 1	351	500			
		AG	15/06/96	GL	LWV 1	305	350			
		AG	15/06/96	GL	LWV 1	398	675			
		AG	15/06/96	GL	LWV 1	360	500			
		AG	15/06/96	GL	LWV 1	380	600			
		AG	15/06/96	GL	LWV 1	348	500			
		AG	15/06/96	GL	LWV 1	310	300			
		AG	15/06/96	GL	LWV 1	300	275			
		AG	15/06/96	GL	LWV 2	344	525			
		AG	15/06/96	GL	LWV 2	352	450			
		AG	15/06/96	GL	LWV 2	300	250			
		AG	15/06/96	GL	LWV 2	372	550			
		AG	15/06/96	GL	LWV 2	370	550			
		AG	15/06/96	GL	LWV 3	336	400	voluntering milt	male	
		AG	15/06/96	GL	LWV 3	368	500			
		AG	15/06/96	GL	LWV 3	308	300			
		AG	15/06/96	GL	LWV 3	318	325			
		AG	15/06/96	GL	LWV 3	354	400			
		AG	15/06/96	GL	LWV 3	262	200			
		AG	15/06/96	GL	LWV 3	340	400			
		AG	15/06/96	GL	LWV 3	322	300			
		AG	15/06/96	GL	LWV 3	314	300			
		AG	15/06/96	GL	LWV 3	335	375			
		AG	15/06/96	GL	LWV 3	348	400			
		AG	15/06/96	GL	LWV 3	372	650			
		AG	15/06/96	GL	LWV 3	308	350			
		AG	15/06/96	GL	LWV 3	310	300			
		AG	15/06/96	GL	LWV 3	322	325			
		AG	15/06/96	GL	LWV 3	344	400			
		AG	15/06/96	GL	LWV 3	350	450			
		AG	15/06/96	GL	LWV 3	324	325			
		AG	15/06/96	GL	LWV 3	342	375			
		AG	15/06/96	GL	LWV 3	358	450			
		AG	15/06/96	GL	LWV 3	342	425			
		AG	15/06/96	GL	LWV 3	330	400			
		AG	15/06/96	GL	LWV 4	364	450			
		AG	15/06/96	GL	LWV 4	333	400			
		AG	15/06/96	GL	LWV 4	343	475			
		AG	15/06/96	GL	LWV 4	297	300			
		AG	15/06/96	GL	LWV 4	337	400			
		AG	15/06/96	GL	LWV 4	343	400			
		AG	15/06/96	GL	LWV 4	357	475			
		AG	15/06/96	GL	LWV 4	322	350			
		AG	15/06/96	GL	LWV 4	314	300			
		AG	15/06/96	GL	LWV 4	339	375	voluntering eggs	female	
		AG	15/06/96	GL	LWV 4	326	425			
		AG	15/06/96	GL	LWV 4	295	250			
LITTLE WOLVERINE LAKE	**Longnose sucker**	LNS	15/06/96	GL	LWV 1	430	1000			
		LNS	15/06/96	GL	LWV 1	460	1350			

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		LNS	15/06/96	GL	LWV 1	480	1400			
		LNS	15/06/96	GL	LWV 1	400	875	voluntering eggs	female	
LITTLE WOLVERINE LAKE	**Lake trout**	LT	24/09/96	ANG	LWV	650				
		LT	24/09/96	ANG	LWV	623	2650	on spawning site	M7	hairbal?=5
		LT	24/09/96	ANG	LWV	418	750	on spawning site	F2	shrimp=10,clams=0
		LT	24/09/96	ANG	LWV	2700				
		LT	15/06/96	GL	LWV 1	437	975			
		LT	15/06/96	GL	LWV 1	395	750			
		LT	15/06/96	GL	LWV 1	428	1000			
		LT	15/06/96	GL	LWV 1	400	925			
		LT	15/06/96	GL	LWV 1	410	900			
		LT	15/06/96	GL	LWV 1	476	1250			
		LT	15/06/96	GL	LWV 1	468	1200			
		LT	15/06/96	GL	LWV 1	429	1100			
		LT	15/06/96	GL	LWV 1	368	550			
		LT	15/06/96	GL	LWV 1	425	900			
		LT	15/06/96	GL	LWV 1	402	750	Sample # 9		
		LT	15/06/96	GL	LWV 1	462	1300			
		LT	15/06/96	GL	LWV 1	444	1100			
		LT	15/06/96	GL	LWV 2	440	800			
		LT	15/06/96	GL	LWV 2	786	6050	Sample # 8		
		LT	15/06/96	GL	LWV 2	392	775			
		LT	15/06/96	GL	LWV 2	338	425	Sample # 10		
		LT	15/06/96	GL	LWV 2	364	500			
		LT	15/06/96	GL	LWV 3	770	6500			
		LT	15/06/96	GL	LWV 3	466	900			
		LT	15/06/96	GL	LWV 3	500	1400			
		LT	15/06/96	GL	LWV 3	382	650	Sample #11		
		LT	15/06/96	GL	LWV 3	415	650			
		LT	15/06/96	GL	LWV 4	528	1450			
		LT	15/06/96	GL	LWV 4	400	800			
LITTLE JIMMY LAKE	**Arctic grayling**	AG	14/06/96	GL	MHL 1	249	175			
		AG	14/06/96	GL	MHL 1	334	400			
		AG	14/06/96	GL	MHL 1	322	425			
		AG	14/06/96	GL	MHL 1	299	300			
		AG	14/06/96	GL	MHL 1	285	275			
		AG	14/06/96	GL	MHL 1	274	200			
		AG	14/06/96	GL	MHL 1	262	200			
		AG	14/06/96	GL	MHL 1	289	300			
		AG	14/06/96	GL	MHL 1	341	500			
		AG	14/06/96	GL	MHL 1	306	375			
		AG	14/06/96	GL	MHL 1	362	525			
		AG	14/06/96	GL	MHL 1	272	200			
		AG	14/06/96	GL	MHL 2	330	375			
		AG	14/06/96	GL	MHL 2	n/a	350			
		AG	14/06/96	GL	MHL 2	274	200			
		AG	14/06/96	GL	MHL 2	305	450			
		AG	14/06/96	GL	MHL 2	318	450			
		AG	14/06/96	GL	MHL 2	342	450			
		AG	14/06/96	GL	MHL 2	327	400			
		AG	14/06/96	GL	MHL 2	348	525			
		AG	14/06/96	GL	MHL 2	285	300			
		AG	14/06/96	GL	MHL 2	318	350			
		AG	14/06/96	GL	MHL 2	358	450			
		AG	14/06/96	GL	MHL 2	343	450			
		AG	14/06/96	GL	MHL 3	330	500			
		AG	14/06/96	GL	MHL 3	318	450			
		AG	14/06/96	GL	MHL 3	342	525			
		AG	14/06/96	GL	MHL 3	289	250			

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		AG	14/06/96	GL	MHL 3	346	500			
		AG	14/06/96	GL	MHL 4	322	325			
		AG	14/06/96	GL	MHL 4	342	400			
		AG	14/06/96	GL	MHL 4	348	375			
		AG	14/06/96	GL	MHL 4	322	350			
		AG	14/06/96	GL	MHL 4	350	400			
		AG	14/06/96	GL	MHL 4	350	450			
		AG	14/06/96	GL	MHL 4	327	475			
		AG	14/06/96	GL	MHL 4	322	450			
		AG	14/06/96	GL	MHL 4	360	450			
		AG	14/06/96	GL	MHL 5	324	350			
		AG	14/06/96	GL	MHL 5	332	425			
		AG	14/06/96	GL	MHL 5	223	100			
		AG	14/06/96	GL	MHL 5	274	200			
		AG	14/06/96	GL	MHL 5	320	300			
		AG	14/06/96	GL	MHL 5	288	200			
		AG	14/06/96	GL	MHL 5	324	400			
		AG	14/06/96	GL	MHL 5	320	325			
		AG	14/06/96	GL	MHL 5	337	375			
		AG	14/06/96	GL	MHL 5	344	375			
		AG	14/06/96	GL	MHL 5	323	325			
		AG	14/06/96	GL	MHL 5	358	450			
		AG	14/06/96	GL	MHL 5	319	325			
		AG	14/06/96	GL	MHL 5	277	250			
		AG	14/06/96	GL	MHL 5	362	450			
		AG	14/06/96	GL	MHL 5	342	450			
		AG	14/06/96	GL	MHL 5	321	350			
		AG	14/06/96	GL	MHL 5	334	320			
		AG	14/06/96	GL	MHL 5	355	550			
		AG	14/06/96	GL	MHL 5	350	400			
		AG	14/06/96	GL	MHL 5	339	400			
		AG	14/06/96	GL	MHL 5	335	350			
		AG	14/06/96	GL	MHL 5	362	450			
		AG	14/06/96	GL	MHL 5	347	450			
		AG	14/06/96	GL	MHL 6	317	300			
		AG	14/06/96	GL	MHL 6	312	300			
		AG	14/06/96	GL	MHL 6	351	450			
		AG	14/06/96	GL	MHL 6	350	400			
		AG	14/06/96	GL	MHL 6	345	500			
		AG	14/06/96	GL	MHL 6	329	450			
		AG	14/06/96	GL	MHL 6	368	500			
		AG	14/06/96	GL	MHL 6	340	425			
		AG	14/06/96	GL	MHL 6	320	325			
		AG	14/06/96	GL	MHL 6	352	400			
		AG	14/06/96	GL	MHL 6	320	400			
		AG	14/06/96	GL	MHL 6	340	420			
		AG	14/06/96	GL	MHL 6	339	400			
		AG	14/06/96	GL	MHL 6	340	425			
		AG	14/06/96	GL	MHL 6	338	475			
		AG	14/06/96	GL	MHL 6	355	450			
		AG	14/06/96	GL	MHL 6	344	400			
LITTLE JIMMY LAKE	**Lake trout**	LT	24/09/96	ANG	LJ	418	850	on spawning site	M10	empty
		LT	24/09/96	ANG	LJ	395	650	on spawning site	F5	clam=0,eggs=0,sculpin=15
		LT	24/09/96	ANG	LJ	395	700	on spawning site	F5	bettle=0,eggs=5,shrimp=15
		LT	24/09/96	ANG	LJ	400	750	on spawning site	M10	eggs=0,rocks=0
		LT	24/09/96	ANG	LJ	385	600	on spawning site	M10	eggs=5
		LT	24/09/96	ANG	LJ	410	700	on spawning site	F2	eggs=4,rocks=1
		LT	24/09/96	ANG	LJ	435	900	on spawning site	F5	plecoptra=2,rocks=4,eggs=4,snail=0
		LT	14/06/96	GL	LJ 4	472	650			
		LT	14/06/96	GL	LJ 5	652	3550			
		LT	14/06/96	GL	LJ 6	705	4800			

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
MONEY CREEK	**Arctic grayling**	AG	14/07/96	ANG	M3	365				
		AG	14/07/96	ANG	M3	240				
		AG	14/07/96	ANG	M3	290				
		AG	17/07/96	ANG	M6	430				
		AG	17/07/96	ANG	M6	405				
		AG	17/07/96	ANG	M6	370				
		AG	17/07/96	ANG	M6	365				
		AG	14/07/96	ELS	M3	26				
		AG	14/07/96	ELS	M3	26				
		AG	14/07/96	ELS	M3	24				
		AG	14/07/96	ELS	M3	18				
		AG	14/07/96	ELS	M3	27				
		AG	14/07/96	ELS	M3	26				
		AG	14/07/96	ELS	M3	30				
		AG	14/07/96	ELS	M4	98				
		AG	14/07/96	ELS	M5	23				
		AG	14/07/96	ELS	M5	19				
		AG	14/07/96	ELS	M5	18				
		AG	14/07/96	ELS	M5	19				
		AG	14/07/96	ELS	M5	22				
		AG	14/07/96	ELS	M5	21				
		AG	14/07/96	ELS	M5	24				
		AG	14/07/96	ELS	M5	24				
		AG	15/07/96	ELS	M6	18				
		AG	15/07/96	ELS	M6	102				
		AG	15/07/96	ELS	M7G	102				
		AG	15/07/96	ELS	M7G	84				
		AG	15/07/96	ELS	M7G	21				
		AG	15/07/96	ELS	M8	80				
		AG	15/07/96	ELS	M9	18				
		AG	14/07/96	SN	M5	19				
		AG	14/07/96	SN	M5	21				
		AG	14/07/96	SN	M5	22				
MONEY CREEK	**Dolly varden**	DV	14/07/96	ELS	M4	84				
		DV	14/07/96	ELS	M4	75				
		DV	14/07/96	ELS	M4	102				
		DV	14/07/96	ELS	M4	36				
		DV	14/07/96	ELS	M4	38				
		DV	14/07/96	ELS	M4	34				
		DV	14/07/96	ELS	M4	95				
		DV	14/07/96	ELS	M4	39				
		DV	14/07/96	ELS	M4	142				
		DV	14/07/96	ELS	M5	216				
		DV	15/07/96	ELS	M6	135				
		DV	15/07/96	ELS	M6	90				
		DV	15/07/96	ELS	M6	78				
		DV	15/07/96	ELS	M7G	75				
		DV	15/07/96	ELS	M7G	84				
		DV	15/07/96	ELS	M7G	90				
		DV	24/09/96	ELS	M7G	90				
MONEY CREEK	**Slimy sculpin**	SS	14/07/96	ELS	M4	20				
		SS	14/07/96	ELS	M4	20				
		SS	14/07/96	ELS	M4	20				
		SS	14/07/96	ELS	M4	20				
		SS	14/07/96	ELS	M4	40				
		SS	14/07/96	ELS	M4	80				
		SS	14/07/96	ELS	M4	80				
		SS	15/07/96	ELS	M7G	88				
		SS	15/07/96	ELS	M7G	76				

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		SS	15/07/96	ELS	M7G	91				
		SS	15/07/96	ELS	M7G	71				
		SS	11/06/96	SN	M1	45				
		SS	11/06/96	SN	M1	55				
		SS	11/06/96	SN	M1	45				
		SS	11/06/96	SN	M1	47				
		SS	14/07/96	SN	M5	59				
		SS	14/07/96	SN	M5	101				
		SS	14/07/96	SN	M5	62				
		SS	14/07/96	SN	M5	80				
		SS	14/07/96	SN	M5	89				
GO CREEK	**Dolly varden**	DV	15/07/96	ELS	G1	64				
		DV	15/07/96	ELS	G1	168				
GO CREEK	**Slimy sculpin**	SS	15/07/96	ELS	G1	76				
		SS	15/07/96	ELS	G1	78				
NOUGHA CREEK	**Arctic grayling**	AG	16/07/96	ANG	N4	280				
		AG	16/07/96	ANG	N4	290				
		AG	16/07/96	ANG	N4	170				
		AG	16/07/96	ANG	N4	200				
		AG	16/07/96	ANG	N4	380				
		AG	16/07/96	ANG	N4	260				
		AG	16/07/96	ANG	N4	270				
		AG	25/09/96	ELS	N2	64				
		AG	25/09/96	ELS	N2	60				
		AG	25/09/96	ELS	N2	66				
		AG	25/09/96	ELS	N2	66				
		AG	25/09/96	ELS	N2	70				
		AG	25/09/96	ELS	N2	70				
		AG	25/09/96	ELS	N2	80				
		AG	25/09/96	ELS	N2	58				
		AG	25/09/96	ELS	N2	56				
		AG	25/09/96	ELS	N2	54				
		AG	25/09/96	ELS	N2	59				
		AG	25/09/96	ELS	N2	64				
		AG	25/09/96	ELS	N2	68				
		AG	25/09/96	ELS	N2	69				
		AG	25/09/96	ELS	N2	66				
		AG	25/09/96	ELS	N2	62				
		AG	25/09/96	ELS	N2	66				
		AG	25/09/96	ELS	N2	70				
		AG	25/09/96	ELS	N2	70				
		AG	16/07/96	ELS	N4	34				
		AG	16/07/96	ELS	N4	29				
		AG	16/07/96	ELS	N4	27				
		AG	16/07/96	ELS	N4	36				
		AG	16/07/96	ELS	N4	28				
		AG	16/07/96	ELS	N4	29				
		AG	16/07/96	ELS	N4	31				
		AG	16/07/96	ELS	N5	18				
		AG	16/07/96	ELS	N5	22				
		AG	16/07/96	ELS	N5	30				
		AG	16/07/96	ELS	N5	33				
		AG	16/07/96	ELS	N5	21				
		AG	16/07/96	ELS	N5	20				
		AG	16/07/96	ELS	N5	41				
		AG	16/07/96	ELS	N5	42				
		AG	16/07/96	ELS	N5	45				

