HEMMERA ENVIROCHEM INC.
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Date Received: 28-OCT-16
Report Date: 07-DEC-16 16:57 (MT)
Version: FINAL REV. 3

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1850525

Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.21
C of C Numbers:
Legal Site Desc:

Comments:

7-DEC-2016 This report replaces the previous version and contains to certain samples Sampling Dates/Times.

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1850525-1 WATER 25-OCT-16 12:40 E7	L1850525-2 WATER TRAVEL BLANK	L1850525-3 WATER 25-OCT-16 12:40 DUP2	L1850525-4 WATER 25-OCT-16 11:30 E4	L1850525-5 WATER 24-OCT-16 11:10 E3
WATER						
Physical Tests	Conductivity (uS/cm)	1140	<2.0	1130	1200	950
	Hardness (as CaCO3) (mg/L)	644	<0.50 HTC	642	696	589
	pH (pH)	7.98	5.48	8.00	7.93	8.24
	Total Suspended Solids (mg/L)	<3.0	<3.0	3.0	<3.0	6.3
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0366	<0.0050	0.0378	0.0313	0.0133
	Nitrate (as N) (mg/L)	0.138	<0.0050	0.146	0.199	0.535
	Nitrite (as N) (mg/L)	<0.0050 DLDS	<0.0010	<0.0050 DLDS	<0.0050 DLDS	<0.0050 DLDS
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	0.0030	0.0093
	Sulfate (SO4) (mg/L)	409	<0.30	426	484	332
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	11.4		11.4	10.9	11.4
Total Metals	Aluminum (Al)-Total (mg/L)	0.0362	<0.0030	0.0368	0.0219	0.126
	Antimony (Sb)-Total (mg/L)	0.00041	<0.00010	0.00044	0.00055	0.00158
	Arsenic (As)-Total (mg/L)	0.00110	<0.00010	0.00109	0.00147	0.00171
	Barium (Ba)-Total (mg/L)	0.0811	<0.000050	0.0807	0.0638	0.0929
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.070	<0.010	0.072	0.104	0.168
	Cadmium (Cd)-Total (mg/L)	0.000106	<0.0000050	0.000112	0.0000956	0.0000475
	Calcium (Ca)-Total (mg/L)	119	<0.050	122	118	95.6
	Chromium (Cr)-Total (mg/L)	0.00070	<0.00010	0.00072	0.00084	0.00242
	Cobalt (Co)-Total (mg/L)	0.00192	<0.00010	0.00192	0.00181	0.00038
	Copper (Cu)-Total (mg/L)	0.00149	<0.00050	0.00152	0.00133	0.00183
	Iron (Fe)-Total (mg/L)	0.411	<0.010	0.417	0.452	0.289
	Lead (Pb)-Total (mg/L)	0.000096	<0.000050	0.000062	0.000056	0.000142
	Lithium (Li)-Total (mg/L)	0.0222	<0.0010	0.0228	0.0284	0.0067
	Magnesium (Mg)-Total (mg/L)	86.0	<0.10	85.3	95.2	77.5
	Manganese (Mn)-Total (mg/L)	0.730	<0.00010	0.734	0.326	0.130
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00170	<0.000050	0.00178	0.00190	0.00159
	Nickel (Ni)-Total (mg/L)	0.0275	<0.00050	0.0273	0.0311	0.0132
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	1.37	<0.10	1.38	1.45	1.16
	Selenium (Se)-Total (mg/L)	0.00119	<0.000050	0.00118	0.00148	0.00147
	Silicon (Si)-Total (mg/L)	5.96	<0.050	6.11	5.97	7.02
	Silver (Ag)-Total (mg/L)	0.000033	<0.000010	0.000032	0.000018	0.000018
	Sodium (Na)-Total (mg/L)	8.01	<0.050	8.08	8.94	7.99

