Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility

Environmental Assessment Registration
Section 4

February 2023

Prepared for:

Bear Head Energy Inc.

Prepared by:

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File: 121431287

4.0 ENVIRONMENTAL SETTING

The description of environmental setting substantively relies on the previously approved environmental assessments of the LNG Import Facility (JWEL 2004) and Bear Head LNG Project (SNC Lavalin 2015) that were proposed and fully approved for construction at the site. Where relevant, the Bear Paw Pipeline Environmental Assessment (Stantec 2016) is also referenced. The Bear Paw Pipeline was proposed to support the Bear Head LNG Project and while it received EA approval in 2016, it was never constructed. Where new research/data collection has been undertaken, this is referenced. Unless noted otherwise, the description of environmental setting has been adopted from the *Bear Head LNG Updated Registration Document* (SNC Lavalin 2015).

4.1 PHYSICAL ENVIRONMENT

4.1.1 Physiography, Surficial and Bedrock Geology

The Bear Head site (i.e., Project Area) was described in the Bear Head LNG Terminal Environmental Assessment (JWEL 2004) as low relief near the shoreline with a shallow cove, Bear Island Cove, and several lagoons to the southeast. The relief was described as being more pronounced near the west end of the site and ranging from 10 to 30 m along the coast to 40 m inland. Elevations of the site were considered in detail in 2004 when a road extending east of Bear Island Road was built for access to the site. This road runs from elevations of 10 m to 30 m, west to east. The road splits the site into north (tank foundations, roads, ditch, swales, etc.,) and south (jetty ponds) sections. Development elevations can be described by dividing the northern section into quadrants, NW, NE, SW and SE. A cliff slightly north of NW shows a drop from 42 – 32 m. Built platforms on the NW and SW quadrants show elevations of 33 and 30 m, respectively. A drop from SW to the road occurs from 30 – 16 m. Eastern quadrants show elevations of 44 m (NE) and an elevation gradient from 30 – 20 m (SE). A drop occurs from the SE quadrant to the road from 20 – 10 m. The southern portion of the site contains the jetty pond and runs from the road to the shore. The maximum elevation gradient in this area runs from 30 m to sea level. Other slopes run from 10 m to sea level.

The Project Area is located on the Strait of Canso which passes through the northern part of Chedabucto Bay. The Chedabucto Bay themed region is classified as sedimentary lowland. Most of the rock deposits are sedimentary and were deposited during the late Devonian and Carboniferous periods (Barr and White 2017). The Bear Head site sits on bedrock geology classified as the Cumberland Group (Figure 4.1). This is an undivided group containing late carboniferous shales, fluvial sandstones, siltstones, thin calcareous fragmented beds, and coal contained in thin seams (Barr and White 2017). Cumberland Group geology is not sulphide-bearing or prone to acid rock drainage.

The bedrock landscape was developed by glacial ice moving from northwest of the region into Chedabucto Bay. This movement deposited red-brown sandy till over the area. Marine erosion resulted in gravel beaches that produce salt marshes and small lagoons (Davis and Brown 1996b). As shown in Figure 4.1, glacial till can be used to characterize the surficial geology of the site. The bedrock and till surfaces are irregular resulting in erratic till depths. The surficial geology within the Project Area is primarily silty till plain (ground moraine) and stony till plain (ground moraine) (Stea 2004).

Low cliffs composed of glacial till occur along the shoreline of Chedabucto Bay and the Strait of Canso. Erosion is occurring due to coastal processes, exposing large sections of bedrock that consist of closely jointed and highly weathered sandstone, with bedding layer thickness varying from 10 mm – 200 mm and bedding plane joints of 70 mm spacing or greater (JWEL 2004).

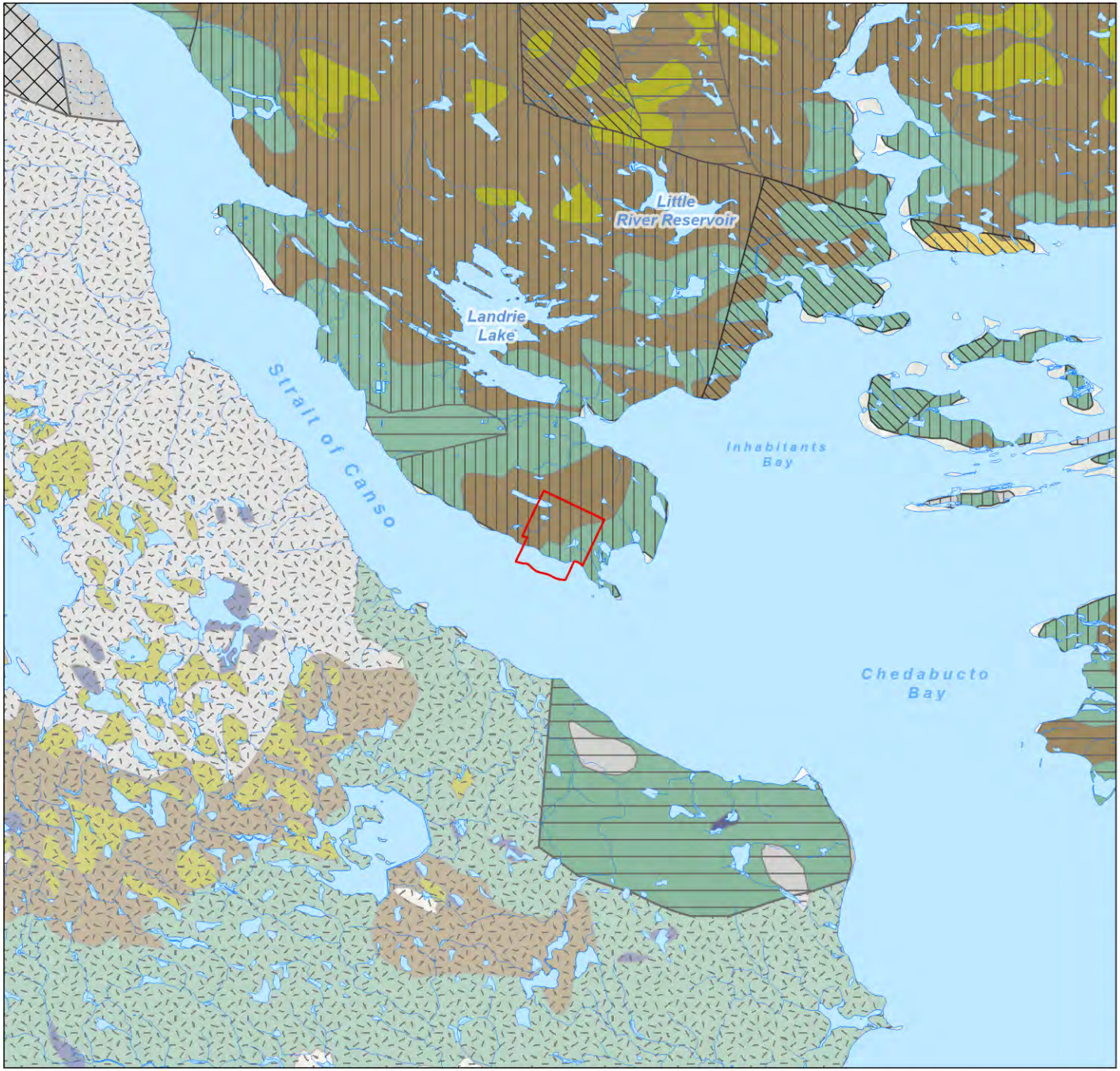

Figure No.
4.1
Title
Geology

Client/Project 121431287-023

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NWhite on 2023-01-05

Richmond County, NS

N

0 1 2 Kilometres
(At original document size of 8.5x11)
1:100,000

Legend

- Project Area
- Waterways (1:10k)
- Waterbody (1:10k)

Bedrock Geology

- Cumberland Group
- George River Metamorphic Suite: undivided
- Horton Group: northern mainland
- Mabou Group
- Proterozoic - Devonian granite
- Windsor Group: Cape Breton Island

Surficial Geology

- Silty Till Plain (Ground Moraine)
- Stony Till Plain (Ground Moraine)
- Silty Drumlin (Drumlin Facies)
- Bedrock
- Organic Deposits
- Colluvial Deposits

Project Location

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: NS DNRR, NS DOE, NSTB, NSODB, Service NS (Government of Nova Scotia)
3. Background: NSODB, Service NS (Government of Nova Scotia

Stantec

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4.1.2 Hydrogeology

The hydrogeology of the site is controlled by the surficial and bedrock geology, as well as the local surface water hydrology and recharge to the site. Groundwater recharge will generally occur first through the glacial till surficial geology (stony, clayey and silty deposits) downwards towards the bedrock aquifer system, where groundwater will flow through the rock fractures of the shales, sandstones and siltstones of the Cumberland Group.

The glacial till surficial geology indicates that the low hydraulic conductivity conditions will likely be present. The peat bogs, fens and marshes that are present on the peninsula also suggest that groundwater is not freely draining to either the fractured bedrock aquifer system, or the ultimate discharge to the Atlantic Ocean. Groundwater flow through rock fractures will depend on the aperture and number of fractures in the bedrock, as well as their connectivity to each other. In general, more fractures occur in the top 30 m of bedrock systems due to pressure releases during the retreat of the glaciers during the Wisconsinian period and most groundwater flow above these depths in a bedrock aquifer.

The groundwater flow direction on site is anticipated to be generally from the northeast towards the southwest, generally following the topographic contours towards the Bear Island Cove.

Table 4.1 lists water wells within 2 km of the Project Area. There are no residential wells located within 800 m of the Project Area. The nearest offsite industrial wells are associated with the NSPI Point Tupper Generating Station and the Port Hawkesbury Paper facility. There is one known monitoring well on the Project site (MW-5) and a well that supplies water to a temporary construction trailer. Previous onsite monitoring wells (NSPI-MW-2 and MW-1) were unable to be located during a 2014 survey as part of the EA for the Bear Head LNG Project and were believed to have been buried during construction and subsequent maintenance of the existing infrastructure (roads, ditches, site clearing) (SNC Lavalin 2015).

Table 4.1 Water Wells Within 2 km of the Project Area (NSECC 2020)

Well ID	Community	Use	Depth (m)	Casing (m)	Bedrock (m)	Static (m)	Yield (Lpm)	Easting	Northing
001720	Middle Melford	Domestic	36.54	6.09	0.91	-9999	13.62	630500	5044500
010487	Middle Melford	Domestic	42.63	24.36	1.83	-9999	11.35	630500	5044500
680121	Port Malcolm	Domestic	52.07	7	5.48	6.09	31.78	633500	5048500
680737	Point Tupper	Domestic	16.75	6.09	3.04	4.57	22.7	632901	5048609
690113	Port Hawkesbury	Domestic	49.33	6.09	3.04	4.57	27.24	632753	5048424
710689	Port Malcolm	Domestic	18.27	6.09	5.48	5.48	27.24	633500	5048500
720236	Steep Creek	Domestic	31.97	6.7	4.57	1.83	158.9	630705	5044631
730187	Port Malcolm	Domestic	29.84	12.79	11.57	3.04	9.08	633587	5048562
730326	Melford	Unknown*	90.44	13.09	10.66	3.04	90.8	632072	5043718
740147	Middle Melford	Industrial	75.21	19.79	18.27	3.65	10.22	631159	5044352
740199	Port Hawkesbury	Domestic	90.13	13.09	11.57	3.96	13.62	632499	5048438

Note:
* Drilled in 1973 for NS Department Lands and Forest, water use is unknown

4.1.3 Surface Water

The land portion of the site is located on gently sloped terrain situated along the north coast of the Strait of Canso. Natural surface drainage tends to flow in a southerly direction. A stream located to the southwest of the site (Stream A) receives approximately one quarter of the site runoff. Another stream (Steam B) located to the southeast of the site receives approximately half of the site runoff. The remaining quarter of the site drains directly to the Strait of Canso. Civil works, including drainage ditches and culverts, have been constructed to control site and access-road runoff and to prevent erosion and associated sedimentation (Figure 4.2).

During three site visits in 2014 (May 8, October 22, and December 22), water samples were taken from several locations around the Project site. Samples were taken in Stream A, Stream B and the drainage ditch along the north property boundary. Table 4.2 summarizes the water quality results from the 2014 site visits. No samples were taken from the drainage ditch in October 2014.

Table 4.2 Physical Observations and Water Quality Measurements at the Bear Head Site, Point Tupper, Nova Scotia (2014)

Parameter	Stream A			Stream B			North Ditch	
	May	Oct	Dec	May	Oct	Dec	May	Dec
Temperature (°C)	8.3	-	2.1	11.8	-	2.4	17.5	1.5
Oxygen Saturation (%)	65.7	-	94.3	90.4	-	94.5	89.4	82.5
Dissolved Oxygen (mg/L)	7.71	-	13.3	9.78	-	12.9	8.47	11.8
Conductivity (µs)	253.8	580-700	197.6	324.8	460	291.8	649	269.3
Salinity (ppt)	0.2	-	-	0.2	-	-	0.4	-
TSS (mg/L)	<0.5	<3.0	<0.5	<0.5	<2.0	<0.5	2.2 (downstream)	1.0
pH	6.1	5.99-7.08	6.8	7.4	7.7	6.6	7.3	7.4
Turbidity (Visual and NTU)	Clear and colourless	0.18-0.38	Very pale yellow	Clear and colourless	0.2	Very pale yellow	Clear and colourless (yellow flow on the bottom)	Very pale yellow

It is noted that the waters show low turbidity, low total suspended solids (TSS), and a low to neutral pH. All analyzed parameters were below the CCME Canadian Water Quality Guidelines for Freshwater Aquatic Life (FWAL) except pH, aluminum and boron (SNC Lavalin 2015).

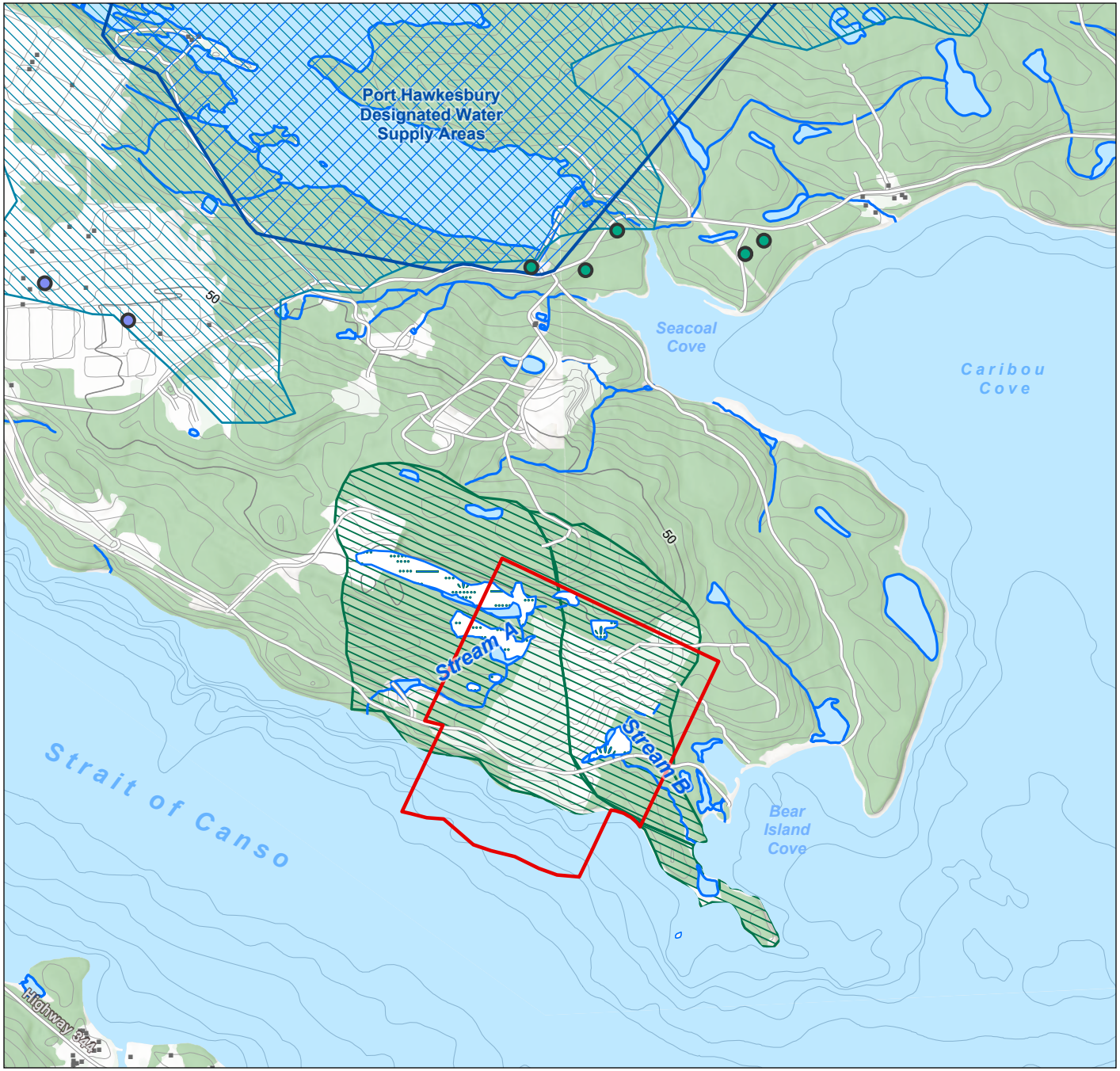

Figure No.
4.2
Title
Surface and Groundwater Features

Client/Project 121431287_022

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NWhite on 2023-01-05

Richmond County, NS

N

0 250 500 750 Metres
(At original document size of 8.5x11)
1:28,000

Legend

- Project Area

Water Wells

- Domestic
- Industrial
- Local Road
- Contour (5 m)

Waterways and Watersheds

- Watercourse (1:10k)
- Overland Drainage [2]
- Waterbody (1:10k)
- Wetlands (SNC, 2015[2])
- Watershed (SNC, 2015[3])
- Protected Water Area[4]
- Natural Watershed Municipal Surface Water Supply Area[4]

Project Location

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Stantec, 2022.
3. SNC - Lavalin. 2015. Bear Head LNG Updated Registration Document. Bear Head LNG Corporation.
4. Nova Scotia Dept. of Environment and Climate Change, 2022
5. Background: NS DNRR, NS ECC, NS Topographic Database, Service NS, Esri, NASA, NGA, USGS, Province of Nova Scotia, Esri Canada, Esri, HERE, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Internal Services Department, Esri, USGS

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A sample taken in Stream A in October 2014 had a pH of 5.99 which is below the pH range of 6.5-8.0. This sample also exceeded the guideline for aluminum, 5 ug/L, with a concentration of 350 ug/L. Four samples taken in Stream A in October 2014 exceeded the guideline for boron, 1500 ug/L, with concentrations of 2900 ug/L, 2300 ug/L, 2300 ug/L and 2200 ug/L respectively (SNC Lavalin 2015).

In November 2022, in situ water quality was measured at several locations within Stream A and Stream B (Table 4.3).

Table 4.3 In Situ Water Quality Measurements at the Bear Head Site, Point Tupper, Nova Scotia (November 2022)

Stream	Location	Latitude	Longitude	Water Quality Depth (m)	Water Clarity	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (mS/cm)	pH
Stream A	US of WL2	45.56189	-61.30294	0.09	Clear	12.86	4.92	1.815	7.10
Stream A	US of WL2	45.56109	-61.30301	0.08	Clear	13.68	9.64	1.799	8.17
Stream A	DS of WL2	45.56004	-61.30372	0.15	Clear	15.19	7.43	1.096	7.27
Stream A	DS of WL2	45.55972	-61.30375	0.13	Clear	15.18	8.05	1.095	7.60
Stream A	DS of WL2	45.55909	-61.30483	0.25	Clear	14.89	8.28	1.079	7.74
Stream A	DS of WL2	45.55846	-61.30612	0.35	-	14.25	8.20	1.050	7.83
Stream A	DS of WL2	45.55877	-61.307	0.1	Clear	14.26	9.34	1.042	8.00
Stream A	DS of WL2	45.55898	-61.30753	0.34	Clear	14.48	8.31	1.031	7.89
Stream B	DS of culvert	45.55603	-61.29681	0.1	Clear	14.95	5.24	0.836	7.45
Stream B	DS of culvert	45.55578	-61.29652	0.3	Clear	13.66	5.52	0.849	6.91

Notes:
US=upstream
DS=downstream

4.1.4 Climate

The general climate and weather patterns, temperature normals and extremes, wind normals and extremes, and adverse weather in the Project Area are described below.

4.1.4.1 General Climate and Weather Patterns

Nova Scotia's climate is subject to variability, with distinctive changes often occurring daily. Substantial precipitation occurs in the province, and temperature ranges throughout the year; overcast days and coastal fog are common (Davis and Browne 1996a).

The Project is in the Atlantic Coastal region. The Strait of Canso is connected to Chedabucto Bay, the largest bay on the Atlantic Coast. The Strait of Canso is relatively sheltered, which means it experiences warmer water temperatures during the summer months than other more exposed areas of the Nova Scotia coast. The proximity of the Strait of Canso to the sea results in cool summers and warm winters (relative to the rest of the province). High amounts of rainfall and heavy sea fog are common (Davis and Browne 1996b).

The winter brings prevailing winds from the west and northwest, consisting of cold continental arctic air and humid maritime polar air. Cloud cover is heavier, and winds are at their highest during this time of year. Occasional thaws and warm spells can occur due to warm southwest winds generated by storms tracking north. The spring is often delayed due to the cool waters of the Atlantic, and fog is heavy and common due to temperature differences between warming air and the cold ocean waters. Summer is brief but brings warmer temperatures as the southern edge of the arctic air mass moves northward around June. Fall brings with it heavy rains and storm activity, with the greatest hurricane activity occurring during this period. Offshore waters are at their warmest, prolonging the fall season; weather between storms can be some of the clearest and most enjoyable of the year (Davis and Browne 1996a).

4.1.4.2 Temperature Normals and Extremes

The climate in a given area is generally described by the most recent 30-year period of data, for which ECCC has developed statistical summaries, referred to as climate normals data. There is an ECCC weather station located 6 km southwest from the Project (Eddy Point), however the most recently available data is from the year 1985. There is also an ECCC weather station located in Port Hawkesbury (approximately 7 km north-northwest from the Project), however climate normals data is not available. The closest weather station to the Project with the most recently available climate normals data (1981 – 2010) is the Deming station, located approximately 40 km south of the Project, on Deming Island. The average annual climate data by month recorded at the Deming station are summarized in Table 4.4. The yearly average temperature is 6.1 ˚C with an extreme maximum of 31.1˚C and an extreme minimum of -25.0˚C.

Table 4.4 Annual Average Climate Data at the Deming Weather Station (1981 – 2010)

Month	Daily Average (°C)	Daily Maximum (°C)	Daily Minimum (°C)	Extreme Maximum (°C)	Extreme Minimum (°C)
Jan	-4.0	-0.5	-7.4	10.5	-25.0
Feb	-4.1	-0.9	-7.3	10.0	-25.0
Mar	-1.5	1.3	-4.3	11.0	-19.0
Apr	2.6	5.3	-0.2	20.0	-11.0
May	6.6	9.7	3.5	24.0	-3.5
Jun	11.1	14.3	7.9	31.1	-0.6
Jul	15.1	17.9	12.2	30.0	4.4
Aug	17.4	20.2	14.6	28.5	4.4
Sep	15.2	18.1	12.2	26.1	2.0
Oct	10.1	12.8	7.3	21.7	-4.4
Nov	5.0	7.6	2.3	19.4	-12.0
Dec	-0.3	2.7	-3.3	12.2	-23.5
Year (Average)	6.1	20.2	-7.4	31.1	-25
Source: ECCC 2022a					

The average annual precipitation data by month recorded at the Deming station are summarized in Table 4.5. The annual average rainfall is 1320.8 millimeters (mm), annual average snowfall is 119.7 centimetres (cm), and annual average total precipitation is 1440.5 mm.

Table 4.5 Annual Average Precipitation Data at the Deming Weather Station (1981 – 2010)

Month	Rainfall (mm)	Snowfall (cm)	Precipitation (mm)	Extreme Daily Rainfall (mm)	Extreme Daily Snowfall (cm)	Extreme Daily Precipitation (mm)
Jan	85.6	30.4	116.1	59.7	26	59.7
Feb	75	28.9	103.9	60	28	65
Mar	97.6	22.4	120	87.8	22.9	87.8
Apr	128.1	10.4	138.5	114	27.9	114
May	116.6	0.7	117.3	86.9	8.9	86.9
Jun	100.4	0	100.4	55.9	0	55.9
Jul	101.8	0	101.8	95	0	95
Aug	100.9	0	100.9	90.7	0	90.7
Sep	114.8	0	114.8	103.6	0	103.6
Oct	144.2	0	144.2	100.2	2.5	100.2
Nov	142.8	5.2	148	115.6	17	115.6
Dec	113	21.6	134.6	67.3	28.2	67.3
Year	1320.8	119.7	1440.5	115.6*	28.2*	115.6*

Note:
*Maximum precipitation recorded in the year
Source: ECCC 2022a

4.1.4.3 Wind Normals and Extremes

Winds in Nova Scotia tend to be predominantly from the west, due to the general circulation of air from the North Pole being deflected by the Coriolis Effect, with three main air masses converging on the province. Dry and cold continental arctic air from the northwest, warmer air from the north and northeast and cool, humid from the south or southwest cause the variability in Nova Scotia's weather. Low pressure storm systems frequently cross the region, bringing with them strong winds and heavy precipitation. Coastal influences result in sea fog, cold inland winds, pack ice and freezing spray. The area is characterized by alternating high and low pressure systems (Davis and Browne 1996a).

