

5.6 GROUNDWATER QUANTITY AND QUALITY

For the purpose of this EIS, the inventory and description of groundwater resources (hydrogeology) within the footprint of the Logistics Park and associated rail corridor to Auld's Cove was documented by conducting an on-line data search, and a review of available water well data. The transmission corridor and revisions to the rail corridor, including the extension to Linwood Station, have not been included in this study but will be addressed following approval of this EIS as part of the monitoring and follow-up program.

Additionally, upon EIS approval, a complete water well survey will be undertaken by the proponent together with a groundwater and geotechnical investigation at the Project site.

5.6.1 Background

Groundwater is an important source of water for private wells, public water supplies, agricultural supplies, industrial supplies, and commercial supplies throughout the province. Of the 82 municipal water supplies in Nova Scotia, approximately 34 percent obtain water from groundwater sources and 12 percent use a combination of groundwater and surface water (NSE 2008a). In addition, groundwater supplies are used by most of the small registered public water systems in Nova Scotia, which provide water to facilities such as rural schools, day cares, nursing homes, restaurants, and campgrounds (NSE 2008a). The province's water table is usually found within about 5 m of ground surface, but can be deeper in areas with higher topography, such as the Cape Breton Highlands (NSE 2008a).

5.6.2 Groundwater Quantity

In Nova Scotia, groundwater is found in bedrock aquifers and in overburden aquifers (i.e. loose soil and rock located above the bedrock) (NSE 2008a). Bedrock aquifers are the most commonly utilized aquifers to obtain water in the province, usually via drilled wells that are typically less than about 90 m in depth (NSE 2008a). There are 3 main groundwater regions in Nova Scotia, separated by the three main (in general) rock types present in bedrock aquifers:

- 1) igneous and metamorphic rocks such as slate, quartzite, and granite, which yield water mainly from fractures;
- 2) sedimentary rocks such as sandstone, shale, and conglomerate, which yield water from spaces between the grains and from fractures; and
- 3) carbonate and evaporite rocks such as limestone and gypsum, which yield water mainly from fractures and cavities (NSE 2008a).

The ground water region in the area of the proposed Project site is made-up of sedimentary rocks (Figure 5.6-1)

5.6.3 Groundwater Quality

Naturally-occurring water quality problems in Nova Scotia include arsenic, chloride, hardness, iron, manganese, radionuclides, radon, sulphate, and uranium. Most of these problems are related to the natural chemistry of the soil and rock where the well is located (NSE 2008a). Chloride problems may also come from seawater, a common problem in wells that are located close to the ocean (NSE 2008a).

The most common parameters that exceed health-related drinking water guidelines include arsenic, bacteria, nitrate and uranium while, chloride, hardness, iron and manganese are the most common parameters exceeding aesthetic drinking water guidelines (NSE 2008a). It should be noted that Nova Scotia has adopted Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ) (NSE 2008b)

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Historical water resource studies of the Canso Area conducted in 1975, categorized the lands where the proposed Site is located, as having good water quality with a low degree of total dissolved solids (TDS) but a tendency towards hardness and a poor source of groundwater (Figure 5.6-2) (Canada-Nova Scotia Strait of Canso Environment Committee 1975). The surficial deposits are classified as clay till despoits with varying depths (Canada-Nova Scotia Strait of Canso Environment Committee 1975).

5.6.4 Water Well Records

Groundwater has a dynamic relationship with surface water, and provides a potable water supply to all of the un-serviced residences adjacent to and nearby the proposed Site.

Based on the water well results for the Melford area, (NS Well Logs Database, 2007) groundwater ranges from 0 to 33 m below ground surface (bgs) with an average depth to groundwater of about 5m bgs. Overburden thickness in the area ranges from about 1 to 33 m (3 to 105 ft) with an average thickness of about 10 m.