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		AG	16/07/96	ELS	N5	41				
		AG	16/07/96	ELS	N5	38				
		AG	16/07/96	ELS	N5	43				
		AG	16/07/96	ELS	N5	44				
		AG	16/07/96	ELS	N5	21				
		AG	16/07/96	ELS	N5	27				
		AG	16/07/96	ELS	N5	18				
		AG	16/07/96	ELS	N5	47				
		AG	16/07/96	ELS	N5	48				
		AG	16/07/96	ELS	N5	49				
		AG	16/07/96	ELS	N5	49				
		AG	16/07/96	ELS	N5	44				
		AG	16/07/96	ELS	N5	41				
		AG	16/07/96	ELS	N5	42				
		AG	16/07/96	ELS	N5	45				
		AG	16/07/96	ELS	N5	47				
		AG	16/07/96	ELS	N5	38				
		AG	16/07/96	ELS	N5	43				
		AG	16/07/96	ELS	N5	49				
		AG	16/07/96	ELS	N5	39				
		AG	16/07/96	ELS	N5	25				
		AG	16/07/96	ELS	N5	32				
		AG	16/07/96	ELS	N5	26				
		AG	16/07/96	ELS	N5	38				
		AG	16/07/96	ELS	N5	108				
		AG	16/07/96	ELS	N5	132				
		AG	25/09/96	VIS	N2	120				
		AG	25/09/96	VIS	N2	190				
NOUGHA CREEK	**Burbot**	BB	16/07/96	ELS	N5	115				
		BB	16/07/96	ELS	N5	132				
		BB	16/07/96	ELS	N5	108				
NOUGHA CREEK	**Longnose sucker**	LNS	16/06/96	ELS	N1	35				
NOUGHA CREEK	**Slimy sculpin**	SS	16/06/96	SN	N1	43				
		SS	16/06/96	SN	N1	22				
		SS	16/06/96	SN	N1	26				
		SS	16/06/96	SN	N1	25				
		SS	16/06/96	SN	N1	28				
		SS	16/06/96	SN	N1	23				
		SS	16/06/96	SN	N1	25				
		SS	16/06/96	SN	N1	25				
		SS	16/06/96	SN	N1	25				
		SS	16/06/96	SN	N1	22				
		SS	16/06/96	SN	N1	26				
		SS	16/06/96	SN	N1	21				
		SS	16/06/96	SN	N1	26				
		SS	16/06/96	SN	N2	50				
		SS	16/06/96	SN	N2	43				
		SS	16/06/96	SN	N2	24				
		SS	16/06/96	SN	N2	26				
		SS	16/06/96	SN	N2	26				
		SS	16/06/96	SN	N2	22				
WIND CREEK	**Arctic grayling**	AG	16/07/96	ELS	WND	121				
		AG	16/07/96	ELS	WND	26				
		AG	16/07/96	ELS	WND	28				
		AG	16/07/96	ELS	WND	32				
		AG	16/07/96	ELS	WND	32				
		AG	16/07/96	ELS	WND	43				
		AG	16/07/96	ELS	WND	45				

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
WIND LAKE	**Arctic grayling**	AG	23/09/96	GL	WNDL1	300				
		AG	23/09/96	GL	WNDL1	310				
		AG	23/09/96	GL	WNDL1	290				
		AG	23/09/96	GL	WNDL1	305				
		AG	23/09/96	GL	WNDL2	260				
		AG	23/09/96	GL	WNDL2	265				
		AG	23/09/96	GL	WNDL2	275				
		AG	23/09/96	GL	WNDL2	240				
		AG	23/09/96	GL	WNDL2	300				
		AG	23/09/96	GL	WNDL2	300				
		AG	23/09/96	GL	WNDL2	345				
		AG	23/09/96	GL	WNDL3	250				
		AG	23/09/96	GL	WNDL3	210				
		AG	23/09/96	GL	WNDL3	290				
		AG	23/09/96	GL	WNDL3	210				
WIND LAKE	**Longnose sucker**	LNS	23/09/96	GL	WNDL1	310	400			
		LNS	23/09/96	GL	WNDL2	380	600			
		LNS	23/09/96	GL	WNDL3	320				
WIND LAKE	**Lake trout**	LT	23/09/96	GL	WNDL1	700	5600			
TRIBUTARIES TO WOLVERINE LAKE	**Arctic grayling**	AG	13/07/96	ANG	TWV6	410				
		AG	13/07/96	ANG	TWV6	432				
		AG	13/07/96	ELS	TWV3	85				
		AG	13/07/96	ELS	TWV4	32				
		AG	13/07/96	ELS	TWV5	408				
		AG	13/07/96	ELS	TWV5	385				
		AG	13/07/96	ELS	TWV5	398				
		AG	13/07/96	ELS	TWV5	425				
		AG	13/07/96	SN	TWV6	25				
		AG	13/07/96	SN	TWV6	27				
		AG	13/07/96	SN	TWV6	29				
		AG	13/07/96	SN	TWV6	28				
TRIBUTARIES TO WOLVERINE LAKE	**Burbot**	BB	13/07/96	ELS	TWV3	92				
		BB	13/07/96	ELS	TWV3	108				
		BB	13/07/96	ELS	TWV3	86				
		BB	13/07/96	ELS	TWV5	106				
		BB	13/07/96	ELS	TWV5	86				
		BB	13/07/96	ELS	TWV5	92				
		BB	13/07/96	ELS	TWV6	96				
		BB	13/07/96	ELS	TWV6	115				
		BB	13/07/96	ELS	TWV6	88				
		BB	13/07/96	ELS	TWV6	84				
		BB	13/07/96	ELS	TWV6	87				
TRIBUTARIES TO WOLVERINE LAKE	**Longnose sucker**	LNS	13/07/96	ELS	TWV4	73				
		LNS	13/07/96	ELS	TWV4	83				
		LNS	13/07/96	ELS	TWV4	68				
		LNS	13/07/96	ELS	TWV4	71				
		LNS	13/07/96	ELS	TWV4	65				
		LNS	13/07/96	ELS	TWV4	72				
		LNS	13/07/96	ELS	TWV4	74				
		LNS	13/07/96	ELS	TWV4	79				
		LNS	13/07/96	ELS	TWV4	81				
		LNS	13/07/96	ELS	TWV4	75				
TRIBUTARIES TO WOLVERINE LAKE	**Lake trout**	LT	13/07/96	ANG	TWV6	400				
		LT	13/07/96	ANG	TWV6	440				
		LT	13/07/96	ANG	TWV6	515				
		LT	13/07/96	ANG	TWV6	410				
		LT	13/07/96	ELS	TWV5	42				
		LT	13/07/96	ELS	TWV5	41				

Location	Species	Species code	Date (m/d/yr)	Method	Site	Fork Length (mm)	Round Weight (g)	Comments	sex/mat	stomach
		LT	13/07/96	ELS	TWV5	41				
		LT	13/07/96	ELS	TWV5	42				
		LT	13/07/96	ELS	TWV5	45				
		LT	13/07/96	ELS	TWV6	39				
		LT	13/07/96	ELS	TWV6	36				
		LT	13/07/96	ELS	TWV6	34				
		LT	13/07/96	ELS	TWV6	33				
		LT	13/07/96	ELS	TWV6	64				
		LT	13/07/96	ELS	TWV6	40				
		LT	13/07/96	ELS	TWV6	37				
		LT	13/07/96	ELS	TWV6	35				
		LT	13/07/96	SN	TWV6	32				
		LT	13/07/96	SN	TWV6	34				
		LT	13/07/96	SN	TWV6	41				
TRIBUTARIES TO WOLVERINE LAKE	**Slimy sculpin**	SS	13/07/96	ELS	TWV3	51				
		SS	13/07/96	ELS	TWV3	60				
		SS	13/07/96	ELS	TWV3	83				
		SS	13/07/96	ELS	TWV3	62				
		SS	13/07/96	ELS	TWV5	66				
		SS	13/07/96	ELS	TWV5	64				
		SS	13/07/96	ELS	TWV5	56				
		SS	13/07/96	ELS	TWV5	71				
		SS	13/07/96	ELS	TWV5	63				
		SS	13/07/96	ELS	TWV5	71				
		SS	13/07/96	ELS	TWV5	61				
		SS	13/07/96	ELS	TWV5	68				
		SS	13/07/96	ELS	TWV6	51				
		SS	13/07/96	ELS	TWV6	58				
		SS	13/07/96	ELS	TWV6	60				
		SS	13/07/96	ELS	TWV6	58				
		SS	13/07/96	ELS	TWV6	75				
		SS	13/07/96	ELS	TWV6	63				
		SS	13/07/96	ELS	TWV6	68				
		SS	13/07/96	ELS	TWV6	61				
		SS	13/07/96	ELS	TWV6	61				
		SS	13/07/96	SN	TWV6	57				
		SS	13/07/96	SN	TWV6	37				
		SS	13/07/96	SN	TWV6	41				
		SS	13/07/96	SN	TWV6	42				
TRIBUTARIES TO LITTLE WOLVERINE LAKE	**Burbot**	BB	12/07/96	ELS	TLW1	105				
		BB	12/07/96	ELS	TLW4	88				
	Lake trout	LT	12/07/96	ELS	TLW4	42				
		LT	12/07/96	ELS	TLW4	36				
TRIBUTARIES TO LITTLE WOLVERINE LAKE	**Slimy sculpin**	SS	12/07/96	ELS	TLW1	80				
		SS	12/07/96	ELS	TLW1	84				
		SS	12/07/96	ELS	TLW1	91				
		SS	12/07/96	ELS	TLW1	63				
		SS	12/07/96	ELS	TLW1	56				
		SS	12/07/96	ELS	TLW2	73				
		SS	12/07/96	ELS	TLW2	81				
		SS	12/07/96	ELS	TLW2	75				
TRIBUTARIES TO LITTLE JIMMY LAKE	**Burbot**	BB	14/07/96	ELS	TLJ1	82				
	Lake trout	LT	14/07/96	ELS	TLJ1	91				

Table 6 . Number of Visual Observations of Fish in the Wolverine Lake Area, 1996.

Date (d/m/yr)	Site	Species: lake trout	Arctic grayling	longnose sucker	dolly varden	Unidentified
13/06/96	WC		20			
13/06/96	WO	1	37			
14/06/96	WC					100
15/06/96	WI		200+			
13/07/96	TWV4		30	95		
13/07/96	TWV5		5			
16/07/96	WND		2000+	2000		
17/07/96	M6				1	
24/09/96	WI		1			
25/09/96	N2		2			

Table A Sampling period,number of gillnet sets,and surface water temperatures at sampling locations during gillnetting surveys wolverine lake,1996.

Lake	Sampling Period	Number of net sets	Surface Temperature © at Sample Locations		
			Average	Maximum	Minimum
Wolverine	June 12 - 15, 1996	24.5	4.8	6.8	3.1
Little Wolverine	15-Jun-96	4	7.9	8.9	7.5
Little Jimmy	14-Jun-96	6	5.8	6.2	5.4

Table B Mean fork lengths and weights of lake trout and Arctic grayling captured during index gillnetting, spring 1996.

Lake	Sample size		Mean Fork Length (mm)		Mean Weight (gm)	
	Lake Trout	Arctic Grayling	Lake Trout	Arctic Grayling	Lake Trout	Arctic Grayling
Wolverine	57	63	431.6	370.8	1263.1	603.4
Little Wolverine	25	57	453	333.2	1344	395.9
Little Jimmy	3	79	609.7	325.4	3000	381.2

Table C Catch/Effort statistics (CPUE) generated from index gillnetting results , spring 1996.

Lake	Number captured per Gillnet Hour		Kilograms Captured per Gillnet Hour	
	Lake Trout	Arctic Grayling	Lake Trout	Arctic Grayling
Wolverine	2.3	2.57	2.94	1.55
Little Wolverine	6.25	14.25	8.4	5.6
Little Jimmy	0.5	13.2	1.5	5

APPENDIX 1

Complete General Descriptions of Creeks Crossed
by the
Two Possible Access Roads to the Wolverine Property

(Based on data collected on June 23- 26, July 29-31, and September 14-17,1997)

Site: **TeastL (TE)**
Location: S.E. end East Lake
Aspect: South
Date Sampled: 25/06/97
Cover: 100% Willow filled draw
Photos: Plate 1
Comments: Creek has no apparent above ground flow. Possible ground flow enters TWND1 before entering the wetland area associated with East Lake.
Fish: Zero fish habitat.

Site: **TW1**
Lat/Long: 61°30.52 N / 130°25.48 W
Location: outlet of Creek to Wind Lake
Aspect: South East
Date Sampled: 23/06/97
Average Depth: 0.5 m
Average Width 3 m
Average Velocity: >0 m/s
Temperature: 10.2 °C
Substrate: sand and sorted gravels in main flow, silt in adjacent slow water
Banks: abrupt up to 3 m high, mud banks
Cover: 60% willow
Vegetation: Willow, Dwarf birch and sedges
Channel: glides with slow pools
Photos: Plates 2, 3, 4, 5
Comments: Outlet has several ponds associated along the lake shore. beaver present
Fish: Numerous adult Arctic grayling in creek and occasional slimy sculpin and long nose sucker.

Site: **TW1**
Location: 30m u/s of Wind Lake to 300 m u/s of Wind Lake
Date Sampled: 30/07/97
Average Depth: 0.4 m
Average Width: 1.2 m
Average Velocity: >0.25 m/s
Temperature: 7.9 °C
Substrate: mostly silt, some gravel
Channel: even, slow glide
Comments: three old beaver dams have created a series of ponds, sporadic patches of pea gravel may provide spawning sites for grayling
Fish: many (65+) grayling juvenile/ sub adults and fry.

Site: **TW1**
Location: 30m u/s of Wind Lake to 300 m u/s of Wind Lake.
Date: 14/09/97
Substrates: a new layer of organic silts covers all substrates, including in flow areas.
Fish: abundant Arctic grayling fry

Site: **TW2**
Lat/Long: 61°30.51 N / 130°24.06 W
Location: Outlet to Wind Lake
Aspect: South
Date: 25/06/97
Average Depth: 0.5 m
Average Width: 0.3 m
Average Velocity: < 0.3 m/s
Temperature: 0.8°C
Substrate: silted sand and gravel
Banks: incised silt and sand 0.2 m high
Cover: 100% willow choked within 30 m of Wind Lake
Channel: above 35 m from lake narrow and incised, below 1-3 m wide flooded pools
Photos: Plates 6, 7, 8, 9
Comments: Zero fish habitat above 30 m from lake
Fish: Sub adult Arctic grayling adjacent to lake

Site: **TW2**
Location: outlet area at Wind Lake
Date: 30/07/97
Average Depth: 0.4 m
Average Width: 0.75 m
Average Velocity: >0 m/s
Temperature: 1.2°C
Vegetation: willow/sedge
Cover: 15% willow/sedge to 100% willow by 35 m u/s
Channel: first 35 m is glide in lake influence area, then to riffle in narrow confined channel (velocity is >1 m/sec above 35 m)
Comments: creek narrows 35 m from lake to 0.3 m wide into sedge / willow draw
Fish: very limited fish habitat u/s of 35 m

Site: **WO**
Location: Mouth of Nougha Creek at Wolverine Lake
Date: 25/06/97
Average Depth: 0.5 m
Average Width: 12 m
Average Velocity: > 1 m/s

Temperature: 11.2°C
Substrate: cobble / gravel with occasional boulders
Banks: abrupt rising 0.6 m above water level
Cover: 15% willow alder along shorelines only
Channel: Mostly Glide / reach ends with first riffles
Comments: see previous surveys
Fish: numerous grayling adult/ sub-adult, lake trout fry and juvenile., slimy sculpin, burbot

Site: **WO**
Date: 29/07/97
Fish: Arctic grayling adults, juvenile and post fry, lake trout adults, juveniles and fry, longnose sucker juveniles, slimy sculpin.

Site: **WO**
Date: 17/09/97
Fish: Arctic grayling adults (numerous), juvenile and fry, lake trout adults, burbot juveniles, long nose sucker juveniles and slimy sculpin

Site: **TN1**
Lat/Long: 61°30.11 N / 130°19.01 W
Location: Outlet to Nougha Creek
Aspect: South East
Date: 25/06/97
Average Depth: 0.15 m
Average Width: 0.5 m
Average Velocity: 1 m/s
Temperature: 5.6 °C
Substrate: 90 % gravel / 10 % boulders
Banks: tight and confined in places, undefined in others with flow through grass and trees
Cover: willow
Channel: mostly fast riffles with the occasional boulder pool
Photos: Plates 10, 11
Comments: 2 trails cross the creek 30 and 40 m from Nougha Creek, some gravel has become exposed on the trails and has developed into shallow riffles.
Fish: Zero observed / poor and limited fish habitats

Site: **TN1-1**
Location: outlet at Nougha Creek u/s for 20 m
Date: 29/07/97
Average Depth: 0.05 m
Average Width: 0.35 m
Average velocity: >1 m/s

Temperature: 4.5 °C
Substrate: gravel/boulder, occasional cobble
Fish: none captured or observed

Site: **TN1-2**
Location: trail crossing 30to 40 meters u/s from Nougha
Date: 29/07/97
Average Depth: 0.05 m
Average Width: 0.35 m
Average Velocity >1 m/s
Temperature: 4.5 °C
Substrate: 40 % cobble/ 60% gravel
Banks: open roadway with shallow sandy edges
Vegetation: sedge, with willows adjacent to roadway
Fish: none captured or observed

Site: **TN1**
Location: outlet to Nougha Creek u/s for 20 m
Date: 17/09/97
Temperature: 0.9°C
Fish: none recorded

Site: **TN2**
Location: Outlet to Nougha Creek
Aspect: South
Date: 25/06/97
Substrate: organics
Banks: undefined
Cover: 100%willow/alder
Channel: overland seepage
Photos: Plates 12, 13, 14, 15
Comments: Channel not defined, flow apparent only were it parallels Nougha Creek for 20 m, spills over banks over 5 m reach with no distinct outlet.
Fish: Zero fish habitat

Site: **TN2**
Location: uppermost winter road crossing
Date: 17/09/97
Comments: Creek channel crossing roadway is fed by ground welling approximately 1 m upstream of the roadway.