Wind data is available from several observation stations such as Eddy Point and from regional wind and wave hindcast datasets, summarized in JWEL (2004) and CBCL (2015). At Eddy Point, the strongest winds occur in winter, during the months of November through February; these are predominantly from the west and northwest. In summer, during the months of June, July and August, winds diminish, and predominantly from the southwest (nearly 40% of the time). Intermediate wind directions and speeds are observed in the spring and fall. At Port Hastings, located further from the site, high winds are particularly common from mid-December to mid-June for more than 5% of the time (JWEL 2004).

Figure 4.3 and Figure 4.4 depict more recently collected wind data, including annual and seasonal wind rose plots (wind direction and speed) for a period of five years (2013 to 2017) at Port Hawkesbury, Nova Scotia (Hersbach et al. 2017). The dominant winds are from the northwest and southwest quadrants (Figure 4.3 and Figure 4.4). There is some variability from season to season (e.g., more dominant winds from the northwest in the winter, and more dominant winds from the southern quadrant in the summer) as shown in Figure 4.4. The highest wind speeds (over 11.1 metres/second) occur in the winter from the east-southeast and in the fall from the west-northwest.

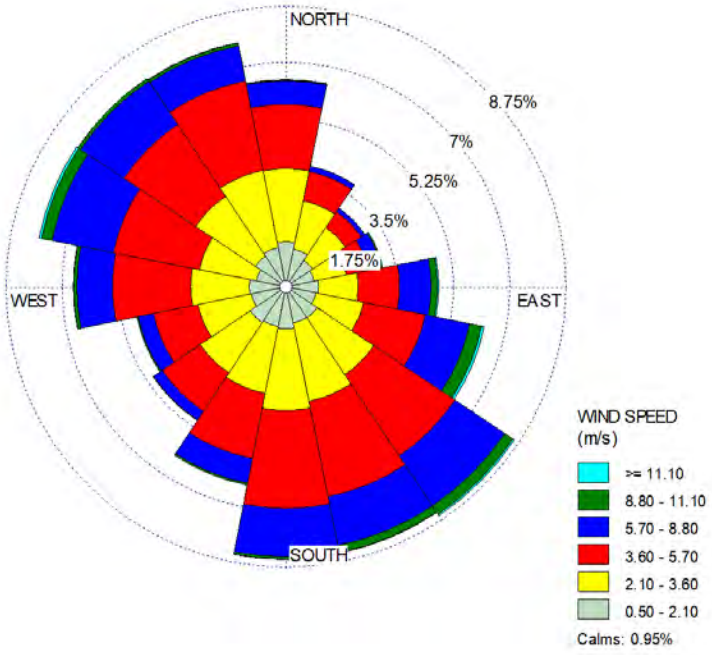


Figure 4.3 Wind Rose Plots – Port Hawkesbury, Nova Scotia, 2013 – 2017

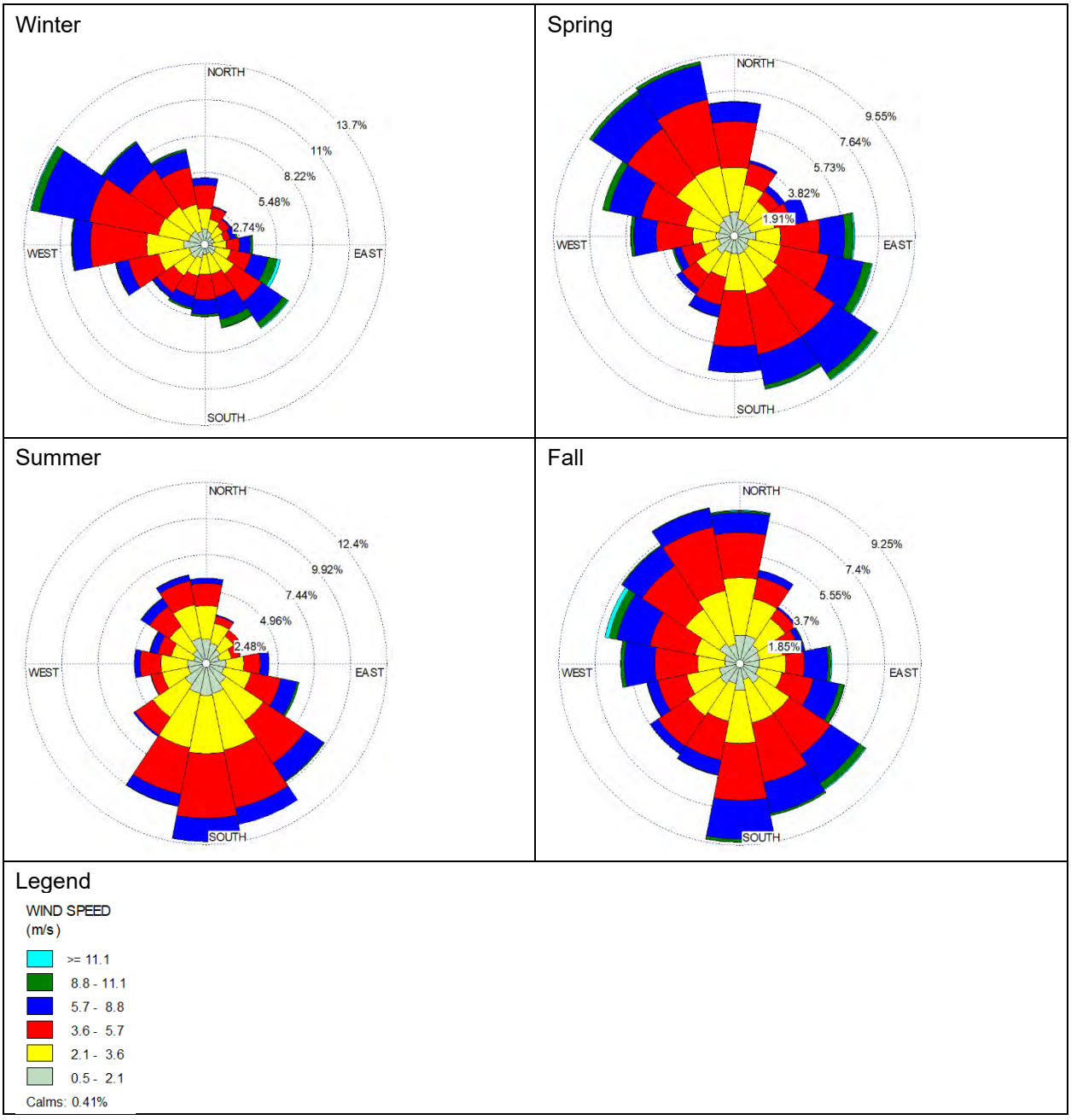


Figure 4.4 Seasonal Wind Rose Plots – Port Hawkesbury, Nova Scotia, 2013 – 2017

4.1.4.4 Adverse Weather

Adverse weather at the Bear Head Site can include fog, freezing rain, snow and high winds. Fog is common to the area regardless of season and can cause reduced visibility. It is more prevalent during spring and early summer when warming air interacts with ocean water that is still cool. Fall tends to be the least foggy time of year due to warmer waters and generally clear skies.

Heavy winds and cold air temperatures in the winter often cause sea spray to freeze, which can cause issues with accumulation on vessels, buildings, and could pose an issue to Project infrastructure. Freezing spray can occur from November through to April and is most common when northeasterly winter winds occur alongside freezing temperatures.

4.1.5 Ambient Air Quality

The ambient air quality in the Project Area is characterized by obtaining and reviewing the air monitoring results from the National Air Pollutant Surveillance (NAPS) station in Port Hawkesbury (approximately 8 km away). This was done for the years 2018 – 2020 (2020 is the most recently available complete dataset). Data completeness in the years reviewed was greater than 96%. Pollutants measured include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and fine particulate matter ($PM_{2.5}$, particulate matter having a diameter of 2.5 micrometres or less). Monitoring results are compared with the standards in Schedule A of the Nova Scotia Air Quality Regulations for SO_2, NO_2 and O_3 and with the Canadian Ambient Air Quality Standards (CAAQS) from CCME for O_3 and $PM_{2.5}$. Concentrations of all pollutants were below both sets of standards, indicating that ambient air quality at the site is very good. The annual average ground level concentrations of SO_2 and NO_2 were very low in comparison to the requirements in the Air Quality Regulations (1% and 5%, respectively). The results are presented in Table 4.6.

Table 4.6 Summary of Ambient Air Quality Monitoring Results in Port Hawkesbury, NS Compared with Applicable Air Quality Standards

Sulphur Dioxide (SO_2) ppb				
Year	**1 Hour Maximum**	**24 Hour Maximum**	**Annual Average**	**% Data Completeness**
2020	52	13	<1	>99
2019	46	7	<1	99
2018	61	17	<1	>96
*NS Air Quality Regulations***	340	110	60	N/A
Nitrogen Dioxide (NO_2) ppb				
Year	**1 Hour Maximum**	**24 Hour Maximum**	**Annual Average**	**% Data Completeness**
2020	45	17	<3	99
2019	39	20	<3	>98
2018	59	22	<3	>97
NS Air Quality Regulations	210	N/A	50	N/A

Table 4.6 Summary of Ambient Air Quality Monitoring Results in Port Hawkesbury, NS Compared with Applicable Air Quality Standards

Ozone (O_3) ppb				
Year	**1 Hour Maximum**	**Daily 8-hour Maximum**	**9th Percentile of Daily 8-Hour Maximums**	**% Data Completeness**
2020	58	52	49	>96
2019	59	49	48	>97
2018	55	51	48	>98
NS Air Quality Regulations	82	N/A	N/A	N/A
3 year average (2018 – 2020)	N/A	N/A	48	N/A
Values for comparison with federal CAAQS 3 year average*	N/A	N/A	62 for 2020 60 for 2025	N/A
Fine Particulate Matter ($PM_{2.5}$) µg/m³				
Year	**24 Hour Maximum**	**8th Percentile of 24 Hour Maximums**	**Annual Average**	**% Data Completeness**
2020	14	10	5	100
2019	22	11	<6	100
2018	18	11	5	98
3 year average (2018 – 2020)	N/A	11	5	N/A
CAAQS 3 year average*	N/A	27 for 2020	8.8 for 2020	N/A

Notes:
ppb = parts per billion
µg/m³ = micrograms per cubic metre
*CAAQS values for 2025 are not available (N/A) for $PM_{2.5}$
** The Air Quality Regulations are currently under review and consultation.
Source: ECCC 2022b

Current industrial emissions of SO_2, NO_X (nitrous oxides), CO, VOCs, total particulate matter (TPM), PM_{10} (particulate matter with a diameter of 10 micrometres or smaller) and $PM_{2.5}$ from major industrial and power installations in the Port Hawkesbury and Point Tupper area are shown in Table 4.7. These estimates of annual emissions were obtained from the National Pollutant Release Inventory for 2020 (most recently available data).

Table 4.7 Summary of Industrial Atmospheric Emissions in the Project Area (2020)

Facility Name and Location	Tonnes (t)						
	SO_2	NO_X	CO	VOCs	TPM	PM_{10}	$PM_{2.5}$
Port Hawkesbury Paper L.P., Port Hawkesbury	N/A	N/A	N/A	51	N/A	N/A	N/A
Nova Scotia Power Incorporated, Port Hawkesbury	6,019	897	54	N/A	55	42	25
Nova Scotia Power Incorporated, Point Tupper	45	356	792	N/A	76	41	36
NuStar Terminals Canada Partnership[1], Point Tupper	N/A	N/A	N/A	65	N/A	N/A	N/A

Note:
[1]Now Everwind Terminals Canada Partnership
Source: ECCC 2021

4.1.6 Acoustic Environment

A noise assessment of the Bear Head LNG Project was conducted by SNC Lavalin. As part of the assessment, monitoring was performed on October 1 and 2, 2014 at one location in the Project Area and three residential receptors across the Strait for a period of 24 hours. Subsequent monitoring was also performed between 18:00 and 19:00 at four locations on the site boundary, for two minute intervals. The site has limited noise sources, and as such the monitoring performed was considered representative of background ambient noise levels. Sound levels when winds exceeded 20 km/h were excluded from the assessment. The 2014 noise assessment is considered relevant for current background ambient noise levels because the proposed facility will be located within the footprint of the previously approved Bear Head LNG Project, and because the area surrounding the project footprint has not changed considerably (i.e., there are no new sources of loud, persistent noise).

Noise level measurements are presented as a weighted continuous sound level (L_{Aeq}). Sound pressure levels are measured in decibels (dB). For environmental assessments where the effect of sound on humans is the focus, an A-weighted dB scale (dBA) is used to report sound pressure levels as the A weighting most closely mirrors the frequency perception of the human ear.

At the Project site, birds, insects, and the adjacent wind farm could be heard during noise monitoring. An occasional noise of banging on metal could be heard across the Strait. At the southernmost site, S3, waves could be heard breaking on the shoreline. A summary of the ambient sound levels measured can be seen in Tables 4.8 and 4.9. It can be seen that L_{Aeq} levels range from 32 – 50 dBA; all measured ambient sound levels are below the noise criteria referenced in the provincial *Guideline for Environmental Noise Measurement and Assessment* (NSEL 1990).

Table 4.8 Ambient Sound Levels at the Bear Head Site, October 1, 2014

Monitoring Location	Coordinates (ATS77 MTM4)		Measured L_{Aeq} (dBA)	Provincial Criteria*
	Latitude	Longitude		
S1	4515671	5046815	35	65
S2	4515383	5046637	35	65
S3	4515383	5046228	44	65
S4	4515760	5046396	32	65
*Source: Guideline for Environmental Noise Measurement Assessment (NSEL 1990), 7:00 – 19:00 L_{Aeq} (dBA)				

Table 4.9 Ambient Sound Levels at Residential Monitoring Sites and the Bear Head Site, October 1-2, 2014

Monitoring Location	Coordinates (ATS77 MTM4)		Approximate Distance from Site Boundary, Loading Platform (km)	07:00 to 19:00 L_{Aeq} (dBA)	19:00 to 23:00 L_{Aeq} (dBA)	23:00 to 07:00 L_{Aeq} (dBA)	Day-Night Average Sound Level (Ldn) (dBA)**
	Latitude	Longitude					
R1	4517855	4517855	4.4	50	47	43	55
R2	4513977	4513977	1.8	50	43	42	55
R3	4512490	5045776	2.8	50	41	40	54
S5	4515546	5046557	N/A	46	39	37	46
Provincial Criteria*				65	60	55	N/A

Notes:
NA = Not Applicable
*Source: Guideline for Environmental Noise Measurement Assessment (NSEL 1990), 7:00 – 19:00 Laeq (dBA)
**Ldn is the average noise level over a 24-hour period, with a penalty added for noise during nighttime hours.

4.1.7 Physical Oceanography

The description of physical oceanography for the Project is based on literature reviews and field studies undertaken to support the *Environmental Assessment for the Proposed Bear Head LNG Terminal* (JWEL 2004), the *Bear Head LNG Updated Registration Document* (SNC Lavalin 2015) and the *Bear Paw Pipeline Environmental Assessment* (Stantec 2016), and associated federal permitting (e.g., CBCL 2015, CBCL 2016a). The Bear Paw Pipeline was proposed to support the Bear Head LNG Project.

The Bear Head Site is situated on the north shore at the southern end of the Strait of Canso off Chedabucto Bay. The Strait of Canso is a tidal inlet and effectively an artificial harbour created by the construction of the Canso Causeway in 1953-54, which cuts it off from open access to St. Georges Bay in Northumberland Strait, Southern Gulf of St. Lawrence (Buckley et al. 1974).

Chedabucto Bay is a broad, relatively shallow embayment, approximately 16 km north-to-south and 35 km in the east-west dimension, and open along the south and east to the Atlantic Ocean. A shallow shelf (less than 30 m) on the northern side contains a system of islands, of which the largest are Isle Madame and Janvirn Island, and several semi-enclosed bays and passages.

The Strait of Canso is relatively deep, ranging from 44 m where it meets Chedabucto Bay to more than 60 m in several seabed depressions in the vicinity of the Canso Causeway (Vilks et al 1975; Gregory et al 1993); the maximum depth near the proposed terminal is approximately 44 m. Near the Bear Head Site, the Strait meets Chedabucto Bay through a relatively deep channel that terminates in central Chedabucto Bay at a sill depth of 35 m (Cranston et al. 1974). Apart from the shelf on the north side of Chedabucto Bay, the depth gradually increases from 30 m in mid-bay to 90-100 m or more on the eastern margin, and reaches 80-90 m in a trough on the south side of the bay.

4.1.7.1 Water Column Properties

Waters in the Strait of Canso are typically highly stratified in summer with temperature and salinity in the upper 20 m (Stewart and White 2001). Warmer and fresher surface water tends to accumulate near the causeway end of the Strait of Canso and is periodically replaced by more saline and colder ocean waters that replenish the bottom waters (McCracken 1979). Salinity ranges from approximately 29 practical salinity units (psu) at the surface to 31 psu near the bottom (McCracken 1979).

Winds toward Chedabucto Bay in the Strait can cause upwelling at the head of the Strait, and net seaward flow caused by prevailing along-Strait northwest winds create an estuarine-like circulation near the mouth (Buckley et al 1974; Stewart and White 2001). The passage of weather systems can result in rapid flushing of the surface layers as it does elsewhere along the Atlantic coast (e.g., Heath 1973; Platt et al 1972). As the sill depth at the mouth of the Strait of Canso is well below the depth of the summer thermocline, deeper waters in the Strait can be affected by coastal upwelling / downwelling and by shelf-generated internal waves (JWEL 2004).

As part of the assessment of the Bear Paw Pipeline Project (Stantec 2016), water column profiles were taken at three stations during a large high tide in the Strait of Canso on September 30, 2015. The highest temperature recorded was 16.4°C near the surface, which decreased to 6.6°C at a depth of 42 m near the bottom. The temperature was generally above 15°C in the top 10 m of the water column, decreasing steadily to approximately 8°C at 40 m; temperatures dropped another 2°C before maximum depth (Stantec 2016).

Salinity increased more evenly from the surface to the bottom and ranged between 29.7 psu near the surface, to 31.8 psu below 40 m. Turbidity measurements increased from 5.2 nephelometric turbidity units (NTU) near the surface to 6.0 NTU around 30 m, where it was largely consistent to the bottom. Turbidity measurements are often used as an indicator of water quality based on clarity and estimated total suspended solids in water. However, turbidity is not a direct measurement of the total suspended materials in water. Instead, as a measure of relative clarity, turbidity is often used to indicate changes in the total suspended solids concentration in water without providing an exact measurement of solids (Kemker 2014). The depth at which peak turbidity was measured was the depth selected for sampling TSS in the water column. These were collected at 38 m, 30 m, and 20 m water depths. The TSS concentrations at each of these depths/stations were 3.2 mg/L, 1.0 mg/L, and <1.0 mg/L (not detected), respectively (Stantec 2016).

4.1.7.2 Tides, Storm Surge and Sea Level Rise

An oceanographic analysis conducted for the Bear Head LNG Project to support marine terminal design in 2015 (CBCL 2015; Appendix D) concluded that tidal currents at the site are weak, with the maximum near-surface tidal current of approximately 0.02 m/s; non-tidal currents, driven by wind, may be many times stronger than the tidal currents (CBCL 2015). Offshore swell is greatly attenuated before reaching the site, and local waves are fetch limited (the longest fetch direction being 5.5 km). Mean or relative sea level changes with time as a result of factors related to volume of seawater in the ocean, melting of ice caps and sheets, and properties of the earth's crust. Sea level has been rising in recent times (i.e., within the last 2,500 years) at between 25 and 30 cm per century (Shaw et al 1998; Scott et al 1981). This will result in an estimated maximum increase of approximately 0.8 m globally in the next century and over 1 m along the East Coast of Nova Scotia, from Halifax to North Sydney (Zhai et al 2014). For the probable 30-year design life of the Project, the estimated sea level increase due to climate change and global warming by 2050 will be approximately 0.4 m (CBCL 2015).

4.1.7.3 Waves and Currents

Wave climate in the study area (Chedabucto Bay and Strait of Canso) includes an oceanic component generated outside of and strongly influencing Chedabucto Bay, and an inshore component generated locally and reflecting factors such as wind fields, depth and coastal configuration. The proposed terminal site is sheltered from much of the ocean wave activity and is exposed to winds and waves generated mainly from the southeast (CBCL 2015). The peak wave height measured during the 2005 to 2006 winter season was 0.87 m during a storm event with the hourly winds peaked at 25 m/s (CBCL 2015). The majority of wave peak periods were 2 to 4 seconds, accounting for approximately 71% of the wave

observations that were recorded (CBCL 2015). Wave heights and their severity have been taken into account in the design of the marine facilities.

Extreme significant wave heights were modelled at the Bear Head site for specific wind speeds by CBCL (2015). The model incorporated various factors including wave refraction, shoaling, depth and steepness induced wave breaks, diffraction, wave-wave growth, and wave-wave interaction. Table 4.10 presents the results from the model for case-specific wind speeds.

Table 4.10 Extreme Values for Case-specific Wind Speeds (CBCL 2015)

Case	Wind speed (m/s)	Maximum significant wave height (m)	Peak period (s)
10-year return	29.7	1.6	4.4
50-year return	33.8	1.9	4.7
100-year return	35.2	2.1	4.6

Currents in the Strait of Canso southeast of the Canso Causeway are generally weak and are predominantly wind-driven (McCracken 1979). Wind is the dominant factor influencing currents and marine operations in the study area, and because of the lack of ice cover in winter, wind is important year-round. A description of wind in the study area, including normals and extremes, is presented in Section 4.1.4.3. The direction of the current is aligned with the length of the Strait; the average current speed is 0.1 m/sec to 0.2 m/s, and the peak velocity (0.3 m/s to 0.6 m/s) at a depth of 8 m (CBCL 2015). Currents are weaker at depth (0.05 m/s to 0.1 m/s) compared to those at the surface, where the peak current observed was 0.65 m/s (CBCL 2015).

As part of the planning and assessment of the proposed Bear Paw Pipeline (Stantec 2016), currents were measured in the vicinity of a proposed crossing of the Strait of Canso using an Acoustic Doppler Current Profiler (ADCP). ADCP measurements for currents were taken during a large spring tide and also were weak. The prevailing direction of the surface and bottom currents when the tide is flooding was northwesterly, with the strongest currents (0.41 m/s to 0.50 m/s) measured only on the surface along the Cape Breton side of the Strait. During the ebbing tide, the strongest currents are also on the surface, but flowing primarily in a southeasterly direction (velocities in the range of 0.1 m/s to 0.4 m/s), with much weaker bottom currents primarily in a northeastern and opposite direction to the surface currents (Stantec 2016).

4.1.7.4 Ice Cover

The Strait of Canso and Chedabucto Bay are ice free in winter (O'Neill 1977); ice does not therefore interfere with typical wave and current patterns and mixing. Some ice, however, will form in coastal areas and among islands along the coast and occur as drift in the Bay.

4.2 TERRESTRIAL BIOLOGICAL ENVIRONMENT

The description of the terrestrial biological environment relies primarily on the *Bear Head LNG Updated Registration Document* (SNC Lavalin 2015), which incorporated information from the *Environmental Assessment for the Proposed Bear Head LNG Terminal* (JWEL 2004). However, updated information from site reconnaissance studies conducted in 2022 has been incorporated with respect to wetlands, fish habitat, and wildlife. The terrestrial environment study area includes lands within a 5 km radius of the Project Area.

A data request was submitted to the Atlantic Canada Conservation Data Centre (AC CDC) for records of species at risk or of conservation concern within a 100 km radius of the Project Area. Results of this data request are included as Appendix I. The AC CDC database records reliable occurrences of important species, and when combined with the availability of suitable habitat at the site, provides an indication of the potential for species of concern to occur.

