5.0 Environmental Effects Assessment

The following sections provide the assessment of Project-related environmental effects using the standardized framework for each VEC as described in Section 4.0.

5.1 ATMOSPHERIC RESOURCES

Atmospheric Resources includes the assessment of the quality of ambient air and the acoustic environment due to the construction, operation and maintenance, and decommissioning and reclamation of the Donkin Export Coking Coal Project.

Atmospheric Resources has been selected as a VEC due to:

- Sensitivity of human health to air quality;
- Sensitivity of the environment to air contaminants;
- Aesthetics connected to the contamination of the atmosphere by air pollutants and noise;
- Regulatory provisions of the federal *Canadian Environmental Protection Act* and the Air Quality Regulations under the Nova Scotia *Environment Act*;
- Health Canada policy and guidelines for noise impact through annoyance on community health;
- Cape Breton Regional Municipality Noise By-law; and
- National and provincial concerns with greenhouse gas emissions as promulgated in the requisite reporting inventories of emissions.

The releases of Project-related greenhouse gases (GHGs) have also been assessed within the Atmospheric Resources VEC as they are a contributing factor in anthropogenic alteration of climate.

5.1.1 Scope of Assessment

5.1.1.1 Regulatory Setting

The regulatory requirements for assessing environmental effects on Atmospheric Resources are prescribed by both federal and provincial governments and in the Project-specific EIS Guidelines (CEA Agency 2012). The EIS Guidelines state that the EIS must assess the environmental effects related to the construction, operation and maintenance, and decommissioning and reclamation of the Project on Climate and Greenhouse Gas Emissions, Ambient Air Quality and the Acoustic Environment.

For climate and GHG emissions, national guidance is provided by the CEA Agency (CEA Agency 2003) and includes guidance on the environmental assessment of GHG emissions from the Project and from the related industrial sector. In the guidance document it is suggested that, where Project emissions are medium or high, preparation of a GHG Management Plan is required. Further regulation at the federal level is anticipated to occur in the future. The intentions are described in the “Regulatory Framework for Air Emissions” (GOC 2007), and “Turning the Corner: Regulatory Framework for Industrial GHG Emission” (GOC 2008).

Air quality in Nova Scotia is regulated under the NS Air Quality Regulations. Ambient air quality regulations for criteria air contaminants (CAC) are presented in Schedule A of the Regulation as Maximum Permissible Ground Level Concentrations. Federally, the main legislative instruments for managing air quality are the *Canadian Environmental Protection Act (*CEPA*)* and Canada Wide Standards (CWS). Additional guidelines are under development by the Canadian Council of Ministers of the Environment (CCME), and ultimately this body may develop Canada Wide Standards that harmonize the regulations in all jurisdictions. The National Ambient Air Quality (NAAQ) Objectives and Canada Wide Standards are presented in Table 5.1.1. The Nova Scotia Air Quality Regulations are presented in Table 5.1.2.

Table 5.1.1 Federal Ambient Air Quality Objectives

Pollutant and units (alternative units in brackets)	**Averaging Time Period**	**Canada**			
		Canada Wide Standards	**Ambient Air Quality Objectives**		
			Maximum Desirable	**Maximum Acceptable**	**Maximum Tolerable**
Nitrogen Dioxide µg/m^3 (ppb)	1 hour	-	-	400 (213)	1000 (532)
	24 hour	-	-	200 (106)	300 (160)
	Annual	-	60 (32)	100 (53)	-
Sulphur Dioxide µg/m^3 (ppb)	1 hour	-	450 (172)	900 (334)	-
	3 hour				
	24 hour	-	150 (57)	300 (115)	800 (306)
	Annual	-	30 (11)	60 (23)	-
Total Suspended Particulate Matter (TSP) µg/m^3	24 hour	-	-	120	400
	Annual	-	60	70	-
$PM_{2.5}$ µg/m^3	24 hour (Based on the 98th percentile ambient measurement annually, averaged over 3 consecutive years.)	30	-	-	-
PM_{10} µg/m^3	24 hour	-	-	-	-

Table 5.1.1 Federal Ambient Air Quality Objectives

Pollutant and	Averaging Time	Canada			
Carbon monoxide mg/m^3 (ppm)	1 hour	-	15 (13)	35 (31)	-
	8 hour	-	6 (5)	15 (13)	20 (17)
Oxidants – ozone µg/m^3 (ppb)	1 hour	-	100 (51)	160 (82)	300 (153)
	8 hour (Based on 4th highest annual value, averaged over 3 consecutive years.)	65	-	-	-
	24 hour	-	30 (15)	50 (25)	-
	Annual	-	-	30 (15)	-

Table 5.1.2 Nova Scotia Air Quality Regulations, Schedule "A"

Contaminant	Averaging Period	Maximum Permissible Ground Level Concentration µg/m^3	Maximum Permissible Ground Level Concentration pphm
Carbon Monoxide (CO)	1 hour	34 600	3000
	8 hours	12 700	1100
Hydrogen Sulphide (H_2S)	1 hour	42	3
	24 hours	8	0.6
Nitrogen Dioxide ($N0_2$)	1 hour	400	21
	Annual	100	5
Ozone (O_3)	1 hour	160	8.2
Sulphur Dioxide ($S0_2$)	1 hour	900	34
	24 hours	300	11
	Annual	60	2
Total Suspended	24 hours	120	-
Particulate (TSP)	Annual	70*	-

* - geometric mean
µg/m^3 - micrograms per cubic metre
pphm - parts per hundred million

For sound emissions, Health Canada has published *Health Canada's Suggested Information Needs for Consideration of Human Health in Environmental Assessments* (Health Canada 2009), which is now incorporated into *Useful Information for Environmental Assessments* (Health Canada 2010). These documents provide objectives for noise levels based on day-night average sound levels and percent annoyance. The concept of annoyance is based on work by the US EPA investigating community responses to perceived noise issues. Health Canada policy is that annoyance is a community health impact, therefore within their mandate. Although Health Canada do not publish regulations with respect to noise, and do not have noise guidelines, their publications provide guidance on the assessment methods for noise impact, with emphasis on the annoyance methods from the US EPA (1974). Annoyance is calculated from the daytime and weighted nighttime sound levels by a response function to give percent highly annoyed, or percent HA. In short, the 15 daytime hours and 9 nighttime hours, exactly from 07:00 to 22:00 and 22:00 to 07:00 respectively, are energy averaged, with a bias of +10 dB applied to the nighttime before averaging. This bias reflects the greater sensitivity or responsiveness of the community to noise impacts during this part of the day.

