Gartner Lee

Table 2 Surface Water Samples from Hackett River, 2005

General Chemistry Analysis (mg/L)

Station	Detection Limits	Water Quality Guidelines	Upper Sunken Lake	Upper Sunken Lake Outflow	Sunken Lakes Outflow	Boot Lake	Boot Lake Outflow	Cleaver Lake	Spur Lake	Mara U/S	Mara D/S	Mara Inflow #1	Mara Inflow #2
Date		CCME [a]	7-5-2005	7-4-2005	7-3-2005	7-6-2005	7-7-2005	7-6-2005	7-6-2005	7-6-2005	7-6-2005	7-6-2005	7-6-2005
Physical Tests													
Temperature (°C)			9.3	10.2	9.4	9.6	11	11.5	11.4	10.1	10	7.4	11.1
Conductivity (lab) (uS/cm)	2		80.7	72.6	71.7	163	76.9	165	159	13.5	13.6	55.4	87.8
Conductivity (field) (uS/cm)			79.6	68.8	68	157.4	74.9	122.4	111.6	12.8	12.6	53	62.3
Total Dissolved Solids	1		37.2	36.4	37.4	72.5	35.3	83.9	82.4	6.2	6.5	22.0	40.6
Hardness CaCO3	0.54		24.4	24.4	24.4	58.5	27.5	62.8	65.6	4.30	4.47	21.7	35.2
pH (lab)	0.01	6.5-9.0	6.47	6.45	6.30	6.48	6.61	6.58	6.88	6.60	6.62	6.92	6.93
pH (field)			8.16	7.47	7.07	6.63	7.33	7.02	7.07	6.85	6.9	6.86	6.88
TSS	4		<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Turbidity (NTU)	0.1		0.92	0.80	0.69	0.24	0.27	0.49	0.24	0.54	1.11	0.36	0.50
Dissolved Anions													
Alkalinity-Total CaCO3	1		4.8	4.0	2.7	4.2	6.1	9.6	18.2	4.4	4.4	16.3	17.3
Chloride	0.5		4.78	4.66	4.51	34.5	10.2	13.2	1.06	<0.50	<0.50	0.73	0.68
Sulphate SO4	1		20.0	19.4	20.7	11.6	11.6	43.0	53.3	1.8	1.8	10.1	23.3
Nutrients													
Ammonia Nitrogen	0.0050		0.0050	0.0270	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0060	0.0075	0.0077	0.0050
Total Kjeldahl Nitrogen	0.050		0.119	0.137	0.132	0.134	0.145	0.112	0.188	0.154	0.145	0.128	0.159
Nitrate Nitrogen	0.0050	13	0.0070	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	0.0060	<0.0050	0.0100	<0.0050
Nitrite Nitrogen	0.0050	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate/Nitrite Nitrogen	0.0071		<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	0.0100	<0.0071
Dissolved ortho-phosphate	0.0010		<0.0010	<0.0010	0.0027	<0.0010	<0.0010	<0.0010	<0.0010	0.0027	0.0027	0.0027	0.0027
Total Phosphate	0.0020		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Organic Parameters													
Dissolved Organic Carbon	0.50		0.59	1.56	1.40	1.56	1.72	1.12	1.91	1.92	1.90	1.87	2.32
Total Organic Carbon	0.50		1.72	1.69	1.55	1.84	1.81	1.42	2.15	2.09	2.11	1.98	2.44

All units mg/L unless otherwise noted

[a] *Canadian water quality guidelines for the protection of aquatic life, Council of Ministers of the Environment, 1999*

* *Average of sample and replicate*

Italic *results exceed CCME Aquatic Life Guidelines*

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Table 2 (continued) Surface Water Samples from Hackett River, 2005

General Chemistry Analysis (mg/L)