Species at risk (SAR) are defined as those species that meet any of the following criteria:

- Species that are listed under Schedule 1 of the federal *Species at Risk Act* (SARA) as endangered, threatened, vulnerable, or of special concern
- Species that are listed under the Nova Scotia *Endangered Species Act* (NS ESA) as endangered, threatened, vulnerable, or of special concern
- Species that are not yet listed under provincial or federal legislations but have been identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as being endangered, threatened, or of special concern

Species of Conservation Concern (SOCC) are defined as those species that do not meet the above definition of SAR, but are ranked as S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in Nova Scotia by the AC CDC. A numeric range rank (e.g., S2S3) is used by the AC CDC to indicate any range of uncertainty about the status of the species or community in the province (ACCDC 2022a).

SAR and SOCC are described where applicable in relevant sections below with a summary presented in Section 4.2.8.

4.2.1 Overview

The greater landscape surrounding Point Tupper is primarily forested, typical of what is found throughout the eastern portions of Cape Breton Island. The landscape is dominated by a matrix of coniferous and mixed forest, with patchy deciduous forest interspersed throughout. Due in part to the long history of industrial forestry and heavy industrial development in the area, the majority of forests in the area are dominated by early seral pioneer species. Little in the way of climax or old-growth forest exists south of Highway 104. Much of the area is poorly drained and is typically colonized by climax species including black spruce (*Picea mariana*), red maple (*Acer rubrum*) and tamarack (*Larix laricina*). Mesic or dry sites tend to support mixed forest communities composed primarily of black spruce, white pine, red maple, eastern hemlock, trembling aspen, balsam fir and yellow birch. The coastal influence on vegetation can be clearly seen, with salt tolerant conifers, such as white and black spruce, dominating the shoreline.

Much of the Project Area was cleared in 2005 to accommodate the roads and foundation infrastructure for the previously approved Bear Head LNG Project (Figure 4.5). The balance of the Project Area is comprised of undisturbed features such as mixed forest, wetlands, abandoned farmland, streams and marine coastline. Wetlands are common around the margin of the site; these include various habitats including basin bog, sloped fen, and treed and riparian swamps which contain various coniferous and mixed wood trees and several wildlife species.

4.2.2 Freshwater Fish and Fish Habitat

There are two streams in the vicinity of the Project Area. Stream A is located on the west side of the property, and Stream B is on the east (Figure 4.5). Surveys were completed in 2003 and 2014 to inform EAs for the LNG Import Facility (JWEL 2004) and the Bear Head LNG Project (SNC Lavalin 2015). To inform the current EA, further surveys were completed in November 2022 to confirm stream conditions had not changed substantively from 2003 and 2014 and to provide an updated description of fish habitat characteristics in Streams A and B.

Fish Habitat

Fish habitat surveys were completed in November 2022 to evaluate the general condition of Streams A and B. Fish habitat information, including habitat type (i.e., riffle, run, pool), substrate type as well as other habitat characteristics (i.e., cover, bank stability) was collected to inform this EA. Approximately 800 m of Stream A upstream of the settling pond and 600 m of Stream B was surveyed in 2022 within the existing Project Area.

Stream A is a small intermittent stream, which flows adjacent to the project footprint before flowing into the Strait of Canso. Originating at Wetland 6, the stream flows south through Wetlands 2 and 3. It eventually empties into a settling pond a few hundred meters to the west of the previously developed footprint (Figure 4.5). The water level management structure on the settling pond was thought to be a barrier to fish following baseline surveys (JWEL 2004). A rock outcrop in a lower section of Stream A may also impede fish migration during low flow conditions (JWEL 2004).

Stream A is characterized by shallow runs (80%) and riffles (20%). At the time of the survey in 2022, the average wetted width of the watercourse was 1.62 m (range 0.55 to 2.8 m) and average channel width was 1.81 m (range 0.58 to 3.0 m). The substrate consisted of boulders (60%), cobble (23%), and some gravel (13%). Aquatic vegetation covered 15% of the streambed. The banks were generally stable and were most commonly bare (34%) with some riparian vegetation consisting of conifer (20%) and deciduous trees (20%).

In situ water quality was measured at eight locations within Stream A (Table 4.3). Water temperature ranged between 12.86 and 15.19°C. Specific conductivity ranged between 1.031 and 1.815 mS/cm. Dissolved oxygen (DO) concentrations were 4.92 to 9.64 mg/L and generally above the CCME WQG-PAL recommended value of 6.5 for all life stages of fish; only one reading was below the guideline value (CCME 1999). DO concentrations were generally below the guideline of 9.5 mg/L for early life stages with only one reading above (CCME 1999). The pH range was 7.10 to 8.17, within the CCME WQG-PAL recommended range (6.5 – 9.0). Similarly, field water quality measurements and chemical analyses of samples taken in December 2014 indicated that water in Stream A was acceptable for aquatic life (SNC Lavalin 2015).

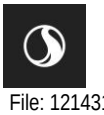


Figure No.
4.5

Title
Wetlands, Watercourses, and Sensitive Terrestrial Species

Client/Project 121431287_018

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NW on 2022-12-19

Richmond County, NS

N

0 200 400 Metres

(At original document size of 11x17)
1:10,000

Legend

- Project Area

Species at Risk / Species of Special Concern

- Southern twayblade (*Neottia bifolia*)[2]
- Autonomous Recording Unit Deployment (Bat Survey)
- Watercourse (1:10k)
- Waterbody (1:10k)
- Overland Drainage [3]
- Field-delineated Wetlands (SNC Lavalin 2015[4])
- Wetlands[5]
- Wetland of Special Significance

Project Location

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. AC CDC. 2022. Data Report 7469: Bear Head, NS. 20 pp.
3. Stantec, 2022.
4. SNC - Lavalin. 2015. Bear Head LNG Updated Registration Document. Bear Head LNG Corporation.
5. Nova Scotia Dept. of Environment and Climate Change, 2022.
6. Background: NS DNRR, NS ECC, NS Topographic Database, Service NS, Province of Nova Scotia, Esri Canada, Esri, HERE, Garmin, FAO, NOAA, USGS, NRCan, Parks Canada, Esri, USGS, Maxar

Stantec

Figure 4.6 Representative Habitat in the Downstream Portion of Stream A (November 2022)

Stream B flows from Wetland 1 through a culvert under Bear Island Road. From there it flows approximately 550 m downstream into Bear Island Cove/Strait of Canso. No obstructions to fish passage occur in the downstream reaches (SCN Lavalin 2015).

Downstream of the culvert, to the approximate boundary of the Project Area, Stream B is a run. At the time of the 2022 survey, the wetted width of the watercourse ranged from 1.50 to 2.15 m, and the channel width ranged from 2.30 to 3.00 m. The substrate consisted of predominantly of fine sediments (50%) and organic material (25%), with smaller amounts of cobble (10%) and gravel (10%). The banks were generally stable and riparian vegetation predominately consisted of bare banks (50%), shrubs (30%), and grass (15%).

In situ water quality was measured at two locations in Stream B, downstream of the culvert under Bear Island Road (Table 4.3). Water temperature was recorded as 13.66°C and 14.95°C. Conductivity readings were 0.836 and 0.849 mS/cm. DO concentrations were 5.24 and 5.52 mg/L, below the CWQG PAL recommended maximum value of 6.5 for all life stages of fish and below the 9.5 mg/L for early life stages (CCME 1999). The pH readings were 6.91 and 7.45, within the CWQG PAL recommended range (6.5 – 9.0). Similarly, field water quality measurements and chemical analyses of samples taken in December 2014 indicated that water in Stream B was acceptable for aquatic life (SNC Lavalin 2015).

Figure 4.7 Representative Habitat in Stream B, Downstream of the Bear Island Road Culvert (November 2022)

Fish Species

Within the Project Area, fish are not known to occur upstream of the settling pond on Stream A (JWEL 2004). This determination was based on field measurements which showed low pH, an electrofishing survey which did not find fish, and the assessment of downstream fish access (JWEL 2004). No fish were incidentally observed in Stream A in 2022.

Within the Project Area, fish are not known to occur upstream of the culvert on Bear Island Road (JWEL 2004). This determination was based on an electroseining survey which did not find fish (JWEL 2004). In May 2014, unidentified fish were observed immediately below the culvert on Bear Island Road in the downstream reaches (SNC Lavalin 2015). No fish were incidentally observed upstream or downstream of the Bear Island Road culvert in 2022.

The downstream portions of both streams could potentially include fish species common to small streams such as, brook trout (*Salvelinus fontinalis*), rainbow smelt (*Osmerus mordax*), Gaspereau (*Alosa pseudoharengus and Alosa aestivalis*) and small minnow or forage species such as banded killifish (*Fundulus diaphanus*), and stickleback species (SNC Lavalin 2015). SAR/SOCC species that could potentially be present include American eel (*Anguilla rostrata*) which is listed as Threatened by COSEWIC, and the Eastern Cape Breton population of Atlantic salmon (*Salmo salar*), which is listed as Endangered by COSEWIC.

Information on fish species that reside in estuarine and marine waters of Bear Island Cove and the Strait of Canso is provided in Section 4.3.4.

4.2.3 Wetlands

The Project Area includes all or part of six wetlands identified in baseline studies for the earlier environmental assessment (JWEL 2004) and a later survey (JWEL 2005). These conditions were confirmed in May 2014 for the previously approved Bear Head LNG Project. In November of 2022, the site was revisited to determine if wetland and conditions had changed since the last field surveys had been completed.

Small parts of two wetlands (Wetlands 1 and 2) were partially infilled, and a third small wetland (Wetland 5) was infilled entirely to construct the base pad for the previously approved project; all alterations authorized and compensated under *Environment Act* Water Approval 2004-043228. No further alteration to wetlands is anticipated, and the necessary site drainage and erosion and sediment control measures will be maintained to ensure the protection of the remaining wetlands on site. Wetlands 1, 2, 3, 4, and 6 are described below.

Wetland 1 is a 1.7 ha combination of slope fen, mixed-wood treed spring swamp. And coniferous treed basin bog located entirely within the property boundary on the eastern portion of the site. The wetland is the origin of Stream B, which exits the southeast part of the site and flows to Bear Island Cove. The water supply for the wetland includes groundwater and runoff from the eastern part of the site, most of which flows through a detention/settling pond before entering the wetland. No rare vascular plants were found in the wetland in the baseline surveys (JWEL 2004). During 2022 reconnaissance surveys, this wetland was

found to have potentially increased in size relative to what was presented in the *Bear Head LNG Updated Registration Document* (SNC Lavalin 2015), and continue on the south side of the site access road, associated with Stream B. Newly formed wetland area is primarily freshwater marsh (Figure 4.8). Formal wetland delineations will be conducted within the growing season in 2023.

Figure 4.8 Representative Photos of Wetland 1 (Freshwater Marsh, Coniferous Treed Basin Bog, November 2022)

Wetland 2 is a combination of mixed-wood treed stream swamp, coniferous treed stream swamp, and tall shrub-dominated stream swamp on the northwest side of the Project site. This swamp was partly infilled during construction of the previously approved Bear Hear LNG facility, alterations were made, and compensation carried out under the Water Approval. No rare vascular plants had been found in the part that was modified (JWEL 2004). The remaining and largest portion of this wetland extends west. It receives groundwater flow, spillover from the western stream (Stream A) which passes through it, and surface water from ditches on the northeast and northwest sides of the base pad. The boundary delineated during reconnaissance surveys conducted in fall 2022 was largely south of the wetland shape from previous field surveys, and closer to the provincially-mapped wetland shape. In addition, the portion of the wetland closest to the infilled area appears to be currently dominated by cattails (*Typha* spp.), a change that may have resulted from impoundment related to the infilling.

Figure 4.9 Representative Photo of Wetland 2 (November 2022)

Wetland 3 is small (0.1 ha) and consists of a coniferous treed swamp and coniferous treed basin bog. It is located along the western stream (Stream A) near the west side of the base pad (JWEL 2004). A population of southern twayblade was found near the eastern margin of this wetland in 2004 within the coniferous treed stream swamp plant community (see Section 4.2.4). The 2022 reconnaissance surveys indicate that this wetland is likely larger than initially delineated, extending west into the provincially-mapped wetland shape.

Figure 4.10 Representative Photo of Wetland 3 (November 2022)

Wetland 4 is a small (0.2 ha) coniferous treed basin bog located immediately southwest of Wetland 3 within the property boundary (JWEL 2004; JWEL 2005). The eastern edge of the wetland and the area between it and the western stream (Stream A), supports a population of northern comandra, a species previously considered an SOCC. A buffer zone was established separating northern comandra from the developed area. This wetland was preliminarily delineated during reconnaissance surveys conducted in fall 2022 and appears to extend further west than it was initially mapped.

Figure 4.11 Representative Photo of Wetland 4 (November 2022)

Wetland 6 is a 0.7 ha combined treed basin bog and treed sphagnum swamp wetland that extends west from the northwest corner of the property. The primary water source of the wetland is precipitation, but some runoff enters the area at the margin and from the main drainage ditch which runs along the northern boundary of the site. The eastern end of the wetland supports a separate population of southern twayblade (*Neottia bifolia*) (JWEL 2007). No alteration to this wetland is anticipated based on the preliminary site plan. Reconnaissance surveys conducted in fall 2022 indicate that this wetland has changed shape since previous surveys but remains a similar size. Similar to Wetland 2, the portion of the wetland closest to the infilled area appears to be currently dominated by cattails (*Typha* spp.), a change that may have resulted from impoundment related to infilling.

Figure 4.12 Representative Photo of Wetland 6 (November 2022)

The site also had a coniferous treed slope bog, approximately 0.1 ha in area, located in the southeast corner of the proposed base pad. This wetland was formerly known as Wetland 5 and was completely infilled and compensated in accordance with Water Approval 2004-043228.

Two other wetlands were preliminarily delineated during the fall 2022 reconnaissance surveys that were not included in results of work previously completed for the Project. These wetlands are south of Wetland 4 and associated with Stream A. Wetlands have also formed within the developed Project footprint following past construction. However, as described in the NS Wetland Conservation Policy (NSE 2019), “wetlands that develop as the unintended result of urban, commercial, industrial or agricultural construction projects completed less than 20 years before the current calendar year” do not require permitting approvals.

Figure 4.13 Previously Unidentified Wetland South of Wetland 4 (East) (November 2022)

Figure 4.14 Previously Unidentified Wetland South of Wetland 4 (West) (November 2022)

Wetland surveys will be undertaken in summer 2023 to update wetland delineations and confirm no additional wetland alterations are required for continued site development.

4.2.4 Rare Plants

The Bear Head site was surveyed in 2003-2004, and 2007, and in 2022 field reconnaissance was conducted by biologists to determine plant communities, wetland distribution, and occurrence of species at risk. Field surveys conducted in 2003-2004 observed 247 species, the majority of which were typical of natural forested uplands and wetlands areas in the area. One SOCC, southern twayblade was observed in wetlands near the west boundary of the site (JWEL 2004). Site development was planned to avoid the plants and leave a buffer zone. Two populations of southern twayblade were observed: one containing 35 plants (situated in Wetland 3, coniferous treed swamp), and another with over 100 plants (Wetland 6, a treed basin bog and treed sphagnum swamp) (JWEL 2004; JWEL 2007). Wetland surveys conducted in 2015 observed a population of southern twayblade in Wetlands 3 and 4, and suitable habitat in Wetland 6 but no species present (SNC Lavalin 2015).

The previous site surveys determined a population containing five patches of northern comandra occurs in the same general area as the southern population of the southern twayblade, on the west side of the property; however, the S rank of this species has been downgraded since those surveys occurred (to S3S34), and it is no longer considered an SOCC.

In 2022, an updated information request for the Project was submitted, and AC CDC reported there is one species at risk lichen, blue felt lichen (*Pectenia plumbea*), and one other rare lichen, eyed mossthorns woollybear lichen (*Polychidium muscicola*), within 5 km of the Project Area. AC CDC records also showed one rare vascular plant within 5 km of the Project Area (southern twayblade) which had been previously identified on the site (Appendix I).

Surveys will be undertaken in the Project Area in summer 2023 to search for rare lichen species and verify the presence and extent of southern twayblade previously identified on the site.

4.2.5 Birds

4.2.5.1 Overview

The Project Area and surrounding environment includes habitats for many species of birds including inland forests; marine coasts and marine coastal waters; islands; and lakes, streams and wetlands. Birds frequenting these habitats may be seen in the vicinity of the Project Area. During migrations, many different bird species move through the area and may occur in the Project Area.

Given the site location at the junction of the Strait of Canso, Inhabitants Bay and Chedabucto Bay, it is likely to be comparatively more important as a route for migratory movements for songbirds and other species. It has been suggested that the Bear Head area may be a ‘migration trap’ for migrating songbirds about to cross the Strait of Canso to mainland Nova Scotia (CBCL 2010; J. Kearney, pers. comm. 2015). Coastal headlands such as Bear Head can also be major points of concentration for disoriented, off-course, or re-orienting migrants. Bear Head, the approaches to the Strait of Canso through Chedabucto Bay and the area adjacent the causeway are important for stopovers and coastal aggregations of water-associated birds during migration. The nearest Important Bird Area, as designated by Bird Studies Canada, is NS009 Pomquet Beach Region, approximately 40 km northwest of the Project Area (Bird Studies Canada 2022).

Information on the distribution and abundance of birds in the vicinity of the Project Area has been obtained mainly through published sources including the Maritime Breeding Birds Atlas (MBBA) database (MBBA 2013); a review of the AC CDC database (AC CDC 2003, 2014, 2022); review of Important Bird Areas mapping (Bird Studies Canada 2022) field surveys (April, June, July 2003); site reconnaissance (Pulsifer 2022a); and literature review (e.g., Lock et al. 1994).

Tables 4.11 and 4.12 present the birds recorded in the study during field surveys within the Project Area in 2003.

Table 4.11 Abundance and Breeding Status of Birds Observed within the Project Area During 2003 Field Surveys (Pre-Development) (JWEL 2004)

Common Name	Scientific Name	Breeding Status	Number Observed
Common Loon	*Gavia immer*	Ne	1
Double-crested Cormorant	*Phalacrocorax auritus*	Ne	2
American Black Duck	*Anas rubripes*	Pr	2
Osprey	*Pandion haliaetus*	Ne	2
Bald Eagle	*Haliaeetus leucocephalus*	Ne	1
Spruce Grouse	*Dendrogapus canadensis*	Po	1
Ruffed Grouse	*Bonasa umbellus*	Po	1
Spotted Sandpiper	*Actitis macularia*	Po	1
Herring Gull	*Larus argentatus*	Ne	1
Great Black-backed Gull	*Larus marinus*	Ne	2
Gull sp.	*Larus sp.*	Ne	1
Common Tern	*Sterna hirundo*	Ne	2
Belted Kingfisher	*Ceryle alcyon*	Po	2
Northern Flicker	*Colaptes auratus*	Ne	2
Olive-sided Flycatcher	*Contopus cooperi*	Po	3
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Po	4
Alder Flycatcher	*Empidonax alnorum*	Po	2
Blue Jay	*Cyanocitta cristata*	Ne	1
Gray Jay	*Perisoreus canadensis*	Po	2
American Crow	*Corvus brachyrhynchos*	Po	4
Common Raven	*Corvus corax*	Ne	1
Black-capped Chickadee	*Poecile atricapillus*	Po	1
Boreal Chickadee	*Poecile hudsonicus*	Po	1
Red-breasted Nuthatch	*Sitta canadensis*	Po	1
Brown Creeper	*Certhia americana*	Pr	1
Winter Wren	*Troglodytes hiemalis*	Po	1
Golden-crowned Kinglet	*Regulus satrapa*	Po	4
Ruby-crowned Kinglet	*Regulus calendula*	Po	5
Swainson’s Thrush	*Catharus ustulatus*	Po	6
Hermit Thrush	*Catharus guttatus*	Cf	9
American Robin	*Turdus migratorius*	Pr	5
Cedar Waxwing	*Bombycilla cedrorum*	Pr	3
Blue-headed Vireo	*Vireo solitarius*	Po	5

Table 4.11 Abundance and Breeding Status of Birds Observed within the Project Area During 2003 Field Surveys (Pre-Development) (JWEL 2004)

Common Name	Scientific Name	Breeding Status	Number Observed
Red-eyed Vireo	*Vireo olivaceus*	Po	1
Nashville Warbler	*Leiothlypis ruficapilla*	Po	7
Magnolia Warbler	*Setophaga magnolia*	Pr	25
Yellow-rumped Warbler	*Setophaga coronata*	Pr	4
Blackburnian Warbler	*Setophaga fusca*	Po	3
Palm Warbler	*Setophaga palmarum*	Pr	1
Bay-breasted Warbler	*Setophaga castanea*	Po	2
Blackpoll Warbler	*Setophaga striata*	Po	2
Black-and-white Warbler	*Mniotilta varia*	Po	3
American Redstart	*Setophaga ruticilla*	Po	2
Ovenbird	*Seiurus aurocapillus*	Po	1
Mourning Warbler	*Geothlypis philadelphia*	Po	2
Common Yellowthroat	*Geothlypis trichas*	Pr	7
Song Sparrow	*Melospiza melodia*	Po	2
Lincoln's Sparrow	*Melospiza lincolnii*	Po	1
Swamp Sparrow	*Melospiza georgiana*	Pr	3
White-throated Sparrow	*Zonotrichia albicollis*	Pr	17
Dark-eyed Junco	*Junco hyemalis*	Cf	21
Pine Grosbeak	*Pinicola enucleator*	Po	1
Purple Finch	*Carpodacus purpureus*	Po	1
American Goldfinch	*Spinus tristis*	Pr	4

Notes:
Breeding bird survey was conducted on June 23, 2003. Additional bird data collected on April 14 and July 27, 2003.
Breeding Status Codes
Po = Possible Breeder
Pr = Probable Breeder
Cf = Confirmed Breeder
Ne = No Evidence of Breeding

Table 4.12 Number of Birds Observed within Habitat Types in the Project Area (Pre-Development) During 2003 Surveys (JWEL 2004)

Species	Habitat													
	MM	IM	MS	IS	CC	BA	CS	TS	LS	TB	CB	OW	HU	FO
Common Loon												1		
Double-crested Cormorant												1		2
American Black Duck												2		
Osprey														2
Bald Eagle														1
Spruce Grouse			1											
Ruffed Grouse	1													
Spotted Sandpiper											1			
Herring Gull												1		
Great Black-backed Gull												1		1
Gull sp.												15		
Common Tern												1		2
Belted Kingfisher			1											1
Northern Flicker			1											1
Olive-sided Flycatcher			1										2	
Yellow-bellied Flycatcher	2		2											
Alder Flycatcher		2												
Blue Jay								1						
Gray Jay	1		1											
American Crow													5	1
Common Raven													1	
Black-capped Chickadee							1							

Table 4.12 Number of Birds Observed within Habitat Types in the Project Area (Pre-Development) During 2003 Surveys (JWEL 2004)

Species	Habitat													
	MM	IM	MS	IS	CC	BA	CS	TS	LS	TB	CB	OW	HU	FO
Boreal Chickadee	2													
Red-breasted Nuthatch			1											
Brown Creeper			1											
Winter Wren			1											
Golden-crowned Kinglet	1	1	2											
Ruby-crowned Kinglet		4											1	
Swainson's Thrush	2		3	1										
Hermit Thrush	5	2	1	1									1	
American Robin		2	2											1
Cedar Waxwing			1											2
Blue-headed Vireo	2		3											
Red-eyed Vireo		1												
Nashville Warbler	1		5				1							
Magnolia Warbler	2	13	9			1								
Yellow-rumped Warbler	2	1					1							
Blackburnian Warbler	1	2												
Palm Warbler						1								
Bay-breasted Warbler		2												
Blackpoll Warbler	1		1	1										
Black-and-white Warbler			3											
American Redstart		2												
Ovenbird	1													

Table 4.12 Number of Birds Observed within Habitat Types in the Project Area (Pre-Development) During 2003 Surveys (JWEL 2004)

Species	Habitat													
	MM	IM	MS	IS	CC	BA	CS	TS	LS	TB	CB	OW	HU	FO
Mourning Warbler					1	1								
Common Yellowthroat		2	1			2	1	1		1				
Song Sparrow		2												
Lincoln's Sparrow		2												
Swamp Sparrow							1	1	1					
White-throated Sparrow	6	6	2			1	1			1				
Dark-eyed Junco	11	6	4	2			1							
Pine Grosbeak	1													
Purple Finch							1							
American Goldfinch		1	2			1								2
Total	42	51	49	5	1	1	8	3	1	2	1	22	10	16

Notes:

Habitat Codes.

MM = Mature Mixedwood Forest
IM = Immature Mixedwood Forest
MS = Mature Softwood Forest
IS = Immature Softwood Forest
CC = Clear-cut
BA = Barrens
CS = Coniferous Treed Swamp
TS = Tall Shrub Swamp
LS = Low Shrub Swamp
TB = Treed Bog
CB = Cobble Beach
OW = Open Water
HU = Habitat Unknown
FO = Flew Over.

Although the site has experienced considerable clearing and development since these surveys were conducted in 2003, the habitat in undeveloped parts of the Project and surrounding lands are expected to be similar to those described in JWEL (2004) as the dominant upland vegetation surrounding the site has not changed from 2004 to 2022.