The methods for computing percent HA are to be found in Canadian Standards Association *in ISO 1996-1:2003, Acoustics – Description, measurement and assessment of environmental noise* For the operations phase of the Project, the percent HA should also be calculated using the same procedure for the baseline and project conditions. If, after mitigation has been applied, the percent HA increases by 6.5 percent or more, the potential environmental effect may again be substantial.

A summary of Health Canada's (2010) guidance to noise assessments is provided in Table 5.1.3.

Table 5.1.3 Summary of Health Canada's Guidance to Assessing Noise

Phase	Criterion	Limit	Rationale
Temporary Construction (<2 months)	Community consultation is advised	-	-
Short Term Construction (<1 year)	Mitigation is advised if levels are predicted to result in widespread complaints	-	Mitigation required if resulting levels are predicted to result in widespread complaints or strong community reaction
Construction (>1 year or operation with noise levels between 45-75 dB)	%HA	Change in %HA between project and baseline <6.5%	Annoyance is deemed to be a community health impact and mitigation is required if the %HA between baseline and project exceeds 6.5%
Construction (>1 year) or operation with noise levels 45-75 dB)	Noise Levels	75 dBA	>75 dB mitigation required

In addition to these limits, Health Canada also advises proponents to adhere to a number of other guidelines that include World Health Organization guidelines (WHO 1999) dealing with sleep disturbances and community noise. WHO has established a guideline of 30 dBA inside a dwelling to avoid sleep disturbance.

The province of Nova Scotia has published a noise guideline, "Guideline for Environmental Noise Measurement and Assessment" (NSE 1989). This guideline includes noise criteria for different periods of the day (day, evening and night) and includes a measurement duration of a minimum of two continuous hours of data in one time period to be representative. The Nova Scotia noise guidelines are presented in Table 5.1.4. Although not explicity stated, these values are interpreted to represent hourly averages measured at the property boundary of sensitive receptors (*e.g.*, residential properties).

Table 5.1.4 NSE Noise Guidelines

Averaging Time Period	NSE Noise Guideline (dBA)
Day (7:00 to 19:00)	65
Evening (19:00 to 23:00)	60
Night (23:00 to 7:00)	55

Locally, the Cape Breton Regional Municipality has developed a noise by-law that states no person shall engage in any activity that unreasonably disturbs or intends to disturb the peace, comfort and tranquility of a resident of the municipality. Various activities and prohibited times have been identified in Appendix A of the by-law and deemed to disturb the peace, comfort and tranquility of a resident (CBRM 2001); the bylaw addresses the operation of construction equipment, which is prohibited between the hours of 12:00 am and 6:00 am.

5.1.1.2 Influence of Consultation and Engagement on the Assessment

Engagement of the regulatory agencies, community members, stakeholder groups, and the general public has resulted in a number of issues and concerns identified with regards to Atmospheric Environment. The main issues raised during consultation were potential pollution related to the coal dust and the noise generated during trucking operations. These have been taken into consideration in the assessment of this VEC.

5.1.1.3 Selection of Environmental Effects and Measurable Parameters

The Atmospheric Resources is a component of the environment that comprises the layer of air near the earth's surface to a height of approximately 10 km. It is divided into three key aspects for consideration in the EIS, reflecting key Project-Atmospheric interactions:

- Change in Climate and GHG Emissions;
- Change in Ambient Air Quality; and
- Change in Acoustic Environment.

The measurable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 5.1.5.

Table 5.1.5 Measurable Parameters for Atmospheric Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Air Quality	• Emissions and ambient concentrations of criteria air contaminants (CAC) and non-criteria air contaminants (Non-CAC)	Regulatory objectives, guidelines and/or standards exist provincially and federally for SO_2, NO_x, PM, PM_{10}, $PM_{2.5}$, O_3 and others including specific valued environmental component (VOC), metals and other toxics (*e.g.*, benzene)

Table 5.1.5 Measurable Parameters for Atmospheric Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Acoustic Environment	• Changes in ambient sound levels as measured in A-weighted sound pressure levels in decibels and percent annoyance	Health Canada has published Guidance on Noise Assessment for projects requiring assessment under CEAA. This includes consideration of daytime and nighttime noise exposure of sensitive receptors and percent annoyance. Nova Scotia also has noise guidelines that are applied in this assessment.
Change in GHG Emissions	• Greenhouse gas emissions (*e.g.*, CO_2, CH_4, N_2O and SF6, PFCs and HFCs) in units of CO_2 equivalents	Incorporating climate change considerations in environmental assessment is guided by the CEA Agency (CEA Agency 2003). GHG emissions from the Project are put in industry context.

5.1.1.4 Temporal and Spatial Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Atmospheric Resources include the periods of construction, operation and maintenance, and reclamation and decommissioning.

The spatial boundaries for the environmental effects assessment of the Atmospheric Resources are defined below.

Project Development Area (PDA): The PDA includes the area of physical disturbance (*i.e.*, "footprint" for the Project including infrastructure for the mine site as well as stockpiles, coal waste piles, conveyor system, 138 kV transmission line, and trucking routes. The PDA also includes the barge load-out facility and transshipment mooring and vessel route between the two.