A ground water search was completed through the Nova Scotia Water Well Database (2007) for an area extending from Sand Point (southeast of footprint), through to Auld’s Cove. The search revealed approximately 71 domestic and industrial water wells. An elimination of water wells was done on the criterion that wells outside a buffer zone of 500m from the site footprint and rail corridor would not be at risk of being effected. Also eliminating a large area is the town water source of Mulgrave which has a reservoir system that services all residents within town limits. A list of these wells (44 in total, within 500m of the Site and rail corridor) is available in Appendix 5.6-A. Twenty-two wells are located in Sand Point, three in Pirate Harbour and nineteen in Middle Melford. Field inspections will be undertaken by MITI to identify the presence of additional water supply wells and to map / verify well locations within 800m of any blasting activity. This inspection will be conducted as part of the detailed design phase and prior to any construction activities.

Table 5.6-1 provides summary details on the 44 wells in the area. The average well depth was 45 m deep yielding approximately 7 gallons per minute (GPM); with some wells as deep as 75 m and a few with yield rates upwards of 20 GPM.

Table 5.6-1: Summary of Water Well Records in Buffer Zone

	Well Depth (m)	Estimated Yield (GPM)	Water Depth (m)	Overburden Thickness (m)
Minimum	4.5	1	-0.3	0.9
Maximum	75	20	32	32
Average	45	6.8	4.9	7.9
Median	44.5	5	12	5.3
Number	42	42	36	28

Overall, the water is described generally as good quality with tendencies of being slightly alkaline and hard. Mapping of Nova Scotia’s drinking and well water revealed that the area near the proposed Site footprint has the potential for uranium content in the drinking water (Figure 5.6-3) (NSE 2008a). Additionally, arsenic could also be present (Figure 5.6-4). As noted above in Section 5.6.3, these substances are commonly found in drinking water and wells in Nova Scotia.

5.6.5 Water Well Survey

As a precautionary measure and to address local concerns, a well survey was conducted on domestic water wells. A group of 8 wells was sampled representing an area spanning from the Southeast extent of the proposed terminal, to the Southeast edge of the town limits of Mulgrave

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(Figure 5.6-5). Residents were selected by location as to ensure a representation of the entire area and with consultation of a municipal officer who is familiar with the area and the residents. The individual well survey consisted of completing a questionnaire about the current and past status of the water well. Further, a water sample was collected from each surveyed well using approved NSE sampling protocols and submitted to an independent laboratory for analyses of general water quality parameters and metals. The analytical results are presented in the following Tables 5.6-2 and 5.6-3.

Table 5.6-2: Domestic Water Well Survey – Water Quality

Station ID		WW1	WW2	WW3	WW4	WW5	WW6	WW7	WW8
	Units								
Calculated Parameters									
Anion Sum	me/L	3.23	1.68	0.65	2.75	2.36	1.92	0.55	1.02
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	115	45	8	120	98	78	6	25
Calculated TDS	mg/L	177	97	41	147	124	104	36	62
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	1	<1	<1	2	<1	<1	<1	<1
Cation Sum	me/L	3.1	1.69	0.66	2.66	2.25	1.89	0.57	1.02
Hardness (CaCO ₃)	mg/L	100	48	19	110	91	78	13	32
Ion Balance (% Difference)	%	2.05	0.3	0.76	1.66	2.39	0.79	1.79	0
Langelier Index (@ 20C)	N/A	0.219	-1.06	-2.55	0.622	-0.01	-0.222	-3.99	-2.36
Langelier Index (@ 4C)	N/A	-0.032	-1.31	-2.8	0.371	-0.26	-0.473	-4.25	-2.62
Nitrate (N)	mg/L	<0.05	0.42	<0.05	<0.05	0.06	<0.05	<0.05	0.81
Saturation pH (@ 20C)	N/A	7.89	8.47	9.64	7.72	8.04	8.05	10	8.94
Saturation pH (@ 4C)	N/A	8.14	8.72	9.89	7.97	8.29	8.3	10.3	9.2
INORGANICS									
Total Alkalinity (Total as CaCO ₃)	mg/L	120	45	8	120	99	78	6	25
Dissolved Chloride (Cl)	mg/L	11	20	11	8	8	9	11	14
Colour	TCU	<5	<5	<5	<5	<5	<5	<5	<5
Nitrate + Nitrite	mg/L	<0.05	0.42	<0.05	<0.05	0.06	<0.05	<0.05	0.81
Nitrite (N)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	<0.05	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	<0.05
Total Organic Carbon (C)	mg/L	<0.5	1.4	1.1	0.7	<0.5	<0.5	<0.5	1.2
Orthophosphate (P)	mg/L	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
pH	pH	8.11	7.41	7.09	8.34	8.03	7.83	6.01	6.58
Reactive Silica (SiO ₂)	mg/L	7.3	3.1	3.2	5.4	8.2	6	3.9	5.8
Dissolved Sulphate (SO ₄)	mg/L	29	9	8	5	8	5	6	4
Turbidity	NTU	0.2	2.6	0.2	0.5	0.1	1.5	0.2	1.3
Conductivity	uS/cm	310	180	81	270	220	180	68	110