Bird species observed during a site reconnaissance by a professional biologist (Mark Pulsifer) in July 2022 are presented in Table 4.13. All of the species observed during the site visit in 2022 had been previously recorded during previous bird surveys at the site. No bird SAR or SOCC were observed during the 2003 surveys or 2022 site visit.

Table 4.13 Observed Bird Species within the Project Area -July 11, 2022 (Pulsifer 2022a)

Scientific Name	Common Name
Corvus brachyrhynchos	American Crow
Turdus migratorius	American Robin
Mniotilta varia	Black and White Warbler
Geothlypis trichas	Common Yellowthroat
Catharus guttatus	Hermit Thrush
Setophaga magnolia	Magnolia Warbler
Regulus calendula	Ruby-Crowned Kinglet
Bonasa umbellus	Ruffed Grouse
Catharus ustulatus	Swainson's Thrush
Melospiza georgiana	Swamp Sparrow
Zonotrichia albicollis	White-throated Sparrow

4.2.5.2 Raptors

Various raptor species occur in the general vicinity of the Bear Head LNG facility based both on breeding surveys (MBBA 2013) and observations made during site visits (JWEL 2004; Pulsifer 2022a, b). These raptor species include: bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), broad-winged hawk (*Buteo platypterus*), northern harrier (*Circus cyaneus*), northern goshawk (*Accipiter gentilis*), sharp-shinned hawk (*Accipiter striatus*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), barred owl (*Strix varia*), great horned owl (*Bubo virginianus*), and northern saw-whet owl (*Aegolius acadicus*).

During a site visit in 2014, a potential osprey nest was observed. A subsequent site visit was undertaken on September 6, 2022, and two osprey and an occupied nest were observed, as well as evidence of juveniles from a successful nesting season. Osprey often nest on man-made structures such as power poles so the presence of an osprey nest on the developed portions of the site is not unexpected. The adjacent forested areas are predominantly second-growth forests and unlikely to contain prime nesting habitat for most raptor species.

4.2.5.3 Seabirds and Coastal Waterfowl

Seabirds found in the study area include species that are neritic, spending most of their life cycle in coastal areas, and pelagic species that only return to land to breed. Common coastal birds include cormorants, gulls, terns, and guillemots. Pelagic birds include storm petrels, alcids like dovekies (*Alle alle)*, puffins and murres, shearwaters and kittiwakes. Most seabirds breed in colonies on islands or cliffs where they are relatively secure from predation or disturbance.

The Project Area is located in nearshore waters and neritic seabirds are most abundant. Common tern and double-crested cormorant nesting is known in the general area but no nesting was observed during 2004 field surveys likely due to a lack of suitable nesting habitat. There were occasional sightings of common terns at the site during breeding season, which consisted of adults foraging in local waters. The nearest recorded tern colonies are on Scanlan's Island in Inhabitants Bay and Long Pond in the Strait of Canso located 10 km and 15 km from the Project Site, respectively. Three double-crested cormorant colonies are located off Janvirn Island and Isle Madame in Chedabucto Bay. Colonies of both double-crested and great cormorant species occur in coastal areas in the approaches of Chedabucto Bay. Additionally, herring gull and great black-backed gull nest throughout the study area along the south shore of Chedabucto Bay.

Pelagic seabirds including but not limited to greater shearwaters (*Puffins gravis*), sooty shearwaters (*Ardenna grisea*), Wilson's storm-petrels (*Oceanites oceanicus*), and northern gannets (*Morus bassanus*), migrate through the area for fall and summer migrations, and are found near the mouth of Chedabucto Bay. Alcids (including common murre (*Uria aalge*), thick-billed murre (*Uria lomvia*), razorbill (*Alca torda*), Atlantic puffin (*Fratercula arctica*), and dovekie), move south to overwinter on the continental shelf off Newfoundland and Nova Scotia, and can be seen in Chedabucto Bay over the winter.

Coastal waterfowl like sea ducks, loons, and grebe species regularly occur within the study area. Most of these species breed in freshwater habitats and spend the fall, winter and early spring in coastal waters, most commonly occurring in Nova Scotia during spring and fall migration. These common species include common eider (*Somateria mollissima*), black scoter (*Melanitta americana*), white-winged scoter (*Melanitta deglandi*), surf scoter (*Melanitta perspicillata*), red-breasted merganser (*Mergus serrator*), long-tailed duck (*Clangula hyemalis*), common goldeneye (*Bucephala clangula*), common loon (*Gavia immer*), horned grebe (*Podiceps auritus*), and red-necked grebe (*Podiceps grisegena*). Dabbling ducks like the American black duck (*Anas rubripes*) are also present in large numbers, but are restricted to shallow sheltered embayments and salt marshes. Coastal waterfowl found in the Study Area varies seasonally with migration, with the largest abundance occurring during spring migration, and lowest during summer months.

Large groups of non-breeding common loons are found along the Strait of Canso, during spring and fall migrations. Common loons were occasionally reported near the Bear Head site in 2004 field surveys (JWEL 2004). Common terns are also found along the coast of the Strait of Canso and Chedabucto Bay.

4.2.5.4 Bird Species of Risk and Species of Conservation Concern

The 2022 AC CDC data request for species recorded within a 100 km radius of the Project Area revealed five bird SAR recorded within 5 km of the BHE Project Site: barn swallow (*Hirundo rustica*), Canada warbler (*Cardellina canadensis*), common nighthawk (*Chordeiles min*or), olive-sided flycatcher (*Contopus cooperi*) and evening grosbeak (*Coccothaustes vespertinus*). Several additional bird SOCC were noted as shown in Table 4.14.

Table 4.14 Bird Species at Risk or of Conservation Concern that May Occur in the Project Area (AC CDC 2022)

Scientific Name	Common Name	COSEWIC	SARA	NS ESA	AC CDC S Rank
Hirundo rustica	Barn Swallow	Special Concern	Threatened	Endangered	S3B
Cardellina canadensis	Canada Warbler	Special Concern	Threatened	Endangered	S3B
Chordeiles minor	Common Nighthawk	Special Concern	Threatened	Threatened	S3B
Coccothraustes vespertinus	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M
Contopus cooperi	Olive-sided Flycatcher[1]	Special Concern	Threatened	Threatened	S3B
Sterna hirundo	Common Tern[1]	-	-	-	S3B
Rallus limicola	Virginia Rail	-	-	-	S2S3B
Bucephala clangula	Common Goldeneye	-	-	-	S2S3B,S5N,S5M
Perisoreus canadensis	Canada Jay	-	-	-	S3
Poecile hudsonicus	Boreal Chickadee[1]	-	-	-	S3
Spinus pinus	Pine Siskin	-	-	-	S3
Spatula discors	Blue-winged Teal	-	-	-	S3B
Charadrius vociferus	Killdeer	-	-	-	S3B
Tringa semipalmata	Willet	-	-	-	S3B
Pheucticus ludovicianus	Rose-breasted Grosbeak	-	-	-	S3B
Falco sparverius	American Kestrel	-	-	-	S3B,S4S5M
Gallinago delicata	Wilson's Snipe	-	-	-	S3B,S5M
Setophaga striata	Blackpoll Warbler[1]	-	-	-	S3B,S5M
Cardellina pusilla	Wilson's Warbler	-	-	-	S3B,S5M
Pinicola enucleator	Pine Grosbeak[1]	-	-	-	S3B,S5N,S5M
Botaurus lentiginosus	American Bittern	-	-	-	S3S4B,S4S5M

Table 4.14 Bird Species at Risk or of Conservation Concern that May Occur in the Project Area (AC CDC 2022)

Scientific Name	Common Name	COSEWIC	SARA	NS ESA	AC CDC S Rank
Setophaga castanea	Bay-breasted Warbler[1]	-	-	-	S3S4B,S4S5M
Actitis macularius	Spotted Sandpiper[1]	-	-	-	S3S4B,S5M
Leiothlypis peregrina	Tennessee Warbler	-	-	-	S3S4B,S5M
Calidris maritima	Purple Sandpiper	-	-	-	S3S4N

Notes:

[1] Observed during 2003 pre-construction surveys

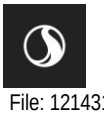
AC CDC S ranks: S1 = critically imperiled because of extreme rarity or steep declines; S2 = imperiled due to restricted range and few populations; S3 = vulnerable due to few populations, declines, or other factors; S4 = Apparently secure; S5 = secure, widespread, common.

Only one of the SAR species listed in Table 4.14 has been observed in the Project Area. Olive-sided flycatcher was observed during the 2003 pre-construction surveys. Olive-sided Flycatcher has a preference for coniferous forest edges, often located along water or wetlands and containing snags used as perching sites for foraging (NSDNR 2021). Three olive-sided flycatchers were observed at the site during field surveys in 2003 (JWEL 2004), and there are records of this species from 2.5 to 3 km from the site. Treed wetlands and the forested areas in the Project Area provide suitable nesting habitat for olive-sided flycatcher. Although no other bird SAR recorded within 5 km of the area (AC CDC data) have been observed in the Project Area, there may be suitable habitat available in or near the Project Area for some of these SAR species.

Barn swallows typically nest in artificial structures (e.g., barns and bridges), and foraging is concentrated with areas with flying insects near ground or water surfaces (Nova Scotia Department of Lands and Forestry 2021). No barn swallows were seen during the field studies undertaken in 2004 and it is unlikely they will nest at the site.

Canada warbler utilizes a variety of habitats but require a dense shrub layer, a moss understory and trees to perch in (NSDNR 2021). In Nova Scotia, most Canada warblers use forested wetlands as nesting habitat. As noted in previous EAs (JWEL 2004; SNC Lavalin 2015), there is suitable nesting habitat in the undeveloped parts of the Project Area and surrounding environs.

Common nighthawk habitat varies and can include open habitats like sandy areas (e.g., beaches), open forests (e.g., open mixedwood stands and clear-cuts), grasslands (e.g., sparse pastures and grassy plains), wetlands (e.g., bogs), rocky areas (gravel pits), and some landscaped areas (e.g., parks, cultivated fields) (Nova Scotia Department of Lands and Forestry 2021). Common nighthawk was not observed during any of the field studies in 2004 or site visit in 2022, although based on MBBA data and availability of preferred habitat, JWEL (2004) identified it as a probable breeding species in the area. Exposed gravel and sparsely vegetated areas in the Project Area could be used by common nighthawk as nesting habitat.



Evening grosbeak forages in treetops and branches and lives in mature mixed and softwood boreal forests. Treed wetlands and forest areas within the Project Area may provide suitable habitat for nesting and foraging, although this species was not observed during the 2004 surveys or any subsequent site visits.

Six SOCC have been observed in the Project Area during 2003 surveys: bay-breasted warbler, blackpoll warbler, boreal chickadee, common tern, pine grosbeak, and spotted sandpiper (JWEL 2004). As noted above, additional SAR and SOCC not previously observed, may breed in the Project Area based on habitat preferences and available habitat in or near the Project Area. As shown in Table 4.15, suitable breeding habitat may occur in the Project Area for 12 bird SOCC.

Table 4.15 Habitat Preferences for Bird SAR and SOCC and Likelihood of Being Present in the Project Area

Scientific Name	Common Name	Habitat	Likely to Breed in Project Area?	Likely to Breed in Habitat within 500 m of the Project Area?
Species at Risk				
Hirundo rustica	Barn Swallow	Medium-sized migratory songbird found in open country habitats. Loss of important nesting sites due to fewer barns and other artificial structures (e.g., bridges) may be implicated with declines. Barn swallows forage over open country habitats, including farmland, lakeshore and riparian habitats, roads, clearings in wooded areas, parkland, urban and rural residential areas, and wetlands.	Unlikely	Unlikely
Cardellina canadensis	Canada Warbler	Canada warblers are found in a variety of forest types, but are most common in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. It is also found in shrub swamps, red maple stands, eastern white cedar stands, conifer swamps dominated by black spruce and larch, and riparian woodlands along rivers and lakes.	Possible	Possible
Chordeiles minor	Common Nighthawk	Common nighthawks nest in a variety of open habitats with minimal ground vegetation including open forest (especially areas with cuts, burns or rock outcrops), short grass prairie, dry bogs, rock areas (such as quarries, gravel pits, and bedrock outcrops), sandy coastal habitats and settled areas that resemble open natural areas such as railways, gravel roads, airports, cultivated fields, orchards, parks, buildings with gravel roofs, oil-well pads, and pipelines. Common nighthawks are opportunistic generalist foragers and aggregate in areas where flying insects are abundant including waterways, lighted areas, and wetlands.	Possible	Possible
Coccothraustes vespertinus	Evening Grosbeak	Lives in mature mixed and softwood boreal forest. Preferred nesting habitat is open mature mixedwood forest where fir species and/or white spruce are dominant and spruce budworm is abundant.	Unlikely	Unlikely
Contopus cooperi	Olive-sided Flycatcher[1]	In NS, olive-sided flycatchers are found in forested areas where scattered trees remain after clear-cutting or fire, as well as mature stands of black spruce adjacent to bogs, fens, beaver ponds, or clearcuts. Nests are established in black spruce trees.	Possible	Possible

Table 4.15 Habitat Preferences for Bird SAR and SOCC and Likelihood of Being Present in the Project Area

Scientific Name	Common Name	Habitat	Likely to Breed in Project Area?	Likely to Breed in Habitat within 500 m of the Project Area?
Species of Conservation Concern				
Botaurus lentiginosus	American Bittern	Shallow freshwater marshes with tall emergent vegetation, including vegetation fringes and shorelines.	Unlikely	Unlikely
Falco sparverius	American Kestrel	Open and semi-open habitats, including meadows, agricultural fields, grasslands, urban/suburban areas. Suitable nest trees and perches required.	Unlikely	Possible
Setophaga castanea	Bay-breasted Warbler[1]	Breeds in boreal spruce and fir forest. Winters in lowland tropical forest and second growth.	Possible	Possible
Setophaga striata	Blackpoll Warbler[1]	Breeds in boreal coniferous forest (primarily spruce) and woodland, mixed coniferous-deciduous second growth, tall shrubs, and alder thickets; in migration and winter found in a variety of forest, woodland, scrub and brushy habitats.	Possible	Possible
Spatula discors	Blue-winged Teal	Fertile freshwater ponds, marshes.	Unlikely	Unlikely
Poecile hudsonicus	Boreal Chickadee[1]	Boreal forest, including both young and mature coniferous forests. Usually found in spruce forests, but sometimes in balsam fir.	Possible	Possible
Perisoreus canadensis	Canada Jay	Boreal and subalpine forests across northern North America, usually where black or white spruce trees are common. Other tree species often found in its habitat include aspen, white birch, balsam fir, sugar maple, jack pine, red spruce, and eastern white cedar.	Possible	Possible
Bucephala clangula	Common Goldeneye	Clear water lakes and ponds without submergent and emergent vegetation. Nearby, forested habitat with mature trees (deciduous or coniferous) to provide suitable nesting cavities.	Unlikely	Unlikely
Sterna hirundo	Common Tern[1]	Coastal and freshwater islands, coastal beaches and salt marshes.	Unlikely	Unlikely
Charadrius vociferus	Killdeer	Nest in open areas such as sandbars, mudflats, grazed fields lawns, driveways, athletic fields, parking lots, airports, and golf courses. Generally, the vegetation in fields inhabited by Killdeer is no taller than one inch. They can occur both near and far from water.	Possible	Possible
Pinicola enucleator	Pine Grosbeak[1]	Breeds in open coniferous forests. Wintering areas determined by food availability, so found in wider variety of habitats, including urban areas.	Possible	Possible

Table 4.15 Habitat Preferences for Bird SAR and SOCC and Likelihood of Being Present in the Project Area

Scientific Name	Common Name	Habitat	Likely to Breed in Project Area?	Likely to Breed in Habitat within 500 m of the Project Area?
Spinus pinus	Pine Siskin	Generally nest in open coniferous or mixed forests, but also inhabit parks, cemeteries, and suburban woodlands, where they breed in ornamental conifers or deciduous trees. While pine siskins favor feeding in open forest canopies where cone seeds are abundant, they will forage in habitats as diverse as deciduous forests and thickets, meadows, grasslands, weedy fields, roadsides, chaparral, and backyard gardens and lawns.	Possible	Possible
Calidris maritima	Purple Sandpiper	Purple sandpipers do not nest in Nova Scotia. They nest in low tundra near shorelines, as well as gravel beaches along rivers. Winters along exposed, rocky coastlines and man-made jetties.	Unlikely	Unlikely
Pheucticus ludovicianus	Rose-breasted Grosbeak	Rose-breasted Grosbeaks breed in moist deciduous forests, deciduous-coniferous forests, thickets, and semi open habitats. They are typically found in second-growth woods, suburban areas, parks, gardens, and orchards, as well as shrubby forest edges next to streams, ponds, marshes, roads, or pastures.	Possible	Possible
Actitis macularius	Spotted Sandpiper[1]	Spotted Sandpipers are typically found along the shores of rivers, streams and lakes, as well as near the sea coast. Breeding territories generally need to have a shoreline, a semi open area where the nest will be, and patches of dense vegetation for sheltering the chicks. Spotted Sandpipers spend the winter along the coasts of North America or on beaches, mangroves, rainforest, and cloud forest in Central and South America.	Possible	Possible
Leiothlypis peregrina	Tennessee Warbler	Breeds in boreal forest, in open areas containing grasses, dense shrubs, and young deciduous trees. Winters in open second growth forests and agricultural habitats, such as shade coffee plantations.	Possible	Possible
Rallus limicola	Virginia Rail	Freshwater marshes; occasionally inhabits salt marshes. Lives in dense emergent vegetation.	Unlikely	Unlikely
Gallinago delicata	Wilson's Snipe	Wilson's Snipes can be found in a variety of wetlands including bogs, fens, alder and willow swamps, wet meadows, and along rivers and ponds. They avoid areas with tall, dense vegetation, but need patches of cover.	Possible	Possible
Cardellina pusilla	Wilson's Warbler	Riparian shrub thickets, edges of lakes or bogs, overgrown clear cuts. Often breeds in clearings in bogs or moist early successional forests or stunted conifers.	Possible	Possible

Note: [1] Observed during 2003 pre-construction surveys.

Additional bird surveys will be conducted in 2023 prior to further site development including breeding bird surveys for forest passerine species and nightjar surveys.

4.2.6 Mammals

The Project Area contains various habitats suitable for mammals including mixed-wood and softwood stands, forested and shrub swamps, drainage ditches, rock piles, talus slopes, and beaver flooded areas. Table 4.16 summarizes mammal species that have been recorded during field surveys within or near the Project Area including recent surveys conducted in July 2022 (Pulsifer 2022a) and January 2023 (winter track survey) (Pulsifer 2023).

Table 4.16 Mammal Species Recorded Within or Near the Project Area

Scientific Name	Name	Source
Lepus americanus	Snowshoe hare	JWEL 2004; Pulsifer 2022a; Pulsifer 2023
Tamias striatus	Eastern chipmunk	JWEL 2004
Tamiasciuris hudsonicus	American red squirrel	JWEL 2004; Pulsifer 2023
Castor canadenis	Beaver	JWEL 2004; Pulsifer 2022a
Peromyscus maniculatus	Deer mouse	JWEL 2004
Myodes gapperi	Southern Gapper's red-backed vole	JWEL 2004
Napaeozapus insignis	Woodland jumping mouse	JWEL 2004
Zapus hudsonicus	Meadow jumping mouse	JWEL 2004
Ondatra zibethica	Muskrat	JWEL 2004
Mircotus pennsylvanicus	Meadow vole	JWEL 2004
Erithizon dorsatum	Porcupine	JWEL 2004
Vulpes vulpes	Red fox	JWEL 2004
Canis latrans x Canis Lycaon	Eastern coyote	JWEL 2004; Pulsifer 2022a
Ursus americanus	Black bear	JWEL 2004; Pulsifer 2022a
Procyon lotor	Racoon	JWEL 2004
Neovison vison	Mink	Pulsifer 2022a
Mustela erminae[1]	Short-tailed weasel	Pulsifer 2023
Pekania pennanti	Fisher	Pulsifer 2022a
Lynx rufus	Bobcat	Pulsifer 2022a
Odocoileus virginianus	White-tail deer	JWEL 2004; Pulsifer 2022a; Pulsifer 2023
Alces alces	Moose	JWEL 2004; Pulsifer 2022a
Myotis lucifugus	Little brown myotis	Stantec 2022

Note:
[1]*Species first identified in the Project Area during the 2023 Winter Track Survey.*

To determine the presence of bats within or near the Project Area, bat acoustic surveys were conducted in the fall of 2022. Four Wildlife Acoustics Song Meter Mini Bat Detectors (autonomous recording units [ARUs]) were deployed within the Project Area on August 24 (Figure 4.5). The detectors were programmed to record daily from sunset to sunrise, and were retrieved on September 20, for a total of 27 recording nights. The acoustic data was analyzed using Kaleidoscope Pro software. Upon detector retrieval, it was discovered that one of the SD cards had malfunctioned, and no data was recorded. Data was analyzed for the remaining three detectors.

Results of the bat surveys are summarized in Table 4.17. One species of bat, little brown myotis (*Myotis lucifugus*), was identified at all three detectors. Little brown myotis is listed as Endangered under SARA and the NS ESA. Not all bat calls could be identified to species due to the quality of the recording. Where species could not be identified, and where the minimum frequency was >35kHz, the call was identified as high-frequency unknown. These calls may represent a Myotis species (Little brown myotis or northern long-eared myotis (*Myotis septentrionalis*), tri-colored bat (*Perimyotis subflavus*) or eastern red bat (*Lasiurus borealis),* although the latter is less common in Nova Scotia.

Table 4.17 Bat Acoustic Survey Results

Detector ID	Start Date	End Date	Valid Recording Nights	Number of Recordings per Species		
				Little Brown Myotis	High-frequency Unknown	Total
8087	24-Aug-22	20-Sep-22	27	5	2	7
8131	24-Aug-22	20-Sep-22	27	6	5	11
8215	24-Aug-22	20-Sep-22	27	10	4	14
8501	24-Aug-22	20-Sep-22	0	No Data		

With the exception of the myotis species, none of the mammals recorded in or near the Project Area are considered SAR or SOCC.

Mainland moose (*Alces alces americana*) is listed as Endangered under the NS ESA. Moose in Cape Breton belong to the *andersonii* subspecies which was introduced to Cape Breton after the native *americana* subspecies had been extirpated from Cape Breton. This introduced subspecies is not considered a SAR.

An incidental observation of a beaver on site was also noted in 2022, with evidence of a beaver flooded area, beaver cuttings, and recent beaver tracks (Pulsifer 2022a). A beaver was also observed in previous 2004 surveys of the site. The beaver is not a protected species under the NS ESA or SARA.

4.2.7 Herpetofauna (Reptiles and Amphibians)

The forest, wetland and surface water environments surrounding the site are expected to support many of the common reptile and amphibian species found in Nova Scotia. Sixteen species of amphibian and reptile have been recorded during 2004 field surveys in the general vicinity of the Project Area (southwestern Cape Breton) and ten of these have been recorded in the Project Area (Table 4.18).

Table 4.18 Reptiles and Amphibians Observed Within or Near the Project Area

Species	Common Name	Found in Bear Head Project Area	Cape Breton1
Clemmys insculpta	**Wood Turtle[2]**		✓
Plethondon cinereus	Red-backed Salamander	✓	✓
Hemidactylum scutatum	Four-toed Salamander		✓
Ambystoma maculatum	Yellow-spotted Salamander	✓	✓
Ambystoma laterale	Blue-spotted Salamander		✓
Notophthalmus viridescens	Red-spotted Newt		✓
Bufo americanus	American Toad		✓
Pseudacris crucifer crucifer	Northern Spring Peeper	✓	✓
Rana clamitans melanota	Green Frog	✓	✓
Rana sylvatica	Wood Frog	✓	✓
Rana pipiens	Northern Leopard Frog	✓	✓
Rana palustris	Pickerel Frog	✓	✓
Rana septentrionalis	Mink frog		✓
Storeria occipitomaculata occipitomaculata	Northern Redbelly Snake	✓	✓
Thamnophis sirtalis pallidula	Maritime Garter Snake	✓	✓
Liochlorophis vernalis borealis	Eastern Smooth Green Snake	✓	✓

Notes:
SAR/SOCC species are bolded.
[1]Observed by JWEL biologists on other nearby sites (2004) and/or recorded in AC CDC data search (2022).
[2] Wood turtle was not previously detected in the study area during field surveys in 2004, but was reported by AC CDC (2004; 2015; 2022) to be within 5 km of the study area.
Source: JWEL 2004; Pulsifer 2022a

Of the species listed in Table 4.18, only the wood turtle is considered to be a SAR/SOCC. The wood turtle is protected as a Threatened by the NS ESA and SARA. Although no wood turtle has been observed within the Project Area, AC CDC has recorded observations of this species within 5 km of the Project Area. A herpetofaunal survey will be conducted in the Project Area in spring or summer of 2023 with a focus on SAR/SOCC (i.e., wood turtle).