Local Assessment Area (LAA): For the Atmospheric Resources the LAA has been divided into two separate areas due to the size of the area covered by Project activities. One LAA covers the land and shore based activities (underground mine site, CHPP site including ancillary infrastructure and stockpiles, coal and mineral rock waste disposal sites, conveyor system, 138 kV transmission line and the barge load-out facility) and the other offshore activities (transshipment location). The LAA for land and shore based activities is therefore defined as an area that is 2.5 km (east-west) by 2.5 km (north south) extending from the center of the land based activities. The LAA for offshore based activities is defined as an area extending 2.5 km by 2.5 km from the location of the transshipment area. The LAAs are analogous to the local modelling domains used for dust and acoustic modelling.

Regional Assessment Area (RAA): The RAA is the area within which cumulative environmental effects for the Atmospheric Resources may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects. There are no other significant sources within the immediate area for either air or sound emissions; however the RAA includes the Point Aconi and Lingan power plants given potential overlapping air contaminants.

For a Change in GHG Emissions, since the environmental effect of GHG on the environment is a global concern, the spatial boundary is provincial, national and ultimately global in geographic extent.

5.1.1.5 Residual Environmental Effects Description Criteria

Terms that will be used to characterize residual environmental effects for Atmospheric Resources are presented in Table 5.1.6.

Table 5.1.6 Characterization Criteria for Residual Air Quality Effects

Criterion	Ranking/Description
Direction	**Adverse:** condition of the atmospheric resources is worsening in comparison to baseline conditions and trends. **Positive:** condition of the atmospheric resources is improving in comparison to baseline conditions and trends. **Neutral:** no change in the condition of the atmospheric resources compared to baseline conditions and trends.
Magnitude	**Negligible:** no measurable adverse effect anticipated. **Low:** effect occurs that is detectable but is within normal variability of baseline conditions. **Moderate:** effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives. **High:** effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries.
Geographical Extent	**Site-specific:** effect restricted to the Project footprint within the local assessment area (LAA). **Local:** effect restricted to the LAA. Global: Provincial, National or Global scale (GHG Emissions only)
Frequency	**Once:** effect occurs once. **Sporadic:** effect occurs at sporadic intervals. **Rarely:** effect occurs on a regular basis and at regular intervals. **Frequently:** effect occurs continuously throughout the Project life.
Duration	**Short-term:** effect occurs for less than three years. **Medium-term:** effect occurs for between 3 and 20 years. **Long-term:** effect persists beyond 20 years.
Reversibility	**Reversible:** effect ceases when Project operations cease. **Irreversible:** effect continues after Project operations cease.
Ecological Context	**Undisturbed:** effect takes place within an area that is relatively or not adversely affected by human activity. **Disturbed:** effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present.

5.1.1.6 Threshold for Determining the Significance of Residual Environmental Effects

The significance criteria for environmental effects on Atmospheric Resources are described below.

For a Change in Ambient Air Quality a **significant adverse residual environmental effect** is defined as a Project-related environmental effect that degrades the quality of the ambient air such that the maximum Project-related ground-level concentration being assessed repeatedly exceeds the respective air quality objective, guideline or standard.

For a Change in the Acoustic Environment a **significant adverse residual environmental effect** is defined as a Project-related environmental effect that results in sound pressure levels at the nearest residential receptors or sensitive receptors (*i.e.,* daycares, schools, hospitals, places of worship) that cause a change in calculated percent HA from baseline greater than 6.5 percent.

For a Change in Greenhouse Gases, following the CEA Agency guidance, "the environmental assessment process cannot consider the bulk of GHG emitted from already existing developments. Furthermore, unlike most project-related environmental effects, the contribution of an individual project to climate change cannot be measured" (CEA Agency 2003). It is, therefore, recognized that it is not possible to assess significance related to a measured environmental effect on climate change on a project-specific basis. At the same time, it is recognized that a scientific consensus is emerging in respect of global emissions of GHG and consequent changes to global climate as generally representing a significant cumulative environmental effect. Project emissions of GHG will contribute to these significant cumulative environmental effects, but the contribution, although measurable and potentially important in comparison to local and provincial levels, will be small in a global context. Policies and regulations are being developed by the Government of Canada for regulating GHG emissions for specific sources or industry sectors.

Thus, instead of setting a specific residual environmental effects significance criterion for environmental effects on climate change and determining whether and how it can be met, a Change in GHG Emissions is considered by: conducting a preliminary scoping of GHG emissions; determining jurisdictional considerations (including GHG policies or plans); determining the industry profile (where possible); and by considering the magnitude, intensity and duration of Project emissions as directed by the CEA Agency guidance (CEA Agency 2003). The Project-related GHG emissions are compared to similar projects, and to provincial, national, and global GHG emissions. Three categories are described in the CEA Agency guidance: low, medium and high. In this EIS these are attributed to numerical values (on a tonnes CO_{2eq} per annum basis) of less than 10^5, greater than 10^5 and less than 10^6, and greater than 10^6, for low, medium and high categories, respectively. Where the GHG emissions are considered to be either medium or high, a GHG Management Plan must be prepared.

5.1.2 Existing Conditions

The majority of the Project activities are to be located on and surrounding the existing Donkin Mine site on the Donkin Peninsula, Cape Breton, Nova Scotia. The nearest residential receptors to the existing mine site are located approximately 1.5 km away, along Long Beach Road. The town of the Donkin is located approximately 2.5 km west of these residents.

The PDA also includes the transshipment loading location and the transmission line corridor. The transshipment mooring will be located southwest of Cape Morien approximately 8.8 km from the barge load-out facility. The land located to the west of the proposed transshipment location is largely unpopulated; however there are a few cottages/residents located near South Port Morien.

The proposed transmission line will extend from Victoria Junction to the Project site and will pass in close proximity to a number of small towns.

Descriptions of the existing ambient air quality, acoustic environment and greenhouse gases in and around the PDA are provided below. A description of the existing climate within the PDA has been provided in Section 8 (Effects of the Environment on the Project).

