
Appendix C

Groundwater Chemical Results

- Groundwater Quality – General Chemistry - Table C-1
 - Time-Concentration Graphs – Figures C-1 to C-3
 - Residential Groundwater Quality – Tables C-2 to C-6
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**TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING DATES					
			BH05-2	BH05-2	BH05-2	BH05-2	BH05-2	BH05-2
DATE			15-Apr-14	15-Sep-14	31-Mar-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters								
pH	pH	6.5 - 8.5	7.65	7.35	8.4	7.16	7.54	6.98
Temperature	°C	15	3.8	9.2	5.7	10.8	7.1	9.4
Conductivity	(µS/cm)		422	397	430	420	481	346
Dissolved Oxygen	mg/L		10.86	9.3	10.4	11.9	11.5	10.5
Turbidity	NTU	5	>200	>200	>200	>200	232	>200
Inorganics								
TDS	mg/L	500	236	250	212	238	250	230
Hardness (CaCO3)	mg/L	80 - 100	209	250	226	239	256	233
Total Ammonia-N	mg/L		0.49	<0.02	0.08	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		398	471	429	422	458	439
Dissolved Organic Carbon	mg/L	5.0	1.5	1	1.9	1.5	0.8	1.2
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10	<0.10	<0.10
pH	pH	6.5 - 8.5	8.13	8.05	8.01	8.03	8.07	7.92
Sulphate (SO4)	mg/L	500	2.84	3.35	3.78	2.19	2.48	2.28
Alkalinity (Total as CaCO3)	mg/L		191	228	224	223	253	227
Chloride (Cl)	mg/L	250	1	1.13	1.24	0.94	1.17	0.94
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05	<0.05	<0.05
Nitrate (N)	mg/L	10.0	0.08	0.07	0.15	0.06	0.08	0.22
Nitrate + Nitrite	mg/L	10.0	0.08	0.07	0.15	<0.07	0.08	0.22
Metals								
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	0.004	0.004	0.009	0.006
Barium (Ba)	mg/L	1.0	0.022	0.032	0.028	0.026	0.027	0.028
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L		78.5	91.8	84.3	89.6	96.3	87
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		3.27	4.95	3.79	3.65	3.75	3.72
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.004	<0.003	<0.003
Phosphorus (P)	mg/L		0.04		0.98	0.44	0.39	0.73
Potassium (K)	mg/L		0.47	0.69	0.53	0.67	0.56	0.56
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	0.81	0.96	0.94	0.75	0.91	0.85
Strontium (Sr)	mg/L		0.107	0.134	0.113	0.108	0.117	0.119
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005	0.006	<0.005

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "" indicates value based on lab value.

TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT

PARAMETERS	UNITS	ODWQO	MONITORING DATES					
			BH05-18	BH05-18	BH05-18	BH05-18	BH05-18	BH05-18
DATE			15-Apr-14	15-Sep-14	31-Mar-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters								
pH	pH	6.5 - 8.5	7.74	7.83	7.62	7.07	7.7	7.65
Temperature	°C	15	6	10.4	6.4	10.1	8.4	11
Conductivity	(µS/cm)		450	381	426	382	473	374
Dissolved Oxygen	mg/L		10.32	9.1	11.0	10.6	10.7	8.98
Turbidity	NTU	5	>200	>200	>200	>200	>200	194
Inorganics								
TDS	mg/L	500	280	254	232	276	244	290
Hardness (CaCO3)	mg/L	80 - 100	201	218	208	247	228	226
Total Ammonia-N	mg/L		0.33	0.04	0.2	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		451	435	420	445	450	473
Dissolved Organic Carbon	mg/L	5.0	1.1	0.8	1.3	1.2	0.7	2.4
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10	<0.10	<0.10
pH	pH	6.5 - 8.5	8.16	8.08	8.07	8.02	7.9	7.92
Sulphate (SO4)	mg/L	500	4.3	5.02	4.69	4.6	4.85	4.27
Alkalinity (Total as CaCO3)	mg/L		158	163	170	171	179	176
Chloride (Cl)	mg/L	250	8.1	7.81	7.24	8.25	8.74	8.99
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05	<0.05	<0.05
Nitrate (N)	mg/L	10.0	10.8	9.39	9.26	12	15.5	15.2
Nitrate + Nitrite	mg/L	10.0	10.8	9.39	9.26	12	15.5	15.2
Metals								
Aluminum (Al)	mg/L	0.1	<0.004	0.004	<0.004	<0.004	0.008	0.004
Barium (Ba)	mg/L	1.0	0.051	0.056	0.054	0.064	0.058	0.061
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L		64.6	71.9	66.7	82.8	74.1	73.8
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		9.66	9.36	10	9.82	10.4	10.1
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.003	<0.003	<0.003
Phosphorus (P)	mg/L		0.04		2.7	2.37	2.11	0.08
Potassium (K)	mg/L		0.73	0.8	0.69	1.12	0.74	0.78
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	2.13	2.52	2.31	2.57	2.87	2.88
Strontium (Sr)	mg/L		0.123	0.132	0.113	0.117	0.121	0.133
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "" indicates value based on lab value.

TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT

PARAMETERS	UNITS	ODWQO	MONITORING DATES					
			BH05-19 15-Apr-14	BH05-19 15-Sep-14	BH05-19 31-Mar-15	BH05-19 21-Sep-15	BH05-19 16-Mar-16	BH05-19 27-Sep-16
DATE								
Field Parameters								
pH	pH	6.5 - 8.5	7.82	6.7	7.96	7.37	7.45	7.45
Temperature	°C	15	5.4	12.6	9.6	18	8.8	8.8
Conductivity	(µS/cm)		465	406	484	393	474	474
Dissolved Oxygen	mg/L		11.21	10.2	10.5	8.5	10.9	10.9
Turbidity	NTU	5	>200	>200	>200	>200	>200	>200
Inorganics								
TDS	mg/L	500	274	290	232	256	250	242
Hardness (CaCO3)	mg/L	80 - 100	208	236	236	250	240	243
Total Ammonia-N	mg/L		0.06	0.06	0.26	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		453	452	467	431	448	463
Dissolved Organic Carbon	mg/L	5.0	1	2	1.4	2.1	0.9	<0.5
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10	<0.10	<0.10
pH	pH	6.5 - 8.5	8.08	8.12	8.02	8.06	8.03	8.06
Sulphate (SO4)	mg/L	500	6.98	6.82	6.33	6.51	7.67	6.43
Alkalinity (Total as CaCO3)	mg/L		190	196	217	202	222	215
Chloride (Cl)	mg/L	250	2.93	2.53	3.29	2.71	5.13	3.4
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05	<0.05	<0.05
Nitrate (N)	mg/L	10.0	5.52	4.91	6.01	4	6.48	4.88
Nitrate + Nitrite	mg/L	10.0	5.52	4.91	6.01	4	6.48	4.88
Metals								
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	<0.004	0.011	0.059	0.007
Barium (Ba)	mg/L	1.0	0.067	0.066	0.068	0.074	0.069	0.097
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L		63.9	74.5	74.4	81.3	76.1	77.6
Chromium (Cr)	mg/L	0.05	0.011	<0.003	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010	0.053	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		11.8	12.1	12.3	11.5	12.1	12
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002	0.007	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		0.004	<0.003	<0.003	0.003	<0.003	<0.003
Phosphorus (P)	mg/L		0.66		<0.05	0.08	<0.05	<0.05
Potassium (K)	mg/L		0.75	0.94	0.88	1.18	0.88	0.83
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	1.96	1.96	1.91	2.18	2.2	1.83
Strontium (Sr)	mg/L		0.146	0.149	0.134	0.137	0.146	0.137
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

NOTES:

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2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
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5. "" indicates value based on lab value.

**TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING DATES					
			BH05-20 17-Jun-14	BH05-20 15-Sep-14	BH05-20 31-Mar-15	BH05-20 21-Sep-15	BH05-20 16-Mar-16	BH05-20 27-Sep-16
DATE								
Field Parameters								
pH	pH	6.5 - 8.5	7.78*	7.5	8.28	7	7.81	DRY
Temperature	°C	15		13.1	6.5	11.8	6.7	
Conductivity	(µS/cm)		542*	494	598	510	588	
Dissolved Oxygen	mg/L			7	3.8	5.34	4	
Turbidity	NTU	5	>200	>200	>200	>200	136	
Inorganics								
TDS	mg/L	500	336	314	316	332	312	
Hardness (CaCO3)	mg/L	80 - 100	247	294	297	335	321	
Total Ammonia-N	mg/L		0.29	<0.02	0.03	<0.02	<0.02	
Ammonia (unionized)	mg/L		<0.02	<0.02	<0.02	<0.02	<0.02	
Conductivity	uS/cm		542	546	596	589	568	
Dissolved Organic Carbon	mg/L	5.0	2.5	1.4	1	0.9	0.7	
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10	<0.20	
pH	pH	6.5 - 8.5	7.78	8.22	7.94	7.94	8.09	
Sulphate (SO4)	mg/L	500	8.12	8.18	7.46	7	6.79	
Alkalinity (Total as CaCO3)	mg/L		292	261	305	297	313	
Chloride (Cl)	mg/L	250	2.84	3.14	4.36	4.17	5.78	
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05	<0.10	
Nitrate (N)	mg/L	10.0	<0.05	<0.05	<0.10	<0.05	<0.10	
Nitrate + Nitrite	mg/L	10.0	<0.07	<0.07	<0.07	<0.07	<0.07	
Metals								
Aluminum (Al)	mg/L	0.1	<0.004	0.013	<0.004	<0.004	0.006	
Barium (Ba)	mg/L	1.0	0.017	0.019	0.016	0.017	0.016	
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010	<0.010	
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001	<0.001	
Calcium (Ca)	mg/L		81.5	99.6	100	115	110	
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003	<0.003	
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003	<0.003	
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	
Magnesium (Mg)	mg/L		10.5	11	11.4	11.6	11.2	
Manganese (Mn)	mg/L	0.05	<0.002	0.022	0.003	<0.002	<0.002	
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.005	<0.003	
Phosphorus (P)	mg/L				0.43	1.13	0.19	
Potassium (K)	mg/L		0.45	0.51	0.38	1.19	0.39	
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	
Sodium (Na)	mg/L	200/20	4.56	5.17	6.23	5.94	5.65	
Strontium (Sr)	mg/L		0.175	0.197	0.173	0.167	0.16	
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005	0.005	

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "*" indicates value based on lab value.

**TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT**

PARAMETERS	UNITS	ODWQO	MONITORING DATES					
			BH06-1	BH06-1	BH06-1	BH06-1	BH06-1	BH06-1
DATE			15-Apr-14	15-Sep-14	31-Mar-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters								
pH	pH	6.5 - 8.5	7.71	7.63	7.81	7.28	7.48	7.31
Temperature	°C	15	6.6	9	7.6	8.9	8.2	10
Conductivity	(µS/cm)		477	414	523	434	471	391
Dissolved Oxygen	mg/L		9.92	9	10.3	8.85	10.6	9.3
Turbidity	NTU	5	>200	>200	>200	158	150	>200
Inorganics								
TDS	mg/L	500	306	272	242	266	240	252
Hardness (CaCO3)	mg/L	80 - 100	233	235	259	272	256	264
Total Ammonia-N	mg/L		0.94	<0.02	<0.02	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		449	430	489	495	453	487
Dissolved Organic Carbon	mg/L	5.0	1.1	0.7	1.2	0.7	0.8	0.7
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10	<0.10	<0.10
pH	pH	6.5 - 8.5	8.06	8.19	7.98	8.02	8.02	8.03
Sulphate (SO4)	mg/L	500	7.73	7.84	9.05	8.14	8.46	7.59
Alkalinity (Total as CaCO3)	mg/L		216	203	255	252	257	251
Chloride (Cl)	mg/L	250	1.2	1.37	1.68	1.32	1.35	1.22
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05	<0.05	<0.05
Nitrate (N)	mg/L	10.0	0.08	<0.05	<0.10	0.05	0.14	0.12
Nitrate + Nitrite	mg/L	10.0	0.08	<0.07	<0.07	<0.07	0.14	0.12
Metals								
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	<0.004	<0.004	<0.004	0.006
Barium (Ba)	mg/L	1.0	0.029	0.029	0.032	0.031	0.028	0.031
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L		81.8	81.6	90.5	96.5	90.2	93.2
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		7.08	7.69	7.99	7.61	7.47	7.58
Manganese (Mn)	mg/L	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	<0.003	0.005	<0.003	<0.003
Phosphorus (P)	mg/L		0.35		0.66	0.12	0.2	<0.05
Potassium (K)	mg/L		0.58	0.63	0.63	0.8	0.61	0.67
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	1.56	1.46	1.68	1.76	1.55	1.55
Strontium (Sr)	mg/L		0.15	0.156	0.149	0.14	0.129	0.14
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	<0.005	<0.005	<0.005	<0.005	<0.005	0.009

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "" indicates value based on lab value.

TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT

PARAMETERS	UNITS	ODWQO	MONITORING DATES			
			BH12-1	BH12-1	BH12-1	BH12-1
DATE			15-Sep-14	31-Mar-15	21-Sep-15	27-Sep-16
Field Parameters						
pH	pH	6.5 - 8.5	7.83	8.6	7.92	7.51
Temperature	°C	15	12.3	10	12.9	11.4
Conductivity	(µS/cm)		471	532	460	4211
Dissolved Oxygen	mg/L		7.2	9.1	10.7	8.8
Turbidity	NTU	5	>200	>200	>200	>200
Inorganics						
TDS	mg/L	500	294	258	294	284
Hardness (CaCO3)	mg/L	80 - 100	266	242	233	261
Total Ammonia-N	mg/L		0.1	0.14	<0.10	0.02
Ammonia (unionized)	mg/L		<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		557	505	514	525
Dissolved Organic Carbon	mg/L	5.0	2	2.5	1.7	2.6
Orthophosphate (P)	mg/L		<0.10	<0.20	<0.10	<0.10
pH	pH	6.5 - 8.5	8.18	8.07	8.15	8.03
Sulphate (SO4)	mg/L	500	20.3	15.9	17	16
Alkalinity (Total as CaCO3)	mg/L		245	241	241	255
Chloride (Cl)	mg/L	250	4.34	4.34	3.62	2.99
Nitrite (N)	mg/L	1.0	<0.05	<0.10	<0.05	<0.05
Nitrate (N)	mg/L	10.0	1.65	1.96	1.54	1.5
Nitrate + Nitrite	mg/L	10.0	1.65	1.96	1.54	1.5
Metals						
Aluminum (Al)	mg/L	0.1	0.005	0.291	0.059	<0.004
Barium (Ba)	mg/L	1.0	0.07	0.089	0.094	0.107
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	0.019	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L		75.3	69.1	66	76.8
Chromium (Cr)	mg/L	0.05	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	0.004
Iron (Fe)	mg/L	0.3	<0.010	0.217	0.015	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		18.9	16.8	16.5	16.8
Manganese (Mn)	mg/L	0.05	<0.002	0.036	0.028	0.005
Molybdenum (Mo)	mg/L		0.003	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		<0.003	<0.003	0.004	<0.003
Phosphorus (P)	mg/L			1.77	4.08	1.99
Potassium (K)	mg/L		3.21	2.17	2.32	1.55
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	11.8	10.4	13	6.25
Strontium (Sr)	mg/L		0.812	0.396	0.294	0.291
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	0.257	0.025	0.04	1.12

NOTES:

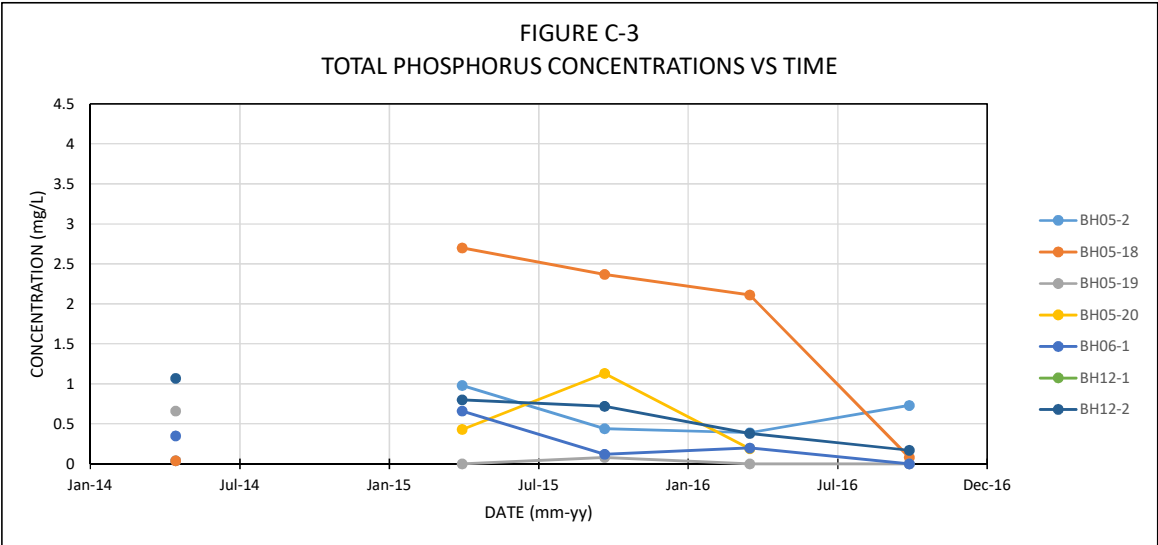
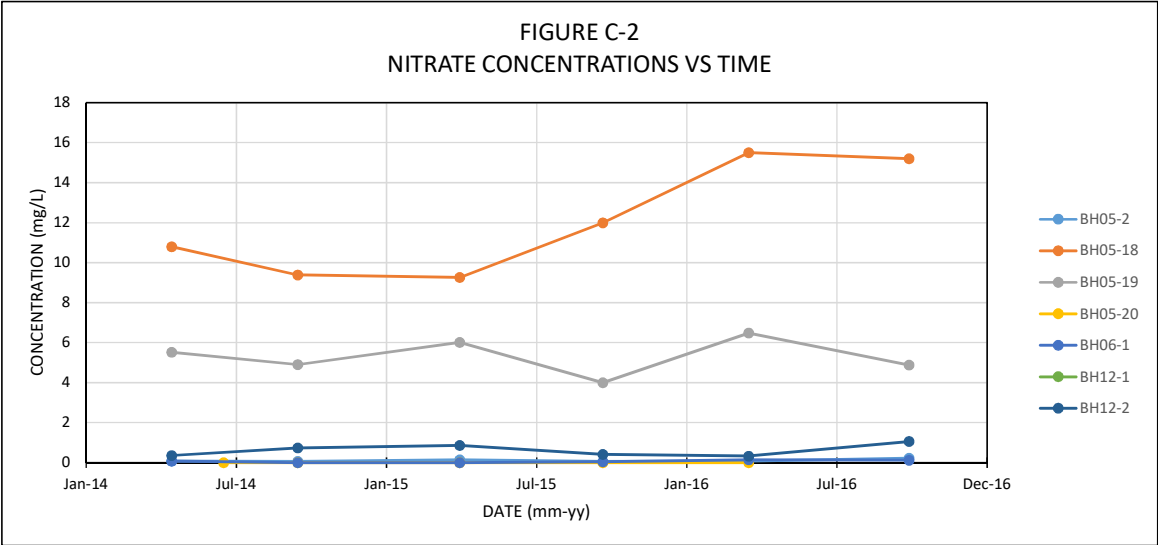
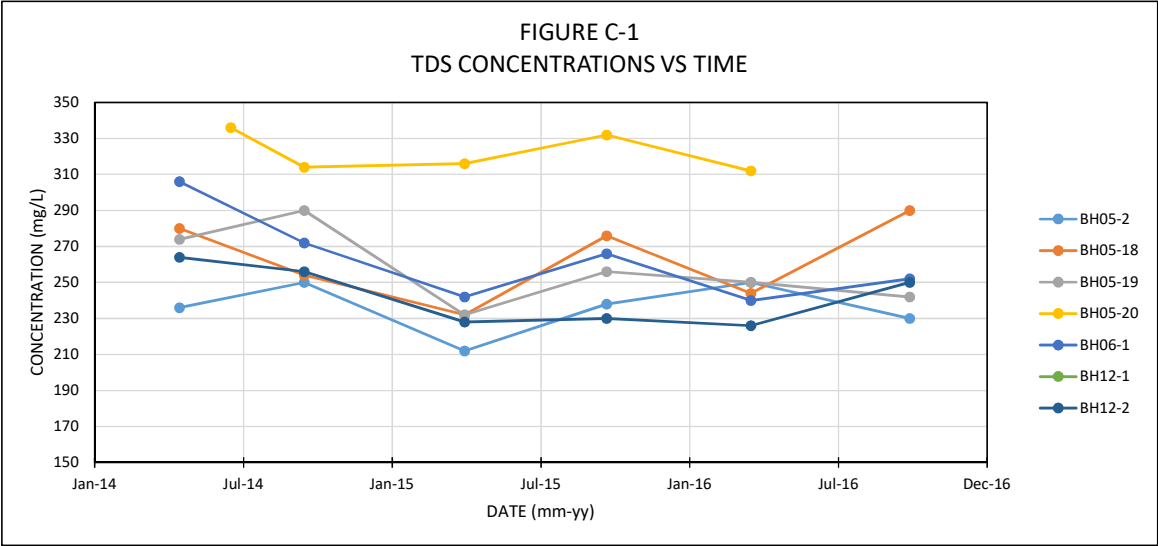
1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "" indicates value based on lab value.

TABLE C-1
GROUNDWATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT

PARAMETERS	UNITS	ODWQO	MONITORING DATES					
			BH12-2	BH12-2	BH12-2	BH12-2	BH12-2	BH12-2
DATE			15-Apr-14	15-Sep-14	31-Mar-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters								
pH	pH	6.5 - 8.5	7.77	7.48	8.2	7.4	7.77	7.77
Temperature	°C	15	6.7	9.3	9.3	9.9	8.3	8.3
Conductivity	(µS/cm)		445	390	440	388	440	440
Dissolved Oxygen	mg/L		10.01	8.8	10.4	9.37	9.9	9.9
Turbidity	NTU	5	>200	>200	>200	>200	311	311
Inorganics								
TDS	mg/L	500	264	256	228	230	226	250
Hardness (CaCO3)	mg/L	80 - 100	224	257	233	194	240	238
Total Ammonia-N	mg/L		0.27	<0.02	0.03	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L		<0.2	<0.02	<0.02	<0.02	<0.02	<0.02
Conductivity	uS/cm		442	459	451	432	429	453
Dissolved Organic Carbon	mg/L	5.0	2.2	0.7	3.5	1.6	0.9	1.2
Orthophosphate (P)	mg/L		<0.10	<0.10	<0.20	<0.10	<0.10	<0.10
pH	pH	6.5 - 8.5	8.04	8.14	8.03	8.04	8.02	8.04
Sulphate (SO4)	mg/L	500	7.94	8.07	8.07	7.54	7.66	6.84
Alkalinity (Total as CaCO3)	mg/L		209	216	226	217	232	224
Chloride (Cl)	mg/L	250	1.89	2.27	2.77	1.6	1.45	2.09
Nitrite (N)	mg/L	1.0	<0.05	<0.05	<0.10	<0.05	<0.05	<0.05
Nitrate (N)	mg/L	10.0	0.36	0.74	0.86	0.41	0.33	1.06
Nitrate + Nitrite	mg/L	10.0	0.36	0.74	0.86	0.41	0.33	1.06
Metals								
Aluminum (Al)	mg/L	0.1	<0.004	<0.004	0.034	<0.004	0.006	0.005
Barium (Ba)	mg/L	1.0	0.186	0.087	0.084	0.08	0.084	0.089
Beryllium (Be)	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	mg/L	5.0	<0.010	<0.010	<0.010	<0.010	0.018	<0.010
Cadmium (Cd)	mg/L	0.005	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Calcium (Ca)	mg/L		74	86.6	76.3	61.9	79.7	79.3
Chromium (Cr)	mg/L	0.05	0.013	<0.003	<0.003	<0.003	<0.003	<0.003
Cobalt (Co)	mg/L		0.007	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	1	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron (Fe)	mg/L	0.3	0.189	<0.010	0.038	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magnesium (Mg)	mg/L		9.44	9.92	10.2	9.5	9.93	9.82
Manganese (Mn)	mg/L	0.05	0.95	<0.002	0.004	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L		0.016	<0.003	<0.003	0.004	<0.003	<0.003
Phosphorus (P)	mg/L		1.07		0.8	0.72	0.38	0.17
Potassium (K)	mg/L		0.89	1.14	0.88	0.86	0.85	0.89
Silver (Ag)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium (Na)	mg/L	200/20	1.81	1.77	1.75	1.77	1.73	1.61
Strontium (Sr)	mg/L		1.02	0.147	0.139	0.125	0.121	0.144
Vanadium (V)	mg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	5	0.012	<0.005	0.009	<0.005	0.006	<0.005

NOTES:

1. OWDWO indicates Ontario Drinking Water Objectives (2006).
2. Bolding and shading denotes concentration exceeds ODWQO.
3. mg/L indicates milligrams per litre.
4. Blank denotes no ODWQO or parameter not tested..
5. "" indicates value based on lab value.