4.2.8 Summary of Species at Risk

As noted above, SAR are defined as those species that meet any of the following criteria:

- Species that are listed under Schedule 1 of the federal SARA as endangered, threatened, vulnerable, or of special concern
- Species that are listed under the NS ESA as endangered, threatened, vulnerable, or of special concern
- Species that are not yet listed under provincial or federal legislations but have been identified by COSEWIC as being endangered, threatened, or of special concern

SOCC are defined as those species that are not SAR but are ranked as S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in Nova Scotia by the AC CDC. A numeric range rank (e.g., S2S3) is used by the AC CDC to indicate any range of uncertainty about the status of the species or community in the province (ACCDC 2022a).

Table 4.19 lists flora and fauna SAR and SOCC that could potentially occur in the Project Area based on AC CDC data (2022) and/or field observations.

Table 4.19 Summary of Flora and Fauna SAR and SOCC that Could Potentially Occur in the Project Area

Scientific Name	Common Name	COSEWIC	SARA	Provincial	S Rank
FLORA					
Pectenia plumbea	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3
Polychidium muscicola	Eyed Mossthorns Woollybear Lichen	-	-	-	S1
Neottis bifolia	Southern Twayblade[1]	-	-	-	S3
FAUNA					
Glyptemys insculpta	Wood turtle[2]	Threatened	Threatened	Threatened	S2
Myotis lucifugus	Little brown myotis[1]	Endangered	Endangered	Endangered	S1
Hirundo rustica	Barn Swallow	Special Concern	Threatened	Endangered	S3B
Cardellina canadensis	Canada Warbler	Special Concern	Threatened	Endangered	S3B
Chordeiles minor	Common Nighthawk	Special Concern	Threatened	Threatened	S3B
Coccothraustes vespertinus	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M
Contopus cooperi	Olive-sided Flycatcher[1]	Special Concern	Threatened	Threatened	S3B
Sterna hirundo	Common Tern[1]	-	-	-	S3B

Table 4.19 Summary of Flora and Fauna SAR and SOCC that Could Potentially Occur in the Project Area

Scientific Name	Common Name	COSEWIC	SARA	Provincial	S Rank
Rallus limicola	Virginia Rail	-	-	-	S2S3B
Bucephala clangula	Common Goldeneye	-	-	-	S2S3B,S5N,S5M
Perisoreus canadensis	Canada Jay	-	-	-	S3
Poecile hudsonicus	Boreal Chickadee[1]	-	-	-	S3
Spinus pinus	Pine Siskin	-	-	-	S3
Spatula discors	Blue-winged Teal	-	-	-	S3B
Charadrius vociferus	Killdeer	-	-	-	S3B
Tringa semipalmata	Willet	-	-	-	S3B
Pheucticus ludovicianus	Rose-breasted Grosbeak	-	-	-	S3B
Falco sparverius	American Kestrel	-	-	-	S3B,S4S5M
Gallinago delicata	Wilson's Snipe	-	-	-	S3B,S5M
Setophaga striata	Blackpoll Warbler[1]	-	-	-	S3B,S5M
Cardellina pusilla	Wilson's Warbler	-	-	-	S3B,S5M
Pinicola enucleator	Pine Grosbeak[1]	-	-	-	S3B,S5N,S5M
Botaurus lentiginosus	American Bittern	-	-	-	S3S4B,S4S5M
Setophaga castanea	Bay-breasted Warbler[1]	-	-	-	S3S4B,S4S5M
Actitis macularius	Spotted Sandpiper[1]	-	-	-	S3S4B,S5M
Leiothlypis peregrina	Tennessee Warbler	-	-	-	S3S4B,S5M
Calidris maritima	Purple Sandpiper	-	-	-	S3S4N

Notes:

[1]Species occurrence recorded in the Project Area.

[2]Species reported within 5km of Project Area by AC CDC but no potential habitat has been observed.

AC CDC S ranks: S1 = critically imperiled because of extreme rarity or steep declines; S2 = imperiled due to restricted range and few populations; S3 = vulnerable due to few populations, declines, or other factors; S4 = Apparently secure; S5 = secure, widespread, common.

Source: JWEL 2004; AC CDC 2022; Pulsifer 2022a

4.3 MARINE BIOLOGICAL ENVIRONMENT

The description of the marine environment relies primarily on the *Bear Head LNG Updated Registration Document* (SNC Lavalin 2015), which incorporated information from the *Environmental Assessment for the Proposed Bear Head LNG Terminal* (JW 2004). Benthic habitat surveys undertaken in the Strait of Canso (Stantec 2016) and the Project Area (CBCL 2016a) have also been referenced where appropriate. No new studies were undertaken to characterize the marine environment for this EA Registration. However, results of an eelgrass survey, undertaken in October 2022 to fulfill conditions of the *Fisheries Act* authorization for the marine terminal have been incorporated in Section 4.3.3.

4.3.1 Ecosystem Overview

The marine environment study area includes the Strait of Canso and adjoining Chedabucto Bay, with a focus on the BHE-owned water lot within the Project Area. The Strait of Canso and the adjoining areas of Chedabucto Bay and the Scotian Shelf support a productive, coastal marine ecosystem. Energy to drive the system comes from the sun, both to support growth of plants, and in part to cause movement and mixing through wind-generated currents and waves, as well as providing seasonal water column stratification (see Section 4.1.7), which is an important physical element that supports the biological functioning of the system. Currents provide a means for long-distance transfer of organisms and reproductive stages. Tides are important locally, providing current regimes and mixing to which biological communities are adapted. The marine ecosystem in the area is complex and extensive.

The ecosystem in the area has been described in a number of summary publications (e.g., McCracken 1979; Stewart and White 2001; Gromack et al 2010; Zwanenburg et al 2006). Key components of the coastal ecosystem include: bacteria (planktonic, benthic); plants (intertidal and subtidal seaweeds and seagrasses and phytoplankton); invertebrate animals (zooplankton in the water column); large commercially important invertebrates such as lobster and sea scallops; other invertebrates (including herbivores, carnivores, detritus and sediment consumers); and vertebrates including marine mammals (whales, dolphins, porpoises and seals) and sea turtles; seabirds and other water-associated birds; and fish, ranging from small species that are typically not a part of a fishery to those that are important as food for other groups of marine animals (sand lance and capelin) and species that support commercial fisheries.

The nearest Ecologically and Biologically Significant Area (EBSA) is the Canso Ledges, which includes inshore waters around the Canso peninsula and captures much of Chedabucto Bay (Figure 4.15). The Canso Ledges EBSA has several notable ecological attributes including having a high abundance and diversity of fishes including at-risk Atlantic wolffish, thorny skate and winter skate (Hastings et al. 2014). This area also has historically been an important spawning area for Atlantic cod (*Gadus morhua*), and a spawning and overwintering area for Atlantic herring (*Clipea harengus*) (Hastings et al. 2014). Chedabucto Bay is also one of a couple of inshore areas known to support snow crab (*Chionoecetes opilo*) and Northern shrimp (*Pandalus borealis*) and has high concentrations of rockweed (*Fucus* sp). The area also supports significant aggregations of several waterfowl and seabirds (Allard et al. 2014) and is one of a few areas where fin whale (*Balaenoptera physalus*) is known to concentrate inshore (Hastings et al. 2014).

Figure No
4.15.

Title
Ecologically and Biologically Significant Areas (EBSAs)

Client/Project 121431287-025

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NWhite on 2022-11-21
Port Richmond
Richmond County, NS

N

0 2 4 6 Kilometres
(At original document size of 8.5x11)
1:325,000

Legend

Project Area

EBSA (Hastings et al. 2014)

Project Location

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Fisheries and Oceans Canada
3. Background: ESRI Topographic 2022, Service NS (Government of Nova Scotia

Stantec

C:\Users\niwhite\OneDrive - Stantec\Working\1214 NS\121431287 - Port Richmond Bear Head\gis\mapping\mxd\General\ArcGIS Pro\Port Richmond BearHeadEnergy\BearHeadEnergy EA 121431287.aprx Revised:

4.3.2 Marine Water and Sediment Quality

Organisms living in seawater can potentially be impacted by contaminants, in circumstances such as industrial releases. Although there are a number of industrial sources of effluent in the industrialized part of the Strait of Canso, levels of contaminants are expected to be not significant or below levels to harm marine organisms present in the Project Area. The impacts generated by industrial releases into the Strait of Canso have been assessed in numerous studies from the 1970s to the 1990s; these were summarized to 1995 in Stewart and White (2001). By 1995 there were no outstanding contaminant issues; most had been associated with industries including the paper mill (e.g., mercury). In addition to industrial contaminants, levels of nutrients in coastal waters are a global concern. Elevated nutrient concentrations from sewage releases associated with urbanization and industrialization can lead to eutrophication, and the Strait of Canso has experienced some influence from the urban development that has taken place in the Port Hawkesbury, Mulgrave and Point Tupper areas. Shipping and other marine-related activities cause detectable and slightly elevated levels of hydrocarbons in coastal waters.

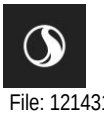
Organisms living on or in the seabed are in close contact with sediments and can be affected by constituents both naturally occurring and those which may be present as the result of industrial activity. Sediments often form a sink for contaminants released into the water column, which become associated with particles and form sediments that settle to the seabed; these contaminants can be released when sediments are disturbed.

Contaminant levels in sediments in the vicinity of the Project Area were measured in 2004 and with the exception of one sample that had a total PCB level of 71.6 µg/kg, exceeding the Interim Sediment Quality Guidelines (ISQG) (CCME 1999) for the Protection of Aquatic Life (34.1 µg/kg), measured levels were within acceptable limits (JWEL 2004). The average PCB level over all stations sampled in the vicinity of the proposed marine terminal was below the CCME ISQG.

The Project Area marine site is not alone in having low level PCB contamination in the sediments. Similar levels have been observed in other nearshore areas in the Strait of Canso, particularly in proximity to the industrialized section between Point Tupper and Peebles Point (Stewart and White 2001; OceanChem 1987; Tay et al 2010) and at the proposed Melford International Terminal site across the Strait from Bear Head (AMEC 2008).

Contaminants from industry, marine activities and sewage from the urban areas surrounding the Strait of Canso are in the sediments, but last measurements in 2015 were at relatively low levels. The JWEL (2004) survey of the mid-Strait of Canso between Peebles Point and Point Tupper, and of deeper water sediments at the ocean disposal site and reference areas, indicated that levels of all heavy metals in surface sediments were lower than CCME probable effects levels; cadmium levels were slightly elevated above guideline levels for ocean disposal in some surface sediments; and PCB levels were not above guideline in the silt clay sediments, but continue to be elevated in other areas (Tay et al. 2010).

As part of the assessment for the proposed Bear Paw Pipeline (Stantec 2016), a sediment sampling program was conducted in the Strait of Canso by Stantec in September 2015. The sampling locations were proximal to, but outside the Project Area. Six sediment stations were originally planned, however only five samples were collected successfully. The sediment collected in the assessment corridor for the



Strait of Canso was primarily silty sand in the deeper areas and for majority of the cross section of the Strait, with coarser sand and gravel sediments found closer inshore. The sediment chemistry results were compared to CEPA Disposal at Sea Lower Level Screening Criteria and the CCME Sediment Probable Effect Levels for the Protection of Marine Aquatic Life, 2012. The analytical results of the five surficial samples collected from the assessment corridor indicate exceedances above guidelines for polychlorinated biphenyls (PCBs) and cadmium for sample CSS5 and above PCB guidelines for sample CSS4. Both of these samples were located closer to the Cape Breton side of the Strait of Canso (Stantec 2016).

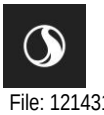
Plankton includes a diverse group of organisms that are linked by their reliance on water column properties and availability of sunlight and nutrients. They live in the water column and are transported by water movements and other physical processes such as stratification, mixing and nutrient exchange. Plankton includes bacterioplankton, phytoplankton, zooplankton and ichthyoplankton (fish larvae and eggs). Their concentration and diversity vary markedly over both temporal and spatial scales as a consequence of a variety of physical, chemical and biological factors. Bacterioplankton are an important group that are rarely studied in coastal waters; they are one of the most important groups overall, forming, together with phytoplankton, the base of the marine ecosystem food chain and accounting for a large proportion of planktonic biomass in the ocean as a whole.

The majority of fish in Nova Scotia coastal waters including Chedabucto Bay and the Strait of Canso reproduce through the release of eggs and larvae, which spend some time in the water column during early development. Comparatively little information exists on the temporal and spatial distribution of fish eggs and larvae in the inshore waters (Chedabucto Bay). On the Scotian Shelf, the greatest abundance occurs from March to June and is lowest during the winter months, December to February (Shackell and Frank 2000; Breeze et al. 2002). Individual species also appear to have multiple or at least protracted spawning periods (possibly indicating variable contributions from different fish stocks).

4.3.3 Marine Benthic Habitat and Communities

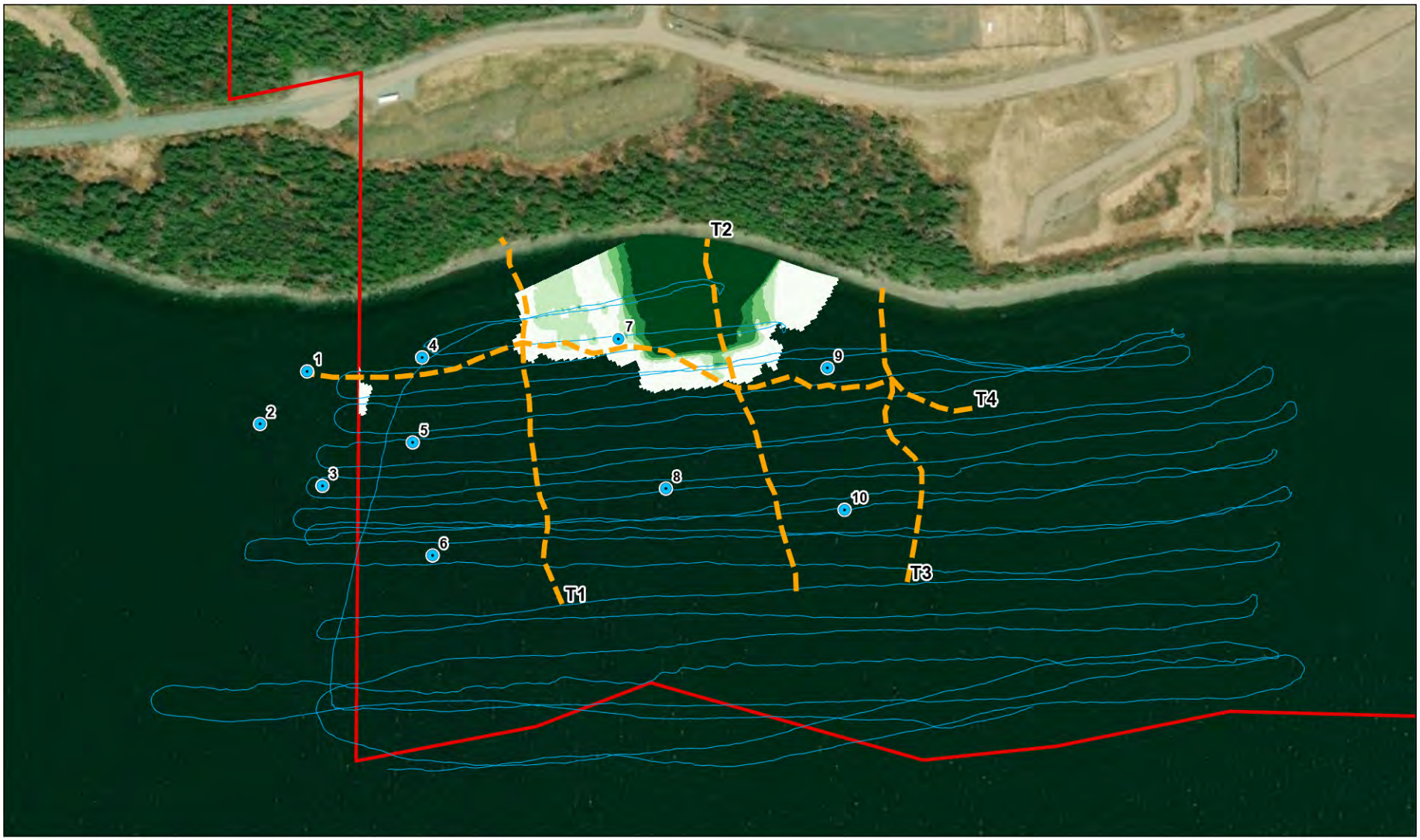
The waters of the Strait of Canso and Chedabucto Bay support seaweed and seabed animal communities typical of moderately exposed coastal inlets on the Nova Scotia coast.

The distribution of sediments in the outer Strait of Canso and in Chedabucto Bay reflects erosion of the coast and the redistribution of fine sediments by wave activity and currents from intertidal and shallow areas to deeper areas.



A benthic habitat survey was undertaken in 2016 to inform the assessment of the proposed Bear Paw Pipeline which was proposed to cross the Strait of Canso to the west of the Project Area (Stantec 2016). Two transects were surveyed using a ROV within an assessment corridor (Figure 4.16). The first transect had a depth range of 7.5 m to 42.9 m in the Strait of Canso, and the sediment composition observed ranged from predominantly silt and sand to rubble and gravel. Macrofauna encountered included brittle stars, occasional sea star (*Asterias sp.*), rock crab (*Cancer irroratus*), unidentified fish and shrimp species, barnacles, and sea anemones. Macroflora observed included: *Saccharina* sp., *Fucus* sp., wireweed, unidentified brown and red algae, and encrusting organisms (possibly crustose algae and bryophytes) on rubble and cobble. Empty shells and fragments were also observed along the transect survey (Stantec 2016).

The second transect had a depth range of less than 1 m to 44.3 m. The substrate consisted of silt, cobble, rubble, boulders, gravel and shell hash. Macrofauna observed along the transect included: brittle stars, occasional sea star, rock crab, unidentified fish, and a vase sponge. Macroflora observed, included *Saccharina* sp., *Fucus* sp., wireweed, unidentified brown and red algae, and smooth cord weed (Stantec 2016).



Project Area

Benthic Habitat Survey (CBCL 2016) [3]

Spot Check ROV

Benthic Survey Transects

Eelgrass Survey (Stantec 2022)

Survey Tracks

Eelgrass Percent Cover

1 - 20

20 - 40

40 - 60

60 - 80

80 - 100

N

0 50 100 Metres

(At original document size of 8.5x11)
1:3,800

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec, CBCL, Bear Head Energy Inc.
3. CBCL. (2016). Bear Head LNG Benthic Habitat Survey. 52pp.
4. Background: ESRI Aerial / Topographic 2022

Stantec

Project Location
Richmond County, NS

Prepared by NW on 2022-12-19

Client/Project
121431287_040

Bear Head Energy
Regulatory Permitting Support

Figure No.
4.16

Title
Marine Habitat Surveys

\\Corp.ads\data\Virtual_Workspace\workgroup\12114\Active\121431287_NS\03_data\gis_cad\gis\mapping\mxd\general\ArcGIS Pro\Port Richmond BeatHeadEnergy\BearHeadEnergy EA 121431287.aprx Revised: 2023-01-06

An analysis of the relative abundance of taxonomic groups among stations showed that the infaunal benthic communities in the Strait of Canso assessment corridor were generally dominated by annelids (primarily polychaetes). Nearshore stations contained the most evenly distributed communities among stations assessed, with no one taxon representing more than 65% of the organisms found, suggesting that these communities were more stable, complex and less impacted by environmental stressors (Stantec 2016). An analysis of the benthic communities by functional feeding group showed that the benthic communities within the assessment corridor that were sampled were dominated by deposit feeders and predators. Nearshore area communities had more evenly distributed relative abundances of species within each feeding group in comparison to the deeper-water stations (Stantec 2016).

Within the Project Area itself, an underwater benthic habitat survey was conducted in 2015 by CBCL Limited in the western portion of the water lot as part of a Request for Review under the *Fisheries Act* related to a change in the design for the MOF. The study consisted of four transects filmed by scuba divers with 10 drop camera video spot checks. Four generalized habitat types were observed within the study area of the 2015 benthic survey of the water lot: rocky intertidal habitat; mixed substrate habitat; eelgrass habitat; and fines dominant habitat (CBCL 2016a; Appendix J).

Macrofloral species identified during the interpretation of the video transect surveys consisted of *Fucus* sp., *Ascophyllum nodosum*, *Chorda filum*, *Laminaria* sp., *Desmarestia* sp., *Agarum cribrosum*, *Chondrus crispus*, *Polysiphonia* sp., *Corallina officinalis*, *Lithothamnium* sp. and *Zostera marina* (CBCL 2016a). Macrofauna positively identified during the interpretation of the transects include American lobster (*Homarus americanus*), rock crab (*Cancer irroratus*), green crab (*Carcinus maenas*), hermit crab (*Pagurus* sp.), rock barnacle (*Balanus* sp.), periwinkle (*Littorina* sp.), sea scallop (*Placopecten magellanicus*), sea star (*Asterias* sp.), plumose anemone (*Metridium senile*), northern cerianthid (*Cerianthus borealis*), sand shrimp (*Crangon* sp.), lungworm (*Arenicola* sp.), sand lance (*Ammodytes americanus*), sculpin (*Myoxocephalus* sp.), cunner (*Tautogolabrus adspersus*) and winter flounder (*Pseudopleuronectes americanus*) (CBCL 2016a).

In 2022, BHE contracted Stantec to complete a survey to further delineate the eelgrass habitat previously identified in the 2016 benthic survey by CBCL. A hydroacoustic survey was conducted in September 2022 to assess the current eelgrass distribution, percent cover and canopy height within the target survey areas in the water lot. Hydroacoustic data were collected using a vessel-mounted, single-beam sonar echosounder where vessel-based transects were spaced approximately 10 m apart (Stantec 2022). Hydroacoustic data collected during the 2022 acoustic survey were used to create a bathymetric layer and vegetation distribution map within the survey area. Water depths in the survey area ranged from 1.5 m chart datum (CD) to 34.0 m CD. A total area of 7.997 m^2 of eelgrass habitat was detected in the survey area (water lot) (Figure 4.16) (Stantec 2022). For additional information on the eelgrass survey and results, refer to Appendix J.

4.3.4 Marine Fish and Fish Habitat

The Project Area is connected to the Atlantic Ocean and the Scotian Shelf through Chedabucto Bay and the Strait of Canso. The study area has many marine habitat types and as a result is suitable for a large number and high diversity of fish species. Many of the fish and invertebrate species that occur in the Strait of Canso and/or Chedabucto Bay are shared with other surrounding areas due to the exchange of water, transportation in egg and larval stages, movements, feeding and breeding requirements, and seasonal and migratory movements. Coastal waters are occupied seasonally by anadromous and catadromous fish. Anadromous fish spend part of their lives in the sea before going to rivers to breed and spawn. Anadromous species in the study area include Atlantic salmon, rainbow trout (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*). Catadromous species (e.g., American eel) migrate down rivers to the sea to spawn.

Demersal and benthic fish spend their time at or near the seabed. Demersal and benthic fish likely to occur in or near the marine Project Area include Atlantic cod (*Gadus morhua*) tomcod (*Microgadus tomcod*), haddock (*Melanogrammus aeglefinus*), pollock (*Pollachius pollachius*), yellowtail flounder (*Limanda ferruginea*), halibut (*Hippoglossus hippoglossus)*, redfish (*Sebastes spp.*), little skate (*Leucoraja erinacea*), winter skate (*Leucoraja ocellata*), and smooth skate (*Dipturus innominatus*).

Pelagic fish live in the water column and make up a large proportion of species occurring in Nova Scotia coastal waters. Some of these species commonly occur in the other, while others are found more occasionally. Fish most frequent along the Strait of Canso are herring, mackerel (*Scomber* scombrus), cunner, and silversides. Atlantic salmon, American eel and trout occur in both coastal and freshwater environments. Other species such as bluefin tuna (*Thunnus thynnus*), swordfish, various shark species, are typically seen offshore but occasionally within the near shore waters.

Invertebrates found in the study area include important mollusc and crustacean species like American lobster that occupy the coastal area throughout their life cycle (Breeze et al. 2002). Several species of crab exist around the coast, particularly rock crab and invasive green crab which are both abundant. Chedabucto Bay is one of just a couple of inshore areas where the bottom reaches temperatures cold enough to support snow crab (*Chionoecetes opilio*) and one of just few known coastal areas in Nova Scotia where northern shrimp (*Pandalus borealis*) occurs (Hastings et al. 2014). Larval stages of sea scallops are distributed throughout the area by water movements, and blue and horse mussels will commonly form beds on suitable rock bottoms in the shallow waters. Additional information on fishery species in the Strait of Canso and Chedabucto Bay can be found in Section 4.4.4.