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1850525-6 WATER 24-OCT-16 11:45 E2	L1850525-8 WATER 24-OCT-16 12:10 GWCC-5	L1850525-9 WATER 24-OCT-16 14:40 R11	L1850525-10 WATER 24-OCT-16 17:45 E8	L1850525-11 WATER 24-OCT-16 16:45 R4
WATER						
Physical Tests	Conductivity (uS/cm)	1150	916	595	435	878
	Hardness (as CaCO3) (mg/L)	658	511	302	210	496
	pH (pH)	8.18	7.97	7.93	8.04	8.14
	Total Suspended Solids (mg/L)	<3.0	<3.0	15.2	7.3	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0254	<0.0050	0.0083	0.0068	0.0362
	Nitrate (as N) (mg/L)	0.182	0.027	0.215	0.228	0.160
	Nitrite (as N) (mg/L)	<0.0050 DLDS	<0.0050 DLDS	<0.0010	<0.0010	<0.0050 DLDS
	Phosphorus (P)-Total (mg/L)	<0.0020	0.012	0.0047	0.0046	<0.0020
	Sulfate (SO4) (mg/L)	491	331	182	112	304
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	13.0	8.24	10.1	10.9	9.47
Total Metals	Aluminum (Al)-Total (mg/L)	0.0146	<0.0030	0.178	0.166	0.0119
	Antimony (Sb)-Total (mg/L)	0.00053	0.00055	0.00015	0.00015	0.00043
	Arsenic (As)-Total (mg/L)	0.00156	0.00057	0.00048	0.00050	0.00334
	Barium (Ba)-Total (mg/L)	0.0562	0.0469	0.0994	0.0690	0.114
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.082	0.026	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000848	0.000125	0.0000573	0.0000457	0.000198
	Calcium (Ca)-Total (mg/L)	116	123	70.7	53.7	115
	Chromium (Cr)-Total (mg/L)	0.00109	0.00045	0.00067	0.00040	0.00027
	Cobalt (Co)-Total (mg/L)	0.00130	<0.00010	0.00031	0.00090	0.00284
	Copper (Cu)-Total (mg/L)	0.00147	0.00093	0.00179	0.00309	0.00135
	Iron (Fe)-Total (mg/L)	0.542	0.026	0.293	0.360	0.078
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000144	0.000060	<0.000050
	Lithium (Li)-Total (mg/L)	0.0231	0.0083	<0.0010	0.0062	0.0040
	Magnesium (Mg)-Total (mg/L)	92.4	49.5	32.1	18.8	50.9
	Manganese (Mn)-Total (mg/L)	0.214	0.00276	0.0740	0.0561	0.330
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00204	0.00176	0.000835	0.000593	0.00148
	Nickel (Ni)-Total (mg/L)	0.0289	0.0223	0.00248	0.00499	0.0177
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	1.33	0.94	0.50	1.50	0.69
	Selenium (Se)-Total (mg/L)	0.00195	0.00500	0.00123	0.000461	0.00283
	Silicon (Si)-Total (mg/L)	5.63	4.82	7.18	6.14	5.98
	Silver (Ag)-Total (mg/L)	0.000013	<0.000010	0.000010	0.000066	<0.000010
	Sodium (Na)-Total (mg/L)	7.33	4.10	8.07	6.93	6.39

