5.7 SURFACE WATER QUANTITY AND QUALITY

5.7.1 Background

Surface water in Nova Scotia is generally of good quality and suitable for expected uses such as drinking water supply, swimming, and fish habitat. However, there are several types of naturally occurring and anthropogenic water quality problems that can occur.

The Atlantic coast is dissected by many fault-controlled river and lake systems that drain into the ocean. At the mouths of most rivers, wetlands receive both tidal and freshwater influences. Surface waters tend to be soft and acidic. Many small to medium-sized lakes are scattered throughout the Sedimentary Lowlands District, and pH ranges between 6.0 and 7.0 (NSMNH 1996a).

The hydrologic regime within this region is largely driven by pluvial (rainfall) and nival (snowmelt) processes. According to the Canadian Climate Normals (1971-2000), mean annual precipitation in nearby Port Hastings (45° 37.8' N, 61° 24.0' W) is 1538.5 mm (EC, 2007). Historical data from Clam Harbour River in provincial drainage basin 1ER, in which the Project footprint is situated, shows that mean monthly stream discharge is highest in March and April due to snow melt, dropping to its lowest level in July to September when precipitation is low and evapotranspiration is at its highest. There is a second stream discharge peak in late fall, corresponding with a seasonal increase in precipitation.

5.7.2 Surface Water Quantity

Annual precipitation is quite high (1300 mm) in Nova Scotia and the geology and prevailing slope of the terrain produces an average surface water runoff of about 70 percent (NSE 2008). Large areas of impermeable rock and thin soils, and the effects of glaciation, have resulted in many lakes, streams, and wetlands (NSE 2008). Overall, approximately 4 percent of Nova Scotia's land surface is covered by freshwater.

5.7.3 Surface Water Quality

Surface water quality in Nova Scotia is generally good (NSE 2008). However, surface waters can be impacted by a number of naturally-occurring and human-made substances including silt, acids, nutrients, metals such as mercury, petroleum products, chlorides from road salt, and coliform bacteria.

Some areas of the province have highly colored surface waters which are naturally-occurring and result from drainage from peat bogs and other wetlands (NSE 2008). These waters have high acidity and low pH and can be less suited for drinking water supplies and recreational uses. They are also sensitive to other acid inputs such as acid rain, and some have become less suited for fish habitat.

5.7.4 Data Sources and Field Work

Precipitation data for the area were taken from EC's Canadian Climate Normals (1971-2000) for nearby Port Hastings (45° 37.8' N, 61° 24.0' W). In order to further characterize the baseline surface water conditions in the area of the proposed Project, aquatic surveys were carried out at all watercourses visible on 1:10,000 scale mapping. Field work was conducted between 27 July and 4 August 2007. Field parameters (pH, conductivity, dissolved oxygen and total dissolved solids) were recorded using a YSI multimeter, hydraulic characteristics were measured, and

streamflow was measured using a Marsh-McBirney Model 201 flow meter at each of the proposed stream crossing sites.

Twenty-six stream crossing sites were identified, five on, or directly downstream of, the Project footprint and twenty-one on, or directly downstream of, the proposed rail corridor (Figure 5.7-1). Two unnamed watercourses located in the community of Pirate Harbour (the site of stream crossings S#10 and S#11) and one tributary to Melford Brook (S#23) were found to be dry channels. A fourth stream crossing site, S#25, was not visited; because there was no influence from S#23, water quality and quantity at this site would have been similar to S#22.

It should be noted that the information provided relates to only the section of the rail corridor that does not currently exist. The existing rail bed extending to Linwood Station also crosses a number of watercourses. A number of these watercourses will not be disturbed during construction activities as culverts already exist and are adequate for the intended purpose however two bridge structures may require upgrading. Further field studies planned for 2008 will provide additional information on watercourses for the entire study area, including the transmission corridor.

5.7.5 Logistics Park

5.7.5.1 Watersheds

The MIT Logistics Park site is located within provincial watershed 1ER, which drains into Chedabucto Bay at the Strait of Canso (Figure 5.7-2). Three subwatersheds are represented within the Project footprint (Table 5.7-1).