Ambient Air Quality

Overall air quality in the vicinity of the Project is generally good due to its remote location. To further describe the existing air quality within and surrounding the PDA, data that has been collected through various monitoring and reporting programs, locally, regionally and nationally has been presented and described in this section.

Existing major sources of air emissions in the region include that of the Lingan Generating Station (located approximately 20 km from the PDA) and the Point Aconi Generating Station (located approximately 40 km from the PDA). The annual emissions emitted from each of these plants, as reported through Environment Canada's National Pollutant Release Inventory (NPRI) database, are provided in below in Table 5.1.7.

Table 5.1.7 2010 Annual Reported Emissions – Lingan and Point Aconi Thermal Generating Stations

Facility	Criteria Air Contaminants (tonnes/yr)					
	Sulphur Dioxide (SO_2)	Carbon Monoxide (CO)	Nitrogen Oxides (NO_x)	Total Particulate Matter (TSP)	Particulate Matter < 10 Microns (PM_{10})	Particulate Matter < 2.5 Microns ($PM_{2.5}$)
Lingan	33,479	379	5,219	663	418	124
Point Aconi	3,365	81	1,747	77	37	13

Environment Canada 2011a

A number of ambient air monitoring stations operate across Canada under the National Air Pollution Surveillance (NAPS) Network. There is one monitoring site operated by Nova Scotia Environment located in Sydney, NS at 71 Welton Street, approximately 27 km from the PDA. This station samples sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3) and particulate matter (PM). A summary of the data collected at this site in 2005 and 2006, which represents the latest data that has been published, is provided in Table 5.1.8.

Table 5.1.8 NAPS Data Summary for Sydney, NS – 2005 and 2006

Year	SO_2 (ppb)	CO (ppb)	NO_2 (ppb)	O_3 (ppb)	PM2.5[1] (µg/m^3)
2005	3.0	0.2	-	24	5.3
2006	1.4	0.3	1.8	27	6.0

[1] Tapered Element Oscillating Microbalance (TEOM) – 1 hour periods

NAPS 2008

The existing ambient air quality within the PDA was assessed on a local scale during the preparation of the Environmental Assessment for the Donkin Underground Exploration Project (CBCL 2008). The assessment involved conducting a baseline field study to measure the existing levels of particulate matter (PM_{10} and $PM_{2.5}$) at two locations on the existing mine site. The locations of these sites are presented in Figure 2 in Appendix H. Hourly averages were collected over a 24-hour period on August 17 and 18, 2008. Monitoring details can also be found in the exploration phase EA (CBCL 2008). Meteorological data was also collected during the field study at monitoring Site 2. The results of the 24-hour ambient air monitoring event along with the meteorological data collected during the monitoring event are presented in Table 5.1.9.

Table 5.1.9 One Hour Baseline Air Monitoring Results, August 17 and 18, 2008

Time[1] (hour)	Site 1		Site 2		Temp (°C)	Humidity (%)	Wind Speed (m/s)	Wind Direction
	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)				
8:45		30.1	35.6	32.6	18.2	89	4.5	S
9:45		28.9	40.8	36.0	17.9	90	4.3	S
10:45		20.6	43.8	35.2	17.9	90	4.8	SSW
11:45		18.1	36.6	30.6	18.4	88	4.4	SSW
12:45		16.4	31.7	28.0	18.6	86	4.3	SW
13:45		15.9	25.2 (26.0)[2]	26.7 (26.0)[5]	17.9	87	3.5	SW
14:45		15.0	15.4(18.4)[2]	20.5 (17.5)[5]	17.4	83	4.1	WSW
15:45	8.3		8.4	11.3	16.5	80	3.3	WSW
16:45	5.8		6.4	9.1	15.5	81	3.1	SW
17:45	3.7		5.0	7.1	14.7	82	3.0	SW

Table 5.1.9 One Hour Baseline Air Monitoring Results, August 17 and 18, 2008

Time[1] (hour)	Site 1		Site 2		Temp (°C)	Humidity (%)	Wind Speed (m/s)	Wind Direction
	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)				
18:45	2.4		7.0	6.5	13.8	86	2.6	S
19:45	1.4		10.0	8.4	14.8	83	2.5	S
20:45	3.1		3.3	5.2	16.9	77	2.7	SW
21:45		4.5	3.5 (1.4)[3]	2.5	18.6	70	3.2	WSW
22:45		4.3	8.9 (2.9)[3]	1.2	19.8	64	204	WSW
23:45		5.9	4.6	2.7	21.2	61	2.8	SW
0:45		6.4	3.7	3.8	20.8	67	3.2	E
1:45		8.1 (4.1)[7]	5.3 (6.1)[4]	5.5	22.4	61	2.6	NW
2:45		8.7 (4.7)[7]	2.2 (6.7)[4]	5.8	22.6	58	2.9	NW
3:45	4.7		5.7 (7.5)[4]	6.4	22.7	58	2.8	N
4:45	4.9		10.1	8.0	22.9	57	1.7	NE
5:45	8.8		15.8	12.6	21.4	66	4.2	SSE
6:45	12.2		23.3	16.7	19.0	79	4.3	SSE
7:45	33.9 (29.4)[6]		36.5	30.5	17.2	86	4.5	S
Max	33.9	30.1	43.8	36.0	22.9	90	4.8	
Min	1.4	4.3	2.2	1.2	13.8	57	1.7	

[1] The time shown represents the end of the sampling period
[2] Instrument reading during zero check was -5 µg/m^3
[3] Instrument reading during zero check was 9 µg/m^3
[4] Instrument reading during zero check was -7 µg/m^3
[5] Instrument reading during zero check was 5 µg/m^3
[6] Instrument reading during zero check was 6 µg/m^3
[7] Instrument reading during zero check was 4 µg/m^3

CBCL 2008

These data were obtained in a disturbed area during a singular weather day that may not reflect the normal conditions. The NAPS data from Sydney are more representative of the regional air quality, showing background concentrations of criteria air contaminants that are well below the regulated objectives.