**TABLE C-2
RESIDENTIAL GROUNDWATER QUALITY -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	DATE		
			26-Jul-11	05-Jul-13	16-Sep-14
TDS	mg/L	500 (AO)	285	252	336
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	270	249	304
Total Ammonia-N	mg/L		0.32	0.21	<0.02
Conductivity	umho/cm		517	496	561
Dissolved Organic Carbon	mg/L	5 (AO)	1.8	1.6	1.8
Orthophosphate (P)	mg/L		<0.01	<0.50	<0.20
pH	pH	6.5 - 8.5 (OG)	7.87	8.49	8.11
Sulphate (SO ₄)	mg/L	500 (AO)	5	3.5	5.63
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	262	258	280
Chloride (Cl)	mg/L	250 (AO)	5	3.22	8.17
Nitrite (N)	mg/L	1.0 (*)	<0.01	<0.25	<0.10
Nitrate (N)	mg/L	10.0 (*)	0.7	<0.25	1.6
Nitrate + Nitrite	mg/L		0.7	<0.07	1.6
Microbiological					
Total Coliforms	CFU/100mL	NOT DETECTED	>2000	0	ND
Fecal Streptococcus	CFU/100mL			<1	ND
Heterotrophic Plate Count	CFU/1mL			0	55
Coliform Background Count	CFU/100mL			0	ND
Escherichia coli	CFU/100mL	NOT DETECTED	7 (1)	0	ND
Metals					
Aluminum (Al)	µg/L	100 (OG)	15	<4	<4
Barium (Ba)	µg/L	1,000 (MAC)*	43	32	45
Beryllium (Be)	µg/L		<0.5	<1	<1
Boron (B)	µg/L	5,000 (IMAC)	17	<10	11
Cadmium (Cd)	µg/L	5 (MAC)*	<0.1	<2	<2
Calcium (Ca)	µg/L		99,000	92,400	113,000
Chromium (Cr)	µg/L	50 (MAC)*	<5	<3	<3
Cobalt (Co)	µg/L		<0.5	<1	<1
Copper (Cu)	µg/L	1,000 (AO)	<1	15	11
Iron (Fe)	µg/L	300 (AO)	<100	91	<10
Lead (Pb)	µg/L	10 (MAC)*	<0.5	<2	<2
Magnesium (Mg)	µg/L		4,700	4,330	5,350
Manganese (Mn)	µg/L	50 (MAC)*	23	60	2
Molybdenum (Mo)	µg/L		<0.5	<2	<2
Nickel (Ni)	µg/L		<1	<3	<3
Phosphorus (P)	µg/L		<100	<50	
Potassium (K)	µg/L		<200	260	260
Silver (Ag)	µg/L		<0.1	<2	<2
Sodium (Na)	µg/L	(**)	2,800	2,350	4,080
Strontium (Sr)	µg/L		170	176	183
Vanadium (V)	µg/L		<0.5	<2	<2
Zinc (Zn)	µg/L	5,000 (AO)	<5	7	20

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. ug/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE C-3
RESIDENTIAL GROUNDWATER QUALITY -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	18-Aug-11	04-Jul-13	16-Sep-14	21-Sep-15	26-Sep-16
DATE							
TDS	mg/L	500 (AO)	314	330	308	322	306
Hardness (CaCO3)	mg/L	80 - 100 (AO)	280	294	285	314	266
Total Ammonia-N	mg/L		<0.05	0.23	0.04	<0.02	<0.02
Conductivity	umho/cm		556	627	563	639	573
Dissolved Organic Carbon	mg/L	5 (AO)	1.1	1.7	1.1	1.2	1.1
Orthophosphate (P)	mg/L		0.01	<0.50	<0.20	<0.50	<0.50
pH	pH	6.5 - 8.5 (OG)	7.87	8.27	8.13	7.89	8.06
Sulphate (SO4)	mg/L	500 (AO)	8	8.7	7.6	7.85	8.12
Alkalinity (Total as CaCO3)	mg/L	30 - 500 (OG)	264	292	270	288	267
Chloride (Cl)	mg/L	250 (AO)	16	15.2	18	18.6	14.3
Nitrite (N)	mg/L	1.0 (*)	<0.01	<0.25	<0.10	<0.25	<0.25
Nitrate (N)	mg/L	10.0 (*)	0.1	1.18	<0.10	<0.25	<0.25
Nitrate + Nitrite	mg/L		0.1	1.18	<0.07	<0.07	<0.35
Microbiological							
Total Coliforms	CFU/100mL	NOT DETECTED	30	128	ND	Overgrowth	37
Fecal Streptococcus/Enterococci	CFU/100mL			<1	ND	<1	11
Heterotrophic Plate Count	CFU/1mL			90	710	ND	405
Coliform Background Count	CFU/100mL			34	ND	ND	185
Escherichia coli	CFU/100mL	NOT DETECTED	0	0	ND	ND	2
Metals							
Aluminum (Al)	µg/L	100 (OG)	6	<4	<4	5	6
Barium (Ba)	µg/L	1,000 (MAC)*	43	51	41	56	48
Beryllium (Be)	µg/L		<0.5	<1	<1	<1	<1
Boron (B)	µg/L	5,000 (IMAC)	11	15	16	13	11
Cadmium (Cd)	µg/L	5 (MAC)*	<0.1	<2	<2	<1	<1
Calcium (Ca)	µg/L		100,000	104,000	101,000	112000	94000
Chromium (Cr)	µg/L	50 (MAC)*	<5	<1	<3	<3	<3
Cobalt (Co)	µg/L		<0.5	<1	<1	<1	<1
Copper (Cu)	µg/L	1,000 (AO)	7	48	8	18	50
Iron (Fe)	µg/L	300 (AO)	<100	<10	<10	10	<10
Lead (Pb)	µg/L	10 (MAC)*	1.2	<2	<2	<2	<2
Magnesium (Mg)	µg/L		7,200	8,300	8,060	8340	7710
Manganese (Mn)	µg/L	50 (MAC)*	7	<2	18	5	<2
Molybdenum (Mo)	µg/L		<0.5	<2	<2	<2	<2
Nickel (Ni)	µg/L		<1	<3	<3	<3	<3
Phosphorus (P)	µg/L		<100	<50		<0.05	<50
Potassium (K)	µg/L		2,600	2,500	2,460	2450	2090
Silver (Ag)	µg/L		<0.1	<2	<2	<2	<2
Sodium (Na)	µg/L	(**)	10,000	8,590	10,700	10900	11100
Strontium (Sr)	µg/L		230	305	271	323	312
Vanadium (V)	µg/L		<0.5	<2	<2	<2	<2
Zinc (Zn)	µg/L	5,000 (AO)	280	449	379	226	168

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. ug/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE C-4
RESIDENTIAL GROUNDWATER QUALITY -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG	
DATE			21-Sep-15
TDS	mg/L	500 (AO)	410
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	428
Total Ammonia-N	mg/L		<0.02
Conductivity	umho/cm		774
Dissolved Organic Carbon	mg/L	5 (AO)	2.3
Orthophosphate (P)	mg/L		<0.50
pH	pH	6.5 - 8.5 (OG)	7.95
Sulphate (SO ₄)	mg/L	500 (AO)	4.98
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	402
Chloride (Cl)	mg/L	250 (AO)	1.95
Nitrite (N)	mg/L	1.0 (*)	<0.25
Nitrate (N)	mg/L	10.0 (*)	<0.25
Nitrate + Nitrite	mg/L		<0.07
Microbiological			
Total Coliforms	CFU/100mL	NOT DETECTED	85
Fecal Streptococcus/Enterococci	CFU/100mL		<1
Heterotrophic Plate Count	CFU/1mL		70
Coliform Background Count	CFU/100mL		45
Escherichia coli	CFU/100mL	NOT DETECTED	ND
Metals			
Aluminum (Al)	µg/L	100 (OG)	7
Barium (Ba)	µg/L	1,000 (MAC)*	60
Beryllium (Be)	µg/L		<1
Boron (B)	µg/L	5,000 (IMAC)	14
Cadmium (Cd)	µg/L	5 (MAC)*	<1
Calcium (Ca)	µg/L		154000
Chromium (Cr)	µg/L	50 (MAC)*	<3
Cobalt (Co)	µg/L		<1
Copper (Cu)	µg/L	1,000 (AO)	11
Iron (Fe)	µg/L	300 (AO)	493
Lead (Pb)	µg/L	10 (MAC)*	3
Magnesium (Mg)	µg/L		10600
Manganese (Mn)	µg/L	50 (MAC)*	167
Molybdenum (Mo)	µg/L		<2
Nickel (Ni)	µg/L		<3
Phosphorus (P)	µg/L		<0.05
Potassium (K)	µg/L		1550
Silver (Ag)	µg/L		<2
Sodium (Na)	µg/L	(**)	3840
Strontium (Sr)	µg/L		342
Vanadium (V)	µg/L		<2
Zinc (Zn)	µg/L	5,000 (AO)	46