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1850525-1 WATER 25-OCT-16 12:40 E7	L1850525-2 WATER TRAVEL BLANK	L1850525-3 WATER 25-OCT-16 12:40 DUP2	L1850525-4 WATER 25-OCT-16 11:30 E4	L1850525-5 WATER 24-OCT-16 11:10 E3
WATER						
Total Metals	Strontium (Sr)-Total (mg/L)	0.786	<0.00020	0.803	0.857	0.537
	Sulfur (S)-Total (mg/L)	150	<0.50	152	168	124
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	0.000016	0.000017	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00136	<0.00030	0.00130	0.00073	0.00368
	Uranium (U)-Total (mg/L)	0.00406	<0.000010	0.00404	0.00381	0.00361
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00086
	Zinc (Zn)-Total (mg/L)	0.0048	<0.0030	0.0072	0.0039	0.0058
	Zirconium (Zr)-Total (mg/L)	0.00176	<0.00030	0.00181	0.00171	0.00051
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD		FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD		FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0052		0.0055	0.0092	0.0110
	Antimony (Sb)-Dissolved (mg/L)	0.00039		0.00037	0.00058	0.00162
	Arsenic (As)-Dissolved (mg/L)	0.00074		0.00076	0.00123	0.00165
	Barium (Ba)-Dissolved (mg/L)	0.0783		0.0781	0.0656	0.0953
	Beryllium (Be)-Dissolved (mg/L)	<0.000020		<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050		<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.068		0.068	0.102	0.173
	Cadmium (Cd)-Dissolved (mg/L)	0.000107		0.0000967	0.0000773	0.0000375
	Calcium (Ca)-Dissolved (mg/L)	119		120	121	98.2
	Chromium (Cr)-Dissolved (mg/L)	0.00039		0.00040	0.00056	0.00099
	Cobalt (Co)-Dissolved (mg/L)	0.00181		0.00181	0.00175	0.00024
	Copper (Cu)-Dissolved (mg/L)	0.00131		0.00132	0.00136	0.00145
	Iron (Fe)-Dissolved (mg/L)	0.136		0.134	0.261	0.050
	Lead (Pb)-Dissolved (mg/L)	<0.000050		<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0221		0.0224	0.0291	0.0068
	Magnesium (Mg)-Dissolved (mg/L)	84.1		83.3	95.7	83.5
	Manganese (Mn)-Dissolved (mg/L)	0.714		0.706	0.327	0.122
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050		<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00160		0.00160	0.00186	0.00149
	Nickel (Ni)-Dissolved (mg/L)	0.0262		0.0262	0.0310	0.0111
	Phosphorus (P)-Dissolved (mg/L)	<0.050		<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.33		1.33	1.46	1.13
	Selenium (Se)-Dissolved (mg/L)	0.00112		0.00119	0.00156	0.00167
	Silicon (Si)-Dissolved (mg/L)	5.84		6.01	6.08	7.34
	Silver (Ag)-Dissolved (mg/L)	<0.000010		<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	7.87		8.00	9.00	7.81

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1850525-6 WATER 24-OCT-16 11:45 E2	L1850525-8 WATER 24-OCT-16 12:10 GWCC-5	L1850525-9 WATER 24-OCT-16 14:40 R11	L1850525-10 WATER 24-OCT-16 17:45 E8	L1850525-11 WATER 24-OCT-16 16:45 R4
WATER						
Total Metals	Strontium (Sr)-Total (mg/L)	0.790	0.682	0.350	0.303	0.632
	Sulfur (S)-Total (mg/L)	174	112	65.6	40.1	107
	Thallium (Tl)-Total (mg/L)	0.000031	0.000016	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00035	<0.00030	0.00434	0.00228	0.00041
	Uranium (U)-Total (mg/L)	0.00338	0.00259	0.00169	0.00214	0.00574
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	0.00077	0.00069	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0044	<0.0030	0.0032	0.0088	0.0085
	Zirconium (Zr)-Total (mg/L)	0.00056	<0.00030	0.00059	0.00055	0.00077
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0088	0.0020	0.0166	0.0595	0.0057
	Antimony (Sb)-Dissolved (mg/L)	0.00050	0.00054	0.00012	0.00014	0.00042
	Arsenic (As)-Dissolved (mg/L)	0.00148	0.00054	0.00033	0.00046	0.00336
	Barium (Ba)-Dissolved (mg/L)	0.0558	0.0474	0.0940	0.0682	0.117
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.078	0.024	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000835	0.000104	0.0000421	0.0000395	0.000200
	Calcium (Ca)-Dissolved (mg/L)	115	123	69.9	53.2	114
	Chromium (Cr)-Dissolved (mg/L)	0.00110	0.00046	0.00037	0.00026	0.00024
	Cobalt (Co)-Dissolved (mg/L)	0.00127	<0.00010	0.00022	0.00087	0.00283
	Copper (Cu)-Dissolved (mg/L)	0.00147	0.00089	0.00140	0.00295	0.00141
	Iron (Fe)-Dissolved (mg/L)	0.462	0.029	0.068	0.203	0.062
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0230	0.0082	<0.0010	0.0061	0.0038
	Magnesium (Mg)-Dissolved (mg/L)	90.3	49.7	31.0	18.7	51.3
	Manganese (Mn)-Dissolved (mg/L)	0.206	0.00293	0.0670	0.0529	0.330
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00197	0.00161	0.000714	0.000540	0.00132
	Nickel (Ni)-Dissolved (mg/L)	0.0282	0.0223	0.00203	0.00481	0.0180
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.30	0.95	0.47	1.49	0.69
	Selenium (Se)-Dissolved (mg/L)	0.00196	0.00534	0.00119	0.000415	0.00290
	Silicon (Si)-Dissolved (mg/L)	5.48	4.77	6.69	5.80	5.91
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	7.16	4.09	7.76	6.86	6.38

