

Table 1 - Surface Water Chemistry
Highway 113 Environmental Assessment
Hammonds Plains, NS
General Chemistry and Metals

Parameter	UNITS	EQL	FWAL	SW2	SW3	SWA-3	SW4	SWA-4	SW5	SW6	SWA-6
				30-Apr-09	15-Dec-08	15-Dec-08	15-Dec-08	15-Dec-08	16-Dec-08	16-Dec-08	16-Dec-08
General Chemistry											
Sodium	mg/L	0.1	**	17	10		5.8		6.8	7.2	
Potassium	mg/L	0.1	**	0.6	1.3		0.7		0.7	0.7	
Calcium	mg/L	0.1	**	2.1	2.4	L	1.7	L	2.7	2.3	L
Magnesium	mg/L	0.1	**	0.8	0.7	O	0.5	O	0.6	0.6	O
Alkalinity (as CaCO3)	mg/L	5	**	nd	nd	C	nd	C	nd	nd	C
Sulfate	mg/L	2	**	2	nd	A	nd	A	nd	nd	A
Chloride	mg/L	1	**	29	16	T	9	T	10	10	T
Reactive Silica	mg/L	0.5	**	0.6	2.7	I	3.0	I	2.8	2.7	I
Orthophosphate (as P)	mg/L	0.01	**	nd	nd	O	nd	O	nd	nd	O
Phosphorus	mg/L	0.1	**	nd	nd	N	nd	N	nd	nd	N
Nitrate+Nitrite (as N)	mg/L	0.05	**	nd	0.09		0.10		0.13	0.11	
Nitrate (as N)	mg/L	0.05	13	nd	0.09		0.10		0.13	0.11	
Nitrite	mg/L	0.01	0.06	nd	nd	D	nd	D	nd	nd	D
Ammonia (as N)	mg/L	0.05	see Legend Note (1)	nd	nd	R	nd	R	nd	nd	R
Colour	TCU	5	Narrative	62	79	Y	110	Y	140	140	Y
Total Organic Carbon	mg/L	0.5	**	5.3	7.9		11		12	12	
Turbidity	NTU	0.1	Narrative	0.3	1.4		1.4		1.9	2.1	
Conductivity (RCAp)	umho/cm	1	**	120	70		49		53	54	
pH	units	NA	6.5-9.0	4.51	5.90		5.11		5.59	5.27	
Hardness (as CaCO3)	mg/L	1	**	8	9		6		9	8	
Bicarbonate (as CaCO3)	mg/L	1	**	nd	nd		nd		nd	nd	
Carbonate (as CaCO3)	mg/L	1	**	nd	nd		nd		nd	nd	
TDS	mg/L	1	**	52	34		21		25	24	
Cation Sum	meq/L	NA	**	0.950	0.660		0.410		0.510	0.510	
Anion Sum	meq/L	NA	**	0.860	0.460		0.260		0.300	0.290	
Ion Balance	%	NA	**	4.97	17.9		22.4		25.9	27.5	
Langelier Index (4°C)	units	NA	**	NC	NC		NC		NC	NC	
Langelier Index (20°C)	units	NA	**	NC	NC		NC		NC	NC	
Saturation pH (4°C)	units	NA	**	NC	NC		NC		NC	NC	
Saturation pH (20°C)	units	NA	**	NC	NC		NC		NC	NC	
Total Suspended Solids	mg/L	1	50 (2)	nd	2		nd		2	2	
Metals											
Aluminum	mg/L	0.005	0.005-0.1 (3)	0.192	0.255		0.284		0.281	0.281	
Antimony	mg/L	0.002	**	nd	nd		nd		nd	nd	
Arsenic	mg/L	0.002	0.005	nd	nd		nd		nd	nd	
Barium	mg/L	0.005	**	0.0241	0.0088		0.0127		0.0140	0.0118	
Beryllium	mg/L	0.002	**	nd	nd		nd		nd	nd	
Bismuth	mg/L	0.002	**	nd	nd		nd		nd	nd	
Boron	mg/L	0.005	**	nd	0.0068		0.0065		0.0086	0.0082	
Cadmium	mg/L	0.000017	see Legend Note (4)	0.000050	0.000026		0.000039		0.000132	0.000042	
Chromium	mg/L	0.001	0.0010 (5)	nd	nd		nd		nd	nd	
Cobalt	mg/L	0.0004	**	nd	nd		nd		nd	nd	
Copper	mg/L	0.002	0.002-0.004 (6)	nd	nd		nd		nd	nd	
Iron	mg/L	0.05	0.3	0.108	0.266		0.239		0.253	0.266	
Lead	mg/L	0.0005	0.001-0.007 (7)	nd	nd		0.00054		0.00067	0.00059	
Manganese	mg/L	0.002	**	0.0666	0.0367		0.0279		0.0659	0.0213	
Molybdenum	mg/L	0.002	0.073	nd	nd		nd		nd	nd	
Nickel	mg/L	0.002	0.025-0.15 (8)	nd	nd		nd		nd	nd	
Selenium	mg/L	0.001	0.001	nd	nd		nd		nd	nd	
Silver	mg/L	0.0001	0.0001	nd	nd		nd		nd	nd	
Strontium	mg/L	0.005	**	0.0123	0.0116		0.0081		0.0108	0.0097	
Thallium	mg/L	0.0001	0.0008	nd	nd		nd		nd	nd	
Tin	mg/L	0.002	**	nd	nd		nd		nd	nd	
Titanium	mg/L	0.002	**	nd	0.0026		0.0025		0.0041	0.0035	
Uranium	mg/L	0.0001	**	nd	0.00012		0.00015		0.00015	0.00015	
Vanadium	mg/L	0.002	**	nd	nd		nd		nd	nd	
Zinc	mg/L	0.005	0.03	0.0063	0.0064		0.0091		0.0129	0.0092	