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. µg/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE C-5
RESIDENTIAL GROUNDWATER QUALITY -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG		
			21-Sep-15	27-Sep-16
DATE				
TDS	mg/L	500 (AO)	480	474
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	342	326
Total Ammonia-N	mg/L		<0.02	<0.02
Conductivity	umho/cm		977	899
Dissolved Organic Carbon	mg/L	5 (AO)	1.1	1.1
Orthophosphate (P)	mg/L		<0.50	<0.50
pH	pH	6.5 - 8.5 (OG)	7.82	8.06
Sulphate (SO ₄)	mg/L	500 (AO)	17	10.1
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	297	316
Chloride (Cl)	mg/L	250 (AO)	116	93.3
Nitrite (N)	mg/L	1.0 (*)	<0.25	<0.25
Nitrate (N)	mg/L	10.0 (*)	0.78	<0.25
Nitrate + Nitrite	mg/L		0.78	<0.35
Microbiological				
Total Coliforms	CFU/100mL	NOT DETECTED	102	1
Fecal Streptococcus/enterococci	CFU/100mL		<1	<1
Heterotrophic Plate Count	CFU/1mL		840	10
Coliform Background Count	CFU/100mL		ND	13
Escherichia coli	CFU/100mL	NOT DETECTED	ND	ND
Metals				
Aluminum (Al)	µg/L	100 (OG)	57	9
Barium (Ba)	µg/L	1,000 (MAC)*	127	120
Beryllium (Be)	µg/L		<1	<1
Boron (B)	µg/L	5,000 (IMAC)	36	30
Cadmium (Cd)	µg/L	5 (MAC)*	<1	<1
Calcium (Ca)	µg/L		113000	108000
Chromium (Cr)	µg/L	50 (MAC)*	5	<3
Cobalt (Co)	µg/L		<1	<1
Copper (Cu)	µg/L	1,000 (AO)	620	59
Iron (Fe)	µg/L	300 (AO)	132	92
Lead (Pb)	µg/L	10 (MAC)*	2	<2
Magnesium (Mg)	µg/L		14600	13600
Manganese (Mn)	µg/L	50 (MAC)*	6	23
Molybdenum (Mo)	µg/L		<2	<2
Nickel (Ni)	µg/L		<3	<3
Phosphorus (P)	µg/L		<0.05	<50
Potassium (K)	µg/L		1580	2590
Silver (Ag)	µg/L		<2	<2
Sodium (Na)	µg/L	(**)	69800	56700
Strontium (Sr)	µg/L		293	277
Vanadium (V)	µg/L		2	<2
Zinc (Zn)	µg/L	5,000 (AO)	62	12

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L indicates milligrams per litre. µg/L indicates micrograms per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

**TABLE C-6
RESIDENTIAL GROUNDWATER QUALITY -
CODRINGTON PIT**

PARAMETERS MEASURED	UNITS	ODWSOG			
			18-Aug-11	11-Apr-13	21-Sep-15
TDS	mg/L	500 (AO)	357	300	356
Hardness (CaCO ₃)	mg/L	80 - 100 (AO)	300	272	340
Total Ammonia-N	mg/L		0.06	0.09	<0.02
Conductivity	umho/cm		628	566	670
Dissolved Organic Carbon	mg/L	5 (AO)	0.9	1.2	1.1
Orthophosphate (P)	mg/L		<0.01	<0.10	<0.50
pH	pH	6.5 - 8.5 (OG)	7.78	8.24	7.96
Dissolved Sulphate (SO ₄)	mg/L	500 (AO)	12	6.57	11.7
Alkalinity (Total as CaCO ₃)	mg/L	30 - 500 (OG)	299	269	308
Dissolved Chloride (Cl)	mg/L	250 (AO)	16	8.94	10
Nitrite (N)	mg/L	1.0 (*)	<0.01	<0.05	<0.25
Nitrate (N)	mg/L	10.0 (*)	0.4	0.14	2.99
Nitrate + Nitrite	mg/L	10.0 (*)	0.4	0.14	2.99
Microbiological					
Background	CFU/100mL			ND	ND
Heterotrophic Plate Count	CFU/1mL			340	1230
Total Coliforms	CFU/100mL	NOT DETECTED	100 (1)	27	Overgrowth
Fecal Streptococcus/Enterococci	CFU/100mL			3	9
Escherichia coli	CFU/100mL	NOT DETECTED	0 (1)	ND	ND
Metals					
Aluminum (Al)	mg/L	0.100 (OG)	<0.005	0.005	0.006
Barium (Ba)	mg/L	1.0 (MAC)*	0.058	0.044	0.065
Beryllium (Be)	mg/L		<0.0005	<0.001	<0.001
Boron (B)	mg/L	5.0 (IMAC)	0.028	0.035	0.037
Cadmium (Cd)	mg/L	0.005 (MAC)*	<0.0001	<0.002	<0.001
Calcium (Ca)	mg/L		110	97.7	120
Chromium (Cr)	mg/L	0.050 (MAC)*	<0.005	<0.003	<0.003
Cobalt (Co)	mg/L		<0.0005	<0.001	<0.001
Copper (Cu)	mg/L	1.0 (AO)	0.027	0.56	0.033
Iron (Fe)	mg/L	0.300 (AO)	<0.100	0.051	<0.010
Lead (Pb)	mg/L	0.010 (MAC)*	0.0007	<0.002	<0.002
Magnesium (Mg)	mg/L		9.4	6.91	9.77
Manganese (Mn)	mg/L	0.050 (MAC)*	<0.002	<0.002	<0.002
Molybdenum (Mo)	mg/L		<0.0005	<0.002	<0.002
Nickel (Ni)	mg/L		<0.001	<0.003	<0.003
Phosphorus (P)	mg/L		<0.100	<0.05	<0.05
Potassium (K)	mg/L		1.3	0.89	1.47
Silver (Ag)	mg/L		<0.0001	<0.002	<0.002
Sodium (Na)	mg/L		17	9.71	123
Strontium (Sr)	mg/L		0.27	0.228	0.312
Vanadium (V)	mg/L		0.0011	<0.002	<0.002
Zinc (Zn)	mg/L	5.0 (AO)	0.01	0.018	0.009

NOTES:

1. ODWSOG - Ontario Drinking Water Standards, Objectives and Guidelines (2003), updated June 2006.
2. (*) denotes health related drinking water standard.
3. OG denotes the Operational Guidelines.
4. AO denotes Aesthetic Objective.
5. Bolding and shading denotes concentration exceeds ODWSOG.
6. mg/L denotes milligrams per litre.
7. Blank denotes no ODWSOG has been set yet.
8. CFU/100ml denotes number of colony forming units per 100 millilitres of water.
9. "<" denotes less than detection limit (not detected).