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1850525-1	L1850525-2	L1850525-3	L1850525-4	L1850525-5
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date	25-OCT-16		25-OCT-16	25-OCT-16	24-OCT-16
Sampled Time	12:40		12:40	11:30	11:10
Client ID	E7	TRAVEL BLANK	DUP2	E4	E3
Grouping / **Analyte**					
WATER					
Dissolved Metals Strontium (Sr)-Dissolved (mg/L)	0.778		0.783	0.866	0.537
Sulfur (S)-Dissolved (mg/L)	146		151	168	132
Thallium (Tl)-Dissolved (mg/L)	<0.000010		<0.000010	0.000018	<0.000010
Tin (Sn)-Dissolved (mg/L)	<0.00010		<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved (mg/L)	<0.00030		<0.00030	<0.00030	0.00032
Uranium (U)-Dissolved (mg/L)	0.00385		0.00379	0.00382	0.00375
Vanadium (V)-Dissolved (mg/L)	<0.00050		<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved (mg/L)	0.0041		0.0043	0.0033	0.0043
Zirconium (Zr)-Dissolved (mg/L)	0.00165		0.00166	0.00168	0.00042
Speciated Metals Chromium (III)-Dissolved (mg/L)					0.00099
Chromium (III)-Total (mg/L)					0.00242
Hexavalent Chromium (mg/L)					<0.0010
Hexavalent Chromium-Dissolved (mg/L)					<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1850525-6	L1850525-8	L1850525-9	L1850525-10	L1850525-11
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date	24-OCT-16	24-OCT-16	24-OCT-16	24-OCT-16	24-OCT-16
Sampled Time	11:45	12:10	14:40	17:45	16:45
Client ID	E2	GWCC-5	R11	E8	R4
Grouping / **Analyte**					
WATER					
Dissolved Metals Strontium (Sr)-Dissolved (mg/L)	0.777	0.676	0.342	0.298	0.621
Sulfur (S)-Dissolved (mg/L)	170	109	62.0	38.3	105
Thallium (Tl)-Dissolved (mg/L)	0.000026	0.000015	<0.000010	<0.000010	<0.000010
Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	0.00039	0.00040	<0.00030
Uranium (U)-Dissolved (mg/L)	0.00324	0.00246	0.00157	0.00202	0.00556
Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc (Zn)-Dissolved (mg/L)	0.0026	0.0014	0.0021	0.0069	0.0079
Zirconium (Zr)-Dissolved (mg/L)	0.00052	<0.00030	0.00054	0.00051	0.00076
Speciated Metals Chromium (III)-Dissolved (mg/L)	0.00110				
Chromium (III)-Total (mg/L)	0.00109				
Hexavalent Chromium (mg/L)	<0.0010				
Hexavalent Chromium-Dissolved (mg/L)	<0.0010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Boron (B)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1850525-1, -10, -11, -3, -4, -5, -6, -8, -9
Matrix Spike	Barium (Ba)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9

Reference Information

	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Manganese (Mn)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Sulfur (S)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9
Matrix Spike	Uranium (U)-Total	MS-B	L1850525-1, -10, -11, -2, -3, -4, -5, -6, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CR-CR3-DIS-CALC-ED	Water	Dissolved Trivalent Chromium in Water	CALCULATION

Chromium (III)-Dissolved is calculated as the difference between the dissolved chromium and the dissolved hexavalent chromium (Cr(VI)) results.