FWAL - Freshwater Aquatic Life Guidelines (CCME, Dec. 2007 Update)

(1) to (8) - see Legend Notes; Surface Water Chemistry

- not analyzed

nd - non detect

NC - non-calculable

L/D - laboratory duplicate

Bold/highlight - exceeds FWAL

Table 1 - Surface Water Chemistry
Highway 113 Environmental Assessment
Hammonds Plains, NS
General Chemistry and Metals

Parameter	UNITS	EQL	FWAL	SW7 16-Dec-08	SWA-7 16-Dec-08	SW8 15-Dec-08	SWA-8 15-Dec-08	SWA-8 L/D 15-Dec-08	SW9 15-Dec-08
General Chemistry									
Sodium	mg/L	0.1	**	9.2	L O C A T I O N	20	21	21	2.6
Potassium	mg/L	0.1	**	1.2		1.1	1.5	1.5	0.2
Calcium	mg/L	0.1	**	3		4.1	4.6	4.7	0.3
Magnesium	mg/L	0.1	**	0.7		0.9	1.0	1.0	0.3
Alkalinity (as CaCO3)	mg/L	5	**	nd		6	nd	nd	nd
Sulfate	mg/L	2	**	nd		5	7	8	nd
Chloride	mg/L	1	**	12		34	37	38	4
Reactive Silica	mg/L	0.5	**	3.4		2.1	3.8	3.8	3.3
Orthophosphate (as P)	mg/L	0.01	**	nd		nd	nd	nd	nd
Phosphorus	mg/L	0.1	**	nd		nd	nd	nd	nd
Nitrate+Nitrite (as N)	mg/L	0.05	**	0.16	D R Y	0.10	0.09	0.10	nd
Nitrate (as N)	mg/L	0.05	13	0.16		0.10	0.09	-	nd
Nitrite	mg/L	0.01	0.06	nd		nd	nd	nd	nd
Ammonia (as N)	mg/L	0.05	see Legend Note (1)	nd		nd	nd	nd	nd
Colour	TCU	5	Narrative	150		36	31	31	56
Total Organic Carbon	mg/L	0.5	**	12		5.6	5	-	7.6
Turbidity	NTU	0.1	Narrative	2.5		0.7	1.9	-	0.4
Conductivity (RCAp)	umho/cm	1	**	61		140	150	150	33
pH	units	NA	6.5-9.0	5.70		6.45	5.23	5.22	4.51
Hardness (as CaCO3)	mg/L	1	**	10		14	16	-	2
Bicarbonate (as CaCO3)	mg/L	1	**	nd	6	nd	-	nd	
Carbonate (as CaCO3)	mg/L	1	**	nd	nd	nd	-	nd	
TDS	mg/L	1	**	31	72	77	-	11	
Cation Sum	meq/L	NA	**	0.650	1.20	1.27	-	0.190	
Anion Sum	meq/L	NA	**	0.360	1.19	1.21	-	0.110	
Ion Balance	%	NA	**	28.7	0.420	2.42	-	26.7	
Langelier Index (4°C)	units	NA	**	NC	-3.77	NC	-	NC	
Langelier Index (20°C)	units	NA	**	NC	-3.52	NC	-	NC	
Saturation pH (4°C)	units	NA	**	NC	10.2	NC	-	NC	
Saturation pH (20°C)	units	NA	**	NC	9.97	NC	-	NC	
Total Suspended Solids	mg/L	1	50 (2)	2	nd	nd	-	nd	
Metals									
Aluminum	mg/L	0.005	0.005-0.1 (3)	0.338		0.132	0.226	0.231	0.299
Antimony	mg/L	0.002	**	nd		nd	nd	nd	nd
Arsenic	mg/L	0.002	0.005	0.0020		nd	nd	nd	nd
Barium	mg/L	0.005	**	0.0138		0.0124	0.0325	0.0330	nd
Beryllium	mg/L	0.002	**	nd		nd	nd	nd	nd
Bismuth	mg/L	0.002	**	nd		nd	nd	nd	nd
Boron	mg/L	0.005	**	0.0135		0.0084	nd	0.0050	nd
Cadmium	mg/L	0.000017	see Legend Note (4)	0.000293		nd	0.000027	0.000029	0.000027
Chromium	mg/L	0.001	0.0010 (5)	nd		nd	nd	nd	nd
Cobalt	mg/L	0.0004	**	nd		nd	nd	nd	nd
Copper	mg/L	0.002	0.002-0.004 (6)	0.0088		nd	nd	nd	nd
Iron	mg/L	0.05	0.3	0.329		0.153	0.082	0.082	0.103
Lead	mg/L	0.0005	0.001-0.007 (7)	0.00104		nd	nd	nd	nd
Manganese	mg/L	0.002	**	0.0303		0.0302	0.0211	0.0216	0.0184
Molybdenum	mg/L	0.002	0.073	nd		nd	nd	nd	nd
Nickel	mg/L	0.002	0.025-0.15 (8)	0.0043		nd	nd	nd	nd
Selenium	mg/L	0.001	0.001	nd		nd	nd	nd	nd
Silver	mg/L	0.0001	0.0001	nd		nd	nd	nd	nd
Strontium	mg/L	0.005	**	0.0118		0.0176	0.0247	0.0250	nd
Thallium	mg/L	0.0001	0.0008	nd		nd	nd	nd	nd
Tin	mg/L	0.002	**	nd		nd	nd	nd	nd
Titanium	mg/L	0.002	**	0.0048		nd	nd	nd	nd
Uranium	mg/L	0.0001	**	0.00018		nd	nd	nd	nd
Vanadium	mg/L	0.002	**	nd		nd	nd	nd	nd
Zinc	mg/L	0.005	0.03	0.0361		nd	0.0066	0.0060	0.0056