Table 5.7-1: Sub-watersheds Located Within the Project Footprint

Subwatershed Name	Area (km^2)
1ER-SD3	**17.55**
1ER-SD4	**16.51**
1ER-3A	**11.03**

5.7.5.2 Water Courses

Melford Brook and the associated tributaries drain most of the area of the Logistics Park footprint. The watercourse flows through a primarily forested area, discharging into a coastal saline pond. A second small, unnamed watercourse originates from a wetland at Melford Loop and flows through a residential lawn and a grassy field before discharging through a pebble-cobble beach.

Although the land is owned by the Crown, much of the cutting rights to this forest are owned by a pulp and paper mill, NewPage, in nearby Point Tupper. Forest harvesting appears to have impacted the watercourse in some areas; high sedimentation due to runoff from recently cleared land was observed in the eastern Melford Brook tributaries (S#18, S#20 and S#21).

Hydraulic characteristics and water quality parameters are summarized in Tables 5.7-2 and 5.7-3, respectively. Most watercourses were relatively small. Channel and wetted widths ranged from 0.5 to 2.5 m, with an average overall depth of approximately 8 cm (range of 5-14 cm), and flows ranging from 0 to 7.4 L/min (Table 5.7-2). The one exception was S#19 (Melford Brook) which has a wetted/channel width of 10 m and an average depth of 40 cm (Table 5.7-2). Flow in this watercourse was measured at 532.5 L/min (Table 5.7-2). Conductivity and TDS were generally quite low in the area, ranging from 1 to 260 µS/cm and from 0.001 to 0.054 g/L

respectively (Table 5.7-3). Dissolved oxygen (DO) ranged from 37.9 percent at S#20, a small, narrow first-order tributary of Melford Brook, to 96.5 percent at the furthest downstream site on Melford Brook (S#19) (Table 5.7-3). On the Project footprint, pH values were near neutral (6.39 to 7.38) (Table 5.7-3).

Table 5.7-2: Hydraulic Characteristics for Watercourses within the Logistics Park footprint

Stream Crossing	Location	Channel Width (m)	Wetted Width (m)	Average Depth (cm)	Maximum Depth (cm)	Slope (%)	Flow (L/min)
S#17	Unnamed watercourse in Melford	1	0.5	5	50	2	1.5
S#18	Unnamed Melford Brook tributary	2.5	1.5	6	8	1	5.0
S#19	Melford Brook	10	10	40	96	1	532.5
S#20	Unnamed Melford Brook tributary	1.5	1	8	10	1	0
S#21	Unnamed Melford Brook tributary	2.5	1.5	14	20	1	7.4

Table 5.7-3: Water Quality Parameters for Watercourses within the Logistics Park footprint

Stream Crossing	Location	Water Quality			
		Conductivity (µS/cm)	TDS (g/L)	Dissolved Oxygen (DO) (%)	pH
S#17	Unnamed watercourse in Melford	290	NM	82.6	7.38
S#18	Unnamed Melford Brook tributary	55	0.036	91.5	6.47
S#19	Melford Brook	38	0.025	96.5	6.48
S#20	Unnamed Melford Brook tributary	83	0.054	37.9	6.39
S#21	Unnamed Melford Brook tributary	1	0.001	80.9	6.48

Note: NM denotes not measured.

5.7.5.3 Reservoirs and Lakes

In general, this region is characterized by many small to medium-sized lakes, with pH values ranging from 6.0 to 7.0. The majority of lakes in the region are shallow, and formed by glacial action (NSMNH, 1996a). Reeves Lake is the only waterbody that exists within the boundaries of the Logistics Park (Figure 5.7-2). This lake has an area of 54785.09 m^2. Drainage occurs in a north westerly direction to wetland areas and the Strait of Canso. Unlike many of the waterbodies in this area, Reeves Lake is not utilized as a reservoir. The only other waterbody in close proximity to the Logistics Park is Englands Lake Reservoir. Information for this surface water feature is provided below in Section 5.7.6.3.