CR-CR3-TOT-CALC-ED	Water	Total Trivalent Chromium in Water	CALCULATION

Chromium (III)-Total is calculated as the difference between the total chromium and the hexavalent chromium (Cr(VI)) results.

CR-CR6-ED	Water	Chromium, Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)

This analysis is carried out using procedures adapted from method 3500-Cr C in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1636 published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.
Results are based on an un-filtered, field-preserved sample.

CR6-D-IC-ED	Water	Chromium, Dissolved Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)

This analysis is carried out using procedures adapted from method 3500-Cr C in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1636 published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.
Results are based on a field-filtered, field-preserved sample.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Reference Information

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Contact: Brent Mack
Company: ALS Environmental
Address: 8081 Lougheed HWY, Suite 100
Burnaby, BC V5A1W9

REFERENCE DATA

Project / Location: L1850525
PO Number: L1850525
ALS Work Order: 1611123

TEM Water Narrative: Analysis performed on FEI Tecnai TEM with integrated EDXA capabilities. Morphology, EDXA, and SAED measurements used to determine fiber species. Representative EDXA spectra of each asbestos type detected included. Compliance samples must be received and filtered within 48 hours of collection. Collection is performed outside ALS and is the responsibility of the client. Samples disposed after 60 days. TEM grids archived 3 years. Results apply only to portions analyzed.

TEM Water Methods: "EPA 100.2" refers to drinking water samples filtered on 47mm, 0.22µm pore MCE filters. "EPA 100.1" refers to drinking water samples filtered on 47mm, 0.1µm pore Polycarbonate filters. No standard method for asbestos in nonpotable water exists. All TEM waters (potable and nonpotable) analyzed at >10,000x magnification for asbestos fibers >10µm long. Whenever possible, sufficient volume is analyzed to yield an AS of <0.20 MFL based on the detection of 1 confirmed asbestos fiber in the total area analyzed. However, the volume analyzed is dependent upon a filter loading of <25% particulate. Samples containing excessive suspended solids may not reach the recommended AS of <0.20 MFL. In any case, a minimum of 4 and a maximum of 10 openings are analyzed regardless of the AS reached or asbestos concentration detected. ALS will report results directly to state of origin only when;

a) the Chain of Custody clearly states "drinking water for state compliance",
b) the appropriate state drinking water form is submitted with the samples,
c) the state form is completely filled out by the client prior to submittal, and
d) the address to which the form is to be sent is provided.

NOTES: *NA=Not Applicable, ND=None Detected, AS=Analytical Sensitivity, MFL=Millions of Fibers per Liter. † Act-Tremolite concentrations include Actinolite as well as the Libby Amphiboles; Tremolite, Winchite, & Richterite.*

OH Lab ID: #4077, Ohio Analysts; P. Johnson #2268, A. Sohn #3431

PA Lab ID: #68-01320, Cert. #003

TEM ANALYSIS DATA

EDXA Resolution (eV): <175
Accelerating Voltage (keV): 100
Prep Start Date: 11/3/2016

Calibration Constant (µm/cm): 0.74
Camera Constant (mm-Å): 129.25
Analysis Start Date: 11/10/2016