Acoustic Environment

In rural areas such as that which constitutes the majority of the PDA, the acoustic environment is likely dominated by:

- the sound of wind in the trees and vegetation;
- the sound of running water in the vicinity of streams or rivers; and
- animal sounds and bird calls.

The proposed transmission line passes close enough to some towns to be influenced by a range of sounds such as:

- traffic, the main component of the “hum” in urban areas;
- sounds of construction;
- workplace sounds such as service stations or workshops; and
- recreational sounds from sports fields and similar activities.

Directive 38 in Alberta (ERCB 2007) that is accepted by British Columbia and verified by Stantec in a number of locations in Nova Scotia, provides for “default” values of baseline sound levels of 35 dBA at night, and 45 during the day. The daytime increase is due to the increase in wind sounds, animal sounds, and the remote sounds of human activity. In areas where there is a significant housing density, or adjacent to a well-travelled road, the levels tend to be increased by 5 dB or more (ERCB 2007). Professional experience confirms this range, although rare, extremely quiet, still nights, may reach minimum levels under 30 dBA and spring peepers can cause local sound levels of over 60 dBA at night.

In the vicinity of human settlements, sound levels are likely to be of the order of 40 dBA at night and 50 dBA during the day, although the proximity of arterial road traffic and industrial activity can increase levels by 5 dBA in suburban areas. Residential density is lower along the road to Donkin than would be expected in a suburban area, but the road is the main artery serving houses located along the coast.

In general terms, the level of background sound likely increases at the towns from the northern terminus toward the southern terminus due to the increase in populations of these centres, but sound is localized, and the majority of the PDA is located on the Donkin Peninsula which is for the most part considered rural.

In 2008, as a component to the exploration phase EA, baseline noise monitoring was carried out at two locations on the existing mine site. These locations are presented in Figure 2 in Appendix H. The data was collected over a 24-hour period on June 2 and 3, 2008. Monitoring details can also be found in the exploration phase EA (CBCL 2008).

In support of the current EA baseline noise monitoring was conducted by Stantec at one location, representing the nearest residential receptor to the Project. This site is also presented in Figure 2 in Appendix H. This 2011 noise monitoring event was conducted for a 24-hour period from December 15, 2011 to December 16, 2011. All measurements were taken using a Type 1 sound pressure level meter, Larsen and Davis Model 824.

The results of the 2008 and 2011 baseline noise monitoring events are presented in Table 5.1.10.

Table 5.1.10 Baseline Noise Monitoring Results (dBA) – 2008 & 2011

Time of Day	2008 Site 1[1]	2008 Site 2[1]	2011 Site
1:00	51	46	41
2:00	51	46	41
3:00	51	45	42
4:00	52	46	43
5:00	49	49	44
6:00	48	51	47
7:00	49	47	49
8:00	47	48	48
9:00	45	46	47
10:00	43	47	49
11:00	44	48	49
12:00	44	50	53
13:00	51	53	41
14:00	58	52	53
15:00	61	55	52
16:00	46	56	46
17:00	45	53	45
18:00	46	53	46
19:00	50	51	45
20:00	56	53	44
21:00	54	56	44
22:00	50	55	43
23:00	56	47	42
24:00	52	45	41

[1]CBCL 2008

All receptors are located along the road, and none, include the monitoring site, have significant local noise sources, therefore the site monitored in 2011 was selected to be representative of the baseline sound levels for receptors along the road; that is, for all receptors in the PDA. Data for 2008 is included in the table for completeness.

The daytime and nighttime average sound levels, expressed as L_{eq}, are presented in Table 5.1.11. As Health Canada's approach to assessing noise effects is to consider the change in percent highly annoyed (percent HA) (Health Canada 2010), the day night average sound level (L_{dn}) and percent HA for background conditions were calculated using these data at this nearest residential location. The data are presented in Table 5.1.11.

Table 5.1.11 Ldn and Percent HA for Baseline Noise at the Nearest Residential Receptor

Site	Stantec 2011
L_{eq} daytime (07:00-22:00)	48 dBA
L_{eq} nighttime (22:00-07:00)	43 dBA
L_{dn}	51 dBA
% HA	2.43 %

Definitions for the sound level terminology presented above have been provided in Appendix H.

Greenhouse Gas Emissions

In March 2004, the Government of Canada, under Environment Canada, implemented the Greenhouse Gas Emissions Reporting Program (GHGRP), which involved the mandatory reporting for any facilities in Canada emitting more than 100 kt of CO_{2eq}. In the 2009 reporting year this reporting threshold was lowered to 50 kt of CO_{2eq}.

The total reported GHG emissions from the province of Nova Scotia in 2009, under the GHGRP, equalled 10,772,602 tonnes of CO_{2eq} (Environment Canada 2010a). These emissions were based on a total of 12 facilities reporting.

The national total for the 2009 reporting year, under the GHGRP, was 250,453,979 tonnes of CO_{2eq}. These emissions were based on a total of 522 facilities reporting and represent only those facilities emitting an excess of 50 kt of CO_{2eq}.

In addition to the GHGRP under Environment Canada, Canada is responsible for submitting an annual GHG inventory report under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The 2009 National Inventory report contains GHG emission data from 1990 to 2009. In the 2009 National Inventory Report (Environment Canada 2011b) Canada's total greenhouse gas emissions were estimated to be 692 Mt CO_{2eq}. Of these estimated emissions, the energy sector produced the majority of the emissions at 566 Mt of CO_{2eq} (82 percent of the total estimated amount). Of these emissions approximately 73 percent resulted from the combustion of fossil fuels. Within this inventory report the Energy Sector represents stationary combustion sources (electricity production, fossil fuel production, mining, oil and gas extraction, *etc.*), transportation (road, railways, navigation, *etc.*) and fugitive sources (coal mining). Table 5.1.12 below provides a summary of the total estimated national GHG emissions over the period of 1990 to 2009 from all sources and from the Energy Sector.