5.7.6 Rail Corridor

5.7.6.1 Watersheds

The rail corridor associated with the MIT site is located within provincial watersheds 1ER to the south, and 1DS to the north; the boundary between the two watersheds is located just north of Pirate Harbour (Figure 5.7-2). Watershed 1ER drains into the Atlantic Ocean at the Strait of Canso, while 1DS drains into both the Georges Bay (Berrys River) and the Strait of Canso (all other watercourses). Thirteen subwatersheds are represented within this part of the Project area (Table 5.7-4).

Table 5.7-4: Sub-watersheds Located Within the Rail Corridor

Subwatershed Name	Area (km^2)
1ER-3A	**11.03**
1ER-2A	**2.14**
1ER-2C	**5.77**
1ER-2E	**3.67**
1ER-SD2	**15.36**
1ER-3B	**24.08**
1ER-SD1	**8.17**
1DS-SD14	**2.21**
1DS-SD13	**7.64**
1DS-SD12	**4.98**
1DS-7B	**19.97**
1DS-7A	**9.46**
1DS-6	**18.02**

5.7.6.2 Water Courses

Named watercourses that are indicated on 1:50,000 topographical maps include Melford Brook, Byers Brook, East Brook, West Brook, Berrys River and Murray Brook.

Melford Brook, East Brook, West Brook and the unnamed watercourses south of the community of Mulgrave flow through primarily forested habitat. As mentioned above, the cutting rights for this Crown Land are owned by the New Page Mill, in nearby Point Tupper. Forest harvesting appeared to have impacted the watercourses in some areas: two unnamed watercourses in the community of Pirate Harbour (S#10 and S#11) and one tributary to Melford Brook (S#23) that had been identified from aerial photographs taken in 1997 were observed during the survey to be dry channels. A watercourse originating from a privately-owned power generating facility contributes a great deal of flow into Melford Brook (S#24); this water is taken from Englands Lake (Reservoir) via a below-ground pipeline.

Murray Brook originates in Grant Lake Reservoir, and follows Old Mulgrave Road through primarily forested habitat and through the town of Mulgrave before discharging into the Strait of Canso. The upstream reaches do not appear to be greatly impacted by human activities. Berrys River also originates in Grant Lake Reservoir, flowing in a northerly direction and discharging into Georges Bay.

Water quality samples were not collected during field surveys; however, baseline surface water quality data was provided by the town of Mulgrave for the Grant Lake Reservoir water supply. The sampling was performed on 10 September 2007 and submitted to Maxxam Analytical Labs in Sydney NS. The results of the data can be found in Appendix 5.7-A and reflect two sampling locations, one of which is untreated water from the intake before treatment at the plant, and a second one which is a treated sample taken from one of the furthest points of the distribution system. The untreated water from the Grant Lake Reservoir sample had a pH of 6.4, which is outside the acceptable range according to the CCME guidelines for freshwater aquatic life (6.5 - 9.0 units; CCME, 2007). Conductivity was low (39 µS/cm), and hardness was 7 mg/L. Few metals were found in measurable concentrations, but the aluminium level of 84 µg/L exceeded

the CCME guideline for freshwater aquatic life (5 µg/L when pH < 6.5; CCME, 2007). The source of the elevated aluminium levels is unknown.

Hydraulic characteristics and water quality parameters are summarized in Tables 5.7-5 and 5.7-6, respectively. Channel and wetted widths of the natural watercourses ranged from 0.2 to 5.5 metres, with an average depth of about 12 cm (range of 2 to 20 cm). Flows ranged from 0 L/min (still water) at S#04 and S#26, to 56.8 L/min on Melford Brook. The man-made channel at S#24 was larger than any of the natural streams, with a width of 5.7 metres, average depth of 45 cm, and a flow rate of 316.3 L/min. As with the watercourses in the Logistics Park area, conductivity and TDS were generally quite low, ranging from 22 to 151 µS/cm and from 0.020 to 0.099 g/L, respectively (Table 5.7-6). DO ranged from 48.3 percent at S#26, a small unnamed tributary to Melford Brook that flows through a shrubby wetland, to 100 percent at an unnamed watercourse in Steep Creek (S#04) (Table 5.7-6). Generally speaking, pH values were highest at Murray Brook and associated tributaries (7.33 to 7.55), and lowest in the watercourses near the community of Steep Creek (5.06 to 5.63); pH in the man-made channel at S#24 was also quite low at 5.66 (Table 5.7-6).