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General Chemistry and Metals

Parameter	UNITS	EQL	FWAL	SW10	SW11	SW12	SW13	SW14
				15-Dec-08	16-Dec-08	30-Apr-09	30-Apr-09	30-Apr-09
General Chemistry								
Sodium	mg/L	0.1	**	2.7	18	56	16	14
Potassium	mg/L	0.1	**	0.2	1.1	1.3	0.6	0.4
Calcium	mg/L	0.1	**	0.3	5.1	7.0	2.0	1.4
Magnesium	mg/L	0.1	**	0.3	1.2	0.9	0.6	0.6
Alkalinity (as CaCO3)	mg/L	5	**	nd	7	10	nd	nd
Sulfate	mg/L	2	**	nd	6	10	4	3
Chloride	mg/L	1	**	4	28	80	25	23
Reactive Silica	mg/L	0.5	**	3.7	3.8	2.2	1.4	3.1
Orthophosphate (as P)	mg/L	0.01	**	nd	nd	nd	nd	nd
Phosphorus	mg/L	0.1	**	nd	nd	nd	nd	nd
Nitrate+Nitrite (as N)	mg/L	0.05	**	nd	0.27	nd	0.19	nd
Nitrate (as N)	mg/L	0.05	13	nd	0.27	nd	0.19	nd
Nitrite	mg/L	0.01	0.06	nd	nd	nd	nd	nd
Ammonia (as N)	mg/L	0.05	see Legend Note (1)	nd	nd	nd	nd	nd
Colour	TCU	5	Narrative	52	32	18	30	12
Total Organic Carbon	mg/L	0.5	**	6.5	5.4	3.0	3.7	2.1
Turbidity	NTU	0.1	Narrative	0.4	0.8	0.5	0.4	0.5
Conductivity (RCAP)	umho/cm	1	**	33	120	320	100	96
pH	units	NA	6.5-9.0	4.57	6.85	6.60	5.00	4.45
Hardness (as CaCO3)	mg/L	1	**	2	18	21	8	6
Bicarbonate (as CaCO3)	mg/L	1	**	nd	7	10	nd	nd
Carbonate (as CaCO3)	mg/L	1	**	nd	nd	nd	nd	nd
TDS	mg/L	1	**	11	69	163	51	46
Cation Sum	meq/L	NA	**	0.190	1.15	2.94	0.870	0.780
Anion Sum	meq/L	NA	**	0.100	1.09	2.65	0.810	0.710
Ion Balance	%	NA	**	31.0	2.68	4.68	3.57	4.70
Langelier Index (4°C)	units	NA	**	NC	-3.16	-3.17	NC	NC
Langelier Index (20°C)	units	NA	**	NC	-2.91	-2.92	NC	NC
Saturation pH (4°C)	units	NA	**	NC	10.0	9.77	NC	NC
Saturation pH (20°C)	units	NA	**	NC	9.76	9.52	NC	NC
Total Suspended Solids	mg/L	1	50 (2)	nd	nd	2	1	nd
Metals								
Aluminum	mg/L	0.005	0.005-0.1 (3)	0.299	0.105	0.0806	0.175	0.289
Antimony	mg/L	0.002	**	nd	nd	nd	nd	nd
Arsenic	mg/L	0.002	0.005	nd	nd	nd	nd	nd
Barium	mg/L	0.005	**	nd	0.0088	0.0558	0.0295	0.0289
Beryllium	mg/L	0.002	**	nd	nd	nd	nd	nd
Bismuth	mg/L	0.002	**	nd	nd	nd	nd	nd
Boron	mg/L	0.005	**	nd	0.0106	0.0058	nd	nd
Cadmium	mg/L	0.000017	see Legend Note (4)	0.000026	nd	0.000020	0.00010	0.000080