Appendix D

Surface Water Data

- Surface Water Quality – General Chemistry – Table D-1
 - Surface Water Flow Rates – Figure D-1
 - Time-Concentration Graphs – Figures D-2 to D-4
 - Surface Water Quality – Codrington Fish Research Centre – Table D-2
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TABLE D-1
SURFACE WATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS										
			Pond North of Pit	SWB	SWB	SWB	SWB	SWB	SWB	SWB	SWB	SWB	SWB
DATE			19-Aug-11	11-Apr-13	4-Jul-13	19-Sep-13	4-Dec-13	15-Apr-14	16-Sep-14	31-Mar-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters													
pH	pH	6.5 - 8.5	8.22	7.75	EF	7.91	8.54	8.23	7.79	8.91	7.41	7.35	6.22
Temperature	t°C		21.6	5.6	11	11	6.5	5.7	10	1.9	11.1	5.6	10.7
Conductivity	(µS/cm)		2287	407	415	346	437	429	376	223	369	436	338
Dissolved Oxygen	mg/L			10	12.31	9.8*	11.4	12.2		10.1	9.6	11.4	10.2
Turbidity	NTU			4.09	<1	1.9*	4.1	7.3		31.3	10.8	1.75	5.62
Flow Rate	L/s			0.35	1.67	0.87	1.13	1.3	1	0.7	0.2	0.1	0.3
Inorganics													
TDS	mg/L		165	238	220	232	232	266		108	216	216	232
Hardness (CaCO3)	mg/L		140	233	218	232	232	218		111	228	238	215
Total Ammonia-N	mg/L		<0.05	0.063	0.143	<0.02	<0.02	0.13		0.06	<0.02	<0.02	<0.02
Ammonia (unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
Conductivity	umho/cm		321	454	443	439	440	447		229	428	420	427
Dissolved Organic Carbon	mg/L		4.2	0.9	1	1.2	1.4	2.5		10.9	0.9	1.3	1.1
Orthophosphate (P)	mg/L		<0.01	<0.100	<0.100	<0.10	<0.10	<0.10		<0.10	<0.10	<0.10	<0.10
pH	pH	6.5 - 8.5	8.16	8.04	8.41	7.78	8.28	8.3		8.08	8.22	8.1	8.2
Sulphate (SO4)	mg/L		5	6.24	5.2	4.73	5.07	5.36		2.48	4.61	5.33	4.02
Alkalinity (Total as CaCO3)	mg/L		169	222	230	250	239	219		111	219	232	220
Chloride (Cl)	mg/L		<1	1.02	0.967	0.99	1.02	1.06		1.18	0.96	1.1	0.86
Nitrite (N)	mg/L		<0.01	<0.050	<0.050	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05
Nitrate (N)	mg/L		<0.1	0.104	0.082	0.08	0.08	0.16		0.38	0.05	0.12	0.07
Nitrate + Nitrite	mg/L		<0.1	0.104	0.082	0.08	0.08	0.16		0.38	<0.07	0.12	0.07
Metals													
Aluminum (Al)	µg/L	75	110	4.2	14	10	<4	22		12	<4	<4	<4
Barium (Ba)	µg/L		33	69.1	57.1	62	64	51		25	66	63	68
Beryllium (Be)	µg/L	1100	<0.5	<2.0	<2.0	<1	<1	<1		<1	<1	<1	<1
Boron (B)	µg/L	200	<10	<10	<10	<10	13	<10		10	<10	<10	16
Cadmium (Cd)	µg/L	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<1	<0.1	<0.1
Calcium (Ca)	µg/L		49000	81700	76600	81800	81100	77300		39700	80500	84200	75800
Chromium (Cr)	µg/L	8.9	<5	<3.0	<3.0	<3	<3	<3		<3	<3	<3	<3
Cobalt (Co)	µg/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Copper (Cu)	µg/L	5	<1	<2.0	<2.0	<2	<2	<2		1	<2	<2	<2
Iron (Fe)	µg/L	300	160	<10	28	<10	230	<10		170	10	4	70
Lead (Pb)	µg/L	25.0	<0.5	<1.0	<1.0	<1	1	<1		<1	<1	<1	<1
Magnesium (Mg)	µg/L		4700	6960	6430	6790	1050	6170		2880	6600	6850	6300
Manganese (Mn)	µg/L		23	3.9	13.7	15	40	6		29	11	11	21
Molybdenum (Mo)	µg/L	40	0.5	<2.0	<2.0	<2	<2	<2		<2	<2	<2	<2
Nickel (Ni)	µg/L	25	<1	<3.0	<3.0	<3	<3	<3		<3	<3	<3	<3
Phosphorus (P)	µg/L	30	<100	36	48	<20	80	30		44	<10	4	20
Potassium (K)	µg/L		950	1130	1030	1110	1200	1240		4820	1190	1110	1090
Silver (Ag)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1
Sodium (Na)	µg/L		1100	1130	1070	1210	1150	1010		950	1190	1140	1110
Strontium (Sr)	µg/L		92	132	115	117	127	125		61	125	129	126
Vanadium (V)	µg/L	6	1.7	<2.0	<2.0	<2	<2	<2		<2	<2	<2	<2
Zinc (Zn)	µg/L	20	<5	<5.0	7	6	8	<5		<5	5	6	7

- NOTES:
1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
 2. Bolding and shading denotes concentration exceeds PWQO.
 3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
 4. Blank denotes no PWQO or parameter not tested..
 5. EF indicates equipment failure.

TABLE D-1
SURFACE WATER QUALITY - GENERAL CHEMISTRY
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS									
			SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC	SWC
DATE			11-Apr-13	4-Jul-13	19-Sep-13	4-Dec-13	15-Apr-14	16-Sep-14	31-Mar-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters												
pH	pH	6.5 - 8.5	8.33	EF	8.02	8.42	7.79	8.02	7.63	7.84	7.33	
Temperature	t°C		3.6	22.6	17.2	3.1	6	14.1	1.4	16.4	4.3	
Conductivity	(µS/cm)		370	355	316	452	420	329	365	327	524	
Dissolved Oxygen	mg/L		9.8	9.49	9.5*	11.6	9.9		9.9	8.0	11.9	
Turbidity	NTU		17.9	1.4	8.8*	6.4	16.6		25.2	9.0	4.5	
Flow Rate	L/s		50	2.8	<1	10.5	51.9	5.6	12.8	1	14.7	DRY
Inorganics												
TDS	mg/L		234	198	220	246	280	280	196	196	266	
Hardness (CaCO3)	mg/L		190	178	172	242	197	197	173	193	257	
Total Ammonia-N	mg/L		0.047	0.275	<0.02	0.03	0.82	0.82	0.6	<0.02	<0.02	
Ammonia (unionized)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Conductivity	umho/cm		412	372	335	458	452	452	368	371	486	
Dissolved Organic Carbon	mg/L		6.7	4.2	4.2	2.8	11.4	11.4	13.1	6.9	4.5	
Orthophosphate (P)	mg/L		<0.100	<0.100	0.22	<0.10	0.51	0.51	0.19	<0.10	<0.10	
pH	pH	6.5 - 8.5	7.87	8.34	7.78	8.28	8.17	8.17	8.12	8.26	8.14	
Sulphate (SO4)	mg/L		7.15	4.35	5.94	7.84	6.97	6.97	6.55	6.39	9.61	
Alkalinity (Total as CaCO3)	mg/L		176	189	185	231	197	197	173	184	240	
Chloride (Cl)	mg/L		8.36	1.84	1.52	1.88	9.95	9.95	5.26	1.36	12.1	
Nitrite (N)	mg/L		<0.050	<0.050	<0.05	<0.05	0.08	0.08	<0.05	<0.05	<0.05	
Nitrate (N)	mg/L		2.08	<0.050	0.16	0.09	0.58	0.58	0.26	<0.05	1.08	
Nitrate + Nitrite	mg/L		2.08	<0.070	0.16	0.09	0.66	0.66	0.26	<0.07	1.08	
Metals												
Aluminum (Al)	µg/L	75	10.4	15.5	13	<4	13	13	28	<4	9	
Barium (Ba)	µg/L		43.9	38.7	62	53	32	32	56	57	52	
Beryllium (Be)	µg/L	1100	<2.0	<2.0	<1	<1	<1	<1	<1	<1	<1	
Boron (B)	µg/L	200	<10	<10	<10	<10	<10	<10	<10	<10	<10	
Cadmium (Cd)	µg/L	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	
Calcium (Ca)	µg/L		64400	58400	56300	82000	67500	67500	57800	64100	86400	
Chromium (Cr)	µg/L	8.9	<3.0	<3.0	<3	<3	3	3	<3	<3	<3	
Cobalt (Co)	µg/L	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Copper (Cu)	µg/L	5	<2.0	<2.0	<2	<2	<2	<2	2	<2	<2	
Iron (Fe)	µg/L	300	240	372	630	140	200	200	450	270	160	
Lead (Pb)	µg/L	25.0	<1.0	<1.0	<1	<1	<1	<1	<1	<1	<1	
Magnesium (Mg)	µg/L		6990	7770	7530	9070	6980	6980	6950	8100	9900	
Manganese (Mn)	µg/L		20	65.7	98	46	39	39	49	44	30	
Molybdenum (Mo)	µg/L	40	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2	
Nickel (Ni)	µg/L	25	<3.0	<3.0	<3	<3	<3	<3	<3	<3	<3	
Phosphorus (P)	µg/L	30	267	70	80	40	270	270	720	60	130	
Potassium (K)	µg/L		6190	<500	960	910	6190	6190	9730	1330	2990	
Silver (Ag)	µg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Sodium (Na)	µg/L		3900	1930	1970	1980	4460	4460	2730	1940	5170	
Strontium (Sr)	µg/L		120	124	127	130	131	131	98	129	164	
Vanadium (V)	µg/L	6	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2	
Zinc (Zn)	µg/L	20	6.7	<5.0	<5	<5	5	5	5	7	7	

NOTES:

1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
2. Bolding and shading denotes concentration exceeds PWQO.
3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
4. Blank denotes no PWQO or parameter not tested.
5. EF indicates equipment failure.