Pamela Johnson
ALS TEM Analyst

Shawn Smythe
ALS Project Manager

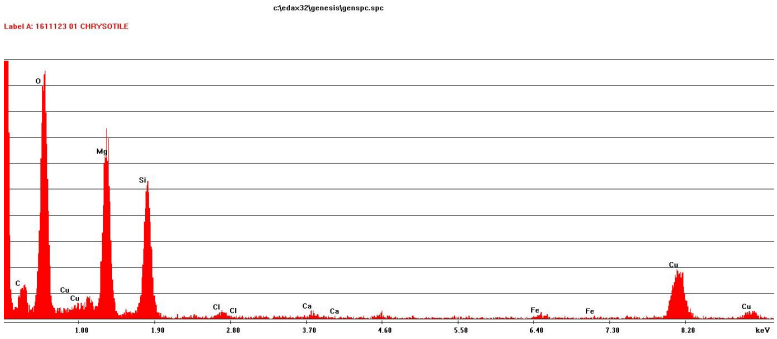
IDENTIFICATION		
Client Sample ID:	L1850525-5 E3	L1850525-7 E2
ALS Sample ID:	1611123-01	1611123-02
Method:	EPA 100.2	EPA 100.2
Date of Collection:	10/24/2016	10/24/2016
Time of Collection:	Not Provided	Not Provided
FILTRATION & ANALYSIS		
Date of Filtration:	11/3/2016	11/3/2016
Time of Filtration:	10:00	10:00
Volume Filtered (L):	0.05	0.05
Openings Analyzed:	4	4
Avg. Opening Area (mm^2):	0.0108	0.0108
AS (MFL):	0.50	0.50
ASBESTOS COUNT		
Chrysotile:	29	16
Amosite:	0	0
Crocidolite:	0	0
Act-Tremolite†:	0	0
Anthophyllite:	0	0
Total Asbestos:	29	16
ASBESTOS CONCENTRATION (MFL)		
Chrysotile:	14.43	7.96
Amosite:	<AS	<AS
Crocidolite:	<AS	<AS
Act-Tremolite†:	<AS	<AS
Anthophyllite:	<AS	<AS
Total Asbestos:	**14.43**	**7.96**

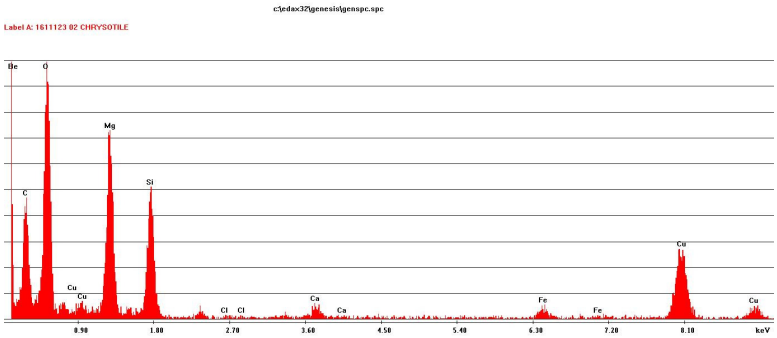
NOTES

Samples L1850525-S-E3 and L1850525-7 E2 contained concentrations of asbestos fibers exceeding the action limit of 7MFL. Analysis was terminated upon completion of the minimum four openings analyzed.

EDXA SPECTRA

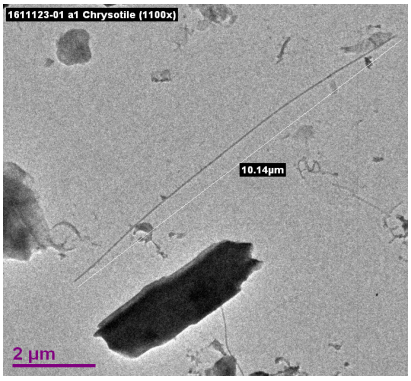
NOTE: Spurious peaks may originate from low background sample holder, column pole pieces, TEM grids, prep solutions or matrix materials.