Table 5.7-5: Hydraulic Characteristics for Watercourses along the Rail Corridor

Stream Crossing	Location	Channel Width (m)	Wetted Width (m)	Average Depth (cm)	Maximum Depth (cm)	Slope (%)	Flow (L/min)
S#01	Unnamed watercourse in Melford	2.5	1.2	10	16	5	0.6
S#02	Byers Brook	3	2	10	20	2	2.3
S#03	Unnamed watercourse between Wheaton and Critchetts Lake	2	2	8	12	1	6.6
S#04	Unnamed watercourse in Steep Creek	3.5	3	10	50	2	0
S#05	East Brook	3	2.5	8	12	2	1.8
S#06	Unnamed watercourse in Pirate Harbour	3	2	10	24	1	2.2
S#07	Unnamed watercourse in Pirate Harbour	2.5	2	10	24	2	2.2
S#08	West Brook	4.5	3.5	15	24	2	14.3
S#09	Unnamed West Brook tributary	3	1.3	12	16	1	3.7
S#10	Unnamed watercourse in Pirate Harbour	0	0	0	0	N/A	N/A
S#11	Unnamed watercourse in Pirate Harbour	0	0	0	0	N/A	N/A
S#12	Unnamed Murray Brook tributary	1.8	1	12	14	1.5	3.1
S#13	Unnamed Murray Brook tributary	5	3.5	20	28	3	17.2
S#14	Murray Brook	3.5	2.5	15	21	1	18.2
S#15	Murray Brook	3	2	15	20	0.5	11.1
S#16	Berrys River	2	1.3	6	8	1	1.5
S#22	Melford Brook	5.5	4.3	15	30	0.5	56.8
S#23	Unnamed Melford Brook tributary	0	0	0	0	N/A	N/A
S#24	(from private generating station to Melford Brook)	5.7	5.7	45	60	0.5	316.3
S#26	Unnamed Melford Brook tributary	0.2	0.2	2	5	0	0

Note: N/A denotes not applicable (dry channel).

Table 5.7-6: Water Quality Parameters for Watercourses along the Rail Corridor

Stream Crossing	Location	Water Quality			
		Conductivity (µS/cm)	TDS (g/L)	Dissolved Oxygen (DO) (%)	pH
S#01	Unnamed watercourse in Melford	53	0.035	93.7	6.74
S#02	Byers Brook	85	0.055	96.1	6.60
S#03	Unnamed watercourse between Wheaton and Critchetts Lake	31	0.020	78.4	5.46
S#04	Unnamed watercourse in Steep Creek	33	0.021	100	5.06
S#05	East Brook	36	0.023	88.6	5.63
S#06	Unnamed watercourse in Pirate Harbour	47	0.031	89.4	6.71
S#07	Unnamed watercourse in Pirate Harbour	39	0.025	76.3	6.53
S#08	West Brook	37	0.024	89.7	6.47
S#09	Unnamed West Brook tributary	108	0.070	98.5	7.39
S#10	Unnamed watercourse in Pirate Harbour	N/A	N/A	N/A	N/A
S#11	Unnamed watercourse in Pirate Harbour	N/A	N/A	N/A	N/A
S#12	Unnamed Murray Brook tributary	101	0.066	97.2	7.55
S#13	Unnamed Murray Brook tributary	79	0.051	93.4	7.51
S#14	Murray Brook	85	0.055	92.8	7.39
S#15	Murray Brook	22	0.020	92.1	7.33
S#16	Berrys River	63	0.041	89.8	6.89
S#22	Melford Brook	36	NM	89.9	6.88
S#23	Unnamed Melford Brook tributary	N/A	N/A	N/A	N/A
S#24	Man-made channel (from private generating station to Melford Brook)	33	NM	93.7	5.66
S#26	Unnamed Melford Brook tributary	151	0.099	48.3	7.04

Note: N/A denotes not applicable (dry channel).
NM denotes not measured.