Site: **TN3**
Lat/Long: 61°30.42 N / 13°18.78 W
Location: Outlet to Nougha Creek
Aspect: East
Date: 25/06/97
Average Depth: 0.3 m
Average Width: 0.75 m
Average Velocity 1 m/s
Temperature: 3.0 °C
Substrate: heavily silted with clayey sands
Banks: mossy 0.5 m high, well defined
Cover: 100% willow above 10 m outlet are
Channel: outlet is smooth glide/ above creek flows as fast riffle
Photos: Plates 16, 17
Comments: crossed by 2 roadways40m from Nougha, large ice builds at upper roadway, entry to Nougha creates good eddy pools up and d/s of outlet
Fish: None observed, has potential especially near outlet

Site: **TN3**
Location: outlet area at Nougha Creek
Date: 29/07/97
Average Depth: 0.35 m
Average Width: 0.8 m
Average Velocity: <1 m/s
Temperature: 3.8 °C
Fish: 2 Arctic grayling post fry in d/s influence area

Site: **TN3**
Date: 17/09/97
Temperature: 1.1 °C
Fish: Arctic grayling juveniles/ post fry within 20 m of Nougha Creek

Site: **TN7**
Lat/Long: 61°33.55 N / 130°14.15 W
Location: Outlet to Nougha Creek
Aspect: North
Date: 24/06/97
Average Depth: 0.35 m
Average Width: 4 m
Average Velocity: 0 m/s
Temperature: 12.7 °C
Substrate: Silt, organic debris and occasional boulder
Banks: flooded
Cover: 30% willow

Channel:	Back filled with water from Nougha Creek., small discernible above ground flow
Photos:	Plates 18, 19, 20
Comments:	Above ground flow appears as seepage from adjacent areas
Fish:	Does not provide fish habitat other than flood bay adjacent to Nougha Creek, 1 grayling juvenile.

Site:	**TN8**
Lat/Long:	61°33.44 N / 130°14.24 W
Location:	Outlet to Nougha Creek
Aspect:	North
Date:	24/06/97
Average Depth:	0.2 m
Average Width:	0.8 m
Average Velocity:	> 2 m/s
Temperature:	2.2 °C
Substrate:	cobble boulder with occasional log
Banks:	pinched and confined, incised
Cover:	100% willow
Channel:	Riffle/rapid
Photos:	Plates 21, 22, 23
Comments:	Channel remains narrow until entering Nougha Creek, Zone of influence greatly reduced by swift current in Nougha Creek.
Fish:	Zero fish observed, very limited habitat, limited access due to velocities

Site:	**TN9-1**
Lat/Long:	61°32.57 N / 130°14.96 W
Location:	Outlet to Nougha Creek
Aspect:	North
Date:	24/06/97
Average Depth:	0.4 m
Average Width:	1 m
Average Velocity:	0.1 m/s
Temperature:	3.2 °C
Substrate:	bedrock and boulders
Banks:	moss covered
Cover:	20% willow
Channel:	Waterfall within 1 m of Nougha, slope greater than 30 % for 20 m
Photos:	Plates 24, 25, 26, 27
Comments:	Waterfall poses major and permanent barrier to fish passage, no outlet area habitat
Fish:	None observed, extremely limited habitat

Site:	**TN9-2**
Location:	80m u/s of outlet to Nougha Creek
Aspect:	north
Date:	30/07/97
Average Depth:	0.1 m
Average Width:	0.5 m
Average Velocity:	>2 m/s
Temperature:	4.1 °C
Substrate:	95% cobble/ 5% boulder
Banks:	steep, mossy, incised banks
Vegetation:	willow/moss
Cover:	100% willow
Channel:	high velocity riffle
Comments:	minimal fish habitat
Fish:	no fish captured or observed

Site:	**TN10-1**
Lat/Long:	61°32.56 N / 130°15.15 W
Location:	Outlet to Nougha Creek u/s for 15m
Aspect:	North
Date:	24/06/97
Average Depth:	0.5 m
Average Width:	0.5 m
Average Velocity:	1 m/s
Temperature:	2.0 °C
Substrate:	Boulders
Banks:	constricting and confining above 15 m from Nougha
Cover:	100% willow above 15 m from Nougha
Channel:	Fast flowing riffle
Photos:	Plate 28
Comments:	potential fish habitat in first 15 m from Nougha. Very limited above constriction.
Fish:	Zero observed

Site:	**TN10-2**
Lat/Long:	61°32.54 N / 130°15.03 W
Location:	15 to 40 m u/s of Nougha
Aspect:	north
Date:	30/07/97
Average Depth:	0.5 m
Average Width:	0.3 m
Average Velocity:	>1 m/s
Temperature:	2.4 °C
Substrate:	silt with occasional boulders

Banks: incised
Vegetation: willow
Cover: 100% willow
Channel: fast, narrow and deep, some undercut banks, riffle : rapid ratio = 10:1
Photos: Plate 29
Fish: Zero observed

Site: **TN10**
Location: Nougha Creek at outlet of TN10
Aspect: north
Date: 30/07/97
Average Depth: 0.35 m
Average Width: 14 m
Average Velocity: 1 m/s
Temperature: 14.1 °C
Substrate: 40% cobble/ 40% boulder/ 20% gravel
Banks: stable, 50% slope with rise of 0.5m
Vegetation: sedge/willow
Cover: 5% willow
Channel: mainly riffle, two islands present
Fish: juvenile grayling

Site: **TN10-1**
Date: 14/09/97
Temperature: 3.0 °C
Fish: Arctic grayling juveniles in TN10 zone of influence of Nougha Creek.

Site: **VB1**
Lat/Long: 61°30.31 N / 130°09.80 W
Location: 500 m reach below 2 headwater tributaries that form Van Bibber Creek
Aspect: East
Date: 25/06/97
Average Depth: 0.2 m
Average Width: 5 m
Average Velocity: 0.75 m/s
Temperature: 2.7 °C
Substrate: 80 % boulder / 20 % cobble / trace gravel
Banks: shallow but well defined, moss covered
Cover: None
Channel: riffle with occasional pool forming behind boulders
Photos: Plates 30, 31, 32, 33
Comments: Very low conductivity ELS at 600 v, large aufies build up at confluence area
Fish: None observed

Site:	**TVB1**
Lat/Long:	61°30.28 N / 130°09.85 W
Location:	immediately above confluence with other feeder to Van Bibber Creek
Aspect:	North East
Date:	25/06/97
Average Depth:	0.3 m
Average Width:	0.8 m
Average Velocity:	> 1 m/s
Temperature:	2.4 °C
Substrate:	60 % boulder/ 35 % cobble / 5 % gravel
Banks:	incised well defined
Cover:	100% willow
Channel:	mostly stepped riffles
Fish:	No fish observed

Site:	**TVB1**
Location:	500 m reach below confluence
Date:	31/07/97
Average Depth:	0.15 m
Average Velocity:	1 m/s
Temperature:	4.4 °C
Substrate:	cobble/boulder
Vegetation:	willow/moss
Channel:	stepped riffle
Fish:	none observed or captured

Sites:	**VB, TVB1,and TVB2**
Date:	14/09/97
Temperature:	2.2 °C
Fish:	None recorded

Site:	**TWV1**
Lat/Long:	61°26.69 N / 130°10.88 W
Location:	Outlet to Wolverine Lake
Aspect:	South West
Date:	26/06/97
Average Depth:	0.2 m
Average Width:	1.2 m
Average Velocity:	< 1 m/s
Temperature:	3.1 °C
Substrate:	80 % gravel / 10 % cobble / 10 % sand
Banks:	well defined
Cover:	70- 100 % willow
Channel:	90 % riffle 10% pooling

Photos: Plates 34, 35
Comments: 10 m from lake channel narrows to 0.5 m width
Fish: Slimy sculpin near outlet

Site: **TWV1**
Location: outlet to Wolverine Lake u/s for 30 m
Date: 30/07/97
Average Depth: 0.15 m
Average Width: 0.6 m
Average Velocity: <2 m/s
Temperature: 4.7 °C
Substrate: 40% cobble / 50% gravel / 10% boulder
Vegetation: willow/moss
Cover: 50% willow for first 10 m then to 100% willow
Fish: Many grayling and lake trout fry in zone of influence of lake

Site: **TWV1**
Location: outlet to Wolverine Lake u/s for 30 m
Date: 16/09/97
Temperature: 1.2 °C
Fish: Slimy sculpin and one post fry Arctic grayling in creek, numerous Arctic grayling and occasional lake trout fry in creek influence zone of lake.

Site: **TWV2**
Lat/Long: 61°27.54 N / 130° 13.90 W
Location: Outlet to Wolverine Lake
Aspect: South West
Date: 26/06/97
Average Depth: 0.2 m
Average Width: 0.4 m
Average Velocity: 1 m/s
Temperature: 1.0 °C
Substrate: 50 % sand / 50 % gravel
Banks: mossy 50% slope rise 1 m
Cover: 100 % willow
Channel: incised and very small
Photos: Plate 36
Comments: Limited habitat with poor cover
Fish: None observed

Site: **TWV3**
Lat/Long: 61° 28.34 N / 130° 16.70 W
Location: Outlet into Wolverine Lake
Aspect: South West

Date:	26/06/97
Average Depth:	0.35 m
Average Width:	1 m
Average Velocity:	< 0.5 m/s
Temperature:	1.1 °C
Substrate:	silted sand/ gravel with much submerged willow
Banks:	abrupt and defined rise 0.5 to 1 m
Cover:	0 for first 20 m from lake
Channel:	4:1 pool : riffle
Photos:	Plates 37, 38
Comments:	shelf ice along creek edge, good cover and habitats in lowest 20 m before lake
Fish:	Lake trout fry, slimy sculpin, and burbot

Site:	**TWV3**
Location:	outlet to Wolverine Lake u/s for 40m
Date:	29/07/97
Average Depth:	0.4 m
Average Width:	1 m
Average Velocity:	< 0.25 m/s
Temperature:	4.7 °C
Substrate:	silt/sand
Channel:	100% glide below 40 m, pool / riffle 1:1 above 40m
Fish:	lake trout fry and slimy sculpin captured

Site:	**TWV3**
Location:	outlet to Wolverine Lake u/s for 40 m
Date:	17/09/97
Temperature:	1.0 °C, Wolverine Lake temp. 8.5 °C
Fish:	14 Arctic grayling juveniles, 1 burbot juvenile, and 6 slimy sculpin.

Table 1 Seine Netting Results from the Wolverine Lake Area, 1997

DATE (d/m/yr)	SITE	TEMP (°C)	EFFORT (m^2)	CATCH						COMMENTS / COORDINATES
				AG	LT	SS	BB	DV	LNS	
23/06/97	TW1	10.2	42	6	0	0	0	0	0	
23/06/97	TW1	10.2	56	23	0	1	0	0	0	
25/06/97	WO	13.2	100	300+	1	0	0	0	0	
26/06/97	TWV3	1.1	49	0	3	4	1	0	0	
30/07/97	TW1		21	3	0	5	0	0	0	
30/07/97	TW1		6	0	0	1	0	0	1	
30/07/97	TN10 (@ Nougha)		28	0	0	0	0	0	0	
30/07/97	TN10 (@ Nougha)		28	1	0	0	0	0	0	
30/07/97	TWV1 (in lake)		84	4	0	0	0	0	0	
30/07/97	TWV1 (in lake)		70	68	16	0	0	0	0	
29/07/97	WO		77	144	0	0	0	0	0	
29/07/97	WO		40	13	0	0	0	0	0	
29/07/97	TWV3		49	3	0	0	0	0	0	
30/07/97	TWV1 (in lake)		70	3	2	0	0	0	0	
14/09/97	N-TN10		45	11	0	0	0	0	0	
14/09/97	WLVLK		105	19	0	2	0	0	0	
14/09/97	WLVLK		84	9	1	0	0	0	0	
16/09/97	M		90	0	0	6	0	0	0	
16/09/97	M		84	0	0	0	0	0	0	
16/09/97	M		42	0	0	0	0	0	0	
16/09/97	M		56	0	0	0	0	0	0	
16/09/97	M		60	0	0	2	0	0	0	
16/09/97	M		40	0	0	1	0	0	0	
16/09/97	M5		224	0	0	1	0	0	0	
16/09/97	M		70	0	0	0	0	0	0	61.18.42; 130.01.18
16/09/97	M		105	0	0	0	0	0	0	61.18.42; 130.01.18
16/09/97	M		63	0	0	0	0	0	0	61.18.42; 130.01.18
16/09/97	M		98	0	0	0	0	0	0	61.18.42; 130.01.18
16/09/97	M		60	0	0	0	0	0	0	61.23.13; 129.54.31
16/09/97	M		40	0	0	0	0	0	0	61.23.13; 129.54.31
16/09/97	M		50	0	0	0	0	0	0	61.23.13; 129.54.31
16/09/97	M6		21	0	0	0	0	0	0	
16/09/97	M5		30	0	0	0	0	0	0	
16/09/97	M5		66	0	0	0	0	0	0	
16/09/97	M		98	0	0	0	0	0	0	
16/09/97	M		60	0	0	0	0	0	0	
16/09/97	M		40	0	0	0	0	0	0	

* Species code: AG= Arctic grayling, LT= lake trout, SS= slimy sculpin, BB= burbot, DV= dolly varden/bull trout
LNS= longnose sucker.

Table 2 Summary of Results from Minnow Trapping in the Wolverine Lake Area, 1997

DATE SET (d/m/yr)	SITE	TIME SET	TIME PULLED	EFFORT (hrs)	CATCH *	
					DV	SS
14/09/97	TWLV1	16:25	18:30	50	0	0
15/09/97	G-1	10:16	9:20	23	0	0
15/09/97	G-2	10:20	9:20	23	0	0
15/09/97	G-3	10:25	9:25	23	0	0
15/09/97	G-4	10:30	9:25	23	0	0
15/09/97	G-5	10:37	9:25	23.2	0	0
15/09/97	M1	10:45	9:10	22.5	0	0
15/09/97	M2	10:45	9:10	22.5	0	0
15/09/97	M3	11:15	9:35	22.3	0	0
15/09/97	M4	11:20	9:35	22.25	0	0
15/09/97	M5	11:30	9:40	22.2	0	0
15/09/97	M6	11:45	10:00	22.25	0	0
15/09/97	M7	11:55	10:05	22.2	1	0
15/09/97	M	12:00	10:15	22.25	0	0
15/09/97	M	12:15	10:20	22	0	0
15/09/97	M	12:20	10:20	22	0	0
15/09/97	M	12:25	10:20	22	1	0
15/09/97	M	12:30	10:30	22	0	0
15/09/97	M	12:35	10:35	22	0	0
15/09/97	M	12:40	10:15	21.5	0	0
16/09/97	CkM4	15:40	9:40	42	0	0
16/09/97	CkM4	15:50	9:45	42	0	0
16/09/97	CkM4	15:50	9:45	42	0	0
16/09/97	CkM4	15:55	9:50	42	0	0
16/09/97	M4	16:00	9:50	41.8	0	0
16/09/97	M4	16:05	9:55	41.8	0	0
16/09/97	M4	16:10	9:55	41.75	0	0
16/09/97	M4	16:15	10:00	41.75	0	1
16/09/97	M4	16:20	10:00	41.6	0	0
16/09/97	M4	16:25	10:00	41.6	0	0
16/09/97	M4	16:25	10:05	41.6	0	0
16/09/97	M4	16:30	10:05	41.6	0	0
16/09/97	M4	16:35	10:10	41.5	0	0
16/09/97	M4	16:40	10:10	41.5	0	0
16/09/97	M4	16:45	9:35	40.8	0	0
16/09/97	M4	16:45	9:35	40.8	0	0