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Table 5.6-3: Domestic Water Well Survey – Water Quality (Metals)

Station ID	CCME Freshwater Drinking Guidelines (ug/L)	Aesthetic Objective (AO) ¹ (ug/L)	WW1	WW2	WW3	WW4	WW5	WW6	WW7	WW8
Sampling Date			26-Nov-07	27-Nov-07						
Aluminum (Al)			<10	15	24	<10	<10	34	38	35
Antimony (Sb)	6		<2	<2	<2	<2	<2	<2	<2	<2
Arsenic (As)	10		3	<2	<2	<2	<2	<2	<2	<2
Barium (Ba)	1000		58	43	32	310	98	130	41	49
Beryllium (Be)			<2	<2	<2	<2	<2	<2	<2	<2
Bismuth (Bi)			<2	<2	<2	<2	<2	<2	<2	<2
Boron (B)	5000		34	11	5	13	19	14	6	8
Cadmium (Cd)	5		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium (Cr)	50		<2	<2	<2	<2	<2	<2	<2	<2
Cobalt (Co)			<1	<1	<1	<1	<1	<1	<1	<1
Copper (Cu)		<1000	22	120	5	15	<2	18	150	22
Iron (Fe)		<300	<50	480	68	94	<50	<50	<50	140
Lead (Pb)	10		<0.5	0.8	<0.5	8	<0.5	<0.5	1.3	1.1
Manganese (Mn)		<50	4	10	3	2300	<2	<2	4	14
Molybdenum (Mo)			<2	<2	<2	<2	3	<2	<2	<2
Nickel (Ni)			<2	<2	<2	<2	<2	<2	<2	<2
Selenium (Se)	10		<2	<2	<2	<2	<2	<2	<2	<2
Silver (Ag)			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium (Sr)			300	71	47	73	220	110	19	44
Thallium (Tl)			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin (Sn)			<2	<2	<2	<2	<2	<2	<2	<2
Titanium (Ti)			<2	<2	<2	<2	<2	<2	<2	<2
Uranium (U)	20		0.3	<0.1	<0.1	0.2	1.8	0.4	<0.1	<0.1
Vanadium (V)			<2	<2	<2	<2	<2	<2	<2	<2
Zinc (Zn)		<5000	<5	160	320	8	<5	7	14	9

¹ AOs are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices.