FIGURE D-1
SURFACE WATER FLOW RATES

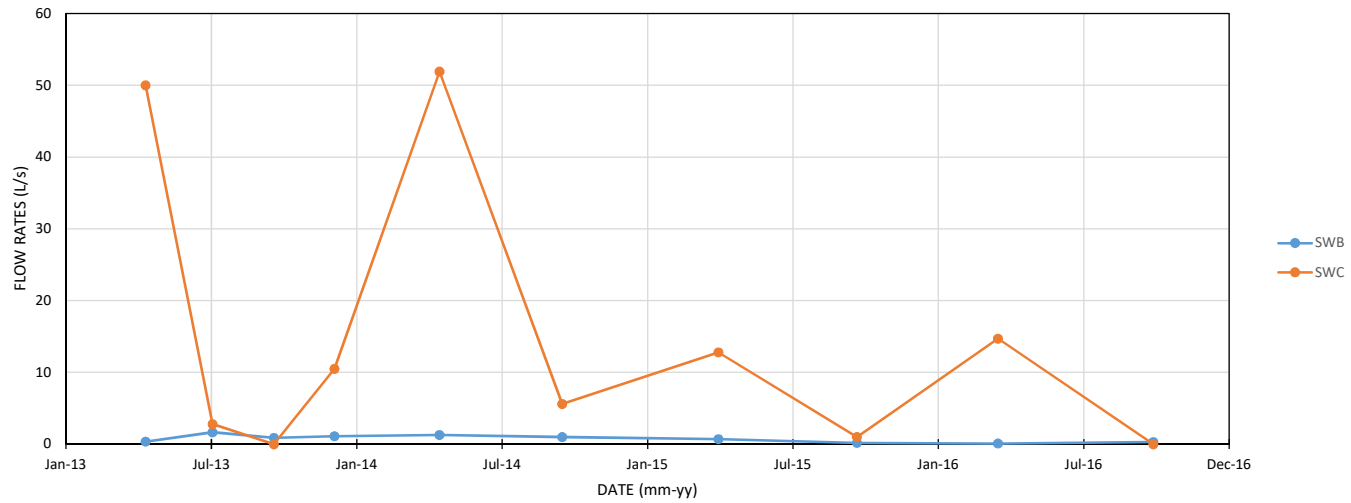


FIGURE D-2
TDS CONCENTRATIONS VS TIME

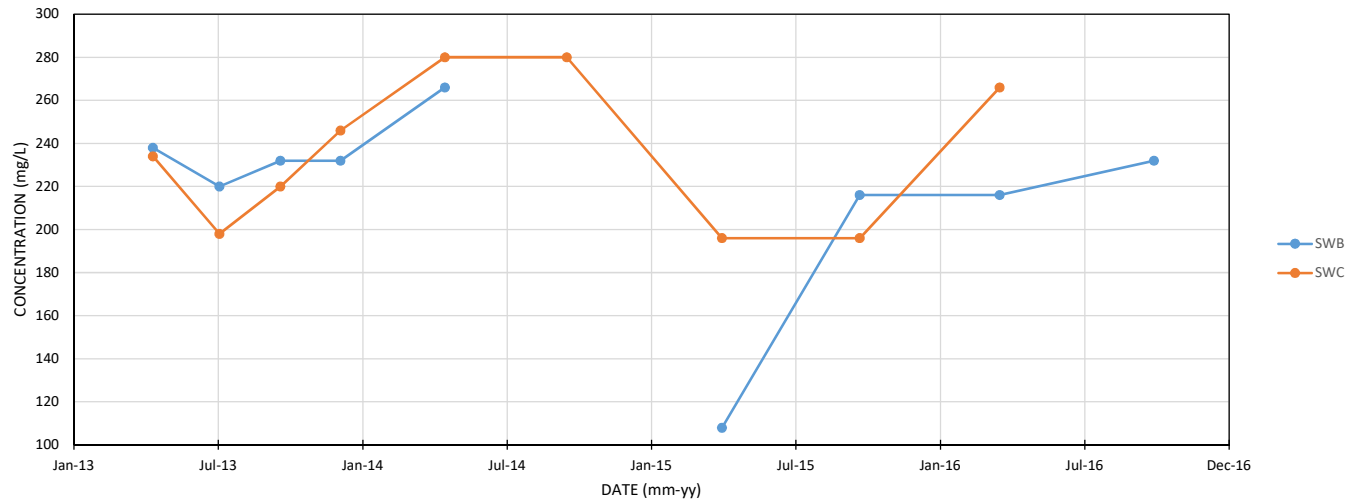


FIGURE D-3
NITRATE CONCENTRATIONS VS TIME

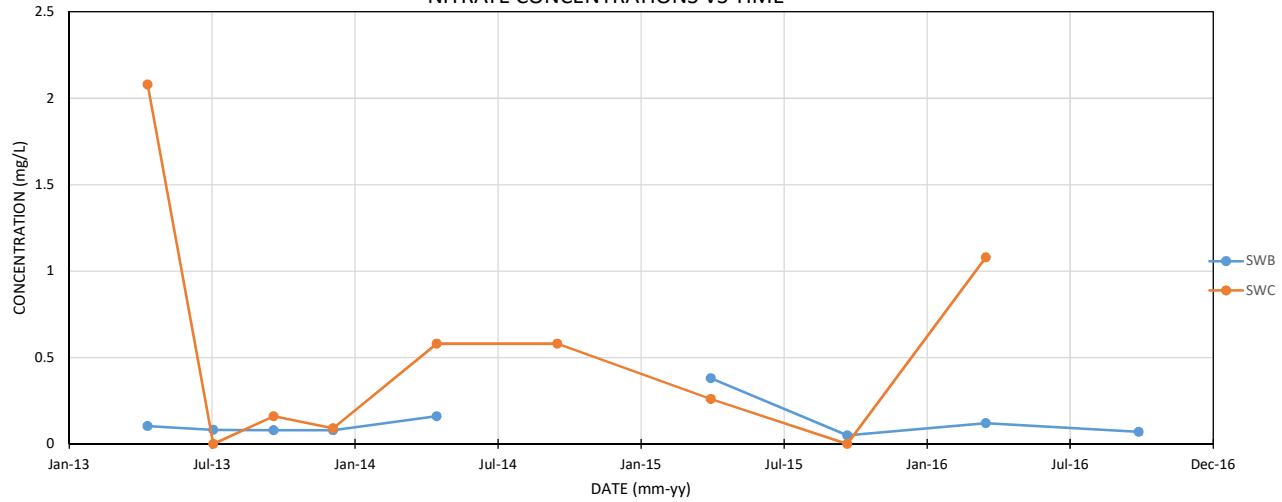


FIGURE D-4
TOTAL PHOSPHORUS CONCENTRATIONS VS TIME

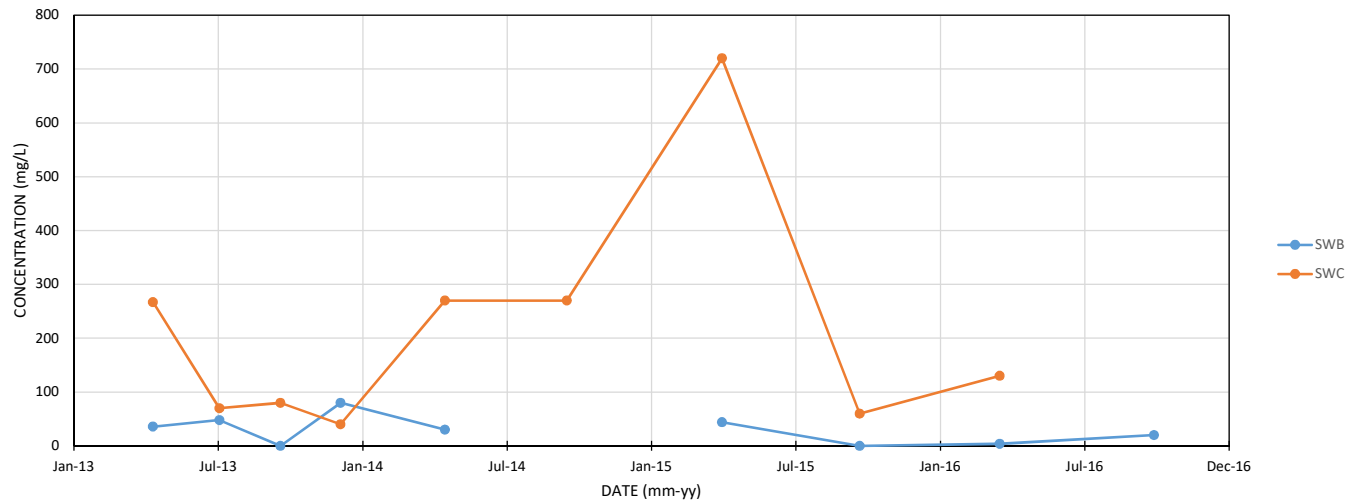


TABLE D-2
SURFACE WATER QUALITY - CODRINGTON FISH RESEARCH CENTRE
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS										
			Fish Hatchery Head Pond	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1	FH-SW1
DATE			28-Sep-11	15-Apr-13	4-Jul-13	19-Sep-13	4-Dec-13	16-Apr-14	17-Sep-14	1-Apr-15	21-Sep-15	16-Mar-16	27-Sep-16
Field Parameters													
pH	pH	6.5 - 8.5	7.92	7.54	EF	6.9	7.55	7.78	7.54	8.36	7.19	7.5	7.57
Temperature	°C		11.1	8.5	9.6	9.7	7.9	8.3	9	8.6	8.5	8.6	8.5
Conductivity	(µS/cm)		507	475	576	483	613	600	531	610	524	614	483
Dissolved Oxygen	mg/L			6.3	5.88	9.7*	4.7	4.69	4.72	5	4.88	EF	4.8
Turbidity	NTU			1	<1	<0.5*	0.31	4.8	4.5	4	6.24	5.32	6.2
Flow Rate	L/s				3.2	3.9	7.2	7.4	2.9	6.8	2.3	3.9	2.4
Inorganics													
TDS	mg/L		302		332	350	316						
Hardness (CaCO3)	mg/L		260		273	318	298						
Total Ammonia-N	mg/L		<0.05		<0.020	<0.02	<0.02						
Ammonia (unionized)	mg/L	0.02	<0.02		<0.02	<0.02	<0.02						
Conductivity	umho/cm		524		612	621	625						
Dissolved Organic Carbon	mg/L		1		1	0.9	<0.5						
Orthophosphate (P)	mg/L		<0.01		<0.100	<0.20	<0.20						
pH	pH	6.5 - 8.5	8.15		8.41	7.76	8.22						
Sulphate (SO4)	mg/L		17		20.8	20.0	20.6						
Alkalinity (Total as CaCO3)	mg/L		241		249	271	253						
Chloride (Cl)	mg/L		12		30	27.9	27.8						
Nitrite (N)	mg/L		<0.01		<0.050	<0.10	<0.10						
Nitrate (N)	mg/L		2.6		1.5	1.54	1.36						
Nitrate + Nitrite	mg/L		2.6		1.5	1.54	1.36						
Metals													
Aluminum (Al)	µg/L	75	5		11.6	9	<4						
Barium (Ba)	µg/L		110		134	142	135						
Beryllium (Be)	µg/L	1100	<0.5		<2.0	<1	<1						
Boron (B)	µg/L	200	11		14	<10	10						
Cadmium (Cd)	µg/L	0.5	<0.1		<0.1	<0.1	<0.1						
Calcium (Ca)	µg/L		81000		83100	98200	91300						
Chromium (Cr)	µg/L	8.9	<5		<3.0	<3	<3						
Cobalt (Co)	µg/L	0.9	<0.5		<0.5	<0.5	<0.5						
Copper (Cu)	µg/L	5	<1		<2.0	<2	<2						
Iron (Fe)	µg/L	300	<100		<10	<10	<10						
Lead (Pb)	µg/L	25.0	<0.5		<1.0	<1	<1						
Magnesium (Mg)	µg/L		13000		15900	17600	17000						
Manganese (Mn)	µg/L		9		<2.0	3	<2						
Molybdenum (Mo)	µg/L	40	<0.5		<2.0	<2	<2						
Nickel (Ni)	µg/L	25	<1		<3.0	<3	<3						
Phosphorus (P)	µg/L	30	<100		<20	<20	20						
Potassium (K)	µg/L		1300		1530	1590	1620						
Silver (Ag)	µg/L	0.1	<0.1		<0.1	<0.1	<0.1						
Sodium (Na)	µg/L		5700		10500	11900	11100						
Strontium (Sr)	µg/L		190		293	316	301						