4.3.5 Marine Mammals and Sea Turtles

Coastal and offshore regions in Nova Scotia attract a variety of marine mammals, including more than 20 species of cetaceans (dolphins, porpoises and whales) and six species of pinnipeds (seals). Although less common, there are also four species of sea turtle that have been recorded in Nova Scotia waters.

4.3.5.1 Cetaceans

Cetacean whales have two subgroups: mysticeti (i.e., baleen whales) and odontoceti (i.e., toothed whales). Most cetaceans are more likely to frequent deeper, offshore waters but could enter the study area in pursuit of prey (e.g., mackerel). Cetaceans known to occur within the marine study area (e.g., Strait of Canso, Chedabucto Bay) include harbour porpoise (*Phocoena phocoena*), fin whales (*Balaenoptera physalus*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), minke whale (*Balaenoptera acutorostrata*), and long-finned pilot whale (*Globicephala melas*). With the exception of long-finned pilot whale, the rest of these species are baleen whales, meaning they have plates of baleen along their jaws instead of teeth and used to strain food organisms from the seawater they consume.

Fin whale is listed as a species of Special Concern under SARA and can gather in Chedabucto Bay in the late winter or early spring to feed on herring (Gromack et al. 2010). Minke whales are frequently observed in coastal waters around Nova Scotia and are likely present in the marine study area during the spring, summer and fall, especially when high concentrations of prey are in the area (JWEL 2004). Harbour porpoise is likely the most common cetacean in the Strait of Canso and its approaches given its preference for shallow waters, and can be expected to be present during the late spring, summer and early fall months. The Atlantic white-sided dolphin would be an uncommon transient given its preference for deeper waters, but has been observed in the Strait of Canso or its approaches. The long-finned pilot whale feeds on cephalopods and fish and may be found in the marine study area occasionally in the summer months (CNSOPB 2016).

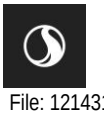
Additional species which may be found in coastal waters of Nova Scotia and therefore could be present in the marine study area include humpback whale (*Megaptera novaengliea*), blue whale (*Balenoptera musculus*), killer whale (*Orcinus orca*), common bottlenose dolphin (*Tursiops truncates*), common dolphin (*Delphinus delphis*), and white-beaked dolphin (*Lagenorhynchus albirostris*) (Hastings et al. 2014; CNSOPB 2016). Although the endangered North Atlantic right whale (*Eubalaena glacialis*) frequents coastal waters of Nova Scotia, the species is primarily found in southwestern Nova Scotia waters and in recent years in the Gulf of St. Lawrence as well, though unlikely to occur in shallower waters of the marine study area in the Strait of Canso.

4.3.5.2 Pinnipeds

Seals are common in offshore waters in the Atlantic Canada, with the most common species found in Nova Scotia being the grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*). Other seal species including the harp seal (*Pagophilus groenlandicus*), the hooded seal (*Cystophora cristata*), ringed seal (*Pusa hispida*), and bearded seal (*Erignathus barbatus*) may be occasionally found along the coast, but are not common (SNC Lavalin 2015).

4.3.5.3 Sea Turtles

There are four sea turtle species that occur offshore in the northwestern Atlantic and may be observed in the study area: the leatherback (*Dermochelys coriacea*), Atlantic ridley (*Lepidochelys spp.*), loggerhead (*Caretta caretta*), and green sea turtle (*Chelonia mydas*). Most common is the leatherback sea turtle, found offshore of the continental shelf in the summer; this species has been documented in Chedabucto



Bay (James et al 2006). Critical habitat for the Endangered leatherback sea turtle has not yet been designated under SARA although important habitat has been identified in the waters off eastern Cape Breton (DFO 2020a). Green sea turtles typically occur in tropical waters, but a juvenile turtle was observed in Chedabucto Bay in 1999 (James et al 2006).

4.3.5.4 Summary of Marine Mammal and Sea Turtles Species at Risk

Table 4.20 summarizes marine mammal and sea turtle SAR and SOCC which could potentially occur in the Strait of Canso or Chedabucto Bay.

Table 4.20 Summary of Marine Mammal and Sea Turtle SAR and SOCC Potentially Occurring in the Strait of Canso and/or Chedabucto Bay

Common Name (Population) ***Scientific Name***	**SARA Schedule 1 Status**	**COSEWIC Designation**
Mysticetes (Toothless or Baleen Whales)		
Blue Whale (Atlantic pop.) *Balaenoptera musculus*	Endangered	Endangered
Fin Whale (Atlantic pop.) *Balaenoptera phyalus*	Special Concern	Special Concern
Odontecetes (Toothed Whales)		
Harbour Porpoise (Northwest Atlantic pop.) *Phocoena phocoena*	Not Listed	Special Concern
Killer whale (Northwest Atlantic/Eastern Arctic pop.) *Orcinus orca*	Not Listed	Special Concern
Sea Turtles		
Leatherback Sea Turtle *Dermochelys coriacea*	Endangered	Endangered
Loggerhead Turtle *Caretta caretta*	Endangered	Endangered

4.4 SOCIO-ECONOMIC ENVIRONMENT

The description of the socio-economic environment generally follows that provided in the *Bear Head LNG Updated Registration Document* (SNC Lavalin 2015) with updates incorporated where relevant. A windshield survey was conducted on December 1, 2022 to verify land use and industrial activity in the region. The study area for the description of the socio-economic environment includes the Municipality of the County of Richmond, with a focus on Point Tupper and Port Hawkesbury. With respect to marine navigation and fisheries, the study area is primarily focused on the Strait of Canso and Chedabucto Bay.

4.4.1 Land Use, Community Services and Infrastructure

4.4.1.1 Land Use

The Project is located in the Point Tupper Industrial Park in the Municipality of the County of Richmond to the south of Port Hawkesbury on the Strait of Canso. The settlements in the area are Port Hawkesbury (population approximately 3,210 (Statistics Canada 2022a)) and Point Tupper in Richmond County. Guysborough County and the Town of Mulgrave (population 7,373 and 627, respectively) are situated across the Strait of Canso (Statistics Canada 2022b, c). Point Tupper is a very small residential community but has a large industrial presence. Port Hawkesbury is the nearest urban service center.

Historically, Point Tupper, just to the south of Port Hawkesbury, was a prominent coastal village with homes, a hotel, two churches, a railroad station and a few stores. In the late seventies, much of the private land was purchased to make way for new industries wishing to locate in the area due to the deep ice-free harbour afforded by the Strait of Canso (Figure 4.17). Today there are less than 10 homes. One of the churches has previously been used by the Point Tupper Heritage Association as a museum, but closed in 2021. The emergence of Port Hawkesbury as the principal urban center coupled with the area's potential for industry and shipping has led to a decline in the Point Tupper population.

Figure No.
4.17

Title
Socioeconomic Features

Client/Project
121431287_017c

Bear Head Energy
Regulatory Permitting Support

Project Location
Prepared by NW on 2022-11-30

Richmond County, NS

N

0 1 2 Kilometres
(At original document size of 11x17)
1:65,000

Legend

- Project Area

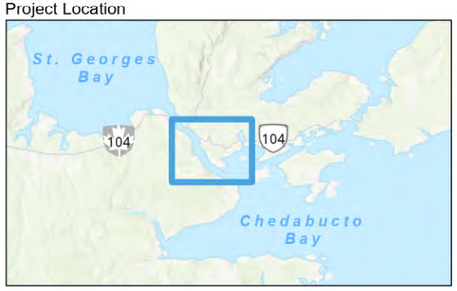
Buildings and Amenities
- Church
- Fire Station
- Hospital
- Library
- Police Station
- School
- Seniors Residence
- Town Hall
- Community Centre
- Pumping Station
- Electrical Generation
- Wind Turbine

Transportation Infrastructure
- Highway
- Local Road
- Railway

Natural Features
- Waterways (1:10k)

Land Use
- Commercial Area
- Industrial Area
- Proposed Everwind Fuels Green Hydrogen / Ammonia Project
- Municipal Boundaries
- Nature Reserve

Project Location



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Strum Consulting. (2022). *Point Tupper Green Hydrogen Ammonia Project Phase 1. Environmental Assessment Registration Document.* 272 pp.
3. Data Sources: Stantec, NS DNR, NS DOE, NSTB, NSODB, Service NS (Government of Nova Scotia)
4. Background: NSODB, Service NS (Government of Nova Scotia)

Stantec

Port Hawkesbury is the largest urban centre in the area. The town experienced its most significant population growth following the opening of the Canso Causeway in 1955 and the development of the Point Tupper Industrial Park in 1959. Between 1956 and 1976, the population nearly quadrupled from a little over a 1,000 to 4,000. Subsequent economic cycles have had a negative impact on growth. Port Hawkesbury covers a land area of 8.11 km^2 with a population density of 396.3 per km^2. In 2021, Port Hawkesbury's population was 3,210 (Statistics Canada 2022a). Sixty-two percent (62%) of the Port Hawkesbury population is between the ages of 15 to 64 (Statistics Canada 2022a). The Town of Mulgrave covers a land area of 17.81 km^2 with a population density of 40.5 per km^2. In 2021, the population was 627. Fifty-nine percent (59%) of the Town of Mulgrave population is between the ages of 15 to 64 (Statistics Canada 2022c).

The Point Tupper Industrial Park (Figure 4.18) is 1,600 hectares and offers deep-water ice and dredge-free ports and wharf facilities designated for heavy industrial use (Municipality of the County of Richmond 2019). The Park includes the following industries/activities:

- Pulp and paper mill (Port Hawkesbury Paper)
- Point Tupper Generating Station (Nova Scotia Power Inc.)
- Petroleum processing and storage (Everwind Terminals, formerly NuStar Energy)
- Waste disposal (asbestos and coal fly ash)
- Gypsum wall board manufacturing and export facility (Cabot ULC)
- Port Hawkesbury Pier and marine shipping terminals (service vessel, fishing boat, tug boat, barge, patrol vessel, pleasure craft, and cruise ship berthage)
- Concrete supplier (Ideal Concrete)
- Coal terminal, storage, and rail loading
- Crane rentals (AW Leil Cranes & Equipment Ltd.)
- Industrial, marine, and hydraulic equipment (Strait Supplies)
- Point Tupper Properties Fabrication

Figure 4.18 Point Tupper Industrial Park

In addition, in the Point Tupper Industrial Park, there are vacant warehouses and commercial buildings associated with past industrial use such as the former site of the Atomic Energy of Canada (heavy water plant) and undeveloped lands owned by the Municipality designated for future commercial/industrial use.

Adjacent land use to the Project Area include the Point Tupper Wind Farm (north of the Project Area, Figures 4.19 and 4.20) and a NSPI coal ash disposal facility (west of the Project Area).

Figure 4.19 Point Tupper Wind Farm, North of the Project Area

Figure 4.20 Bear Head Project Area and Point Tupper Wind Farm as Seen from Across the Strait

Figure 4.21 Everwind Terminals West of Project Area

4.4.1.2 Recreation and Tourism

There are several hotels, motels, cottages, inns, and bed and breakfasts in the Port Hawkesbury, Port Hastings and Troy area. These facilities provide year-round accommodation to visitors to the area. Port Hawkesbury has a range of fast-food restaurants, cafes, pubs, and licensed restaurants.

A search of Recreation NS records found no records of provincial canoe, sea kayaking, hiking or snowmobile trails in the Point Tupper and Bear Head area (NSSRC 2010). However, there are several trails in the Town of Port Hawkesbury, including Spruce Trail, Hemlock Trail, Tamarac Trail, Centennial Woodland Trail, Maple Trail, and the Port Hawkesbury Community Trail (Town of Port Hawkesbury 2022b; AllTrails n.d.). There are various local parks as well, including the Port Hawkesbury Community Park and Granville Green (AllTrails n.d.). There are also a number of designated walking routes throughout Port Hawkesbury, including along Reeves Street, Granville Street, Church Street, and Sydney Road (Town of Port Hawkesbury 2022c). Seasonal recreation activities also take place in Port Hawkesbury. During winter seasons, there is a groomed trail apart of the SANS Trail System used for snowmobiling located adjacent to the Port Hawkesbury Airport (SANS 2022). There is also the Strait of Canso Yacht Club located in Port Hawkesbury which has operated since 1964 for recreational sailing (Cape Breton Island n.d.). Some recreational sailing and power boating does take place in the waters of the Strait of Canso and Chedabucto Bay. Port Hawkesbury offers a variety of entertainment activities for residents and visitors. The facilities include the Port Hawkesbury Civic Centre, the Bowling Center, the Strait Arena Pool the Strait Area Education Recreation Centre, Dance Debut Studio, a number of community halls, and indoor and outdoor sports courts/fields. Seasonal activity flyers are published identifying activities such as yoga, Tai Chi, Qigong, painting, knitting, fitness (swimming, sports, dance),

cooking, and educational classes and programs. Additional seasonal activities include golf, water skiing, scuba diving, kayaking, and skating. Port Hawkesbury is also home to a variety of music and entertainment festivals, such as the Festival of the Strait and the Granville Green Concert Series (Granville Green Resurgence 2022; Town of Port Hawkesbury 2022a).

4.4.1.3 Local Emergency Response Services and Medical Services

Fire Services are provided to the Point Tupper Industrial Park in the first instance by the Town of Port Hawkesbury Volunteer Fire Department and supported by Strait Area Regional Mutual Aid from the Municipality of the County of Richmond. Responses to industrial facilities will be coordinated with those on site who are charged with the first response in accordance with accepted and approved industrial practices. In emergency situations first responders could rely upon the support of additional resources from the surrounding municipalities.

The Bear Head Site is located within the area serviced by the Guysborough Antigonish Strait Health Authority. The closest hospital to the Project site is the Strait Richmond Hospital. The Strait Richmond Hospital provides primary services to patients and is located approximately 20 minutes (16 km) from the Project site in Evanston, Richmond County. Emergency Health Services operates ambulances in Port Hawkesbury; air ambulance services are available and the Strait Richmond Hospital is equipped with a helipad.

For additional services, such as secondary and tertiary medical care including major trauma injuries and maternity procedures, St. Martha's and Cape Breton Regional Hospitals are available. The former, located in Antigonish about 45 minutes from the Project Area, provides primary and secondary health care services. The Cape Breton Regional Hospital in Sydney is 1.5 hours from the site, has over 320 in-patient beds and provides health care services for emergencies, acute and critical care, maternal, mental health, addiction, and palliative care (Health Care Redevelopment in Nova Scotia n.d.).

The Bear Head Site falls within the area served by the Port Hawkesbury RCMP Detachment, which patrols the Park and provide emergency response services. Businesses within the Point Tupper Industrial Park are responsible for individual site security.

4.4.1.4 Transportation Infrastructure

Primary traffic access to the Project site will be via Industrial Park Road from Trunk 4 in Port Hawkesburyto the intersection of Port Malcolm Road, and then Bear Island Road to the site. Trunk 4 is a Nova Scotia arterial road that connects with Trans Canada Highway 104 and 105 at Port Hastings, approximately 6.2 km west of the Trunk 4 / Industrial Park Road intersection. Trunk 4 in this area is a four-lane wide undivided road. In 2004, traffic volumes in the Project area were estimated from 11,600 vehicles per day (vpd) west of Port Hawkesbury to about 14,000 vpd at the Trunk 4/Industrial Park Road intersection. In 2011, the estimated traffic volumes at the same locations have seen a reduction to 8,800 vehicles per day and 6,530 vehicles per day respectively.

The four lane sections of Trunk 4 and all of Industrial Park Road were constructed in the early 1970s to provide construction access for the major industrial projects that were developing. These roads continued to serve the daily access needs of several hundreds of employees at the major industrial plants operating in Point Tupper and to carry truck loads of pulp to the mill and gypsum to the Georgia Pacific terminal (no longer operational). These roads will serve the needs of the Project through its construction and operation. The section of Bear Island Road to the south of the Port Malcolm Road intersection was reconstructed primarily to provide access to the NSPI coal ash dump. The road surface beyond the ash dump access is currently a two-way gravel heavy haul access road rebuilt by BHLNG (now BHE) between 2004 and 2007.

Daily volumes fluctuate seasonally with volumes usually higher in the summer and lower in the winter. Volume fluctuations on the sections of Industrial Park Road between Trunk 4 and the NS Power Plant can be expected to be similar to suburban traffic patterns that only exhibit minor seasonal fluctuations. The distance from the Trunk 4 / Industrial Park Road intersection to the Project is about 8 km. Road types vary from a 0.5 km section of four-lane undivided road, i.e., Industrial Park Road at the north end, to a 1.2 km section of two-way gravel surface road, i.e., Bear Island Road at the south end. NSPI maintains an access to their ash dump location approximately 1.8 km from the start of Bear Island Road.

4.4.2 Economic Development

4.4.2.1 Employment and Income

The median total income of persons 15 years of age and over in Port Hawkesbury was $34, 000 in 2021; 57.6% of this came from employment income, 27.1% from government (Statistics Canada 2022a). Among the labour force in Port Hawkesbury, the average annual earning for full-time employment was $57,200. The employment rate for persons 15 years of age and over was 46.9% and the unemployment rate 18.4% (Statistics Canada 2022a).

For Richmond County, the median total income was $33,200 (including employment income and government transfers) with an average total income of $42,000; 54.9% of this income came from employment, and 29.9% from government transfers. The employment rate for persons 15 years of age and over was 39.8% and the unemployment rate was 16.4% (Statistics Canada 2022d).

4.4.2.2 Business

Major employers in Richmond County include the Port Hawkesbury Paper, Everwind Fuels, Premium Seafoods Group, Lobsters-R-Us, Clearwater Seafoods, Acadia Drywall/Cabot Gypsum, Nova Scotia Power, Samson Enterprises Ltd., Samson Industrial Ltd., and Strait Supplies (Municipality of the County of Richmond 2016). The division of labor force, by industry and occupation, is presented in Table 4.21.

Table 4.21 Labour Force Division for Richmond County (Statistics Canada 2022a)

Labour Force Division	Labour Force Population (aged 15 years and over)	Percentage (%)
Legislative and senior management	35	1.0
Business, finance and administration	400	11.0
Natural and applied sciences and related occupations	150	4.1
Health occupations	310	8.5
Occupations in education, law and social, community and government services	480	13.2
Occupations in art, culture, recreation and sport	80	2.2
Sales and service occupations	800	21.9
Trades, transport and equipment operators and related operations	825	22.6
Natural resources, agriculture and related production occupations	265	7.3
Occupations in manufacturing and utilities	305	8.4
Total	3650	100.0

4.4.3 Marine Navigation

The Strait of Canso Port is a major bulk seaport that handles approximately 61% of Nova Scotia's international and domestic cargo tonnage. Commodities shipped include crude oil and petroleum products, stone aggregate, forestry products, highway salt, and coal. In 2018, the Strait of Canso Port handled 14.4 million metric tonnes of cargo (Strait Superport n.d.).

An integral part of the Canso Causeway is the Canso Canal which allows the continued unobstructed movement of marine traffic between Chedabucto Bay and St. George's Bay. Constructed to be 250 m long, 24.4 m wide and 9.8 m deep at low tide, the Canso Canal was designed to be compatible with the St. Lawrence Seaway, capable of passing a ship 224 m in length, with a draft not exceeding 8.5 m (CG 2019). The Canso Canal is operational for about 254 consecutive days per year on a 24-hour basis during ice free conditions. The Canso Canal is owned by the Government of Canada and operated by the Canadian Coast Guard. An average of 2,069 ships, with an average gross tonnage of 1,878,480 tons pass through the Canso Canal yearly from Chedabucto Bay to St. George's Bay or vice versa. The Canso Canal caters mostly to commercial ships, with about 85% owned and/or operated by shipping companies, fishermen and government (CCG 2019).

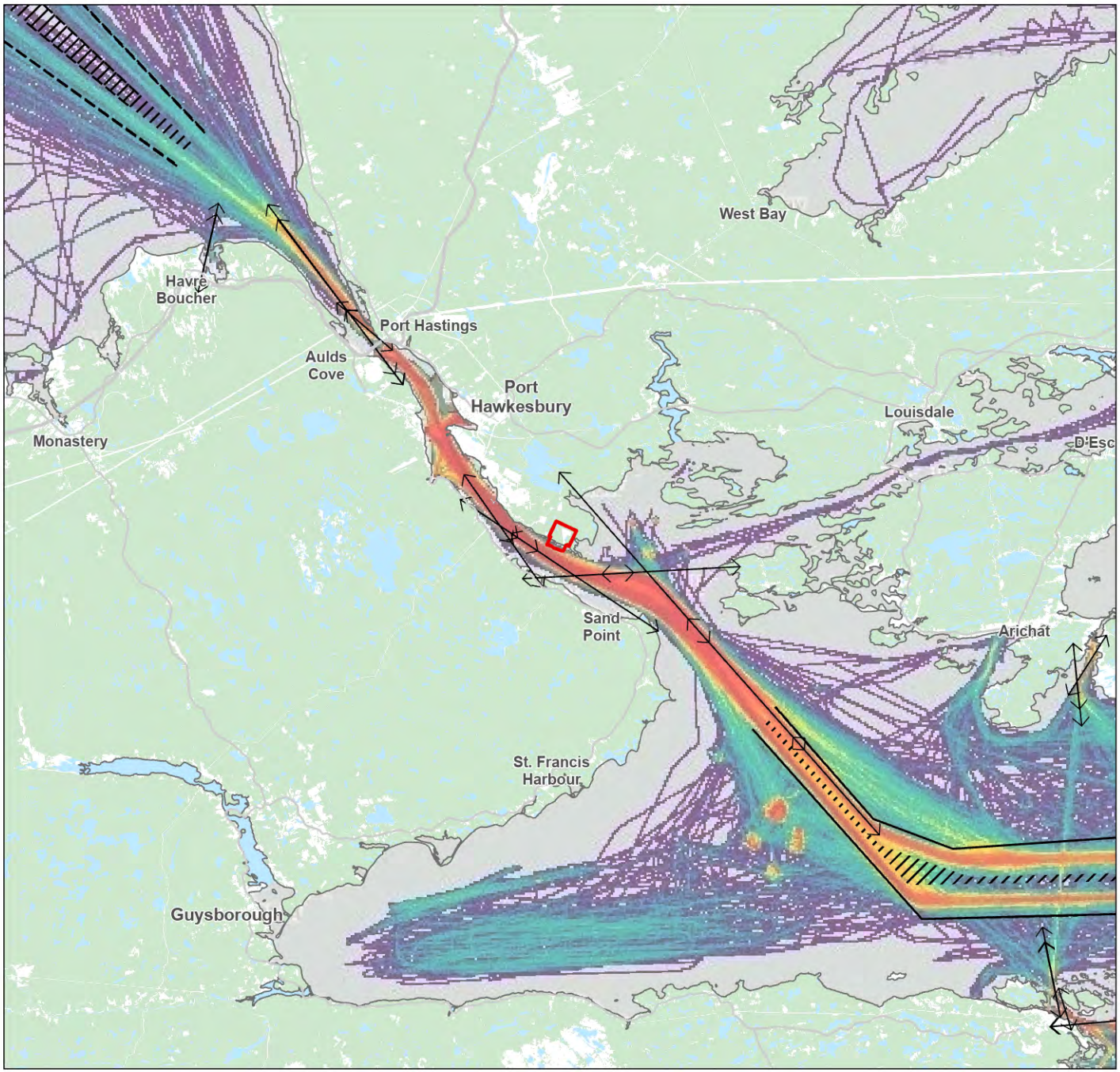


Figure No.
4.22
Title
Marine Navigation Surrounding the Project Area

Client/Project 121431287-027

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NWhite on 2022-12-06

Richmond County, NS

N

0 2 4 6 Kilometres
(At original document size of 8.5x11)
1:300,000

Legend

- Project Area
- Navigation Line
- Traffic Separation Boundary
- Traffic Separation Zone
- Vessel Density [2]

200K+
50K+
521
221
96
51
38
30
27
25
10
5
1
(routes / 0.08km² / year)

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. MarineTraffic.com. (2022) Density Map - All Traffic 2021. Accessed 2022-12-06 from https://www.marinetraffic.com/en/ais/home/centerx:-61.2/centery:45.5/zoom:10
3. Data Sources: Stantec; Marinetraffic.com; Fisheries and Oceans Canada; NS NRR, NS ECC, NSTB, NSODB, Service NS (Government of Nova Scotia)
4. Background: NSODB, Service NS (Government of Nova Scotia)

Stantec

Table 4.22 summarizes marine traffic information for the Strait of Canso attained from the Sydney Marine Communications and Traffic Services (MCTS) for 2014. The "Number of Vessel Movements" describes the movement of a vessel from one designated point to another. For example, a vessel moving from the pilot boarding station to an anchorage is considered one movement. If this vessel then moves from the anchorage to a berth, that is considered a second movement. To provide context, the total number of vessels accessing the Strait of Canso is equal to about half of the number of movements. It should also be noted that only marine traffic over 30 m in length is accounted for; most non-reporting traffic would be small fishing vessels and pleasure craft.