Table 5.1.12 Summary of Canada's Estimated GHG Emissions 1990 – 2009 (Mt CO_{2eq})

GHG Emission Categories	1990	1995	2000	2005	2008	2009
Total	590	640	716	731	732	690
Energy	468	508	586	595	597	566

Table 5.1.12 Summary of Canada's Estimated GHG Emissions 1990 – 2009 (Mt CO_{2eq})

GHG Emission Categories	1990	1995	2000	2005	2008	2009
Stationary Combustion	279	292	343	339	339	315
Transport	146	160	180	193	196	190
Coal Mining	2	3	0.9	0.7	0.8	0.7
Fugitive Sources[1] (including coal mining)	42.1	55.6	63.0	63.1	62.3	60.7

[1]Sources include coal mining, oil, natural gas, venting and flaring
Environment Canada 2011b

In 2004 global GHG emissions were estimated to be 49,000 Mt of CO_{2eq} (Barker *et al.* 2007). Canadian total GHG emissions, at 690 Mt CO_{2eq}, were thus 1.4 percent of the global total in 2004.

5.1.3 Potential Project-VEC Interactions

In Table 5.1.13 below, each Project activity and physical work for the Project is listed, and each interaction ranked as 0, 1, or 2 based on the level of interaction each activity or physical work will have with the Atmospheric Resources.

Table 5.1.13 Potential Project Environmental Effects to Atmospheric Environment

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Air Quality	Change in Acoustic Environment	Change in GHG Emissions
Construction			
Site Preparation (incl. clearing, grading and excavation)	2	2	2
Construction of Mine Site Infrastructure and Underground Preparation	2	2	2
Construction of 138 kV Transmission Line	1	1	1
Construction of Barge Load-out Facility (incl. dredging, infilling and habitat compensation)	2	2	2
Installation of Transshipment Mooring	1	1	1
Operation and Maintenance			
Underground Mining	2	0	2
Coal Handling and Preparation (incl. coal washing and conveyance)	2	2	2
Water Treatment (incl. mine water and surface runoff)	0	0	0

Table 5.1.13 Potential Project Environmental Effects to Atmospheric Environment

Project Activities and Physical Works	Potential Environmental Effects		
	Change in Air Quality	Change in Acoustic Environment	Change in GHG Emissions
Coal and Waste Rock Disposal	2	2	2
Marine Loading and Transportation	2	2	2
Coal Trucking	2	2	2
Decommissioning and Reclamation			
Site Decommissioning	1	1	1
Site Reclamation	1	1	1

0 = No interaction
1 = Interaction occurs; however, based on past experience and professional judgment, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

The Project interactions on each environmental effect are ranked as 0, 1 and 2 for a Change in Air Quality, a Change in Acoustic Environment, and a Change in GHG emissions, based on anticipated quantities of emissions, project experience, and professional judgement of the Study Team.

- Rank 0 is applied where the Project Activities will result in zero or minor emissions of air contaminants, GHG or sound. These are discussed briefly but screened out of further analysis.
- Rank 1 is applied where activities have measurable emissions but there is no potential for interaction that would result in a significant effect. The rationale for this is discussed and they are not carried forward to detailed analysis.
- Rank 2 is reserved for activities that are anticipated to have substantial emissions that have the potential to cause significant environmental effects or which require some more in depth analysis and discussion. The interactions ranked as 2 are assessed in detail in the subsequent section for the environmental effects assessment.

During the operation of the Project, the activity of water treatment is anticipated to generate nominal air contaminants, GHGs, or sound emissions. Since the emissions are anticipated to be zero or nominal, the environmental effect of this activity on a Change in Air Quality, Change in GHG Emissions and a Change in the Acoustic Environment is not expected to be substantive and is thus ranked as 0.

During the operation of the Project, underground mining is not anticipated to generate a Change in the Acoustic Environment that would result in predicted sound pressure levels at the nearest residential receptor to result in a change in percentage HA greater than 6.5 percent. Sounds from underground mining activity will occur at depths generally greater than 205 m below sea level and will be attenuated by the ground (including for marine receptors). Sounds emitted underground will be attenuated by the ground. Therefore the environmental effect of this activity is not expected to be substantive and is thus ranked as 0.

The construction of a 138 kV transmission line between the Project site and Victoria Junction during the construction phase of the Project will be installed where practical along the existing rights-of-way, including along power transmission corridors currently used by NSPI for transmission and distribution lines, between Victoria Junction and Glace Bay. Where there is an existing but abandoned transmission right-of-way from Glace Bay to the Project site, the right-of-way will require clearing. The construction of the transmission line will also involve pole installation and the stringing of the wires. As these activities will involve the temporary combustion of fuel to power equipment (*i.e.,* trucks, earth moving equipment, *etc.*) they will result in emissions of air contaminants, GHGs and sound. These emissions are likely measurable, however given the fact that the majority of the transmission line right-of-way has already been cleared and with the planned mitigation, these quantities of emissions are expected to be low and of short duration. The interaction of the construction of the transmission line with a Change in Air Quality, Change in GHG Emissions and a Change in the Acoustic Environment are therefore ranked as 1.

The installation of the transshipment mooring facility during the construction of the proposed Project will involve the positioning of a single buoy at the transshipment location via four anchors. The installation itself will require the use of a number of vessels, and therefore an interaction with ambient air quality, GHG emissions and the acoustic environment will result. These emissions are likely measurable, however the installation will be short in duration, well buffered by distance, and these emissions are expected to be low. Therefore the interaction of the installation of the transshipment mooring with a Change in Air Quality, Change in GHG Emissions and a Change in the Acoustic Environment is ranked as 1.