Vanadium (V)	µg/L	6	<0.5		<2.0	<2	<2						
Zinc (Zn)	µg/L	20	<5		<5.0	57	<5						

- NOTES:
1. PWQO indicates Provincial Water Quality Objectives (1994 plus updates).
 2. Bolding and shading denotes concentration exceeds PWQO.
 3. mg/L indicates milligrams per litre; µg/L denotes microgram per litre.
 4. Blank denotes no PWQO or parameter not tested..
 5. EF indicates equipment failure.

TABLE D-2
SURFACE WATER QUALITY - CODRINGTON FISH RESEARCH CENTRE
CODRINGTON PIT

PARAMETERS	UNITS	PWQO	SAMPLING STATIONS									
			FH-SW2 15-Apr-13	FH-SW2 4-Jul-13	FH-SW2 19-Sep-13	FH-SW2 4-Dec-13	FH-SW2 16-Apr-14	FH-SW2 17-Sep-14	FH-SW2 1-Apr-15	FH-SW2 21-Sep-15	FH-SW2 16-Mar-16	FH-SW2 27-Sep-16
Field Parameters												
pH	pH	6.5 - 8.5	7.89	EF	8.02	8.06	8.2	8.11	9.1	7.75	7.89	
Temperature	°C		6	12.4	10	4	3.7	8.4	1.6	8.4	5.6	
Conductivity	(µS/cm)		411	462	383	525	373	417	442	404	423	
Dissolved Oxygen	mg/L		10.2	12.58	9.9*	10.5	12.55	11.85	12	11.62	EF	
Turbidity	NTU		2.6	<1	<0.5*	0.86	3.8	3	4	5.33	4.2	
Flow Rate	L/s		27.4	12.6	4.9	6.9	69.4	6.3	36.9	6.4	15.4	DRY
Inorganics												
TDS	mg/L			242	280	266						
Hardness (CaCO3)	mg/L			247	261	259						
Total Ammonia-N	mg/L			0.102	<0.02	<0.02						
Ammonia (unionized)	mg/L	0.02		<0.02	<0.02	<0.02						
Conductivity	umho/cm			491	490	499						
Dissolved Organic Carbon	mg/L			1.2	1.4	1.3						
Orthophosphate (P)	mg/L			<0.100	<0.10	<0.20						
pH	pH	6.5 - 8.5		8.53	7.98	8.31						
Sulphate (SO4)	mg/L			13.8	14.0	13.5						
Alkalinity (Total as CaCO3)	mg/L			244	261	242						
Chloride (Cl)	mg/L			3.3	3.63	3.42						
Nitrite (N)	mg/L			<0.050	<0.05	<0.10						
Nitrate (N)	mg/L			0.964	1.08	0.84						
Nitrate + Nitrite	mg/L			0.964	1.08	0.84						
Metals												
Aluminum (Al)	µg/L	75		13.2	10	<4						
Barium (Ba)	µg/L			79.6	87	76						
Beryllium (Be)	µg/L	1100		<2.0	<1	<1						
Boron (B)	µg/L	200		<10	<10	<10						
Cadmium (Cd)	µg/L	0.5		<0.1	<0.1	<0.1						
Calcium (Ca)	µg/L			79300	84100	83800						
Chromium (Cr)	µg/L	8.9		<3.0	<3	<3						
Cobalt (Co)	µg/L	0.9		<0.5	<0.5	<0.5						
Copper (Cu)	µg/L	5		<2.0	<2	<2						
Iron (Fe)	µg/L	300		<10	<10	<10						
Lead (Pb)	µg/L	25.0		<1.0	<1	<1						
Magnesium (Mg)	µg/L			11800	12400	12200						
Manganese (Mn)	µg/L			11.1	3.0	10						
Molybdenum (Mo)	µg/L	40		<2.0	<2	<2						
Nickel (Ni)	µg/L	25		<3.0	<3	<3						
Phosphorus (P)	µg/L	30		<20	<20	<20						
Potassium (K)	µg/L			1110	1130	1140						
Silver (Ag)	µg/L	0.1		<0.1	<0.1	<0.1						
Sodium (Na)	µg/L			2390	2480	2500						
Strontium (Sr)	µg/L			168	167	167						
Vanadium (V)	µg/L	6		<2.0	<2	<2						
Zinc (Zn)	µg/L	20		<5.0	<5	<5						

- NOTES:
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