* Species code: SS= slimy sculpin, DV= dolly varden/bull trout

Table 3. Summary of Electro-fishing Results, Wolverine Lake Area - 1997

DATE	SITE	EFFORT (sec)	CATCH *						COMMENTS
			AG	LT	SS	BB	LNS	DV	
25/06/97	VB1	868	0	0	0	0	0	0	
25/06/97	TVB1	81	0	0	0	0	0	0	
25/06/97	TW2	174	5	0	0	0	0	0	AG = subadult
25/06/97	TN1	63	0	0	0	0	0	0	
25/06/97	TW2	87	5	0	0	0	0	0	
25/06/97	TN3	99	0	0	0	0	0	0	
25/06/97	TN3	59	1	0	1	0	0	0	downstream of trib
25/06/97	TN3	85	100+	0	0	1	0	0	upstream of trib
25/06/97	TN2	148	100+	0	0	0	1	0	upstream of trib
25/06/97	TN2	319	0	0	1	0	2	0	upstream of trib
26/06/97	TWV3	458	0	0	11	0	1	0	
26/06/97	TWV1	99	0	0	2	0	0	0	
23/06/97	TW1	260	7	0	0	0	0	0	
23/06/97	TW1	250	125+	0	0	0	0	0	
24/06/97	TN7	285	1	0	0	0	0	0	
24/06/97	TN8	106	0	0	0	0	0	0	
24/06/97	TN9	35	0	0	0	0	0	0	waterfall @ mouth = barrier
24/06/97	TN10	202	0	0	0	0	0	0	
30/07/97	TWV1	50	0	0	1	0	0	0	
30/07/97	TLW1	20	3	0	0	0	0	0	below beaver dam
30/07/97	TLW1	60	0	0	0	0	0	0	above beaver dam
30/07/97	TLW2	170	0	1	5	1	0	0	Campbell creek
30/07/97	TLW3 (IN LAKE)	74	0	0	3	0	0	0	at margin of creek apron into lake
30/07/97	TW1	481	75	0	0	0	0	0	
30/07/97	TW1	111	18	0	0	0	0	0	
30/07/97	TN9 (mouth Nougha)	106	4	0	1	0	0	0	Nougha creek at mouth of TN9
30/07/97	TN10	102	0	0	0	0	0	0	mouth u/s 15m
30/07/97	TN10 (mouth Nougha)	108	1	0	1	0	0	0	Nougha creek at mouth of TN10
29/07/97	TWV3	283	0	2	7	0	0	0	
29/07/97	TN3	60	0	0	0	0	0	0	1 unidentified fish
29/07/97	TN3	58	0	0	0	0	0	0	
29/07/97	TN3 (in Nouga)	61	(75-90)	0	0	0	0	0	
29/07/97	TN1	31	0	0	0	0	0	0	
29/07/97	TN1	18	0	0	0	0	0	0	
31/07/97	TW2	275	5	0	3	0	0	0	
31/07/97	TW2	20	0	0	0	0	0	0	
31/07/97	TVB1	511	0	0	0	0	0	0	
31/07/97	TVB1	122	0	0	0	0	0	0	
14/09/97	TVB	515	0	0	0	0	0	0	
14/09/97	TVB1	109	0	0	0	0	0	0	
14/09/97	TN10	135	0	0	0	0	0	0	
15/09/97	M	1044	0	0	69	0	0	4	
15/09/97	M4	170	0	0	0	0	0	0	
15/09/97	M4	127	0	0	2	0	0	2	
15/09/97	MONEY	171	0	0	1	0	0	0	upstream of site M4
17/09/97	WO	256	32	0	9	4	0	0	
17/09/97	WO	64	30	0	1	0	0	0	
17/09/97	TN1	30	0	0	0	0	0	0	
17/09/97	WO	358	10	0	0	0	0	0	
17/09/97	TWL3	148	14	0	6	1	0	0	
17/09/97	TN3	75	0	0	0	0	0	0	
17/09/97	TN3	73	2	0	1	0	0	0	
17/09/97	TN3	119	8	0	0	0	0	0	
17/09/97	WO	64	10	0	1	0	0	0	
17/09/97	WO	135	5	0	7	5	0	0	

* Species Code: AG= Arctic grayling, LT= lake trout, SS= slimy sculpin, BB= burbot, LNS= longnose sucker, DV= dolly varden/bull trout

Appendix 3F

Wolverine Area – Vegetation Studies

Vegetation Study

of the

Wolverine Lake Area

Westmin Resources Limited

December, 1996

Overview

The Wolverine Lake study area falls within the Pelly Mountains Ecoregion as defined by Oswald and Senyk (1977) and the Ecoregions Working Group (1995).The terrain within the study area is generally over 1200 meters with widespread discontinuous permafrost. Much of the area is treeless with treeline occurring at 1350 to 1500 meters. The southern part of the study area was burned by a forest fire in 1994 and is now in the early stage of regenerative growth (refer to Figure 3.4 in the Baseline Biophysical Studies report for the regional vegetation communities).

In 1994, vegetation communities and soil types were classified for the Liard Basin and Logan Mountains by the Yukon Department of Renewable Resources (Zoldeski and Cowell, 1996). The proposed Wolverine Lake mine site lies immediately to the west of this area.

Methodology

Aerial photographs (1:40,000 scale taken in August, 1992) were used to delineate the major vegetation communities in the study area on NTS topographic maps. A ground-truthing of the air photos was carried out during a vegetation/habitat survey in mid-July, 1996. The vegetation sampling method was adapted from the format developed during the Southeast Yukon Ecosystem Classification (Zoldeski and Cowell, 1996).

Sampling plots were selected to represent the vegetation communities identified from the air photos. Plots were accessed by boat, helicopter and on foot. All sampling plots were 10 m x 10 m (100 m^2). The plant species and their cover-abundance were described for each vegetative layer. Tree species 5 m or more in height constituted the overstorey, while the understorey consisted of three shrub layers (<0.5 m, 0.5-2 m and 2-5 m). The relative abundance of herbaceous plant species, bryophytes and lichens were recorded. Notes on elevation, aspect, slope and moisture regime were also taken. Additional observations of plant communities were taken during the walking transects between sampling plots and during other biophysical surveys in the study area. Locations of sampling plots and transects are shown in Figure. 3.5 in the Baseline Biophysical Surveys report).

Vegetation communities were compared to the vegetation types identified by Geomatics International in the southeast Yukon (Zoldeski and Cowell, 1996). The vegetation type classification key provided in the Field Guide to Ecosystem Classification for the Southeast Yukon (Zoldeski and Cowell, 1996) was also used in the identification and naming of plant communities.

Plant specimens were identified in the field where possible. Some specimens were preserved for later identification. Floras used in the identification of vascular plants included Hulten (1968) and Porsild and Cody (1980). Vitt *et al.* (1988) and MacKinnon *et al.* (1992) were used in the identification of bryophytes and lichens. Herbariums located at Forest Resources (DIAND), Fish and Wildlife Branch (Govt. of Yukon) and Agriculture Branch (Govt. of Yukon) were also used in specimen identification.

Vegetation Communities and Habitat Potential

Vegetation in the Wolverine Lake study area includes bog forests and upland forests, as well as alluvial plain shrub, subalpine transition and alpine tundra zones. A map showing vegetation types is presented in Figure. 3.4. Polygons representing vegetation zones have been delineated. Several vegetation types may be shown within each polygon. It should be noted that the boundaries between polygons are not always distinct in some vegetation transition zones.

A complete list of plant species observed is given in Appendix 1. This is not intended to be an exhaustive list of plant species in the study area. A description of individual vegetation types and their extent within the study area is summarized within this section. A description of the strata composition in each vegetation type is presented in Appendix 2.

Closed Trembling Aspen Forest

A closed canopy of trembling aspen (*Populus tremuloides*) with minor occurrences of willow (*Salix* sp.) make up the tree layer. The low shrub layer consists mainly of soapberry (*Shepherdia canadensis*). Kinnikinick (*Arctostaphylos uva-ursi*), twinflower (*Linnaea borealis*) and common juniper (*Juniperus communis*) form the ground cover. The herb layer, not well developed, is dominated by fireweed (*Epilobium angustifolium*). Bryophytes and lichens are uncommon.

The Closed Trembling Aspen Forest vegetation type (V2) of the 1996 Southeast Yukon Ecosystem Classification best describes these aspen stands.

Closed aspen forests are found on well drained sandy sites on south or west facing slopes. This vegetation type is uncommon in the Wolverine Lake area. A few scattered stands occur in the upland vegetation zone, particularly on the southwest facing slopes above Wolverine and Little Wolverine Lakes.

Closed Balsam Poplar Forest

The closed tree canopy and tall shrub layer consist primarily of balsam poplar (*Populus balsamifera*), with occurrences of willow (*Salix* spp.). Soapberry (*Shepherdia canadensis*) and shrubby cinquefoil (*Potentilla fruticosa*) dominate the low shrub layer. Dwarf shrubs include kinnikinick (*Arctostaphylos uva-ursi*), prickly rose (*Rosa acicularis*) and twinflower (*Linnaea borealis*). The herb cover is not extensive, but includes a variety of species. The moss and lichen layer is not well developed.

This vegetation type resembles the Closed Balsam Poplar Forest (V3) of the 1996 Southeast Yukon Ecosystem Classification.

Closed balsam poplar forests, normally found on active alluvial sites, are uncommon in the Wolverine Lake area. A few scattered upland stands occur on the lower slopes northeast of Wolverine Lake.

Open Alpine Fir Forest

The open canopy overstorey in this vegetation type is dominated by alpine fir (*Abies lasiocarpa*). The dwarf shrub layer is particularly well developed and consists mainly of crowberry (*Empetrum nigrum*) and white mountain heather (*Cassiope tetragona*). Herbs are uncommon in this vegetation type. The non-vascular plant layer is comprised primarily of *Cladina* spp.

This vegetation type is similar to the Open Alpine Fir Forest (V16) of the 1996 Southeast Yukon Ecosystem Classification.

Open alpine fir forests are common throughout the subalpine transition zone in the Wolverine Lake area. Alpine fir forests on the upper slopes may transform into krummholtz. The lower extent of these alpine fir stands typically border on white or black spruce forests. On the slopes southwest of Wolverine Lake, alpine fir forests extend almost to the lakeshore.

Open White Spruce Forest

White spruce (*Picea glauca*) dominates the open canopy overstorey. The low and dwarf shrub layer is well developed and consists primarily of shrub birch (*Betula glandulosa*), willow (*Salix* sp.), Labrador tea (*Ledum groenlandicum*) and crowberry (*Empetrum nigrum*). Herbs are poorly represented in this vegetation type. The non-vascular plant layer is dominated by *Pleurozium shreberi* and *Cladina* sp.

This vegetation type resembles the Open White Spruce Forest (V17) of the 1996 Southeast Yukon Ecosystem Classification.

Open white spruce forests are fairly common in the upland vegetation zone, particularly on the slopes northeast of Wolverine and Little Wolverine Lakes. They are typically bordered by black spruce stands in the lower bog forests and extend upslope to open alpine fir forests in the subalpine transition zone.

Open Black Spruce Forest - Lowland

An open canopy of black spruce (*Picea mariana*) makes up the overstorey and tall shrub layers. Low shrubs include black spruce and willows (*Salix* spp.). The dwarf shrub consists of a variety of mainly ericaceous shrubs, predominately Labrador tea (*Ledum groenlandicum*). Herbs, not abundant, include graminoids (*Arctagrostis latifolia*). Sphagnum moss (*Sphagnum* spp.) and lichen (*Cladina* spp.) complete the ground cover.

This vegetation type is best described by the Open Black Spruce Forest (Organic Soil) (V19) of the 1996 Southeast Yukon Ecosystem Classification.

A narrow zone of open black spruce forests on organic soils is found on the lowland bog areas around much of Wolverine and Little Wolverine Lakes. It typically borders on the white spruce forest, alpine fir forest or black spruce forest (mineral soil) of the upland forest zone.

Shrub Birch Low Shrub

Shrub birch (*Betula glandulosa)* thickets, less than 2 m in height, form the dominant vegetative cover. A sparsely developed dwarf shrub layer is formed primarily of crowberry (*Empetrum nigrum*) and Labrador tea (*Ledum groenlandicum*). Herbs are uncommon in this vegetative type. The ground cover consists mostly of lichens (principally *Cladina* spp.).

This vegetation type resembles the Shrub Birch Medium/Tall Shrub (V101) of the 1996 Southeast Yukon Ecosystem Classification.

Low shrub birch thickets are common in the upper subalpine transition zone on the mountains around Wolverine Lake. It is also common in the alluvial plain shrub zone. Shrub birch is a major regeneration species following the 1994 forest fire in the southern portion of the study area.

Willow Low Shrub

A low shrub layer of willows (*Salix* spp.) dominates this vegetation type. The tree layer, mostly white spruce (*Picea glauca*), and tall willow (*Salix* spp.) shrub layer are sparsely developed. Dwarf shrubs consist mainly of crowberry (*Empetrum nigrum*) and Labrador tea (*Ledum groenlandicum*). The herb layer is poorly developed. Non-vascular plants are represented by feather moss (*Hylocomium splendens*), sphagnum moss (*Sphagnum girgensohnii*), and foliose lichens (*Peltigera scabrosa*).

The Willow Medium/Tall Shrub (V104) of the 1996 Southeast Yukon Ecosystem Classification is most similar to this vegetation type.

Stands of low willows are found along the upper tributaries to several of the drainages in the Wolverine Lake area. It also occurs as regeneration following the 1994 forest fire in the southern part of the study area.

Shrub Birch - Labrador Tea Low / Dwarf Shrub

The low and dwarf shrub layers are dominated by shrub birch (*Betula glandulosa*) and Labrador tea (*Ledum groenlandicum*). The sparse tall shrub layer consists of willow (*Salix* sp.) and paper birch (*Betula papyrifera*). Herbs, not abundant, are mostly graminoids, particularly *Festuca altaica*. Non-vascular plants are represented primarily by *Cladina mitis* and *Hyloconium splendens.*

The Shrub Birch-Labrador Tea Medium/Tall Shrub type (V102) of the 1996 Southeast Yukon Ecosystem Classification best resembles these vegetation stands.

This shrub vegetation is found in scattered stands throughout lower slopes of the upland forests around Wolverine Lake. It does not constitute a large portion of the vegetative cover in the area.

Labrador Tea Dwarf Shrub

A dwarf shrub layer of Labrador tea (*Ledum groenlandicum*) and a ground cover of lichen (predominately *Cladina stellaris* and *Cladina rangiferina*) characterize this vegetation type. Herbs are uncommon.

This vegetation type does not correspond to any of those described in the 1996 Southeast Yukon Ecosystem Classification.

This dwarf shrub type covers much of the mid elevation hillside southwest of Wolverine Lake. On slopes with north/northeast aspect, this vegetation extends down to the alpine fir krummholtz of the subalpine transition zone.

Mountain Avens Dwarf Shrub

A dwarf shrub layer of mountain avens (*Dryas integrifolia*) characterizes this alpine vegetation type. Other dwarf shrubs, including net-veined willow (*Salix reticulata*) and cranberry (*Vaccinium vitis-idaea*), also occur as ground cover. A sparse herb layer includes altai fescue (*Festuca altaica*). Lichens include *Dactylina arctica* and *Cetraria* spp.

The Mountain Aven Dwarf Shrub (V107) of the 1996 Southeast Yukon Ecosystem Classification resembles this vegetation type.

Mountain avens are one of a complex of very low shrub types in the alpine tundra zone. They occur in scattered patches on the well drained upper alpine ridges in the Campbell Range north and east of Wolverine Lake.

Willow Dwarf Shrub

Dwarf shrubs, primarily net-veined willow (*Salix reticulata*) and other dwarf willow species (*Salix* spp.) form the most extensive layer in this vegetation type. The herb layer, although not well developed, includes a variety of species and is dominated by altai fescue (*Festuca altaica*) in the mesic zones and water sedge (*Carex aquatilus*) in the wetter sites. Bryophytes and lichens are sparse in the mesic areas, while feather moss (*Tomenthypnum nitens*) forms extensive mats in the wet areas.

This vegetation type resembles the Willow Dwarf Shrub (V108) of the 1996 Southeast Yukon Ecosystem Classification.

Dwarf willow is a common shrub in the alpine tundra zone. In the Wolverine Lake study area, it occurs on the upper slopes of the Campbell Range.

Alpine Bearberry Dwarf Shrub

This dwarf shrub vegetation type is dominated by alpine bearberry (*Arctostaphylos alpina*). Crowberry (*Empetrum nigrum*) and shrub birch (*Betula glandulosa* are also common. Herbs and mosses are uncommon. Lichens, primarily *Cladina stellaris* and *Alectoria ochroleuca*, form much of the ground cover.

This vegetation type resembles the Alpine Bearberry Dwarf Shrub (V118) of the 1996 Southeast Yukon Ecosystem Classification.

A dwarf shrub type that is relatively uncommon in the Wolverine Lake area, it occurs on alpine ridges such as the one west of Little Wolverine Lake.

Low-Bush Cranberry Dwarf Shrub

Low-bush cranberry (*Vaccinium vitis-idaea*) and net-veined willow (*Salix reticulata*) form the dwarf shrub layer. Other significant ground cover includes fruticose lichens (primarily *Alectoria ochroleuca* and *Cladonia* spp.). The herb layer, not extensive, consists mostly of graminoids, usually altai fescue (*Festuca altaica*).

This vegetation type is similar to the Mountain Cranberry Dwarf Shrub (V121) described in the 1996 Southeast Yukon Ecosystem Classification.

Low-bush cranberry is another component of the dwarf shrub vegetation in the alpine tundra zone. It is found on exposed alpine ridges in the Campbell Range.

Grass Herb

Dense stands of altai fescue (*Festuca altaica*) are the characterizing feature of this vegetation type. A variety of other herb species occur in low abundance. Shrubs are uncommon. The ground cover also includes lichens (predominately *Cladina rangiferina*).

The Mesic Grass Herb (V202) of the 1996 Southeast Yukon Ecosystem Classification is the vegetation type that best corresponds to the these graminoid meadows.

Mesic grass meadows make up only a small component of the vegetation in the Wolverine Lake study area. They occur in moderately well drained depressions in the low alluvial shrub zone.

Sedge Herb

These wet sedge meadows are dominated by the water sedge, *Carex aquatilus*. Shrubs and forb species are uncommon. Extensive layers of brown moss, *Tomenthypnum nitens*, are formed in some areas.

This vegetation type resembles the Wet Sedge Herb type (V206) described in the 1996 Southeast Yukon Ecosystem Classification.