The decommissioning and reclamation of the Project will involve the removal of surface structures and buildings, the removal of topsides of the wharf and the transshipment mooring, flooding of the mine tunnels, contouring and re-vegetation of the site and ongoing water treatment. As these activities will involve the combustion of fuel to power equipment (*i.e.*, trucks, vessels) emissions of air contaminants, GHGs and sound are likely. However these emissions will be nominal and temporary and will not likely result in an exceedance of ambient air quality standards or GHG emissions that are considered important on the regional or provincial scale or a change in percentage HA that would exceed 6.5 percent. The potential interaction of this activity on a Change in Air Quality, Change in GHG Emissions and a Change in the Acoustic Environment is therefore ranked as 1.

Thus, in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects of all Project activities and physical works that were ranked as 0 or 1 in Table 5.1.13, on the Atmospheric Resources during any phase of the Project are rated not significant, and are not considered further in the assessment.

5.1.4 Assessment of Project-Related Environmental Effects

In this section, the Changes in Air Quality, GHG Emissions, and Acoustic Environment are assessed on the basis of baseline data (Section 5.2.2), emissions inventories (Appendix H), and modelling predictions (Appendix H). Based on the discussion of Project interactions with the environment presented in Section 5.1.3 above, only the interactions ranked as 2 are considered further in the assessment of Project related environmental effects. All other interactions previously ranked as 0 or 1 were rated as not significant

5.1.4.1 Assessment of Change in Air Quality

5.1.4.1.1 Potential Environmental Effects

During the construction of the Project emissions of air contaminants may result from site preparation activities and the construction of mine site infrastructure and the barge load-out facility. These emissions include those of particulate and combustion gases from the combustion of fuel in construction equipment, and dust emissions from the operation of heavy earth-moving equipment. The only areas requiring significant site surface preparation are the site of the CHPP and planned stockpiles. The emissions related to these activities will be localized and temporary, lasting the duration of the construction activities.

During the operation of the Project, emissions of air contaminants (CO, NO_x, SO_2, TPM, PM_{10}, $PM_{2.5}$) may result from the combustion of diesel fuel in mining equipment and marine transportation vessels and from the handling of coal and reject material. Emissions from mining equipment will be limited to the Project site, and will occur throughout the lifetime of the Project. As the marine transportation vessels travel from the barge load-out facility to the transshipment site, emissions will be spread both spatially and temporally between these two locations. It is expected that marine transportation and associated emissions will occur throughout the lifetime of the Project. Mined coal will be carried from the underground mine to the raw coal handling system, where it will be stockpiled, crushed to appropriate size and reclaimed before it is conveyed to the CHPP. From the CHPP, product coal will be conveyed to a product stockpile, where it will be stored prior to being conveyed to the barge-loading facility for transport. Reject material from the CHPP will be conveyed to the reject stockpile, and later hauled to long term disposal sites. Particulate emissions (TPM, PM_{10}, $PM_{2.5}$) will therefore result from the handling of raw and product coal and reject material on site, the transferring of product coal to the barge and to the larger vessels at the transshipment mooring.

The predominant method of off-site coal transportation will be via the proposed marine terminal. Under exceptional circumstances, coal may be transported off-site by hauling trucks, resulting in air contaminant emissions from diesel fuel combustion and particulate emissions from the coal.

There is potential for stored coal to spontaneously combust including air emissions (refer to Section 2.5.2.2). This risk is considered low due to moisture content of the coal, coal washing and stockpile design. Temperature monitoring of stockpiles will be undertaken if necessary to reduce risk.

Each of the above noted activities will result in emissions of CACs. These emissions may result in an effect on the air quality that may exceed the identified assessment criteria for a Change in the Air Quality without implementation of specified mitigation and have therefore been ranked as 2 in Table 5.1.13 and require further assessment.

5.1.4.1.2 Mitigation of Project Environmental Effects

Several measures for mitigating air contaminant emissions during the construction and operation and maintenance of the Project are planned. Xstrata has a long, successful operating history in mining and has developed air quality management initiatives specifically with respect to the Donkin Export Coking Coal Project.

For construction, these measures include, but are not limited to:

- Use of dust suppressants (*e.g.*, water) during situations that have an increase potential to generate airborne dust;
- Adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance;
- Implementation of a particulate monitoring plan and fugitive dust suppression program; and
- Where possible, implement plans to minimize haul routes to and at the site.

For operation and maintenance, mitigation measures include, but are not limited to:

- Adherence to a comprehensive equipment maintenance program to maintain equipment, and to maximize efficiency and reliability;
- Use of enclosed conveyors, for raw and product coal and reject material;
- Use of enclosed conveyor transfer points;
- Use of misting sprays at the outlet of the raw and product coal conveyors;

- Use of a “Rain Bird”-type dust suppression system at the open coal stockpiles to minimize airborne dust emissions;
- Use of dust hoods on the radial stackers;
- Use of a dust collection system at the transfer point from the overland conveyor to the barge stacker;
- Implementation of a particulate monitoring plan and fugitive dust suppression program;
- Stabilization of the coal and reject stockpiles by vegetation to reduce airborne dust as required;
- Use of real-time particulate monitoring equipment for rapid response to investigate potential problems and control mitigation measures;
- Stockpile design and temperature monitoring (if required) to reduce risk of spontaneous combustion of stored coal;
- During unusual circumstances which involve trucking coal off-site, mitigation will include covered hauling trucks and speed restrictions to minimize particulate emissions;
- The frequency of hauling trucks will be managed so that air contaminant emissions do not exceed federal or provincial standards at any residence along the trucking route;
- Use of barges with movable covers or higher coamings around the cargo hoppers to control dust and protect the coal cargo;
- Careful ship loading by transshipment crane through lowering the bucket far enough into the ships hold to reduce cargo loss;
- Schedule additional loading time to allow operators to perform careful coal loading;
- Good maintenance practices to prevent leakage of coal from transfer infrastructure; and
- Implementation of good management practices and sound operator training to reduce operator error and promote careful cargo loading.