Station	Detection Limits	Water Quality Guidelines	Clear Lake	*Banana Lake	Hackett U/S	Hackett D/S	*Camp Lake	Turtle Outflow	Hood Lake Outflow	Ik lake Outflow	Camp Creek
Date		CCME [a]	7.6.2005	7.7.2005	7.6.2005	7.6.2005	7.7.2005	7.6.2005	7.6.2005	7.6.2005	7.6.2005
Physical Tests											
Temperature (°C)			14.2	10.4	13.4	11.3	13.2	9.8	10.5	11.5	13.2
Conductivity (lab) (uS/cm)	2		26.6	56.45	20.5	31.7	85.45	120	43.4	12.1	39.0
Conductivity (field) (uS/cm)			20.6	55.1	20.1	15.9	81.1	117.2	41.6	11.7	29.3
Total Dissolved Solids	1		13.2	25.4	9.6	15.3	42.6	57.4	20.0	5.4	19.0
Hardness CaCO3	0.54		9.67	20.6	6.61	10.6	28	48.7	15.1	3.63	13.2
pH (lab)	0.01	6.5-9.0	6.75	6.83	6.63	6.59	6.43	6.93	6.68	6.62	6.57
pH (field)			6.83	6.84	6.97	6.98	6.51	7.17	7.03	6.91	6.8
TSS	4		<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Turbidity (NTU)	0.1		0.40	0.47	0.28	0.53	0.94	0.36	0.28	0.34	0.29
Dissolved Anions											
Alkalinity-Total CaCO3	1		7.4	11.3	4.7	5.1	3.7	19.8	6.8	4.6	4.7
Chloride	0.5		<0.50	<0.50	<0.50	0.58	6.48	1.13	<0.50	<0.50	0.80
Sulphate SO4	1		4.8	14.4	4.3	8.1	21.95	35.1	12.1	1.2	10.7
Nutrients											
Ammonia Nitrogen	0.005		0.0061	<0.0050	<0.0050	0.0051	<0.0050	0.0057	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	0.050		0.247	0.179	0.155	0.119	0.1715	0.138	0.125	0.160	0.126
Nitrate Nitrogen	0.005	13	<0.0050	0.005	<0.0050	0.0070	<0.0050	0.0080	<0.0050	<0.0050	0.0060
Nitrite Nitrogen	0.005	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate/Nitrite Nitrogen	0.007		<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	0.0080	<0.0071	<0.0071	<0.0071
Dissolved ortho-phosphate	0.001		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphate	0.002		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Organic Parameters											
Dissolved Organic Carbon	0.50		3.06	1.99	1.81	1.65	1.575	1.64	1.48	1.86	1.67
Total Organic Carbon	0.50		4.11	2.24	1.98	1.85	1.945	1.80	1.76	2.11	1.75

All units mg/L unless otherwise noted

[a] *Canadian water quality guidelines for the protection of aquatic life, Council of Ministers of the Environment, 1999*

**Average of sample and replicate*

Italic *results exceed CCME Aquatic Life Guidelines*

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Table 3 Surface Water Samples from Hackett River, 2005

Total Metals Analysis (mg/L)