Sedge meadows, although not extensive in the Wolverine Lake area, occur in poorly drained areas in the alluvial shrub zone.

Wet Mixed Herb

Sedges (*Carex aquatilus*) form the dominant cover in this vegetation type. Other herb species, particularly tall Jacob's ladder (*Polemonium acutiflorum*) and swamp cinquefoil (*Potentilla palustris*) are also prevalent. Bryophytes and lichens are uncommon.

The Wet Mixed Herb (V214) of the 1996 Southeast Yukon Ecosystem Classification best describes this vegetation type.

Accounting for a very small component of the vegetative cover in the Wolverine Lake area, mixed herb meadows are found on the better drained lowland sites in the alluvial shrub zone. The open meadows near the creek draining Muskrat House Lake is one such example.

Cetraria - Alectoria Fruticose Lichen

This vegetation type is characterized by a ground cover dominated by fruticose lichens (primarily *Alectoria ochroleuca* and *Cetraria nivalis*). Dwarf shrubs include net-veined willow (*Salix reticulata*), arctic willow (*Salix arctica*) and other willow species (*Salix* spp.). The most prominent herb is alpine holy grass (*Heirochloe alpina*).

This vegetation type is similar to the *Cetraria-Alectoria ochroleuca* Fruticose Lichen (V300) of the 1996 Southeast Yukon Ecosystem Classification.

This high alpine vegetation type occurs on the high windswept ridges of the Campbell Range. It does not comprise a large part of the Wolverine Lake study area's vegetation.

Crustose - Fruticose Lichen

Boulder fields covered with fruticose (*Cetraria* spp.) and crustose (unidentified) lichens characterize this vegetation type. Shrubs are absent and herbs, including mainly altai fescue (*Festuca altaica*), are scarce.

The *Rhizocarpon-Umbilicaria* Crustose Lichen vegetation type (V301) of the 1996 Southeast Yukon Ecosystem Classification best describes these alpine boulder fields.

Relatively uncommon in the Wolverine Lake area, these boulder fields are found on the steeper alpine slopes of the Campbell Range.

Cladina Fruticose Lichen

Extensive mats of the lichen *Cladina stellaris* characterize this vegetation type. The herb layer is thin and dominated by arctic blue grass (*Poa arctica*). Shrubs and mosses are uncommon.

The *Cladina* Fruticose Lichen vegetation type (V302) of the 1996 Southeast Yukon Ecosystem Classification best describes these alpine lichen dominated zones.

Although normally an alpine vegetation type, a few isolated *Cladina* dominated communities occur within the alluvial shrub zone, such as in the Go Creek valley.

Other vegetation types observed but not sampled include:

Open Black Spruce Forest - Upland (V18 of the 1996 Southeast Yukon Ecosystem Classification) occurring on mineral soil on the fringes of the lowland bog forest and occassionally at higher elevations in the upland forest.

Willow -Shrub Birch Low/Tall Shrub (V105 of the 1996 Southeast Yukon Ecosystem Classification) occurring intermittently in the subalpine transition zone.

White Heather Dwarf Shrub (V115 of the 1996 Southeast Yukon Ecosystem Classification) occurring on exposed ridges in the alpine tundra zone.

Mesic Mixed Herb (V213 of the 1996 Southeast Yukon Ecosystem Classification) occurring infrequently in the subalpine transition zone.

It should be noted that ***Open Tamarack-Spruce Forests*** (V23 of the 1996 Southeast Yukon Ecosystem Classification) occur just north of the Wolverine Lake study area in the Nouga Creek valley, but was not observed in the study area.

Metal Concentrations in Vegetation

Vegetation samples were collected from five sites in the study area in order to determine background levels of metal enrichment. The locations of these sampling stations are shown in Figure 3.5. Elevations and UTM coordinates are given in Table 1.

TABLE 1 VEGETATION SAMPLING STATIONS

Station	Elevation (m)	Location (UTM)	
1	1150	436850 E	6813350 N
2	1320	441400 E	6808800 N
3	1140	431000 E	6816500 N
4	1770	440550 E	6812100 N
5	1710	435050 E	6816500 N

Samples of lichens (*Cladina* spp.) and the leaves and twigs from willow shrubs (*Salix* spp.) were collected in mid-July, 1996. These species are common within the study area. The entire above ground portion of lichens and the leaves and twigs from the current year's growth of willows were collected. Samples were shipped to a laboratory. for ashing and ICP analysis for metals.

The results of the vegetation metals concentration survey is presented in Table 2. The Labs Ltd.'s certificate of analysis is shown in Appendix 3.

Sensitivity of Vegetation to Disturbance

The sensitivity of vegetation in the Wolverine Lake area to human disturbance depends on factors such as elevation, site moisture, slope and soil texture. Lower elevation vegetation communities generally revegetate more easily, particularly aspen forests and willow and alder thickets which reproduce vegetatively (suckering). Alpine areas revegetate much more slowly because of the slower rate of succession due to climatic conditions and because the thin soil horizons are easily destroyed. The soil erosion hazard increases with the slope and with the silt content in the upper soil horizons. In areas with saturated soils and deep layers of organic materials, the removal of surface vegetation can lead to the melting of permafrost.

The vegetation types most vulnerable to disturbance by human activity in the Wolverine Lake study area include all those in the alpine tundra zone (alpine dwarf shrub and alpine lichen dominated vegetation types). Although soil erosion hazards and terrain constraints in the alpine tundra zone may be minimized by avoiding steep slopes and areas of cryoturbation, reclamation/revegetation of disturbed sites in this zone is difficult.

Removal of the surface vegetation and organic layers (primarily sphagnum peat) from lowland black spruce forests, such as those adjacent to the Wolverine and Little Wolverine Lakes may result in the melting of permafrost.

High water tables and deep organic layers typical of the wet sedge and wet mixed herb meadows that occur in lowlands, such as those along the creek draining Little Jimmy Lake, and in poorly drained areas in the alluvial shrub zone, such as along Go Creek near the airstrip may make these communities sensitive to development as well.

Revegetation / Reclamation

Revegetation with seed mixtures of native species (or agronomic varieties developed from northern native species) are most effective in reclaiming disturbed sites. The following species of native seed selections are recommended for the Pelly Mountains region (Kennedy, 1993):

Plant Community	Native Seed Selection	
White spruce/Black spruce	Ticklegrass	(*Agrostis scabra*)
	Tufted hairgrass	(*Deschampia caespitosa*)
	Altai fescue	(*Festuca altaica*)
	Violet wheatgrass	(*Agropyron violaceum*)
	Fowl bluegrass	(*Poa palustris*)
	Bear root	(*Hedysarum alpinum*)

Mixed deciduous/Coniferous	Yukon wheatgrass	(*Agropyron yukonense*)
	Northern fescue	(*Festuca saximontana*)
	Glaucous bluegrass	(*Poa glauca*)
	Violet wheatgrass	(*Agropyron violaceum*)
	Big bluegrass	(*Poa glauca*)
	Arctic lupine	(*Lupinus arcticus*)
	Yellow locoweed	(*Oxytropis campestris*)
Black spruce	Ticklegrass	(*Agrostis scabra*)
	Tufted hairgrass	(*Deschampsia caespitosa*)
	Polargrass	(*Arctagrostis latifolia*)
	Violet wheatgrass	(*Agropyron violaceum*)
	Fowl bluegrass	(*Poa palustris*)
	Bear root	(*Hedysarum alpinum*)
Alpine fir	Tufted hairgrass	(*Deschampsia caespitosa*)
	Sheep fescue	(*Festuca ovina*)
	Alpine bluegrass	(*Poa alpina*)
	Violet wheatgrass	(*Agropyron violaceum*)
	Glaucous bluegrass	(*Poa glauca*)
	Mackenzie's hedysarum	(*Hedysarum mackenzii*)
	Yellow locoweed	(*Oxytropis campestris*)
Alpine fir/shrub birch-willow	Meadow foxtail	(*Alopecurus pratensis*)
	Tufted hairgrass	(*Deschampsia caespitosa*)
	Sheep fescue	(*Festuca ovina*)
	Alpine bluegrass	(*Poa alpina*)
	Glaucous bluegrass	(*Poa glauca*)
	Violet wheatgrass	(*Agropyron violaceum*)
	Mackenzie's hedysarum	(*Hedysarum mackenzii*)
Alpine dwarf shrub/sedge	Polargrass	(*Arctagrostis latifolia*)
	Tufted hairgrass	(*Deschampsia caespitosa*)
	Sheep fescue	(*Festuca ovina*)
	Glaucous bluegrass	(*Poa glauca*)
	Alpine bluegrass	(*Poa alpina*)

Guidelines for seed mixtures and fertilizer applications have been recommended by Kennedy (1993). Appropriate agronomic substitutions have also been recommended, if native seed selections are not available.

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APPENDIX 1

PLANT SPECIES

PLANT SPECIES

WOLVERINE LAKE STUDY AREA

Vascular Plants

Scientific name	Common name
Abies lasiocarpa	Alpine fir
Achillea nigrescens	Yarrow
Aconitum delphinifolium	Northern monkshood
Anemone narcissiflora	Narcissus-flowered anemone
Anemone parviflora	Northern anemone
Anemone richardsonii	Yellow anemone
Arabis sp.	Rock cress
Arctagrostis latifolia	Grass
Arctostaphylos alpina	Alpine bearberry
Arctostaphylos rubra	Red bearberry
Arctostaphylos uva-ursi	Kinnikinick
Arnica cordifolia	Heart-leaved arnica
Artemesia arctica	Wormwood
Aster sibiricus	Siberian aster
Astragalus alpinus	Alpine milk-vetch
Betula glandulosa	Shrub birch
Betula papyrifera	Paper birch
Betula pumila	Dwarf birch
Campanula sp.	Harebell
Cardamine pratensis	Cuckoo flower
Carex aquatilis	Water sedge
Carex physocarpa	Sedge
Cassiope tetragona	White mountain heather
Cerastium arvense	Mouse-ear chickweed
Claytonia tuberosa	Tuberous spring-beauty
Cornus canadensis	Bunchberry
Corydalis pauciflora	Few-flowered corydalis
Delphinium glaucum	Larkspur
Dryas integrifolia	Mountain aven
Empetrum nigrum	Crowberry
Epilobium anagallidifolium	Willow-herb
Epilobium angustifolium	Fireweed
Epilobium latifolium	Dwarf fireweed
Equisetum arvense	Common horsetail
Equisetum scirpoides	Dwarf scouring-rush
Equisetum sylvaticum	Woodland horsetail
Festuca altaica	Altai fescue
Galium sp.	Bedstraw

Gentiana glauca	Glaucous gentian
Gentiana propinqua	Four-petaled gentian
Geocaulon lividum	Northern comandra
Hierochloe alpina	Alpine holy grass
Hedysarum alpinum	Liquorice root
Juniperus communis	Common juniper
Kalmia polfolia	Bog laurel
Ledum decumbens	Northern Labrador tea
Ledum groenlandicum	Labrador tea
Linnaea borealis	Twinflower
Lupinus arcticus	Arctic lupine
Luzula parviflora	Small-flowered wood rush
Lycopodium complanatum.	Flattened clubmoss
Lycopodium sp.	Clubmoss
Mertensia paniculata	Bluebell
Monenses uniflora	Single delight
Myosotis asiatica	Forget-me-not
Oxyria dgyna	Mountain sorrel
Parnaisia sp.	Grass-of-parnassus
Pedicularis labradorica	Labrador lousewort
Pedicularis sudetica	Sudeten lousewort
Petasites sp.	Coltsfoot
Phyllodoce empetriformis	Pink mountain heather
Picea glauca	White spruce
Picea mariana	Black spruce
Pinus contorta	Lodgepole pine
Poa arctica	Artctic blue grass
Polemonium acutiflorum	Tall Jacob's ladder
Polygonum viviparum	Alpine bistort
Populus balsamifera	Balsam poplar
Populus tremuloides	Trembling aspen
Potentilla diversifolia	Mountain meadow cinquefoil
Potentilla fruticosa	Shrubby cinquefoil
Potentilla multifida	Many-cleft cinquefoil
Potentilla palustris	Swamp cinquefoil
Pyrola asarifolia	Pink-flowered wintergreen
Pyrola grandiflora	Arctic wintergreen
Ranunculus nivalis	Snow buttercup
Ribes sp.	Black currant
Rorippa sp.	Yellow cress
Rosa acicularis	Prickly rose
Rubus chamaemorous	Cloudberry
Rubus idaeus	Red raspberry
Rubus pubescens	Dwarf raspberry
Salix arctica	Arctic willow
Salix reticulata	Net-veined willow

Salix spp.	Willow
Saxifraga caespitosa	Tufted saxifrage
Sedum roseum	Roseroot
Senecio lugens	Black-tipped groundsel
Senecio triangularis	Arrow-leaved senecio
Senecio yukonensis	Yukon groundsel
Shepherdia canadensis	Soapberry
Silene acaulis	Moss campion
Solidago sp.	Goldenrod
Stellaria longipes	Chickweed
Thalictrum sparsifolium	Few-flowered meadowrue
Vaccinium uliginosum	Blueberry
Vaccinium vitis-idaea	Low-bush cranberry
Veronica wormskjoldii	Alpine speedwell
Viburnum edule	High-bush cranberry
Viola sp.	Violet

Non-vascular Plants

Bryophytes

Grimmia sp.
Hylocomium splendens
Pleurozium schreberi
Racomitrium sp.
Sphagnum capillaceum
Sphagnum girgensohnii
Tomenthypnum nitens

Lichens

Alectoria ochroleuca
Bryoria sp.
Cetraria nivalis
Cetraria islandica
Cladina mitis
Cladina rangiferina
Cladina stellaris
Cladonia coccifera
Cladonia coniocraea
Cladonia spp.
Dactylina arctica
Lecidella euphorea
Masonhalea richardsonii
Nephroma arcticum
Peltigera scabrosa
Peltigera sp.
Stereocaulon paschale
Stereocaulon tomentosum

APPENDIX 2

VEGETATION TYPES AND HABITAT UNITS

OPEN ALPINE FIR FOREST

DESCRIPTION

The open canopy overstorey in this vegetation type is dominated by alpine fir (*Abies lasiocarpa*). The dwarf shrub layer is particularly well developed and consists mainly of crowberry (*Empetrum nigrum*) and white mountain heather (*Cassiope tetragona*). Herbs are uncommon in this vegetation type. The non-vascular plant layer is comprised primarily of *Cladina* spp.

This vegetation type is similar to the Open Alpine Fir Forest (V16) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

OVERSTOREY SPECIES

Trees (>5 m): *Abies lasiocarpa*

UNDERSTOREY SPECIES

Tall Shrubs (2-5 m): *Abies lasiocarpa*

Low Shrubs (0.5-2 m): *Abies lasiocarpa, Betula glandulosa*

Dwarf Shrubs (<0.5 m): *Cassiope tetragona, Phyllodoce empetriformis, Kalmia polfolia, Vaccinium vitis-idaea, Empetrum nigrum, Vaccinium uliginosum*

Herbs: *Hierochloe alpina*

Bryophytes: *Plerurozium schreberi, Racomitrium* sp.

Lichens: *Cladina stellaris, Cladina rangeriferina, Cladonia coccifera, Nephroma arcticum, Cetraria nivalis, Bryoria* sp.

OPEN WHITE SPRUCE FOREST

DESCRIPTION

White spruce (*Picea glauca*) dominates the open canopy overstorey. The low and dwarf shrub layer is well developed and consists primarily of shrub birch (*Betula glandulosa*), willow (*Salix* sp.), Labrador tea (*Ledum groenlandicum*) and crowberry (*Empetrum nigrum*). Herbs are poorly represented in this vegetation type. The non-vascular plant layer is dominated by *Pleurozium shreberi* and *Cladina* sp.

This vegetation type resembles the Open White Spruce Forest (V17) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

OVERSTOREY SPECIES

Trees (>5 m): *Picea glauca*

UNDERSTOREY SPECIES

Tall Shrubs (2-5 m): *Salix* sp.

Low Shrubs (0.5-2 m): *Betula glandulosa, Salix* sp.

Dwarf Shrubs (<0.5 m): *Betula glandulosa, Ledum groenlandicum, Vaccinium uliginosum, Vaccinium vitis-idaea, Rosa acicularis, Empetrum nigrum*

Herbs: *Mertensia paniculata, Pedicularis labradorica, Cornus canadensis.*

Bryophytes: *Pleurozium schreberi, Grimmia* sp.

Lichens: *Cladina stellaris, Cladina rangiferina, Stereocaulon paschale,Cetraria nivalis, Nephroma arcticum, Cladonia* sp., *Bryoria* sp.

SHRUB BIRCH - LABRADOR TEA LOW / DWARF SHRUB

DESCRIPTION

The low and dwarf shrub layers are dominated by shrub birch (*Betula glandulosa*) and Labrador tea (*Ledum groenlandicum*). The sparse tall shrub layer consists of willow (*Salix* sp.) and paper birch (*Betula papyrifera*). Herbs, not abundant, are mostly graminoids, particularly *Festuca altaica*. Non-vascular plants are represented primarily by *Cladina mitis* and *Hyloconium splendens.*

The Shrub Birch-Labrador Tea Medium/Tall Shrub type (V102) of the 1996 Southeast Yukon Ecosystem Classification best resembles these vegetation stands.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Tall Shrubs (2-5 m): *Salix* sp.*, Betula papyrifera*

Low Shrubs (0.5-2 m): *Betula glandulosa, Salix* sp.