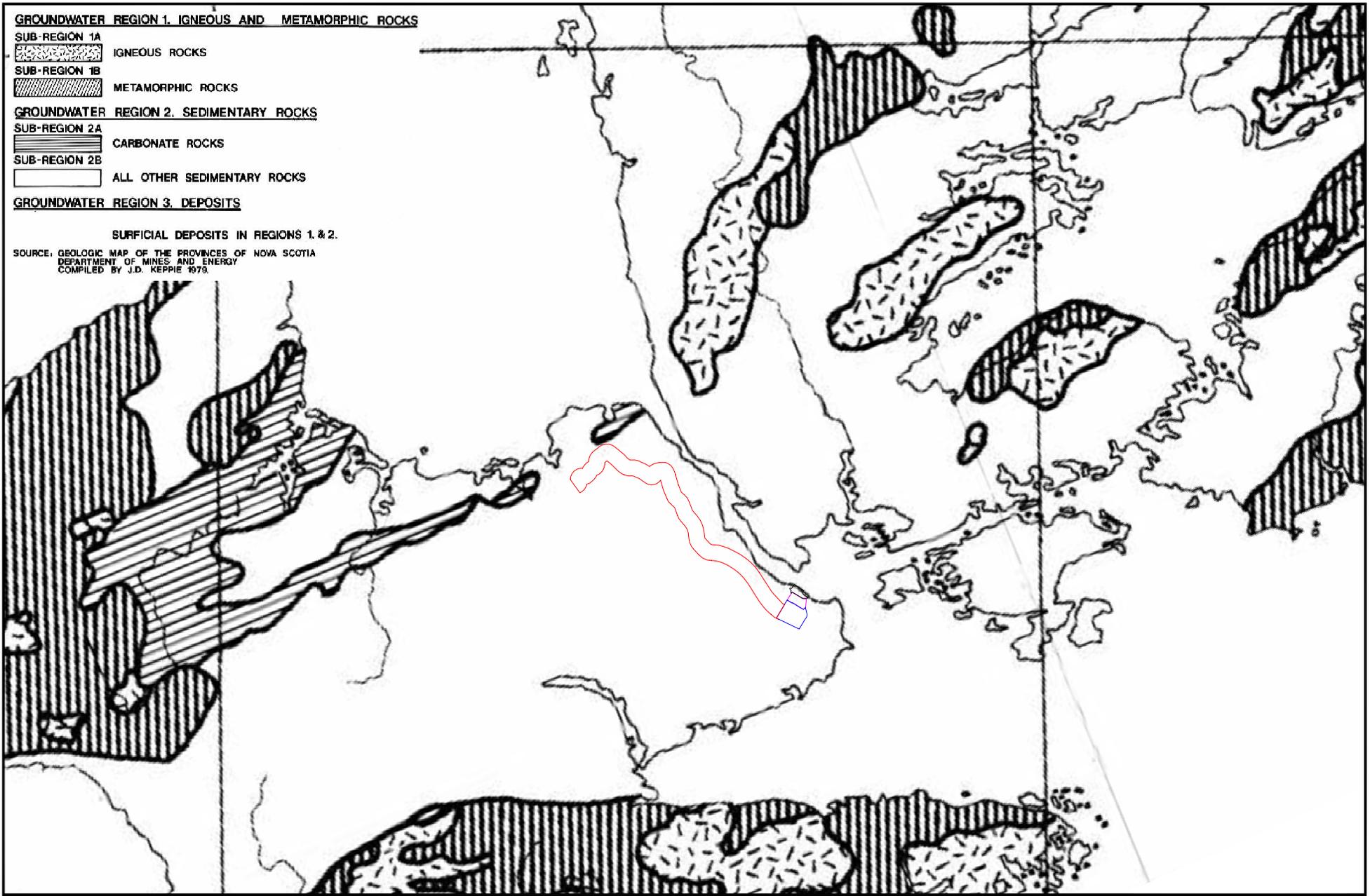
5.6.3 References

Canada-Nova Scotia Strait of Canso Environment Committee. 1975. *Strait of Canso Natural Environment Inventory: Water Resources*. 33pp.

NSE (Nova Scotia Environment), 2008a. Groundwater in Nova Scotia. Available on-line at: <http://www.gov.ns.ca/enla/water/groundwater/groundwaterNS.asp>

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Nova Scotia Water Well Database. 2007. NSEL (Nova Scotia Environment and Labour). 16pp. Available at: http://www.gov.ns.ca/nse/water/docs/well_database_user_manual.pdf



- LEGEND:**
- Proposed Melford International Terminal
 - Environmental Baseline Study Corridor
 - Initial Logistics Park
 - Future Logistics Park Expansion

Figure 5.6-1
 Melford International Terminal
 Groundwater Regions in the Area of the Project
 July 2008

Source:
 Hydrologic Network Review - Nova Scotia A Joint Federal - Provincial Project
 Nsel, 2008. Groundwater In Nova Scotia. Available On-Line At:
<http://www.gov.ns.ca/enla/water/groundwater/groundwaters.asp>