Table 4.22 Number of Vessel Movements in Strait of Canso Area (2014)

Month	Number of Vessel Movements
January	128
February	131
March	187
April	155
May	237
June	195
July	149
August	147
September	157
October	172
November	148
December	117
Total annual vessel movements	1923
Estimated number of vessels	962
Source: 2014 Sydney MCTS Annual Statics, cited in SNC Lavalin 2015	

All vessel traffic entering or leaving the Chedabucto Bay region are required to communicate with the Eastern Canada Vessel Traffic Services Zone (ECREG) and the local MCTS. The Vessel Traffic Services (VTS) Zone begins at the "12-mile limit". Communication must be made to MCTS 24 hours before approaching the area. This advanced warning ensures that MCTS is aware of the vessel from about 200 miles from the shore, ensuring that safe passage is possible and assisting in the scheduling of passages. As a vessel approaches the Chedabucto Bay area, the Master must ensure that MCTS is contacted. This is to inform MCTS of the appropriate time for the pilot to board the vessel, to determine the required speed to maintain, and to identify the side of the vessel for the pilot's boat to approach. The pilot boards the vessel, discusses the plan of vessel passage with the Master and crew and then assumes command of the navigation team. Although the pilot is in control of navigation of the vessel and directs the anchoring activities, the Master remains responsible for all other duties. The pilot is also responsible for vessel navigation once favourable berthing conditions are met.

Most anchoring points within the Chedabucto Bay area are between 25 to 40 m. Once the pilot deems the anchorage has an adequate hold, the pilot disembarks the vessel. The vessel will then remain ready to continue once favorable conditions are met.

In addition to site-specific navigation measures such as those implemented in the Chedabucto Bay and Strait of Canso area, The Government of Canada has several regulatory safety measures in place to help ensure large vessels entering Canadian waters comply with international and Canadian requirements and do not pose an undue risk to safety or the environment.

On November 28, 2014, BHLNG asked Transport Canada to form a Technical Review Committee (TRC) to assess their proposed Bear Head LNG Project under the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL). The TRC included representatives from Transport Canada (chair), DFO, ECCC and the Atlantic Pilotage Authority. BHLNG submitted surveys and studies to support the TERMPOL review process including a Marine Safety Risk Assessment and a Ship Maneuvering Simulations Report (Transport Canada 2017).

The TRC did not identify any major regulatory concerns for Bear Head's LNG carriers, operations, the proposed route, navigability, other waterway users or the project's proposed marine terminal operations. The TRC established several findings and recommendations to help provide for a higher level of safety for LNG vessel operations adequate for the potential increase in traffic. While the TRC did not consider the increase in marine traffic levels to be a safety issue, it did support additional measures to promote shared safe use of the project's preferred shipping route (Transport Canada 2017). A new Enhanced Navigation Safety Assessment Process is being proposed to modernize the TERMPOL process; this initiative is currently underway (Transport Canada 2019). BHE is committed to updating relevant studies including updated ship maneuvering simulations for the Project to update the previous TERMPOL study.

4.4.4 Fisheries, Aquaculture and Marine Harvesting

The completion of the Canso Causeway in 1955 changed the tidal flows in the area, creating a deep-water, ice-free port and catalyzing the industrial expansion of the Strait area (O'Halloran 2018). This development arguably affected migration of fish species, physical habitat, and fishing patterns in the Strait (McCracken 1979; SNC Lavalin 2015; O'Halloran 2018). Commercial fisheries in the Strait of Canso are relatively limited, compared to Chedabucto Bay, since the area is used for shipping and has been extensively industrialized (SNC Lavalin 2015). Nonetheless, commercial, recreational and Indigenous fisheries do exist within the Strait (SNC Lavalin 2015; CBCL 2016a).

Commercial, recreational and Indigenous fisheries that may be present in the Strait of Canso or Chedabucto Bay are presented in Table 4.23. Additional information on these fisheries species is provided below and in CBCL (2016a) (Appendix J).

Table 4.23 Commercial, Recreational and Indigenous Fisheries Occurring In or Near the Project Area (including Chedabucto Bay)

Species		Species Observed in BHE Water Lot (CBCL 2016a)	Commercial Fishery	Recreational Fishery	Indigenous Fishery (FSC or Commercial Communal)	Prey Species to Fisheries Species
Common Name	Scientific Name					
American Lobster	*Homarus americanus*	X	X		X	
Rock Crab	*Cancer irroratus*	X	X		X	X
Snow Crab	*Chionoecetes opilio*		X		X	
American Oyster	*Crassostrea virginica*		X	X		
Atlantic Sea Scallop	*Plactopecten magellanicus*	X	X	X	X	
Sand Shrimp	*Crangon septemspinosa*	X				X
Northern Shrimp	*Panalus borealis*	Potential	X		X	X
Green Sea Urchin	*Strongylocentraotus droebachiensis*	Potential	X		X	
Bar/Soft Shell Clams	*Spisula solidissima/ Mya arenaria*	X		X		X
Hermit Crab	*Pagarus sp.*	X				X
Blue Mussel	*Mytilus edulis*	Shell debris		X		X
Bluefin Tuna	*Thunnus thynnus*		X		X	
Atlantic Mackerel	*Scomber scombrus*		X	X	X	X
Cunner	*Tautogolabrus adspersus*	X		X		X
Atlantic Halibut	*Hippoglossus hippoglossus*		X		X	
Haddock	*Melanogrammus aeglefinus*		X		X	
White Hake	*Urophcis tenuis*	X	X		X	
Winter Flounder	*Pseudopleuronectes americanus*	X	X	X		
Summer Flounder	*Paralichthys dentatus*		X		X	
American Eel	*Anguilla rostrata*		X	X	X	
Atlantic Salmon	*Salmo salar*		X	X	X	

Table 4.23 Commercial, Recreational and Indigenous Fisheries Occurring In or Near the Project Area (including Chedabucto Bay)

Species		Species Observed in BHE Water Lot (CBCL 2016a)	Commercial Fishery	Recreational Fishery	Indigenous Fishery (FSC or Commercial Communal)	Prey Species to Fisheries Species
Common Name	Scientific Name					
Brook Trout	*Salvelinus fontinalis*			X	X	
Atlantic Cod	*Gadus morhua*		X	X		
Mummichog	*Fudulus heteroclitus*					X
Sand Lance	*Ammodytes americanus*	X				X
Atlantic Herring	*Clupea harengus*	Potential		X	X	X
Threespine Stickleback	*Gasterosteus aculeatus*					X
Source: CMM 2015; CBCL 2016a; MGS 2016; Stantec 2016						

4.4.4.1 Commercial Fisheries

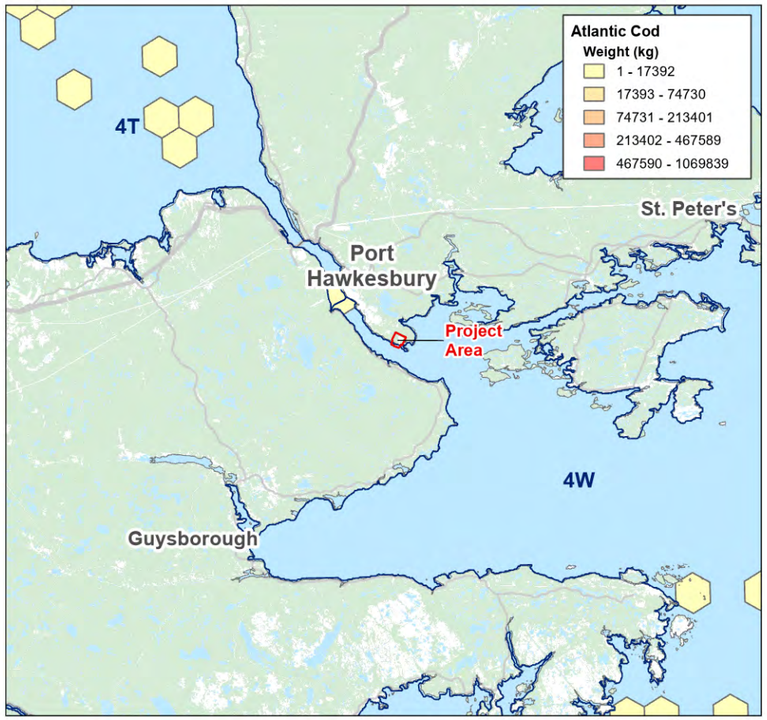
DFO Maritimes Region manages most fisheries in the marine study area, which is located within the Northwest Atlantic Fisheries Organization (NAFO) Unit Area 4Wd. Table 4.24 summarizes catch weight and values from 2013 to 2017 in 4Wd. Figures 4.23 and 4.24 depict landings for various commercial fisheries in the area.

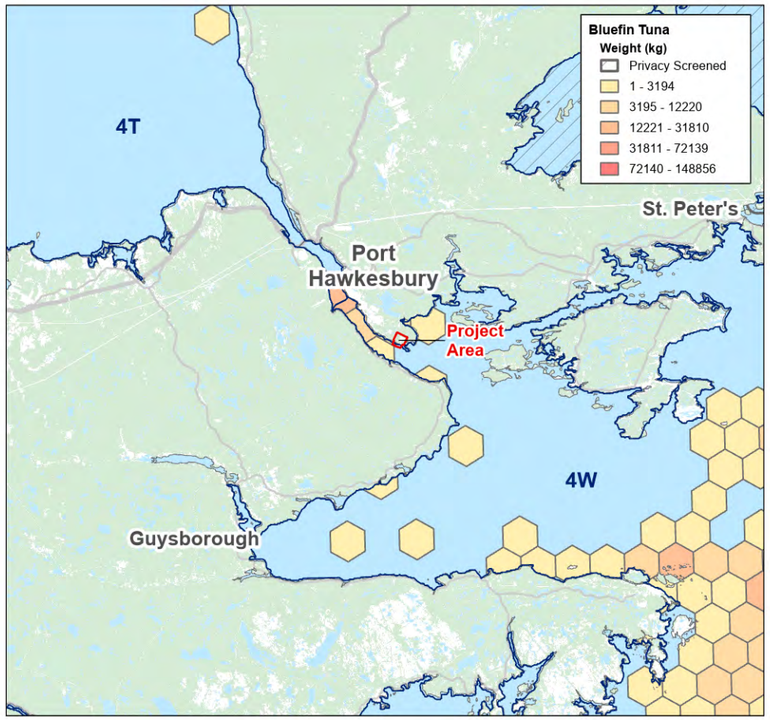
Table 4.24 Catch Landings and Value by Species Group for 4Wd (2013-2017)

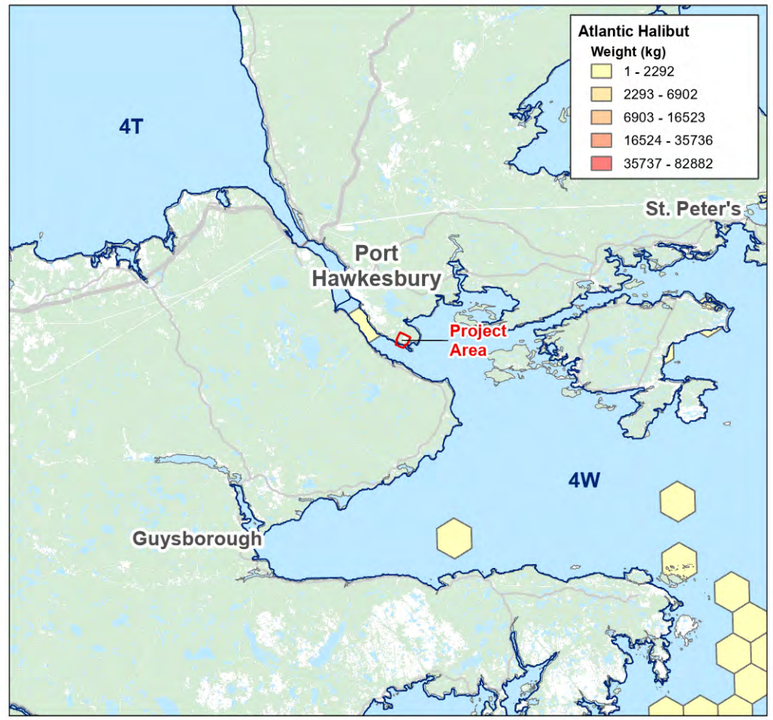
Species Group	2013		2014		2015		2016		2017	
	Weight (t)	Value ($'000)	Weight (t)	Value ($'000	Weight (t)	Value ($'000	Weight (t)	Value ($'000)	Weight (t)	Value ($'000
Groundfish	39	455	41	534	62	829	83	1231	67	970
Shellfish	5466	32246	6891	45841	7271	51493	4984	50802	4068	58144
Pelagics	13	281	19	356	39	465	74	352	41	543
Grand Total	**5,518**	**32,982**	**6,951**	**46,731**	**7,372**	**52,787**	**5,141**	**52,385**	**4,176**	**59,657**

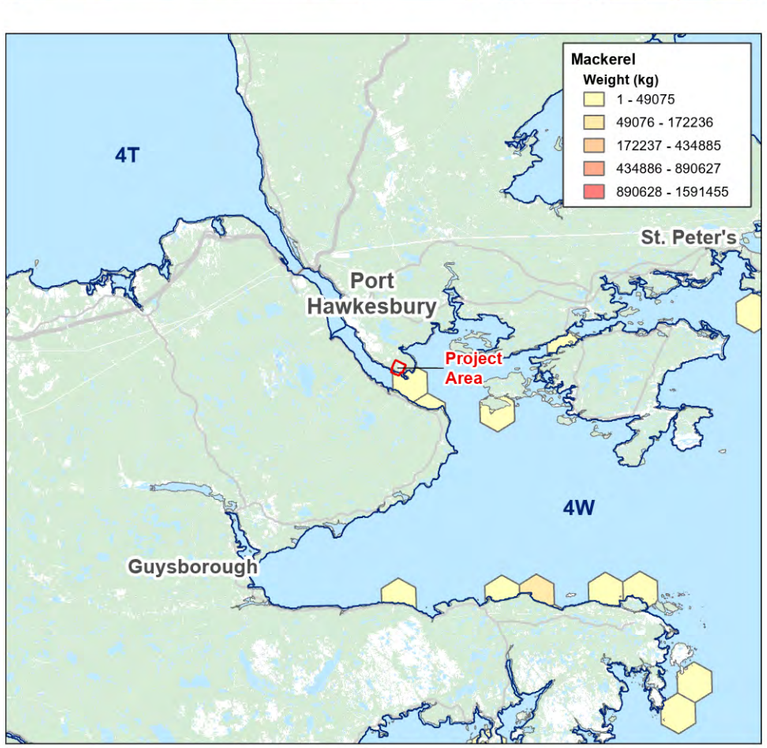
Over 25 species of finfish and shellfish have the potential to be commercially fished in the Strait of Canso region (SNC Lavalin 2015). Commercial fish species for which habitat exists in the Project Area include: white hake, winter flounder, lobster, rock crab, sea scallops, and potentially Atlantic herring, northern shrimp, and green sea urchin (CBCL 2016a). A review of DFO Fisheries Landings data (2016-2020) for the landings reported and harvested in or near the Project Area indicate bluefin tuna and mackerel to be the species most commonly fished, with fewer catches reported for Atlantic cod, Atlantic halibut, and hake (Figure 4.23). Bluefin tuna is fished primarily using rod and reel; trap nets are used to catch mackerel. Arichat and Canso represent important fishing ports in the Chedabucto Bay area. Figure 4.24 shows shellfish landings for shrimp, crab, and scallop. Fishing effort is generally outside of areas frequented by major shipping from the Strait (SNC Lavalin 2015).

Chedabucto Bay is particularly productive and supports various finfish and shellfish fisheries species including but not limited to lobster, shrimp, oyster, sea urchin, rock crab, soft-shelled clam, halibut, cod, haddock, pollock, white hake, Atlantic herring and mackerel (AMEC 2008; CBCL 2016a). In 2022, DFO closed the Atlantic mackerel commercial and bait fisheries in Atlantic Canada and Quebec to allow the stock to rebuild. The recreational and food, social and ceremonial fisheries have remained open (DFO 2022). There are two key fisheries-related features of Chedabucto Bay including a larger overwintering population of herring that can be fished according to the current management plan by large seiners and a trap shrimp fishery operating just inshore of Cape Chedabucto. A large fishery for bluefin tuna exists off Chedabucto Bay in the approaches to the Strait. Bluefin tuna often forms the largest proportion of the pelagic and estuarial catch (SNC Lavalin 2015).









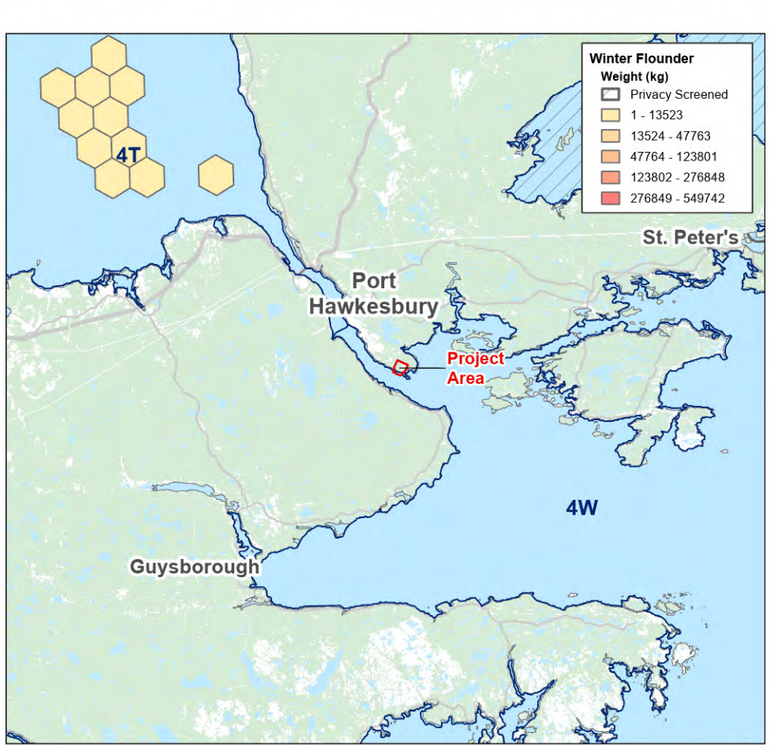


Figure No.
4.23

Title
Commercial Fishery Landings (Pelagic Fish and Groundfish) 2009-2018

Client/Project 121431287_032

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NW on 2022-12-20

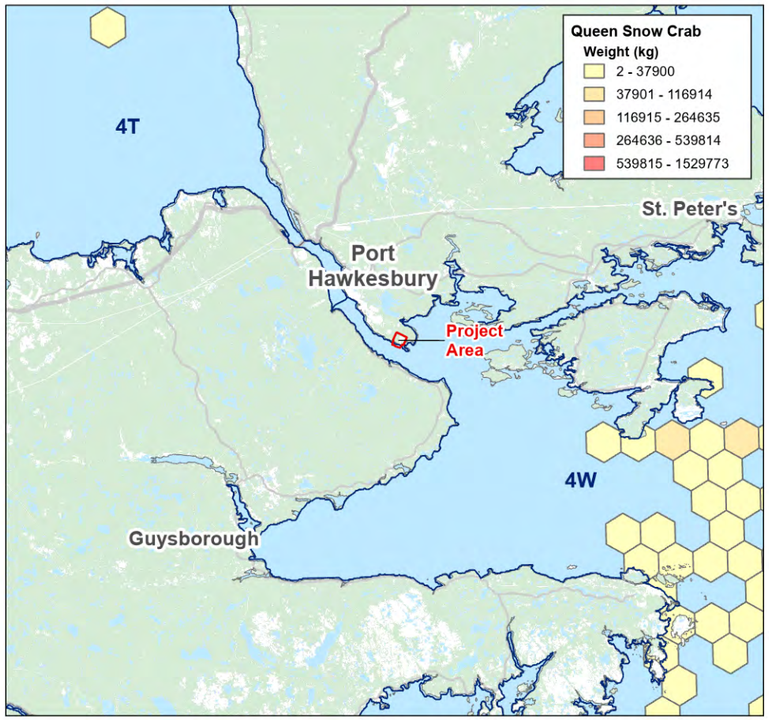
Richmond County, NS

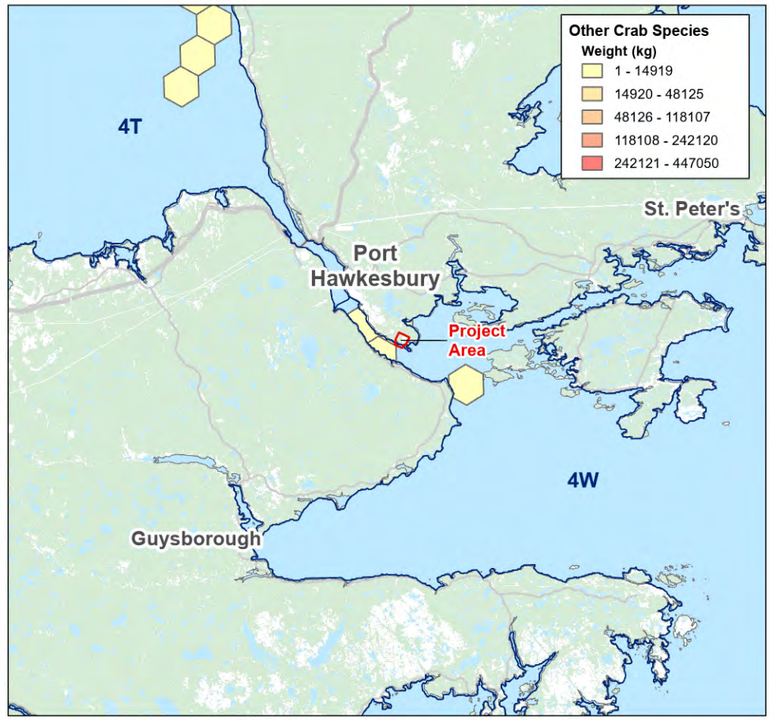
0 5 10 Kilometres
(At original document size of 11x17)
1:580,000

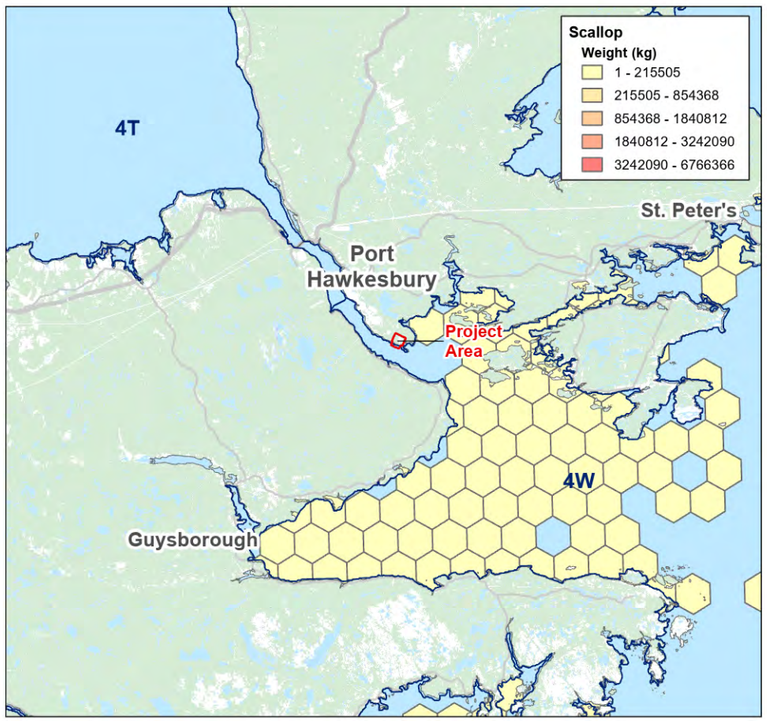
N

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Fisheries and Oceans Canada, North Atlantic Fisheries Organization
3. Background: ESRI Topographic 2022, Service NS (Government of Nova Scotia)