Dwarf Shrubs (<0.5 m): *Ledum groenlandicum, Empetrum nigrum, Arctostaphylos uva-ursi, Vaccinium vitis-idaea, Juniperus communis*

Herbs: *Festuca altaica, Epilobium angustifolium, Mertensia paniculata, Lupinus arcticus, Polemonium acutiflorum, Gentiana propinqua*

Bryophytes: *Hylocomium splendens*

Lichens: *Cladina mitis, Cladonia coccifera, Peltigera* sp.

SHRUB BIRCH LOW SHRUB

DESCRIPTION

Shrub birch (*Betula glandulosa)* thickets, less than 2 m in height, form the dominant vegetative cover. A sparsely developed dwarf shrub layer is formed primarily of crowberry (*Empetrum nigrum*) and Labrador tea (*Ledum groenlandicum*). Herbs are uncommon in this vegetative type. The ground cover consists mostly of lichens (principally *Cladina* spp.).

This vegetation type resembles the Shrub Birch Medium/Tall Shrub (V101) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Low Shrubs (0.5-2 m): *Betula glandulosa, Salix* sp.

Dwarf Shrubs (<0.5 m): *Empetrum nigrum, Ledum groenlandicum, Betula glandulosa, Vaccinium uliginosum, Vaccinium vitis-idaea, Salix* sp.

Herbs: *Pedicularis labradorica*

Bryophytes: *Hylocomium splendens, Grimmia* sp.

Lichens: *Cladina stellaris, Cladonia* sp., *Lecidella euphorea, Stereocaulon paschale, Nephroma arcticum*

LABRADOR TEA DWARF SHRUB

DESCRIPTION

A dwarf shrub layer of Labrador tea (*Ledum groenlandicum*) and a ground cover of lichen (predominately *Cladina stellaris* and *Cladina rangiferina*) characterize this vegetation type. Herbs are uncommon.

This vegetation type does not correspond to any of those described in the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Dwarf Shrubs (<0.5 m): *Ledum groenlandicum, Betula pumila, Vaccinium uliginosum, Empetrum nigrum, Vaccinium vitis-idaea, Salix* sp.

Herbs: *Pedicularis labradorica*

Bryophytes: *Racomitrium* sp.

Lichens: *Cladina stellaris, Cladina rangiferina, Masonhalea richardsonii, Cladonia coniocraea, Dactylina arctica, Cetraria nivalis, Stereocaulon paschale, Alectoria ochroleuca*

Cetraria - Alectoria FRUTICOSE LICHEN

DESCRIPTION

This vegetation type is characterized by a ground cover dominated by fruticose lichens (primarily *Alectoria ochroleuca* and *Cetraria nivalis*). Dwarf shrubs include net-veined willow (*Salix reticulata*), arctic willow (*Salix arctica*) and other willow species (*Salix* spp.). The most prominent herb is alpine holy grass (*Heirochloe alpina*).

This vegetation type is similar to the *Cetraria-Alectoria ochroleuca* Fruticose Lichen (V300) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Dwarf Shrubs (<0.5 m):	*Salix reticulata, Salix arctica, Salix* sp.*, Vaccinium vitis-idaea, Dryas integrifolia, Cassiope tetragona*
Herbs:	*Hierchloe alpina, silene acaulis, Saxifraga caespitosa, Stellaria longipes, Anemone parviflora*
Bryophytes:	*Grimmia* sp.
Lichens:	*Alectoria ochroleuca, Cetraria nivalis, Cladina rangiferina, Stereocaulon tomentosum*

WILLOW DWARF SHRUB

DESCRIPTION

Dwarf shrubs, primarily net-veined willow (*Salix reticulata*) and other dwarf willow species (*Salix* spp.) form the most extensive layer in this vegetation type. The herb layer, although not well developed, includes a variety of species and is dominated by altai fescue (*Festuca altaica*) in the mesic zones and water sedge (*Carex aquatilus*) in the wetter sites. Bryophytes and lichens are sparse in the mesic areas, while feather moss (*Tomenthypnum nitens*) forms extensive mats in the wet areas.

This vegetation type resembles the Willow Dwarf Shrub (V108) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Dwarf Shrubs (<0.5 m): *Salix reticulata, Salix* spp., *Vaccinium vitis-idaea*

Herbs: *Festuca altaica, Carex aquatilus, Carex physocarpa, Petasites* sp., *Stellaria longipes, Mertensia paniculata, Pyrola grandiflora, Anemone narcissiflora, Aconitum delphinifolium, Polemonium acutiflorum, Pedicularis sudetica, Senecio lugens, Equisetum arvense*

Bryophytes: *Tomenthypnum nitens, Hylocomium splendens, Sphagnum capillaceum*

Lichens: *Cetraria nivalis, Masonhalea richardsonii, Dactylina arctica, Cladina stellaris*

WILLOW LOW SHRUB

DESCRIPTION

A low shrub layer of willows (*Salix* spp.) dominates this vegetation type. The tree layer, mostly white spruce (*Picea glauca*), and tall willow (*Salix* spp.) shrub layer are sparsely developed. Dwarf shrubs consist mainly of crowberry (*Empetrum nigrum*) and Labrador tea (*Ledum groenlandicum*). The herb layer is poorly developed. Non-vascular plants are represented by feather moss (*Hylocomium splendens*), sphagnum moss (*Sphagnum girgensohnii*), and foliose lichens (*Peltigera scabrosa*).

The Willow Medium/Tall Shrub (V104) of the 1996 Southeast Yukon Ecosystem Classification is most similar to this vegetation type.

STRATA COMPOSITION

OVERSTOREY SPECIES

Trees (>5 m): *Picea glauca*

UNDERSTOREY SPECIES

Tall Shrubs (2-5 m): *Salix* spp.

Low Shrubs (0.5-2 m): *Salix* spp., *Betula glandulosa*

Dwarf Shrubs (<2 m): *Ledum groenlandicum, Empetrum nigrum, Vaccinium uliginosum, Vaccinium vitis-idaea, Arctostaphylos rubra, Rubus pubescens*

Herbs: *Arctagrostis latifolia, Carex aquatilus, Parnaisia* sp., *Petasites* sp., *Epilobium angustfolium, Anemone richardsonii, Equisetum scirpoides*

Bryophytes: *Hylocomium splendens*

Lichens: *Peligera scabrosa*.

ALPINE BEARBERRY DWARF SHRUB

DESCRIPTION

This dwarf shrub vegetation type is dominated by alpine bearberry (*Arctostaphylos alpina*). Crowberry (*Empetrum nigrum*) and shrub birch (*Betula glandulosa* are also common. Herbs and mosses are uncommon. Lichens, primarily *Cladina stellaris* and *Alectoria ochroleuca*, form much of the ground cover.

This vegetation type resembles the Alpine Bearberry Dwarf Shrub (V118) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Dwarf Shrubs (<0.5 m): *Arctostaphylos alpina, Empetrum nigrum, Betula glandulosa, Vaccinium uliginosum, Vaccinium vitis-idaea*

Herbs: *Lupinus arcticus, Pedicularis labradorica*

Lichens: *Cladina stellaris, Alectoria ochroleuca, Cetraria nivalis, Stereocaulon tomentosum*

GRASS HERB

DESCRIPTION

Dense stands of altai fescue (*Festuca altaica*) are the characterizing feature of this vegetation type. A variety of other herb species occur in low abundance. Shrubs are uncommon. The ground cover also includes lichens (predominately *Cladina rangiferina*).

The Mesic Grass Herb (V202) of the 1996 Southeast Yukon Ecosystem Classification is the vegetation type that best corresponds to the these graminoid meadows.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Herbs:	*Festuca altaica, Artemesia arctica, Aconitum delphinifolium, Mertensia paniculata, Solidago* sp.*, Senecio lugens, Achillea nigrescens, Artemesia arctica*
Bryophytes:	*Hylocomium splendens*
Lichens:	*Cladina rangiferina, Nephroma arcticum, Dactylina arctica, Cladonia coccifera, Cladonia* sp.

MIXED HERB

DESCRIPTION

Sedges (*Carex aquatilus*) form the dominant cover in this vegetation type. Other herb species, particularly tall Jacob's ladder (*Polemonium acutiflorum*) and swamp cinquefoil (*Potentilla palustris*) are also prevalent. Bryophytes and lichens are uncommon.

The Wet Mixed Herb (V214) of the 1996 Southeast Yukon Ecosystem Classification best describes this vegetation type.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Herbs: *Carex aquatilus, Polemonium acutiflorum, Potentilla palustris, Parnaisia* sp., *Luzula parviflora*

SEDGE HERB

DESCRIPTION

These wet sedge meadows are dominated by the water sedge, *Carex aquatilus*. Shrubs and forb species are uncommon. Extensive layers of brown moss, *Tomenthypnum nitens*, are formed in some areas.

This vegetation type resembles the Wet Sedge Herb type (V206) described in the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Herbs: *Carex aquatilus*

Bryophytes: *Tomenthypnum nitens*

Cladina FRUTICOSE LICHEN

DESCRIPTION

Extensive mats of the lichen *Cladina stellaris* characterize this vegetation type. The herb layer is thin and dominated by arctic blue grass (*Poa arctica*). Shrubs and mosses are uncommon.

The *Cladina* Fruticose Lichen vegetation type (V302) of the 1996 Southeast Yukon Ecosystem Classification best describes these alpine lichen dominated zones.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Herbs:	*Poa arctica, Artemesia arctica, Rubus pubescens*
Lichens:	*Cladina stellaris, Masonhalea richardsonii, Cladonia coniocraea*

CLOSED BALSAM POPLAR FOREST

DESCRIPTION

The closed tree canopy and tall shrub layer consist primarily of balsam poplar (*Populus balsamifera*), with occurrences of willow (*Salix* spp.). Soapberry (*Shepherdia canadensis*) and shrubby cinquefoil (*Potentilla fruticosa*) dominate the low shrub layer. Dwarf shrubs include kinnikinick (*Arctostaphylos uva-ursi*), prickly rose (*Rosa acicularis*) and twinflower (*Linnaea borealis*). The herb cover is not extensive, but includes a variety of species. The moss and lichen layer is not well developed.

This vegetation type resembles the Closed Balsam Poplar Forest (V3) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

OVERSTOREY SPECIES

Trees (>5 m): *Populus balsamifera, Salix* sp.

UNDERSTOREY SPECIES

Tall Shrubs (2-5 m): *Populus balsamifera*

Low Shrubs (0.5-2 m): *Shepherdia canadensis, Populus balsamifera, Potentilla fruticosa, Salix* sp.

Dwarf Shrubs (< 0.5 m): *Arctostaphylos uva-ursi, Rosa acicularis, Linnaea borealis, Juniperus communis, Ledum groenlandicum*

Herbs: *Epilobium angustifolium, Delphinium glaucum, Mertensia paniculata, Festuca altaica, Gentiana propinqua, Hedysarum alpinum*

Bryophytes: *Grimmia* sp.

Lichens: *Cladonia coccifera, Cladina ragiferina*

CLOSED TREMBLING ASPEN FOREST

DESCRIPTION

A closed canopy of trembling aspen (*Populus tremuloides*) with minor occurrences of willow (*Salix* sp.) make up the tree layer. The low shrub layer consists mainly of soapberry (*Shepherdia canadensis*). Kinnikinick (*Arctostaphylos uva-ursi*), twinflower (*Linnaea borealis*) and common juniper (*Juniperus communis*) form the ground cover. The herb layer, not well developed, is dominated by fireweed (*Epilobium angustifolium*). Bryophytes and lichens are uncommon.

The Closed Trembling Aspen Forest vegetation type (V2) of the 1996 Southeast Yukon Ecosystem Classification best describes these aspen stands.

STRATA COMPOSITION

OVERSTOREY SPECIES

Trees (>5 m): *Populus tremuloides, Salix* sp.

UNDERSTOREY SPECIES

Low Shrubs (0.5-2 m): *Shepherdia canadensis, Populus tremuloides, Potentilla fruticosa*

Dwarf Shrubs (< 0.5 m): *Arctostaphylos uva-ursi, Linnaea borealis, Juniperus communis, Arctostaphylos rubra, Rosa acicularis, Sherpherdia canadensis, Populus tremuloides, Picea glauca*

Herbs: *Epilobium angustifolium, Festuca altaica, Mertensia paniculata, Lupinus arcticus, Delphinium glaucum, Solidago* sp., *Gentiana propinqua*

Bryophytes: *Racomitrium* sp.

Lichens: *Stereocaulon tomentosum, Peltigera scabrosa*

CRUSTOSE - FRUTICOSE LICHEN

DESCRIPTION

Boulder fields covered with fruticose (*Cetraria* spp.) and crustose (unidentified) lichens characterize this vegetation type. Shrubs are absent and herbs, including mainly altai fescue (*Festuca altaica*), are scarce.

The *Rhizocarpon-Umbilicaria* Crustose Lichen vegetation type (V301) of the 1996 Southeast Yukon Ecosystem Classification best describes these alpine boulder fields.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Herbs: *Festuca altaica, Senecio yukonensis, Anemone parviflora*

Bryophytes: *Racomitrium* sp.

Lichens: *Cetraria nivalis, Cetraria islandica*

MOUNTAIN AVENS DWARF SHRUB

DESCRIPTION

A dwarf shrub layer of mountain avens (*Dryas integrifolia*) characterizes this alpine vegetation type. Other dwarf shrubs, including net-veined willow (*Salix reticulata*) and cranberry (*Vaccinium vitis-idaea*), also occur as ground cover. A sparse herb layer includes altai fescue (*Festuca altaica*). Lichens include *Dactylina arctica* and *Cetraria* spp.

The Mountain Aven Dwarf Shrub (V107) of the 1996 Southeast Yukon Ecosystem Classification resembles this vegetation type.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Dwarf Shrubs (<0.5 m): *Dryas integrifolia, Salix reticulata, Vaccinium vitis-idaea*

Herbs: *Anemone parviflora, Festuca altaica, Saxifraga caespitosa*

Lichens: *Dactylina arctica, Cetraria* spp.

LOW-BUSH CRANBERRY DWARF SHRUB

DESCRIPTION

Low-bush cranberry (*Vaccinium vitis-idaea*) and net-veined willow (*Salix reticulata*) form the dwarf shrub layer. Other significant ground cover includes fruticose lichens (primarily *Alectoria ochroleuca* and *Cladonia* spp.). The herb layer, not extensive, consists mostly of graminoids, usually altai fescue (*Festuca altaica*).

This vegetation type is similar to the Mountain Cranberry Dwarf Shrub (V121) described in the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

UNDERSTOREY SPECIES

Dwarf Shrubs (<0.5 m):	*Vaccinium vitis-idaea, Salix reticulata*
Herbs:	*Festuca altaica, Lupinus arcticus, Anenome parviflora*
Lichens:	*Alectoria ochroleuca, Cladonia* spp., *Cladina* spp.

OPEN BLACK SPRUCE FOREST - LOWLAND

DESCRIPTION

An open canopy of black spruce (*Picea mariana*) makes up the overstorey and tall shrub layers. Low shrubs include black spruce and willows (*Salix* spp.). The dwarf shrub consists of a variety of mainly ericaceous shrubs, predominately Labrador tea (*Ledum groenlandicum*). Herbs, not abundant, include graminoids (*Arctagrostis latifolia*). Sphagnum moss (*Sphagnum* spp.) and lichen (*Cladina* spp.) complete the ground cover.

This vegetation type is best described by the Open Black Spruce Forest (Organic Soil) (V19) of the 1996 Southeast Yukon Ecosystem Classification.

STRATA COMPOSITION

OVERSTOREY SPECIES

Trees (>5 m): *Picea mariana*

UNDERSTOREY SPECIES

Tall Shrubs (2-5 m): *Picea mariana*

Low Shrubs (0.5-2 m): *Salix* sp., *Picea mariana*

Dwarf Shrubs (<0.5 m): *Ledum groenlandicum, Empetrum nigrum, Piece mariana, Vaccinium uliginosum, Vaccinium vitis-idaea, Arctostaphylos rubra, Rubus chamaemorous*

Herbs: *Arctagrostis latifolia, Petasites* sp.*, Veronica wormskjoldii, Equisetum scirpoides*

Bryophytes: *Sphagnum* spp.

Lichens: *Cladina* spp., *Bryoria* sp.