Station	Detection Limits	Water Quality Guidelines	Upper Sunken Lake	Upper Sunken Lake Outflow	Sunken Lakes Outflow	Bowl Lake	Bowl Lake Outflow	Cleaver Lake	Anne Lake	Mara O/S	Mara O/S	Mara Inflow #1	Mara Inflow #2
Date		CCME [a]	7.5.2005	7.5.2005	7.5.2005	7.6.2005	7.7.2005	7.6.2005	7.6.2005	7.6.2005	7.6.2005	7.6.2005	7.6.2005
Total Metals													
Aluminum	0.001	0.005-0.1[b]	0.0693	0.0702	0.0962	0.0206	0.0138	0.0261	0.0103	0.0178	0.0197	0.0136	0.0157
Antimony	0.0001		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0001	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	0.00005		0.00813	0.00785	0.00780	0.0181	0.00819	0.0118	0.00819	0.00206	0.00226	0.00352	0.00429
Beryllium	0.0005		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth	0.0005		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron	0.01		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.00005	0.000017	0.00165	0.00163	0.00164	0.000133	0.000090	0.00699	0.00100	<0.000050	<0.000050	<0.000050	<0.000050
Calcium	0.02		7.17	7.07	6.91	20.8	8.64	19.6	19.8	0.920	0.997	6.40	10.9
Chromium	0.0005	0.001	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	0.0001		0.00070	0.00068	0.00074	0.00025	<0.00010	0.00031	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	0.0001	0.002-0.004[c]	0.0391	0.0387	0.0300	0.00124	0.00280	0.0177	0.0189	0.00078	0.00079	0.00125	0.00180
Iron	0.03	0.3	0.040	0.037	0.075	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	79.6
Lead	0.00005	0.001-0.007[d]	0.000414	0.000404	0.000402	0.000133	<0.000050	0.00118	0.000068	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	0.005		<0.0050	<0.0050	<0.0050	0.0063	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium	0.005		1.76	1.71	1.72	1.81	1.54	3.25	3.80	0.439	0.459	1.49	2.11
Manganese	0.00005		0.0418	0.0416	0.0410	0.0181	0.00150	0.00891	0.0225	0.00125	0.00211	0.00546	0.000999
Mercury	0.00005	0.000026	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	0.00005	0.073	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel	0.0005	0.025-0.15[e]	0.00264	0.00255	0.00287	0.00536	0.00149	0.00457	0.00269	<0.00050	0.00052	<0.00050	<0.00050
Phosphorus	0.3		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	0.05		0.842	0.807	0.815	1.07	0.822	1.15	1.10	0.350	0.368	0.660	0.695
Selenium	0.001	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon	0.05		0.845	0.847	0.858	0.417	0.401	1.59	1.19	0.122	0.127	0.560	0.543
Silver	0.00001	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	0.05		0.627	0.597	0.604	0.948	0.642	0.878	0.589	0.449	0.462	0.558	0.487
Strontium	0.0001		0.0356	0.0348	0.0331	0.149	0.0423	0.0849	0.0165	0.00430	0.00450	0.00795	0.00939
Thallium	0.0001	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin	0.0001		<0.00010	<0.00010	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	0.01		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	0.00001		0.000013	0.000012	0.000017	<0.000010	0.000010	0.000018	0.000028	0.000049	0.000052	0.000018	0.000039
Vanadium	0.001		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	0.001	0.03	0.331	0.331	0.338	0.0309	0.0207	1.10	0.203	0.0012	0.0014	0.0017	0.0058

All units mg/l unless otherwise noted

a) Canadian water quality guidelines for the protection of aquatic life, Council of Ministers of the Environment, 2003

b) 0.005mg/L at pH < 6.5, [Ca2+] < 4 mg/L, DOC < 2 mg/L: 0.1 mg/L at pH ≥ 6.5, [Ca2+] ≥ 4 mg/L, DOC ≥ 2 mg/L

c) 0.002 mg/L at [CaCO3] = 0 - 120 mg/L; 0.003 mg/L at [CaCO3] =120 - 180 mg/L; 0.004 mg/L at [CaCO3] >180mg/L

d) 0.001 mg/L at [CaCO3] = 0 - 60 mg/L; 0.002 mg/L at [CaCO3] =60 - 120 mg/L; 0.004 mg/L at [CaCO3] =120 -180mg/L; 0.007 mg/L at [CaCO3] > 180mg/L

e) 0.025 mg/L at [CaCO3] = 0 - 60 mg/L; 0.065 mg/L at [CaCO3] =60 - 120 mg/L; 0.110 mg/L at [CaCO3] =120 -180mg/L; 0.150 mg/L at [CaCO3] > 180mg/L

**Average of sample and replicate*

Italic *results exceed CCME Aquatic Life Guidelines*