5.7.6.3 Reservoirs and Lakes

Reservoirs are also a common occurrence in this region. The proposed rail corridor is within close proximity to three sources (Figure 5.7-2) :

- Grant Lake Reservoir;
- Goose Harbour Reservoir; and
- England Lake Reservoir.

Grant Lake Reservoir is the drinking water resource for the Town of Mulgrave. The reservoir supplies a Water Treatment Plant on Mill Road in Mulgrave via 22” pipeline, which gravity feeds water to the entire town. The pipeline is owned by Stora Enso and is a shared venture with the Town of Mulgrave. NewPage (formerly Stora Enso) draws water from the reservoir to Point Tupper and a spur off the line provides the Water Treatment Plant with the desired amount of water for the town (Personal comm., L. Ryan, 2007). A Source Water Protection Plan is currently being developed by the Town of Mulgrave (Personal comm., M. Hadley, 2007). There

are an additional two small reservoirs connected to Grant Lake Reservoir that also provide recharge; Mattie's Lake Reservoir and Summers Lake Reservoir.

Goose Harbour Reservoir occupies 968 acres, and is located south of the town limits of Mulgrave. Stora Enso currently possesses the provincial title to the watershed as well as a permit to take water. This large reservoir system falls just outside of the 750 m zone that extends on either side of the associated rail corridor for the proposed terminal. There is an established water pipeline from the lake that extends through the proposed rail corridor to Point Tupper Industrial Park.

England Lake reservoir covers an area of 494 acres. The reservoir is also an alternate source to the Point Tupper Industrial Park with a pumping yield of 9.4 MGPD. To date, this waterbody is reserved as part of a privately owned hydro generating station. This small station is located Northeast of the reservoir and derives water from underground piping.