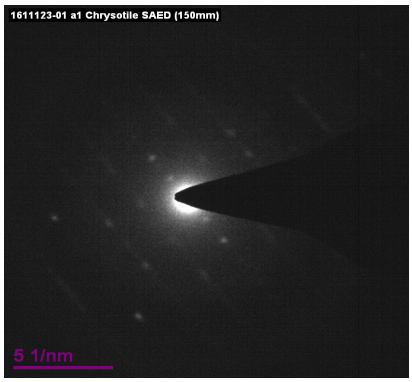


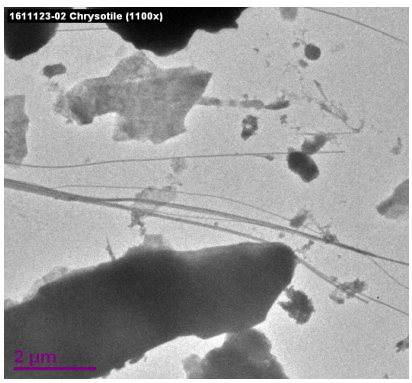


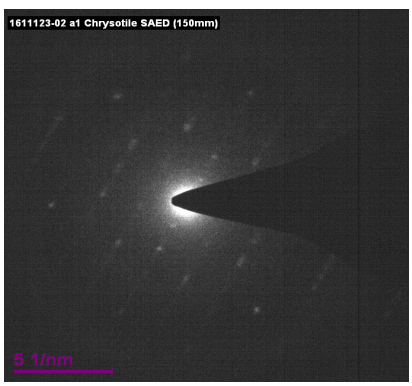
PHOTOMICROGRAPHS

Collected using Gatan Digital Micrograph.









ALS Environmental

www.alsglobal.com

Short Holding Time

Rush Processing

Analytical

8 9878

L1850525-COFC

COC Number: 1

Page 1 of 1

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Hemmera Environchem Inc.	Select Report Format:		R
Contact:	Natasha Sandys	Quality Control (QC) Report with Report	☑ Yes ☐ No	P
Address:	230 - 2237 2nd Avenue Whitehorse, YT	Select Distribution:		E
Phone:	867-456-4865	Email 1 or Fax	nsandys@hemmera.com	E2
		Email 2	chris@elr.ca	Specify Date Required for E2,E or P:

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution:	
Company:	Hemmera Environchem Inc.	Email 1 or Fax	nsandys@hemmera.com
Contact:	Natasha Sandys	Email 2	chris@elr.ca

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q56044	Approver ID:	Cost Center:
Job #:	1343-005.21	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)

ALS Contact:

Sampler: AN/NB

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P Low Level Diss. Met (incl. Hg) and Hardness	P Low Level Tot. Met (incl. Hg) and Hardness	P Chromium Speciation (III/VI) - Total	F/P Chromium Speciation (III/VI) - Dissolved	P Ammonia - N	F/P Dissolved Organic Carbon (DOC)	Nitrate-N	Nitrite - N	Total Phosphorus	Sulphate	pH, Conductivity	Asbestos-TEM-AD	Total Suspended Solids	Number of Containers
	E7	25-Oct-16	12:40	Water	R	R			R	R	R	R	R	R	R		R	10
	TRAVEL BLANK			Water	R	R			R	R	R	R	R	R	R		R	6
	DUP2	25-Oct-16	12:40	Water	R	R			R	R	R	R	R	R	R		R	10
	E4	25-Oct-16	11:30	Water	R	R			R	R	R	R	R	R	R		R	10
	E3	24-Oct-16	11:10	Water	R	R			R	R	R	R	R	R	R	R	R	11
	E2	24-Oct-16	11:45	Water	R	R			R	R	R	R	R	R	R		R	10
	E2	25-Oct-16	10:05	Water												R		1
	GWCC-5	24-Oct-16	12:10	Water	R	R			R	R	R	R	R	R	R		R	10
	R11	24-Oct-16	14:40	Water	R	R			R	R	R	R	R	R	R		R	10
	E8	24-Oct-16	17:45	Water	R	R			R	R	R	R	R	R	R		R	10
	R4	24-Oct-16	16:45	Water	R	R			R	R	R	R	R	R	R		R	10

RUSH

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	Please hold samples for total and dissolved Chromium III/VI pending regular metals analysis results. Please supply ELR EQWIN EDD file with results.
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐ No ☐
Ice packs	Yes ☑ No ☐	Custody seal intact	Yes ☑ No ☐
Cooling Initiated	☐		

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
1.8	2.0		3.6	5.1	0.7

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: Oct.27/16	Time: 9:15.	Received by: EHT	Date: 27 Oct	Time: 09:40	Received by: YMC	Date: Oct 28/16	Time: 11:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-5326a v09 FrontOct January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.