APPENDIX 3

METAL CONCENTRATIONS IN VEGETATION

Appendix 5A

Meetings and Consultations Held for the Wolverine Project – Westmin Resources Limited, 1996-97

June 26, 1996
Land Resources Room 3A Federal Building

Attendees:

D. Mchaina, Westmin, M. Zrum, DIAND Lands, J. Hough, DIAND Lands, M. Fraser, DIAND Lands, D. Cornett, Access Mining Consultants

Issue	**Response**
Project Land Use/Access • Existing land use not documented for area. Want information on existing land use in area. • Planning for project – the earlier the better. • A lot of political based concerns and comments on any project these days. • Possible access routes for project should be considered now. • Access could be a problem/political issue.	• Wildlife being looked at with YTG and RRC • Heritage not being considered for road. • S. Greer met with RRC elders. • Discussed with elders specific comments. • Field survey to identify gravesites, animal licks, cabin sites. • Met with RRC to discuss future work – Aug. 1996. • Also discussed important plants, medicinal, vegetation, trails, and traplines. • Baseline document to be revised based on comments from RRC.
• Access corridor needs to be considered. • Surface tenure for infrastructure and facilities needed. • Basic idea of infrastructure – get to lands ASAP. • File application with basic layout of property ASAP.	• RRC asking for global look at area (global view) • Acknowledge this
• DIAND being asked by RRC re: land/access. • Part of CEAA – impacts – cumulative impacts – historic use of area needs to be addressed.	• RRC concerns: land use; heritage; wildlife • RRC want global component – good for some area i.e. wildlife, more difficult for heritage. • RRC letter – Agreement in Principle to support global view of project area – especially for wildlife.
• RRC – wants global view in other projects. • Level of review different for each project.	• Westmin supports global view for certain areas – wildlife. • Cominco – 13 million tonnes KZK – small • Westmin – good size mine

Issue	Response
CEAA Review • Sooner into the review process the better . • Get lands application submitted. • RRC needs to lobby for global approach.	• Acknowledge
• Will land tenure and land use be included in study. • Sooner Westmin knows project the better • Be advised that threshold limits for surface tenure – Order in Council needed.	• Westmin working on this.
• Keep communication up – in advance of target dates. EA process uncertain.	• Airstrip - June 10 – reclamation underway – camp area being reclaimed where site moved. • Garbage permit for burning. • Did inspection of camp. Would like inspection with Lands – 1 week – 2 week notice for field inspection – 1st week of August – target date/

June 27, 1996
Fisheries Meeting – DFO Boardroom

Attendees:

D. Mchaina, Westmin; G. Faulkner, DFO; C. Osborne, DFO; D. Cornett, Access Mining Consultants Ltd.

Issue	Response
Wolverine Lake Fish Management • Lake trout productivity high in Wolverine Lake. YTG designated as high quality management lake. • YTG to provide copy of YTG order when done. • Restricts fish size – 69 – 100 mm – slot restrict – spawning size restriction. • If in camp, procession of fish restricted. • More strict limits and requirements to release fish – conservation measure.	• If high quality management water lake – what does it mean to Westmin?
• YTG could do more monitoring if needed. Education to ensure conversation of stocks. Idea to inform people of important resources.	• Is monitoring intensified by YTG/DFO?

Issue	Response
Fish Survey • Preliminary fish survey – Identify area for fish compensation?	• Approach to try to document any visible area of concern. But this is a preliminary survey. • Review drainage layout – discuss spring, summer, fall survey overview. • Summer program: good coverage; habitat classification – White Mountain Environmental Consulting (WMEC); check out area for dolly varden use; expect survey to ensure extent of dolly usage. Permit for summer – ensure documented. Westmin to review survey with WMEC.

Issue	Response
Benthos Benthic program: Limited number of control stations for project area: Reference to Report: Environment Canada, June 1993. “Control site” needed on Money and Wolverine Creek. Match habitat types within area – a consideration for control sites.	• Acknowledge. • Revised document in September 1996

June 28, 1996
DIAND Mineral Resources Meeting – Room 4B

Attendees:

D. Mchaina, Westmin; D. Cornett, Access Mining Consultants Ltd., H. Copeland, DIAND Minerals; K. Besso, DIAND Minerals; M. Dejohn, DIAND Minerals; P. MacLeod, Dawson Mining Recorder

Issue	Response
Mining Land Use Regulations • DIAND encourages company to comply with Mining Land Use Regulations so that no surprises down the road.	• Agreed

Issue	Response
Project • When is project decision to be made?	• Fall 1996 – Project overview expected • Baseline study developed with initial scoping meeting with the RRC/Regulatory agencies. • Document not complete – socio economic/land use/ cumulative effects not considered. • Comments incorporated from agencies, review of study plan undertaken in field program this season; • Will also incorporate RRC TEK. • Also plan non-native consultations for study surveys. • Plan to discuss with Liard First Nation down the road, but RRC wants to be main contact.
• Comments from Liard First Nation? • DIAND Minerals problem with Cominco • Project management team (PMT) used for other project which uses First Nations. • PMT is possible approach – DIAND Minerals reviewing	• Westmin concerned with timing and when to involve other First Nation groups

• DIAND Minerals has met with RRC on Mineral Acts. • Better to get all involved from beginning. • RRC knowledge is limited. • DIAND Minerals planning more meetings to discuss Mineral Regulations/Acts with RRC.	

Issue	Response
Wildlife RRC concerns?	• RRC concerned with global wildlife management. • Agreement in Principle with RRC to regional approach to wildlife issues. Don't agree with heritage and land use regional. RRC should spearhead wildlife management. Westmin committed to help/fund; but don't want to see global programs delay project development.
• YTG responsible for wildlife: • Expect scoping exercise – especially for cumulative effects and baseline study. • Plan for scoping meeting.	• Westmin acknowledges this.

Issue	Response
Heritage • RRC view to study?	Heritage Update: • S. Greer & DM visit with RRC; • Identify field visit sites; • Elder were with company and S.Greer – couldn't locate gravesites as located on claim sheets; • A revised Terms of Reference will be developed and trip planned in Sept. 1996
• Document all sites visited (even if no heritage sites found) for IEE	• Not enough time allotted. Need more time on ground.

• Type of protection for sites?	• RRC wants protection of existing sites; • Confidentiality a concern with RRC • No sites in real conflicts with development sites now for roads or mine.

Issue	Response
Rock Characterization • See comments in DIAND Minerals letter (surficial geology)	• First cut mapping at 1:30,000 for surficial geology.
• Detailed map for infrastructure needed (1:10,000 scale better).	• Westmin acknowledges
• Composition of geological units a concern.	• 20 drill holes used. • h.w. – 30 m/range for sampling • f.w. 20 m/range • Composite within geological units used • EP has concerns with 3 sample/unit • For composite geo units – do ABA, check results, direct next stage, esp. kinetic test. • On basis of test results, additional tests to be done. • ICP for all samples, but number of kinetic and sulphide sulphur tests not same. • For further program, when revised, want Environment Canada and DIAND Geology input into study design.

Issue	Response
Mining Land Use Regulations • Claim inspections out recently – Finlayson area • Camp set up to do claim inspections, expect education program for MLUR. • Will be at Wolverine Lake (Rob Thompson, Leo Vankeabek) • Take draft of MLUR • Auto mail out for MLUR update • Fuel storage - 4000 L limit – needs secondary containment in MLUR • Under MLUR – yes. • Keeping fuel to <10 drums at camp;	• Westmin operating procedures – on site protocol – based on MLUR – company auditing use of procedures. • Let camp know that mineral inspection this summer – MLUR/claims/water. • If 20 drums – can have in separate area? • Airstrip secondary fuel area in compliance now.

June 28, 1996
DIAND Water Resources Meeting – Room 4B

Attendees:

D. Mchaina, Westmin; R. Janowicz, DIAND Water Resources; S. Herron, DIAND Water Resources; G. Whitley, DIAND Water Resources; D. Cornett, Access Mining Consultants Ltd.

Issue	Response
General • Any work on Cominco claims?	• None as of yet.

Issue	Response
Climate • Manual meteorological station – monitoring temperature, precipitation. • Expect more sophisticated weather data. • Could use KZK data. • Problem with Cominco site, as not same area.	• Cominco and Westmin relationship means that data is not shared. • Costs for automated weather station high; • Recognize data need.
• Wind, solar radiation should be collected – automatic station needed.	• Student trained for climate data collection. • Westmin/Access Mining Consultants audited student's work. • Doing other data collection.

Issue	Response
Project • Mine plan – any ideas?	• September 1996 – project overview with concepts of mine plan. • Water quality program tied into rock characterization program.

Issue	Response
Water Quality • What are water quality issues?	• Water licence required; therefore, focus on watershed water quality.
• Why were locations for water quality stations chosen?	• Global aspects considered for program that covered off two

	drainages.
• Winter snow survey – should be done for Mar 1997. • Use regional data and tie into program • Need snow data and more low flow data.	• Comments to be incorporated in revised document

June 28, 1996
DIAND Environment Meeting – Room 2B

Attendees:

D. Mchaina, Westmin; M. Crombie, DIAND Environment; Len Mychasiuw, DIAND Environment; D. Cornett, Access Mining Consultants Ltd.

Issue	Response
General • Sheep location on foot claims?	• July 1 post caribou calve survey to look at sheep areas. • March survey – no sheep identified.
• Cominco/Westmin Joint Venture Area?	• Yes – not sure of exploration program in this area.

Issue	Response
RRC Concerns • Cominco IEE – KZK – Wolverine Lake central area from RRC heritage surveys	• Heritage scoping issue discussed with RRC. • Chief RRC wants global approach. • Chief letter to Westmin – agree with Westmin study as long as Westmin support global approach to wildlife. • Westmin – think that heritage is not global.
• What does RRC want done in area?	• RRC wants joint company/government/RRC joint wildlife management in area • Want to have key habitats identified and control measures in place • RRC concern with increased access to area • Westmin committed to participate in wildlife global approach lead by RRC • Westmin could support this with money
• Traditional ecological knowledge (TEK) – oral history – use for specific problems questionable. • Should try to work with RRC to define valued ecosystem component to help use oral history.	• Oral history to be owned by RRC; • Westmin wants to protect heritage resources.

• Use of TEK for other areas – wildlife, etc?	• Use for mitigation program, etc. • TEK document and use for RRC history • Plan to integrate TEK with baseline study • Wildlife information “confidential” • Westmin to respect RRC wishes for confidentiality.

Issue	Response
Land Use • Documenting trapline, outfitter, and recreation use in area.	• Planning to use KZK model • Dorothy Dick did Cominco land use will address.
• Document non traditional use of area? Could also use YTG – hunter survey.	• K. Kiemele passed along existing land use in area – trails/use etc. will be used. • Non-native stakeholder – Westmin still trying to address plan for this.
• Guide operating in area. Recreational use of area.	• Discussed with YTG/Lands Resources.

Issue	Response
Liard First Nation • Why is Liard First Nation not involved?	• RRC letter saying they speak for Kaska Dena. • Contact Liard Band – 3 Liard bands. Should contact each band group.
• Liard First Nation needs to be brought in as Liard First Nation traditional area. • DIAND Environment has map of traditional area.	
• Wolverine Lake outside RRC trapping area – will be private trap line.	• Acknowledge
• Make sure covering all RRC interests in area and land.	• Meeting with Chief in June • Westmin to contact Liard First Nation as well. • RRC Contact: N. Sterriah/George Smith
• DIAND Environment discussion with RRC that in IEE regional land use can’t be considered	• Westmin position – timeline important; Wolverine deposit in area of RRC. Need to focus on deposit area.

Issue	Response
Project • Results of drilling in?	• Expect Sept. 1996 – decision on drilling number of tonnes/ resources. • Use results to make decision on project. • Limnological study to be done; • Vegetation studies – add roots to survey for containment testing. • Vegetation RRC wildlife use – ensure contaminates testing for key plants (roots/leaves/twigs)
• Report on contaminants in vegetation in Yukon. See M. Gamberg or M. Palmer DIAND for copy of report.	• Acknowledge

Issue	Response
Cumulative Effects • Cumulative effects: ensure considered in baseline thinking. • Must consider Cominco in cumulative impacts. • Address Westmin's operation/mitigation for impact, then minimize cumulative impacts.	• Will consider Cominco KZK in cumulative effects. • Consider phased approach – operational, exploration – impacts added to Westmin's cumulative effects. • Cumulative impacts must be looked for CEAA (projects status in area to be looked at)
• Ownership could be tied to anyone – monitoring may have to be shared. • If cumulative effects are outside of area, then have to be addressed. • Wildlife key area in cumulative effects - company policy important in this area.	• Acknowledge

June 28, 1996
YTG Renewable Resources Meeting
Transport Canada Boardroom

Attendees:

D. Mchaina, Westmin, D. Cornett, Access Mining Consultants Ltd.,
YTG: Rick Ward, Val Lorin, Ken Kiemele, Jean Carey, Rob Florkowicz, Rick Farnel, Manfred Hoefs, Bruce McLean, Kelvin Leary

Issue	**Response**
Wildlife • Focus of March Survey?	 • General reconnaissance for caribou and moose

Issue	**Response**
Project • Drills rigs – chopper moved?	 • Access by trail
• Number of drill holes?	• 30 holes 1996 and 1995 • Problems with drilling this year (slow) • Water problems/access
• Project decision date? • How long to get through process?	• Sept/Oct target date – submit project overview • Revise baseline biophysical
• Did Westmin discuss with M. Crombie (DIAND Environment)?	• Discussion planned with DIAND
• Any permits required?	• Land use – expires Oct/95 • YWA notification • Bulk sample – planned – this will require permit for bulk sample • Want to have preliminary understanding for overview.
• Access required for project?	• Access for bulk sample needed – two routes – East Creek via KZK road and Money Creek • Access being looked at for baseline studies

• Comments are global in nature • When specific details are in regarding project, YTG will provide more comments	• Westmin trying global approach (baseline studies such as wildlife/ fish/hydrology); • Approach global – get more specific when details of project are known. • Baseline document to be revised with more specific information – project related; • Ross River wants a global approach to study of area; • Westmin to participate in global wildlife – but RRC to spearhead.

Issue	**Response**
Wildlife Survey • Rob Florkiewicz heading up program for YTG. • YTG looking for corporate participation.	• Need well defined Terms of Reference • This needs to be defined before Westmin supports.
• YTG Management support different than RERC • YTG welcomes Westmin support.	• Westmin supports, but must still meet CEAA requirements.
• Management planning project – Westmin not obligated to participate, but will be a positive thing for company; • Voluntary, specific to wildlife management; • Company involvement in wildlife survey is important.	• Need to keep processes separate; • RRC wants it together; • Need to keep separate
• Management process is YTG process; • Voluntary, welcome Westmin support	• Public hearing for water licence still could be stalled.
• YTG to make clear to RRC that CEAA process and management processes are separate and voluntary, and not linked to issuance of regulatory permits.	
• Terms of Reference for wildlife program being developed. • Circulate draft for comments.	• December meeting with YTG/RRC/Westmin planned. • Are Terms of Reference developed? • Westmin support and needs to see this going.

• Not just wildlife issue with project, Fish and Game, YCS, all stakeholders; • Expect difficulty with review, but find ways to resolve issue. • "do 1990's mining" • can protect Finlayson herd; • Can help with regulatory process • Early consensus on process and project • Benefit to company	• As long as separate, Westmin comfortable.
• Overview of Finlayson Herd provided. • YTG also doing moose survey • YTG comfortable building network of data – Westmin assisting with data collection survey is adequate; • Good to share data and management – leads up to cooperate to plan and address mitigation.	• Westmin to cooperate and share data.
• Exploration – has caused some strain on caribou; less calves in area; displaced cows to lower elevations; • Want to plan ahead to address cumulative effects – good mitigation needed. • Some individual surveys may be needed later. • Post calving survey is on. • YTG assessment of information – is available to Westmin for wildlife report write up	• Westmin to obtain YTG data on caribou survey.

Issue	Response
Cumulative Effects • YTG does agree that this is a potential problem • Take into consideration Cominco's project as well	• Cominco could be hypothetical mine (not existing impact if no mine)
• Include development that exists as potential cumulative effect. • Cumulative impacts must be addressed; • Cominco could be asked to reevaluate impacts; • Need to address Cumulative Effects for whole area.	• If mine – need monitoring to assess prediction for impact.

• Don't expect significant work to address cumulative impacts. What will be required is analysis.	• Westmin to address in EA submissions.

Issue	Response
Fall Survey • Fall survey planned; • Surveys conducted in 1987, 1991 in area west and north of Wolverine Lake. • Information available to Westmin; • YTG could extend study into Westmin project area.	• Westmin agreeable, need to know cost for joint participation.
• 3rd party could be a problem for YTG	

Issue	Response
Moose Survey • Extend area for Westmin moose survey planned for November. • Discuss with YTG re: fall program • Possible concern – seasonal movement if moose in the drainage area • Significance of movement? Impacts? • Expect moose to move out of area in response to snow • Technique to address – YTG open to discussion	Westmin has had land discussion with RRC re: TEK

Issue	Response
Traditional Ecological Knowledge • Cominco did extensive Traditional Ecological Knowledge (TEK) study with elders • Elder – TEK survey to address moose movement • Still need to verify scientific	
• Need to be specific about questions for TEK to fill data gaps.	• Protocols for TEK and Methodology

• James Allen – CAFN – may have TEK methods.	• Possible use of wildlife management committee for TEK
• Topo – terrain maps, vegetation maps – help to pinpoint TEK • YTG has some mapping information available	• Protocols for TEK and Methodology

Northern Affairs Program
Exploration and Geological Services
#345 -300 Main Street
Whitehorse, YT   Y1A 2B5
Phone: (403)667-3828 Fax: (403)667-3198
e-mail Hcopland@hypertech.yk.ca

07 June 1996

David Mchaina, P.Eng.
Westmin Resources Limited
#904-1055 Dunsmuir Street
P.O. Box 49066, The Bentall Centre
Vancouver, BC   V7X 1C4

Dear Sir:

RE: Wolverine Lake - Proposed Baseline Biophysical Surveys

I am in receipt of your Preliminary Baseline Biophysical Survey dated June 3, 1996. The package was originally destined for Diane Emond in our office but she will be on leave until the middle of September and I will be handling her duties until then. It is good to have this early consultation with companies in order that information requirements down the line are facilitated. Our department's main environmental assessment responsibilities are surficial geology and terrain hazards including permafrost and seismic, as well as mine geology as it relates to Acid Rock Drainage.