5.7.7 References

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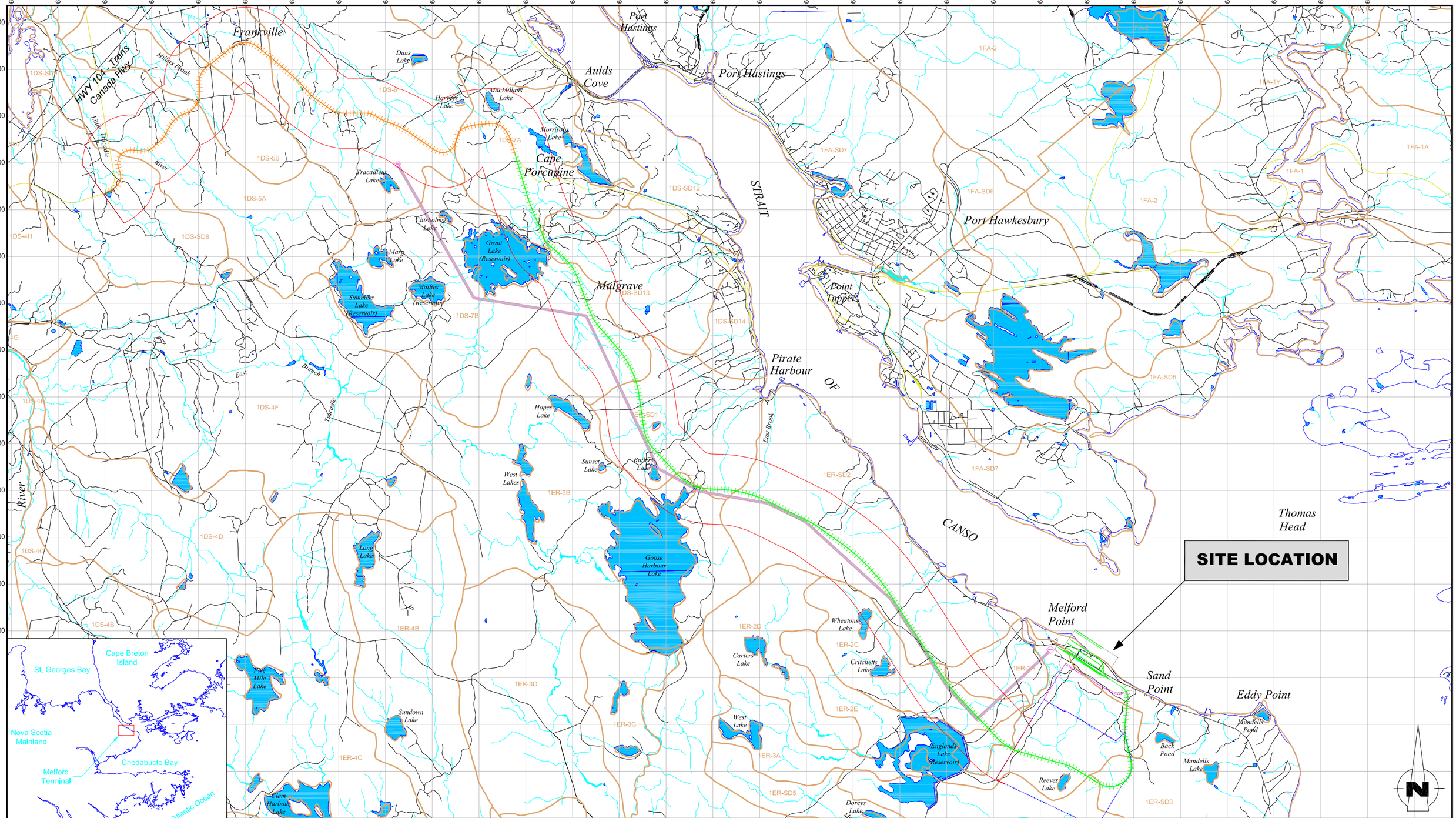
ID	Easting	Northing
S#01	631503.900	5043520.600
S#02	629279.500	5044384.100
S#03	628668.050	5044086.700
S#04	627518.500	5046462.400
S#05	626141.500	5047206.700
S#06	625251.300	5048283.150
S#07	625279.800	5047695.600
S#08	624700.800	5048679.900
S#09	624767.450	5049396.150
S#10	624934.767	5050178.696
S#11	624674.757	5050562.743
S#12	624548.700	5051250.200
S#13	624252.267	5051825.932
S#14	623499.400	5052813.700
S#15	622674.400	5052438.250
S#16	621179.200	5052762.300
S#17	632859.200	5043400.900
S#18	632752.000	5042808.400
S#19	632194.350	5042883.950
S#20	632849.400	5042373.700
S#21	633346.500	5042478.000
S#22	631579.241	5042518.815
S#23	631627.452	5042393.244
S#24	631644.635	5042918.460
S#25	631684.635	5042314.230
S#26	630410.397	5041954.103

SITE LOCATION

LEGEND:
- Proposed Melford Rail Track
- Proposed Melford Rail Track (On Existing Rail Bed)
- Existing Route 344
- Road Network
- Railroad Network
- Proposed Melford International Terminal
- Environmental Baseline Study Corridor
- Initial Logistics Park
- Future Logistics Park Expansion
- Proposed NSPI Easement
- # GPS Locations

Figure 5.7-1
GPS Points of River Crossings
Melford International Terminal
Environmental Assessment Services
July 2008



LEGEND:

- Proposed Melford Rail Track
- Proposed Melford Rail Track (On Existing Rail Bed)
- Watershed Boundaries
- Existing Route 344
- Road Network
- Proposed Melford International Terminal
- Environmental Baseline Study Corridor
- Initial Logistics Park
- Future Logistics Park Expansion
- Proposed NSPI Easement

Figure 5.7-2
Watersheds
Melford International Terminal
Environmental Assessment Services
July 2008