Stantec







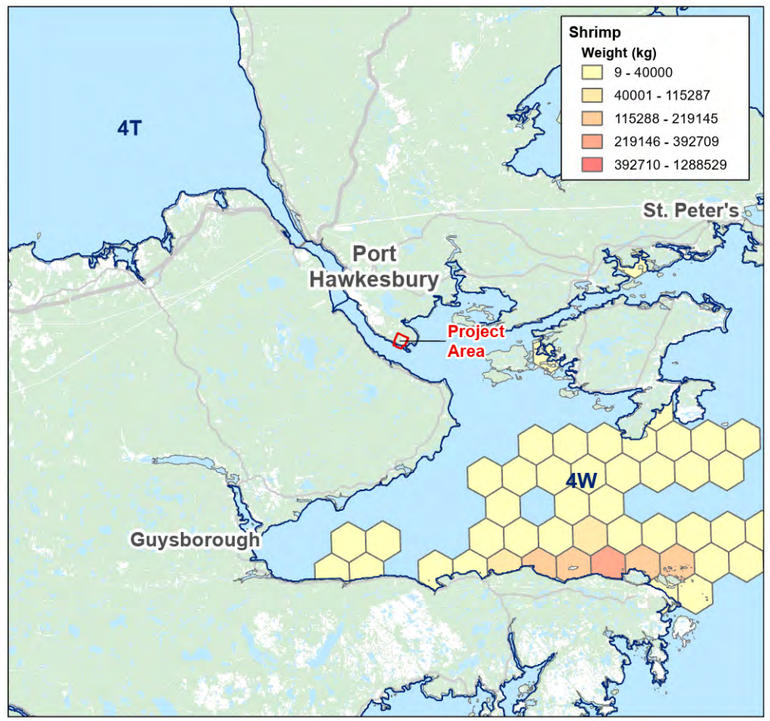


Figure No.
4.24

Title
Commercial Fishery Landings (Shellfish) 2009-2018

Client/Project 121431287_032

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NW on 2022-12-20

Richmond County, NS

0 5 10 Kilometres
(At original document size of 11x17)
1:580,000

N

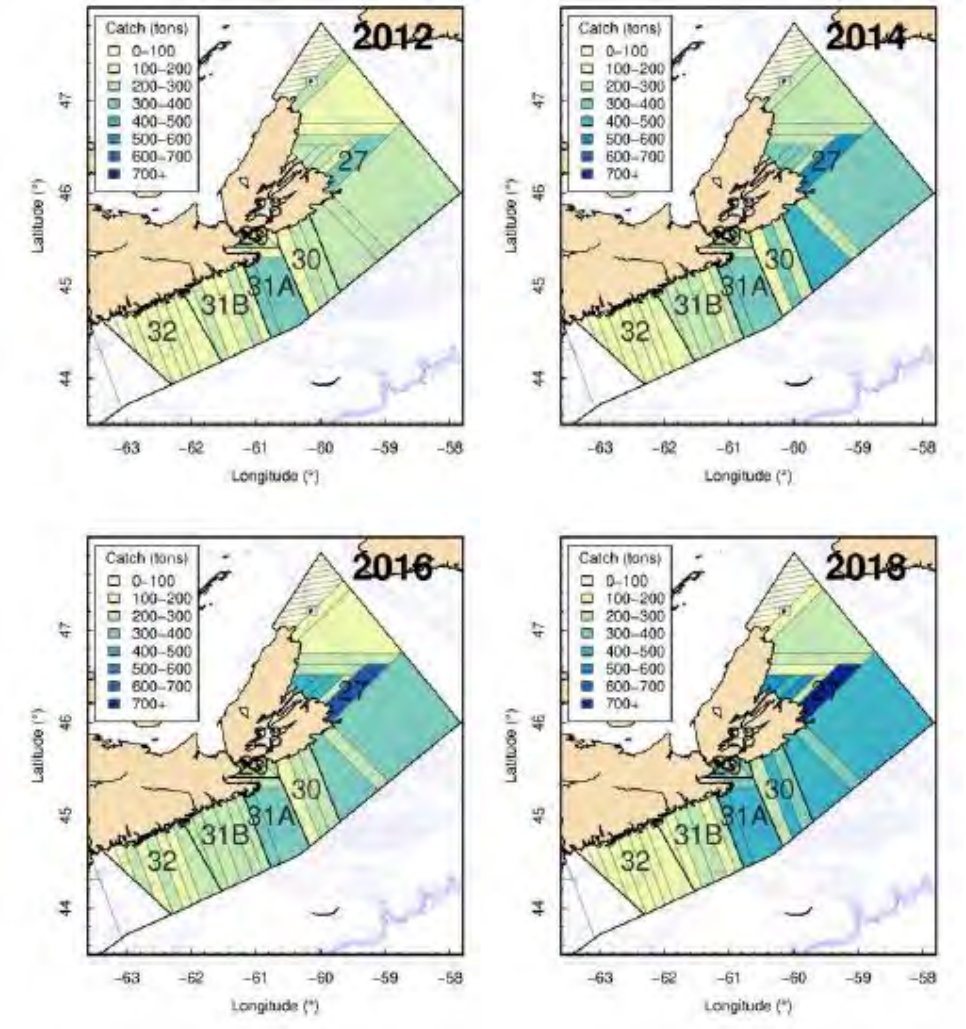
Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Fisheries and Oceans Canada, North Atlantic Fisheries Organization
3. Background: ESRI Topographic 2022, Service NS (Government of Nova Scotia)

Stantec

The steep bathymetry of the Strait of Canso results in a relatively narrow band for lobster habitat and thus a restricted fishing area compared to nearby areas, such as Isle Madame (SNC Lavalin 2015). The fishery is regulated by the number of traps allowed per fisher and fishing season (SNC Lavalin 2015). The Strait and approaches are divided into the three lobster fishing areas (LFA) 29, 30, and 31A with the following seasons:

- LFA 29 (includes Strait of Canso): May 10 - July 10
- LFA 30: May 19 - July 20
- LFA 31A: April 29 - June 30

As depicted by lobster fishery landings shown in Figure 2.25, the Strait of Canso is not as heavily fished as other areas outside the Strait (including other areas within LFA 29).



Source: DFO 2020b

Figure 4.25 Map of the Fishery Footprint Expressed as the Amount of Landings in Each Grid Cell of LFAs 27-32 from 2012, 2014, 2016 and 2018 Seasons

Scallops are fished in various inshore grounds, but fishing areas tend to move from year to year because populations need time to replenish (SNC Lavalin 2015). Oyster, sea urchin and soft-shelled clam are fished in specific inshore habitats, usually by small boats (SNC Lavalin 2015).

Snow crab and northern shrimp are caught in the deeper offshore waters in the approaches to the Strait. Snow crab is the most common and valued species caught and landed in the area, but rock crab is also caught in inshore areas and stone crab in deeper waters (SNC Lavalin 2015). Scallops are fished in various inshore grounds, but fishing areas tend to move from year to year because populations need time to replenish. Oyster, sea urchin and soft-shelled clam are fished in specific inshore habitats, usually by small boat (SNC Lavalin 2015).

The Maritimes Region Southeastern Nova Scotia snow crab fishery occurs in Crab Fishing Area (CFA) 23 and the eastern portion of CFA 24 (formerly N-ENS and S-ENS). The Strait of Canso falls within CFA 24. Northern shrimp (*Pandalus borealis*) is the most abundant shrimp species in North Atlantic waters (DFO 2018). In 2014, Nova Scotia captured approximately 25,000 metric tonnes of shrimp, worth $73 million (Nova Scotia 2014). Shrimp are harvested through two methods: a trap fishery within Chedabucto Bay; and a bottom trawling fishery operating near shore southern Cape Breton Island and in a number of larger deeper “hole’’ further offshore, such as Louisbourg Hole, Misaine Hole and Canso Hole (SNC Lavalin 2015). Trawlers are prohibited from fishing for shrimp within Chedabucto Bay from spring to fall by an “inshore line’’. Shrimp is primarily landed in the ports of Canso, Arichat and Louisbourg. The trap fishery in Chedabucto Bay has been successful in recent years at finding a higher price market in Japan, which is positive for the Canso area.

There is little potential for seaweed, scallop and urchin harvesting and aquaculture in the Strait; these are more important in the outer Bay and around Isle Madame (SNC Lavalin 2015).

4.4.4.2 Indigenous Fisheries

Canada’s Indigenous peoples hold Aboriginal and treaty rights to harvest various species for food, social and ceremonial (FSC) purposes and / or to earn a moderate livelihood from harvesting. These rights are recognized in the Constitution and have been subsequently clarified through the Supreme Court of Canada. Through the 1990 *Sparrow* decision, the Supreme Court of Canada clarified that where an Indigenous group has a right to fish for FSC purpose, it takes priority, after conservation, over other uses of the resource. The Supreme Court also indicated the importance of consulting with Indigenous groups when their fishing rights might be affected (DFO 2012). In response to this decision, DFO launched the Aboriginal Fisheries Strategy and issues FSC licences to Indigenous communities for FSC fisheries. Indigenous communities must fish their FSC allocation in areas specified in their FSC licence and fish harvested under FSC licences cannot be sold, bartered or traded (DFO 2022a). FSC fisheries are generally conducted inshore, closer to communities (DFO 2022a).

The *Marshall* decisions in 1999 affirmed First Nations’ treaty right to fish, hunt and gather in pursuit of a moderate livelihood and applies to 34 Mi’kmaq and Maliseet First Nations in New Brunswick, Prince Edward Island and Nova Scotia and the Gaspé region of Quebec and the Peskotomuhkati Nation at Skutik (DFO 2022b). In response, DFO has implemented several initiatives to help increase Indigenous participation in commercial fisheries and contribute to the pursuit of a moderate livelihood (DFO 2019).

In 2017, DFO received a mandate to negotiate time-limited Rights Reconciliation Agreements on fisheries with Mi'kmaq and Maliseet First Nations in Nova Scotia, Prince Edward Island, New Brunswick, and the Gaspé region of Quebec, as well as with the Peskotomuhkati Nation at Skutik (DFO 2022c). As of 2021, 33 of the 34 First Nations impacted by the *Marshall* decisions participate in the Atlantic Integrated Commercial Fisheries Initiative. The Government of Canada continues to work with interested First Nations communities to implement the Marshall decisions and implement moderate livelihood fishing plans (DFO 2021).

Commercial communal fisheries are an economically significant resource for Indigenous people and revenue from such activities is used to support community programs and services including those that address health, wellness, education and economic development needs as well as employment opportunities (CNSOPB 2022). In 2021, there were a total of 605 commercial communal harvesting licences issued in the Scotia-Fundy region to 22 Indigenous groups or related organizations in Nova Scotia (14), New Brunswick (7) and Newfoundland and Labrador (1) (CNSOPB 2022).

Table 4.23 lists species of interest for Indigenous fisheries in Strait of Canso and Chedabucto Bay. Section 4.4.5 summarizes results of Mi'kmaq Ecological Knowledge Studies that have been conducted to inform EAs for previous developments proposed at or near the Bear Head site and provides additional information on species fished by the Mi'kmaq in the area.

4.4.4.3 Recreational Fisheries

There are previous reports of diving for scallops in the Strait area and sport fishing for trout and salmon (JWEL 2004). Recreational fishing for mackerel may take place close to the Project site, however, it mostly occurs off the Canso Causeway, local wharves and piers around Port Hawkesbury, as well as the tip of land southeast of the Project near Bear Island. Previously recreational anglers launched boats from the beach south of the Bear Head Site using the dirt road around the Project Area, but site access is no longer available (Bear Head LNG 2016).

August, September and October are the months when the majority of recreational fishing takes place. Recreational fishing in the streams located around the Project Area is not known to occur of the Strait of Canso. The southeastern point of Bear Head contains a pond regularly harvested for mussels by recreational harvesters (SNC Lavalin 2015).

Outside the Strait, recreational deep-sea fishing for tuna is also important, especially off Cape Canso (SNC Lavalin 2015).

4.4.4.4 Aquaculture

There are aquaculture sites near the main navigation route to the Project Area but none occurring in the Strait of Canso (Figure 4.26). According to the Nova Scotia Fisheries and Aquaculture Site Mapping Tool[3], the nearest aquaculture site is approximately 5 km south of the Project Area where Open Oceans Systems Inc. has a licence to operate a 4.20 ha finfish farm of Atlantic salmon and rainbow trout in Chedabucto Bay near the entrance to the Strait (development has not yet occurred). The next closest site is a finfish operation, approximately 20 km southeast of the Project Area in Arichat Harbour, where Waycobah First Nation farms Atlantic salmon and rainbow trout. Several shellfish aquaculture operations are proposed southeast of the Project Area in Chedabucto Bay (Deep Walsh, Cove, LeBlanc Harbour, St. Mary's Harbour).

[3] https://novascotia.ca/fish/aquaculture/site-mapping-tool/

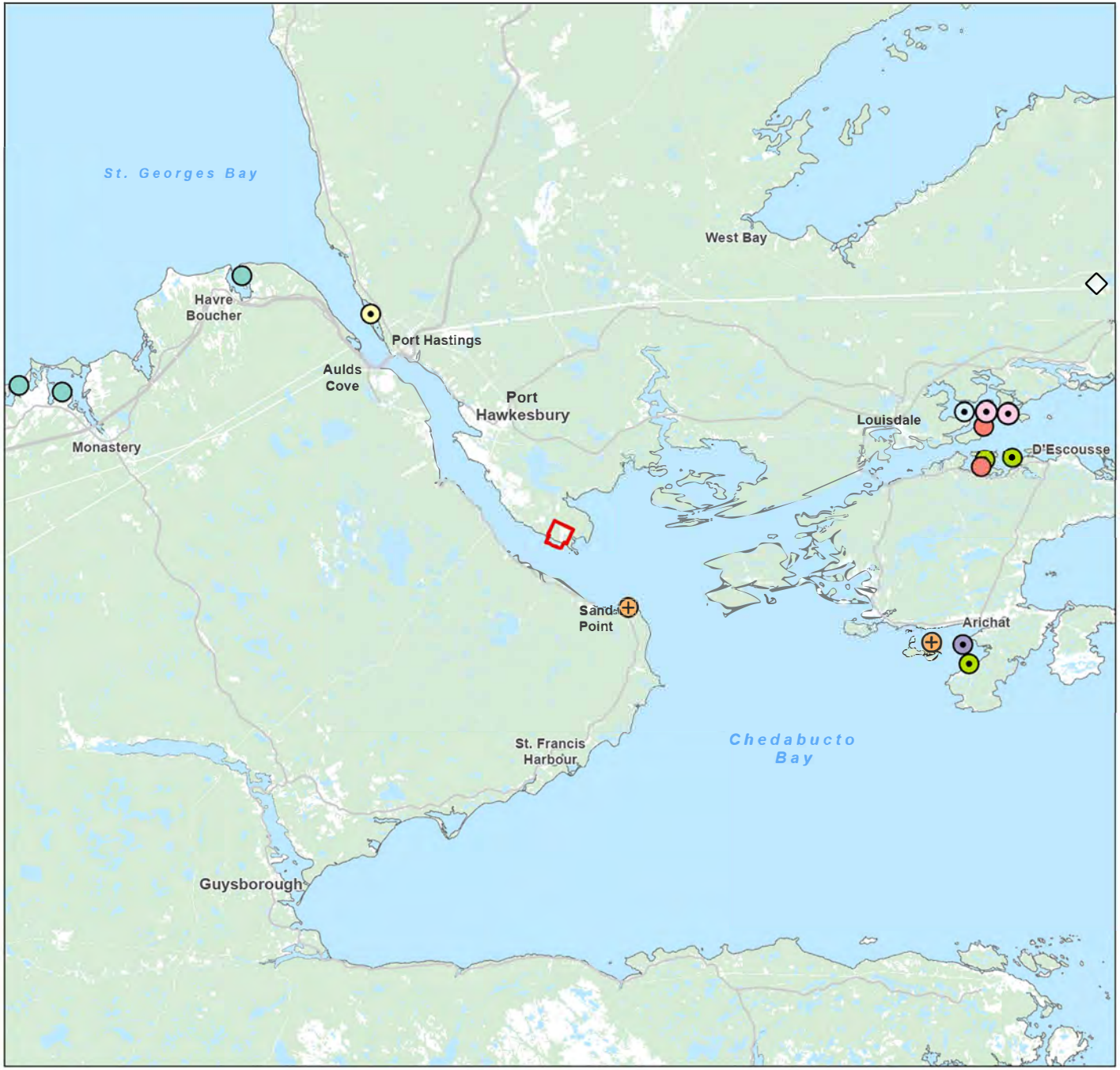


Figure No.
4.26
Title
Aquaculture

Client/Project 121431287-027

Bear Head Energy
Regulatory Permitting Support

Project Location
Port Richmond
Richmond County, NS

Prepared by NWhite on 2022-11-21

N

0 2 4 6 Kilometres
(At original document size of 8.5x11)
1:325,000

Legend

- Project Area

Marine Aquaculture Licenses[2]

- American Oyster
- American Oyster; Blue Mussel; Sea Scallop; Bay Scallop
- American Oyster; Blue Mussel; Sea Scallop; Sugar Kelp
- Atlantic Salmon; Rainbow Trout
- Bay Quahaug; Sea Scallop; Blue Mussel; American Oyster
- Blue Mussel
- Blue Mussel; Sea Scallop
- Blue Mussel; Sea Scallop; Sugar Kelp

Land-based Aquaculture Licenses[2]

- Arctic Char; Brook Trout; Rainbow Trout; Atlantic Salmon

Project Location

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Nova Scotia Department of Fisheries and Aquaculture
3. Background: ESRI Topographic 2022, Service NS (Government of Nova Scotia

Stantec

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4.4.5 Mi'kmaq Land and Resource Use

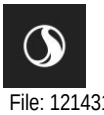
A Mi'kmaw Knowledge Study (MKS) was completed in 2004 by Mi'kmaq Environmental Services Ltd. for the proposed LNG Import Facility to support the integration of Mi'kmaw knowledge of use and occupation of Mi'kma'ki into development decisions via the EA process. The MKS considered a 5 km radius around the property boundary and included:

- A study of historic and current Mi'kmaq land and resource use, including identification of plants of significance to the Mi'kmaq on the site property
- An evaluation of the potential impacts of the project on Mi'kmaq use and occupation and constitutionally based rights
- An evaluation of the significance of those impacts
- Recommendations for mitigation measures, further study or consultation.

As reported in the MKS (Mi'kmaq Environmental Services Ltd. 2004), the Mi'kmaq called the Bear Head area "Red Rock Bank", "Mekwa'sikewe'jk" or "Mekuasikewe'jk", although geographic and climatic conditions suggest that long-term occupation by the Mi'kmaq would be unlikely. Current Mi'kmaq land and resource use of the 5 km radius study area included marine harvesting, deer hunting and trapping, firewood harvesting, camping and a burial site. Several (153) plants of significance to the Mi'kmaq for medicinal, food/beverage and/or craft/art use were recorded in the study area. Eel, scallop and sea urchin harvesting for food was found to be occurring in the study area (Mi'kmaq Environmental Services Ltd. 2004).

In 2015, a MEKS was completed by the Confederacy of Mainland Mi'kmaq (CMM) to augment the 2004 MKS. The 2015 MEKS focused on the same study area, although a broader scope of research was included to show Mi'kmaq use and occupation within Richmond and Guysborough counties. The description of activities undertaken in current Mi'kmaq land and resource use sites at that time was expanded to include harvesting of snow crab, lobster, shrimp, elvers and groundfish. Snow crab, shrimp, tuna, lobster and groundfish were noted to be commercially fished in the Canso Strait and Chedabucto Bay (CMM 2015). Fewer (93) plant species of significance to the Mi'kmaq were found present in the 2015 field surveys (CMM 2015).

In 2016, an MEKS was undertaken by Membertou Geomatics Solutions for the Bear Paw Pipeline Project. The study area for the Bear Paw Pipeline MEKS defined a 500 m wide project site (pipeline corridor) extending 62.5 km from Goldboro in Guysborough County to the Bear Head site. The study area comprised a 5 km radius buffer along the length of the proposed pipeline corridor. The Bear Paw Pipeline MEKS included field surveys, and interviews with Mi'kmaq hunters, fishers and plant gatherers of the Paq'tnkek, Potlotek, We'koqma'q, Wagmatcook and Millbrook First Nation communities (MGS 2016). Because the project site (and corresponding study area) was much larger than the Bear Head site which was the focus of the 2004 and 2015 studies, it is somewhat difficult to discern data applicable to the Bear Head site unless otherwise specified. Trout and salmon fishing were the most reported fishing activities, occurring at several areas throughout the study area including in the-Strait of Canso (MGS 2016). Other species fished included mackerel, eel, sea urchin, striped bass, clam, lobster and scallops, although specific species harvesting areas were not identified for these species. Deer and rabbit hunting activities



were reported as occurring the Bear Head area (MGS 2016). Mushroom gathering activities were described as occurring in areas surrounding Bear Head (MGS 2016).

4.4.6 Archaeological and Heritage Resources

An integral part of the environmental assessment (JWEL 2004) was the execution of a study to determine the archaeological importance of the project site and surrounding lands and waters. This work drew upon the archaeological site records at the Nova Scotia Museum of Natural History, historical literature and archival resources; an archaeological survey of the proposed Project area was undertaken to assess the heritage resource potential (JWEL 2004).

Archaeological research was performed using the previously accepted Bear Head LNG environmental assessment in combination with additional historical research at the Public Archives of Nova Scotia. Using a map created by A.F. Church for Richmond County published between 1883 and 1887, dwellings in and around the Bear Head LNG site were identified (Church 1883-1887). These dwellings may have been related to mining or ship building activities, which were prevalent in the area during the 19th century. All dwellings within the Bear Head LNG site were digitized as part of the 2004 work. These files can be found in Appendix K. Although more names were shown on the A.F. Church map in the Point Tupper area, after digitizing the map and adding geo-referenced points, seven dwellings were identified as having once existed in the vicinity of the Project site[4].

No other archaeological sites were identified on the site. Information in the previous environmental assessment is important to this section as major development occurred following the accepted 2004 Bear Head LNG environmental assessment. Also reported on the 2004 Bear Head LNG Environmental Assessment was communication with a representative of Nova Scotia Museum's Archaeological Sites Inventory Database stating that there were no additional archaeological sites identified in the Bear Head LNG site area (JWEL 2004).

[4] These dwellings were identified under the following names: J. Mackie, P Mackie, A McPherson, T. Mitchell, J. Morash, D. O'Brien and G. Wright.

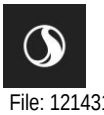


Figure No.
4.27

Title
Bear Head
Archaeological Sites

Client/Project 121431287-024

Bear Head Energy
Regulatory Permitting Support

Project Location Prepared by NWhite on 2022-11-23

Richmond County, NS

N

0 200 400 Metres
(At original document size of 8.5x11)
1:22,000

Legend

- Archaeology Sites[2]
- Project Area
- Watercourse (1:10k)

Project Location

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. SNC Lavalin. 2015. Archeological Impact Assessment (A2003NS55) - Bear Head LNG Updated Registration Document. Bear Head LNGCorporation.
3. Data Sources: Stantec, ACCDC, NS DNR, NS DOE, NSTB, NSODB, Service NS (Government of Nova Scotia)
4. Background: NSODB, Service NS (Government of Nova Scotia)

Stantec

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4.4.6.1 Archaeological Potential – Pre-contact

Pre-contact sites refer to areas of pre-European archaeology, such as Indigenous burial sites (Saskatchewan Archaeological Society, 2015). Three facts lead to the observation that the Bear Head Site is unlikely to be the location of site of pre-contact archaeological importance: few necessary resources for survival, extreme exposure and lack of scholarly reporting of the area. Better resources, including proximity to fresh water, a food supply and transportation is found inland from the site. Also, the Bear Head location is subject to extreme climatic conditions, including winds from the Strait of Canso and Chedabucto Bay. These two facts combined with the lack of published or documented scholarly material make the Bear Head LNG site an unlikely location for pre-contact archaeology (JWEL 2004).

4.4.6.2 Archeological Potential – Historic

As described in the 2004 Bear Head LNG Environmental Assessment and noted in additional research at the Public Archives of Nova Scotia, the oldest information found pertaining to the Bear Head site is on the A.F. Church map from the late 19th century. No earlier historical information was located.

4.4.6.3 Field Survey

An archaeological field survey was undertaken between September 15 and 19, 2004. The survey was performed over the Bear Head Site, and surrounding areas, with focus on the coastline. The potential for Indigenous, or pre- contact archaeology, was considered during planning and throughout the survey. An attempt was made to view all locations within the site that were identified on the A.F. Church map. Using GPS, a search for remnant dwelling features was performed. All features located were photographed and entered on a Maritime Archaeological Resource Inventory Site Survey Form. Information and details from the survey can be found in Appendix K.

As described in the field survey notes of Appendix K, components of the physiography were described, including terrain, plants, and surface rocks. No definitive archaeological sites were found on the beach except for a spoil heap of rocks, possibly from mining activities. Further research did not determine this to be a significant feature. There was no evidence of Aboriginal occupation on the beach (JWEL 2004).

Of the dwellings shown on the A.F. Church map, three could not be located. Using the GPS and including a 50 m buffer capacity, surveyors could not locate any settlement features (cellars) for the A. McPherson, J. Morash, or G. Wright dwellings. All details found pertaining to the other noted dwellings are described in the full report in Appendix K. The observed features included stone foundations, a stone well, and some landscaping. An error on the A.F. Church map location for the T. Mitchell dwelling was assumed. Surveyors found features east of the originally defined area, which are presumed to be part of the Mitchell dwelling. The four foundations that were found during the survey are outside the Project area and were not disturbed by the existing development. The previously performed survey did not suggest a need for further archaeological exploration in the area.