Chromium	mg/L	0.001	0.0010 (5)	0.0011	nd	nd	nd	nd
Cobalt	mg/L	0.0004	**	nd	nd	nd	0.00043	0.00069
Copper	mg/L	0.002	0.002-0.004 (6)	nd	nd	nd	nd	nd
Iron	mg/L	0.05	0.3	0.082	0.101	0.200	0.082	nd
Lead	mg/L	0.0005	0.001-0.007 (7)	nd	nd	nd	nd	nd
Manganese	mg/L	0.002	**	0.0121	0.0074	0.0243	0.0613	0.0857
Molybdenum	mg/L	0.002	0.073	nd	nd	nd	nd	nd
Nickel	mg/L	0.002	0.025-0.15 (8)	nd	nd	nd	nd	nd
Selenium	mg/L	0.001	0.001	nd	nd	nd	nd	nd
Silver	mg/L	0.0001	0.0001	nd	nd	nd	nd	nd
Strontium	mg/L	0.005	**	nd	0.0202	0.0278	0.0145	0.0120
Thallium	mg/L	0.0001	0.0008	nd	nd	nd	nd	nd
Tin	mg/L	0.002	**	nd	nd	nd	nd	nd
Titanium	mg/L	0.002	**	nd	nd	nd	nd	nd
Uranium	mg/L	0.0001	**	0.00014	nd	nd	nd	nd
Vanadium	mg/L	0.002	**	nd	nd	nd	nd	nd
Zinc	mg/L	0.005	0.03	0.0057	nd	0.0053	0.0079	0.0090

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Surface Water - General Inorganic and Metals Chemistry Legend Notes

- 1) The guideline for **ammonia** is dependent on pH and temperature (see factsheet Table 2, FWAL 2001).
- 2) The guideline for **TSS** is from NSE standards for a grab sample.
- 3) The **aluminum** guideline varies from 0.005 mg/L for pH <6.5 units to 0.1 mg/L for pH >6.5 units.
- 4) The guideline for **cadmium** is dependent on hardness: Cd guideline (ug/L) = $10^{(0.86 [\log (\text{hardness in mg/L})] - 3.2)}$; see also Table XXI-1, CCME factsheet.
- 5) The guidelines for **trivalent** and **hexavalent chromium** are 0.0089 and 0.0010 mg/L, respectively (FWAL 1997). **Total chromium** is reported by the lab and compared to the more stringent guideline (0.0010 mg/L).
- 6) The guideline for **copper** varies from 0.002 mg/L for hardness 0 to 120 mg/L CaCO₃ to 0.004 mg/L for hardness >180 mg/L CaCO₃.
- 7) The guideline for **lead** varies from 0.001 mg/L for hardness 0 to 60 mg/L CaCO₃ to 0.007 mg/L for hardness >180 mg/L CaCO₃.
- 8) The guideline for **nickel** varies from 0.025 mg/L for hardness 0 to 60 mg/L CaCO₃ to 0.15 mg/L for hardness >180 mg/L CaCO₃.