Your proposed surficial geology program looks good. We use this information in order to determine the physical stability of foundation materials for tailings dams, buildings, waste dumps, etc., as well as how the surficial materials relate to the hydrogeological characteristics of the region. Proponents in the past have failed to recognize the importance of spatially and physically characterizing permafrost in their project area. Although a survey at 1:30,000 scale is acceptable for the general area, once some indication of where mine facilities will be located, more detailed surficial studies may be necessary in these areas. An indication of the area in which the 1996 surficial mapping is to be conducted would be useful.

With respect to the ARD program there is some overlap in responsibilities with Environment Canada and DIAND Water Resources. We tend to concentrate on determining if the rock types in the area have been adequately characterized by the ARD studies. The ultimate goal of an ARD program is to ensure that once mining commences that waste can be quickly and accurately characterized and disposed of in the appropriate way. The staged approach and the identification of surrogate parameters you have suggested will go a long way in satisfying this requirement.
An early characterization of the ARD potential of the various units in the exploration stage is critical to the success of any program. Suites of samples should be selected on the basis of lithology, alteration, and sulphide mineralization. A complete petrographic study of the samples sent for testing is frequently overlooked in the early stages, but is very important in accurately characterizing the material. The number of samples necessary to give a good statistical representation of the deposit usually comes under close scrutiny. This can not be determined until some idea of the complexity and consistency of the various units can be ascertained. Working closely on this matter should avoid any conflicts or delays down the line.

Some specific points regarding your proposed program: I would be hesitant of compositing over too large an interval in the early stages. General recommendations are for sample intervals of not greater than 1.5 metres unless the variations in the rock over larger intervals can be demonstrated not to be a problem. The criteria for which samples will undergo kinetic testing should be clearly spelled out. It appears from Table 2 that samples with NP:AP ratios >1 will undergo kinetic testing? Environment Canada has in the past preferred that ABA testing be done using modified acid-base accounting procedures with the inclusion of a fizz test. We concur with the more conservative values that these tests usually give. More details can be obtained from Benoit Godin at Environment Canada.

Dan Cornett has tentatively scheduled a meeting with us on June 28. We look forward to meeting with you and discussing your program further at that time.

Sincerely,

Hugh Copland, P. Geo.
Environmental Geologist

Environmental Protection
Mile 917.6 Alaska Highway
Building B,
Whitehorse, Yukon
Y1A 5X7

June 17, 1996 RERC - 71

Mr. David Mchaina
Westmin Resources Ltd.
Suite 904, 1055 Dunsmuir Street,
P.O. Box 49066, The Bentall Centre,
Vancouver, B.C.
V7X 1C4

Dear Mr. Mchaina:

Re: Wolverine Lake Project - Preliminary Baseline Biophysical Survey

Thank you for consulting with our organization for your preliminary baseline study. We have reviewed the document and have the following comments:

The company indicated the current restrictions of the survey are due to the lack of definition of the Wolverine project. The baseline study should, however, assess the biophysical characteristics of all potential mine site components such as roads, tailings ponds, milling sites, waste rock locations, diversions, etc. As indicated, the program will require revisions in light of the 1996 data and a better understanding of the project mining components.

Geochemical Characterization
Section 3.2.1.3.1 Sample collection: The drillholes are usually performed based on a mineral target. Environmental concerns usually originate from waste material. There is an indication of using samples 20 to 30 meters away form the ore

outline. Would these samples be within what may be reported in a waste rock pile from either an underground or open pit extracting method? Would these samples be within the fracture zones of the footwall or hanging wall?

Results from the sequential testing program will be used to select samples for the next testing program. Will the establishment of variability of key chemical stability parameters (e.g. metal concentration, ABA) be the driving force for the next set of samples?

Detailed stratigrafic characterization will be established by the project geologist. How will the “geological variation” be defined? What parameter will be used and what variability criteria will be verified?

Kinetic testing will involve the exposure to fixed wet/dry cycles to simulate the process of oxidation in the natural environment. Although the standard procedures account for a weekly 3 day dry followed by a 3 day humid air and on the 7 th day with flushing with 500 ml of distilled water, these conditions rarely reflect natural conditions. We are concerned that in Yukon conditions, the waste rock material may be exposed to some moist periods (freshet/ rain fall).The waste to precipitation ratio will be completely different and distributed differently during the year. We suspect that the predictions and management of the leachates may be substantially different using schedules reflecting natural conditions than the arbitrary schedule generally used to accommodate laboratory staff schedules. With the current knowledge of the science it is difficult to predict the effects such test variation may have on the Wolverine material without actually performing a comparative study.

Table 2 indicated the type of tests to be performed on the Wolverine material. The preliminary number of samples are indicated for the footwall and hanging wall. Do these numbers include the variation from a stratigraphic or rock unit component?

Section 3.3 Climate monitoring. Will the preliminary information also include the wind direction and speed as part of the program?

Section 3.4.2 Water Quality . Will the “Wolverine Lake Property Surface Water and Stream Sediment Analysis: 1995, Report No. 9503” be available?

Section 3.4.2.6 Wolverine Limnological Study. There are no indications of water quality profile in addition to the water quality sampling. In fact, we argue that the profile is required prior to the sampling in order to properly allocate the sample through the water column. Epilimion, thermocline and hypolimnion water strata may have different water quality characteristics which should be documented to establish the baseline conditions. The lake water profile should include temperature, oxygen, pH and conductivity. We suggest water quality be collected 1 meter below the water surface, 1 meter above and below the thermocline, and 1 meter above the lake bottom.

Analysis regarding productivity (chlorophyll, PO4, TOC) should also include measurement of water transparency. Secci disk measurement is probably the easiest method.

Water quality parameters should include DOC in addition to TOC since it is the proper analysis for metal speciation work. That parameter could be included in key routine water quality site. It may help in the interpretation of metal-ligans interactions.

Section 3.4.3 Stream Sediments
The sediments samples should always be collected from the wetted portion of the stream, rather than from the stream bank. Consideration to prevent the fines from being washed away must be given. We have found that a clear acrylic plastic tube works well enough. We suggest the analysis of metal content be performed on the fraction <63 um rather than 150 um since it contains the greatest surface area/volume ratio. The establishment of metal content of the fine particle size allows the earlier detection of contamination through surface adsorption. Geological baseline metal concentrations can be established through the analysis of particle size between the interval of 10 mesh and 20 mesh [1-2 mm].

Long term storage of archive sediment material should be done on dried and sieved samples. Short term storage (< 3 months) can be done on fresh sediments in cold temperatures. Freezing of the sediment material is not recommended.

Lake sediment samples should be collected based on the evaluation of the bathymetry map where it can be determined based on the slope and topography of the terrain if the sediments collected are within an accumulation zone.

Section 3.4.5.3 Proposed Fisheries studies. We suggest thatconservation of the stomachs of sacrificed fish for analysis of food sources be done..

Should you have any questions, please do not hesitate to contact me at (403) 667-3402.

Yours truly,

Benoit Godin, Head
Environmental Contaminants

cc : Len Mychasiw - DIAND

Appendix 5B

Minutes of Consultation Meetings – Finlayson Project, October 2000

MEMORANDUM

To:	Justin Himmelright, Expatriate Resources	Date:	November 14, 2000
From:	Steve Morison/Don McCallum, Gartner Lee Limited	Ref:	GLL 20-918-9
Subject:	Expatriate Meetings with Yukon/Federal Regulators – Meeting Notes		

Expatriate Resources, represented by Dr. Harlan Meade (CEO) and Mr. Justin Himmleright conducted a series of meetings on October 17/18, 2000 with various Yukon and federal regulatory agencies concerning the Finlayson Project. As requested, Gartner Lee have summarized notes from these meetings and they are attached to this memo for your review.

The following three meetings were conducted during this time:

October 17, 2000 0900 – 1030 YTG Renewable Resources
October 17, 2000 1330 – 1500 DIAND – Whitehorse
October 18, 2000 1500 – 1630 DFO/DOE – Whitehorse

Don't hesitate to call me if you have any questions regarding the attached notes assembled from these meetings.

Meeting with
YTG Renewable Resources

Expatriate Resources Ltd.
Finlayson Project
Meeting Minutes

Meeting with
YTG Renewable Resources,
#10 Burns Road, Whitehorse

October 17, 2000
9:00 – 10:30 a.m.

Attendees:

Justin Himmelright (Expatriate Resources)	Harlan Meade (Expatriate Resources)
Jon Bowen, YTG, Renewable Resources, Manager, Environmental Assessment	Morris George, Renewable Resources, Environmental Assessment
Jan Adamczewski, Renewable Resources, Regional Biologist – Liard Region	
Steve Morison, Gartner Lee Limited	Don McCallum, Gartner Lee Limited

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H. Meade, President of Expatriate Resources, began the meeting with a brief introduction to his company and the Finlayson Project before introducing J. Himmelright, Manager of Environment for Expatriate Resources.

J. Himmelright provided a brief overview of Expatriate Resources and their management team before providing details regarding Expatriate's plans for developing the Finlayson project. He explained that the Finlayson project will incorporate production from both the Kudz Ze Kayah (KZK) and Wolverine deposits. The anticipated Environmental Assessment (EA) and permitting requirements were reviewed. While a screening EA report has previously been completed for developing the KZK deposit (by Cominco Ltd.) it is assumed that the combined KZK/Wolverine project will require a Comprehensive Study Report under CEAA legislation. A schedule outlining Expatriate's plans for bringing this project to production stage was reviewed. Estimates of the anticipated time required to facilitate EA and permitting activities were reviewed in some detail.

Questions and Discussion

1. What are the lengths of the 2 road alternatives being considered for connecting the mine sites?
   - The "north" alternative would be approximately 30 km long while the "south" alternative would be approximately 50 km long.

2. Are there any permafrost issues assoociated with this project ?

3. Where is the camp location at Wolverine ? Is it away from the lake ?

4.What quantities of water are required for mine production and where will it be obtained?

5. What is the expected mine life of the Wolverine deposit?

6. What are the issues associated with selenium? Where and in what form is it emitted?

- Selenium tends to occur at relatively high levels in rock mineralization in the Finlayson area. The concerns associated with selenium are both environmental and metallurgical in nature. Selenium in high concentrations can be toxic to aquatic life. It was noted that surface water in this area has relatively high, natural selenium levels, yet appears to support broad and diverse aquatic life. Selenium in ore concentrate can create difficulties within the smelting process. Test runs indicate that the ore concentrate from the combined KZK/Wolverine operations can be accommodated in smelting operations. Sources of selenium in mine operations will include ore concentrate, waste rock, and tailings.

7. If/when funding partners are brought into this project with Expatriate Resources, how will this affect the permitting process and environmental liabilities?
   - It will not be affected.

8. YTG Comment: It would be preferable, from an environmental impact perspective, to avoid building two separate roads connecting mine sites (1 for exploration and 1 for production) if possible.

9. Do you have any concerns with using the Robert Campbell Highway for a transportation corridor?
   - It is the preferred route but will require upgrading.

10. YTG Comment: Access control to the mine roads will be a significant wildlife-related issue.

11. Is there a need to modify the wildlife agreement in the area?

Meeting with
DIAND - Whitehorse

Expatriate Resources Ltd.
Finlayson Project
Meeting Minutes

Meeting with
DIAND - Whitehorse

Meeting Location:
Suite B – 206 Lowe Street (Gartner Lee Limited Office)

October 17, 2000
1:30 – 3:00 p.m.

Attendees:

Justin Himmelright (Expatriate Resources)	Harlan Meade (Expatriate Resources)
Ian Church (DIAND, Director, Environment)	Bob Holmes (DIAND, Director, Mineral Resources)
Kevin McDonnell (DIAND, Environment)	Mark Zrum (DIAND, Regional Manager, Land Resources)
Hugh Copland (DIAND, Mining Land Use)	Dave Jennings (DIAND, Regional Manager, Mining Land Use)
Steve Morison, Gartner Lee Limited	Don McCallum, Gartner Lee Limited

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Questions and Discussion

1. Does Cominco currently own the KZK water license?
   - They do, however, it will be assigned to Expatriate Resources within a couple of weeks.

2. Are other permits required, ie. use of explosives, Navigable Waters Protection Act, Fisheries Act, and will other federal departments be Responsible Authorities (R.A's)?
   - DIAND will clearly be the *lead* RA on this project while other federal departments such as DFO will participate in the assessment process as RAs. Expatriate will be looking into the need for permitting related to use of explosives.

Meeting with
DIAND - Whitehorse

3. Was the federal government involved in designing the baseline environmental program for the two sites?
   - Yes and a record of consultation will be provided for DIAND.

4. DIAND Comment: Expatriate Resources, as the project proponent, should talk with the CEAA agency (Paul Scott) as soon as possible.

5. DIAND Comment: The timelines included in the "Blue Book" are directly applicable for screening studies and not for Comprehensive Study Reports.

6. Expatriate Comment: Expatriate will circulate the proposed timelines (reviewed at this meeting) to meeting participants.

7. Have the proposed timelines been reviewed with the Water Board?
   - No.

8. DIAND Comment: Proponent should attempt to have both the Quartz license and the Water license approved by the Minister at the same time.

9. What will be the format of the Project Description?
   - The format will follow the guidelines outlined in the Draft Guidelines for Major Mining Projects

10. DIAND Comment: This presentation by Expatriate Resources should be repeated at the next meeting of the Regional Environmental Review Committee (RERC) on November 22, 2000.

11. DIAND Comment: The proposed timeline appears to be very aggressive.

12. Expatriate Comment: Expatriate will circulate the Newcrest investment report of this project to Bob Holmes (DIAND).

13. DIAND Comment: The requirements for a CSR may change with the next version of the federal environmental assessment legislation (5-year review).

14. DIAND Comment: The proponent should not count on obtaining a Project Agreement since there will be multiple RAs associated with this review.

15. Have MLU permits been obtained for next years advanced exploration drilling program?

16. Is Expatriate planning any permit amendments for roads in the near future?

17. DIAND Comment: There is need to include the 2001 bulk sampling into the operating plan.

18. DIAND Comment: Kevin McDonnell will be the DIAND Project Manager if he is available at the time.

19. DIAND Comment: The EA guidelines for mining projects are still in draft format.

20. DIAND Comment: The proponent should feel free to consult non-First Nations communities potentially affected by this development.

Meeting with
DIAND - Whitehorse

21. What kind of infrastructure requirements are associated with this project?
    - Upgrading to the Robert Campbell Highway will be required (YTG is aware of this).

Meeting with
DFO/DoE/ DIAND (Water Resources) - Whitehorse

Expatriate Resources Ltd.
Finlayson Project
Meeting Minutes

Meeting with
DFO, DOE, DIAND (Water Resources)

Meeting Location:
91782 Alaska Highway

October 18, 2000
3:00 – 4:30 p.m.

Attendees:

Justin Himmelright (Expatriate Resources)	Harlan Meade (Expatriate Resources)
George Mackenzie-Grieve (DoE, Manager, Environmental Protection)	Bill Slater (DIAND, Water Resources)
Eric Soprovich (DoE, Environmental Prot.)	Benoit Godin (DoE, Environmental Prot.)
Vic Enns (DoE, Environmental Protection)	Byron Nutton (DFO)
Steve Morison, Gartner Lee Limited	Don McCallum, Gartner Lee Limited

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Questions and Discussion

1. Expatriate Comment: Expatriate will circulate the proposed timelines (reviewed at this meeting) to meeting participants.

2. Why doesn't Expatriate proceed immediately with development of the KZK site since approvals already in place?
   - The development of both deposits (KZK and Wolverine) are required to secure project financing.

3. How firm is the delivery dates of concentrates ?

4. Has Expatriate provided security for the transfer of the KZK water license?

5. Will proposed underground development at KZK preclude returning waste rock into the pit?

- No. It is planned that access to the underground will occur from outside the pit.

6. Will Expatriate be examining operational procedures that will reduce bonding requirements?
   - Yes, Expatriate will be employing progressive reclamation throughout mine production which should be linked to bonding requirements and liability for the permitting of the Finlayson Project.

7. What are the terrain concerns of the "north" connecting road option and has there been geotechnical work completed ? Wildlife habitat may be the key issue for the development of new roads.
   - Permafrost is a key issue.

8. Will the planned connection of the exploration roads at the KZK and Wolverine sites occur along the "north" or the "south" route?
   - North route.

9. Has Expatriate looked at the expected water quality of the milling/flotation process?
   - Yes, Expatriate is currently examining this issue.

10. Has Expatriate reviewed the required mitigation measures outlined in the KZK EA report?
    - Yes.

11. Has Expatriate contracted anyone for the detailed engineering design?
    - No, that will follow the pre-feasibility report, which will be completed in early 2001.

12. DIAND Comment: As a result of several recent court cases involving EAs, some issues considered in the previous EA for the KZK site may need to be re-examined.