These mitigation measures will be implemented wherever technically and economically feasible to minimize potential environmental effects of construction and operation and maintenance of the project on a Change in Air Quality.

5.1.4.1.3 Characterization of Residual Project Environmental Effects

To assess the residual project environmental effects on a Change in Air Quality during Project operation detailed emission inventories of Project-related CAC emissions were prepared. Dispersion modelling was conducted to estimate fugitive dust emissions from Project operations. Details pertaining to the methodologies used to conduct the emissions inventories and dust modelling and the results obtained are provided in Appendix H.

Although the coal contains trace quantities of other contaminants, it is the particulate matter concentrations that have the greatest potential to be a nuisance and to reach the air quality standards without mitigation. Dispersion modelling therefore focuses on the emission of particulate matter. An inventory has been prepared of the criteria air contaminants (CACs) (see below).

The emission of greenhouse gases is addressed because of the growing importance of the issue of climate change and the greenhouse gases associated with it. At a local and regional level, greenhouse gases are not an issue, but must be considered carefully in the global cumulative context.

Construction

An emissions inventory for the construction phase of the Project was not prepared as details pertaining to the type, quantity and amount of fuel consumed and various pieces of construction equipment that would be in use was not available. However, emissions of CACs during construction including site preparation and the construction of mine infrastructure, the underground mine and the barge load-out facility will be temporary and are expected to be well within the regulatory objectives, standards and guidelines and similar to other large industrial projects in Nova Scotia.

Operation and Maintenance

The major sources of emissions of CACs from the operation of an underground coal mine and associated land and marine based activities include:

- Combustion sources (including mining equipment, heavy haul trucks, dozers, graders, tug boats and ocean going vessels) releasing combustion gases (CO, SO_2 and NO_2) and particulate matter (TPM, PM_{10} and $PM_{2.5}$); and
- Fugitive releases of particulate matter (TPM, PM_{10} and $PM_{2.5}$) from coal handling and preparation activities and coal and rock waste disposal.

A summary of the releases of combustion gases and particulate matter from the operation of mobile mining combustion equipment, fugitive emissions coal handling and from raw, product and reject stockpiles, and marine transportation is provided in Table 5.1.14. Details pertaining to the estimated equipment and emission factors used to develop this inventory are provided in Appendix H.

Table 5.1.14 Estimated CAC Emissions from Project Operation

Sources	NO_X (t/y)	SO_2 (t/y)	CO (t/y)	TPM (t/y)	PM_{10} (t/y)	$PM_{2.5}$ (t/y)
Mining Equipment	135.33	0.124	44.2	8.61	8.61	8.61
Fugitive Emissions – Coal Handling	N/A	N/A	N/A	127	96.1	2.58
Fugitive Emissions – Wind Erosion Stockpiles	N/A	N/A	N/A	30.6	30.1	4.51
Marine Transportation/Loading	127.4	0.0446	27.4	9,094	4.07	4.07
Total	**262.73**	**0.1686**	**71.6**	**9,133**	**138.9**	**19.8**
*All table values are approximate and subject to refinement						

As represented above, fugitive releases of particulate matter occur from the erosion of stockpiles, from coal handling and preparation activities, and from coal and waste rock disposal. Table 5.1.15 provides a summary of all the potential sources of fugitive particulate emissions resulting from coal handling and the planned mitigation measures that will be implemented to reduce the emissions.

Table 5.1.15 Sources of Fugitive Particulate Emissions and Planned Mitigation

Source Description	Planned Mitigation	% Control Efficiency (CE)
Raw Coal Unloading to Raw Coal Stockpile	Misting Spray on Head Chute[1]	75
Wind Erosion of the Raw Coal Stockpile	"Rain-bird" Type Dust Suppression - High Volume Spray[1]	75
Raw Coal Load out to Reclaim Conveyor	Un Enclosed Transfer Point	99
Raw Coal Conveying Via Reclaim Conveyor	Enclosed Conveyor	99
Primary Crushing	Enclosed with Dust Collector	90
Secondary Crushing	Enclosed with Dust Collector	90
Raw Coal Load-out to Plant Feed Conveyor	Enclosed Transfer Point/Dust Suppression Spray	99
Raw Coal Conveying to CHPP	Enclosed Conveyor	99
Reject Transfer to Reject Conveyor	Enclosed Transfer Point	99
Reject Conveying to Reject Stockpile	Enclosed Conveyor	99
Reject Unloading to Reject Stockpile	Handling of Moist Material	75
Wind Erosion Reject Stockpile	Rain-bird Type Dust Suppression - High Volume Spray	75
Haul Truck Loading of Reject Material	Handling of Moist Material	75
Haul Truck Unloading to Reject Disposal Site	Handling of Moist Material	75
Reject Disposal Site (East)[1]	-	-
Product Transfer to Product Conveyor	Enclosed Transfer Point	99
Product Conveying to Product Stockpile	Enclosed Conveyor	99

Table 5.1.15 Sources of Fugitive Particulate Emissions and Planned Mitigation

Source Description	Planned Mitigation	% Control Efficiency (CE)
Product Unloading Via Radial Stacker	Moist Material	75
Wind Erosion Product Stockpile	Rain-bird Type Dust Suppression - High Volume Spray	75
Product Loading to Overland Conveyor	Enclosed Transfer Point	99
Product Conveying to Barge Load-out	Enclosed Conveyor	99
Product Transfer from Overland Conveyor to Barge Load-out	Enclosed Transfer Point with Dust Hood[2]	99
Barge Loading – Radial Stacker	Banana Peel Flexible Telescopic Chute with Dust Hood[3]	99

[1] Dust modelling was conducted for year 10 of operation, which represents the worst case scenario in terms of the highest uncovered disposal pile and prior to reclamation. Natural precipitation suppresses dust approximately one third of the time; Frozen ground conditions are also likely present one third of the year.
[2] Assumes venting to collection system.
[3] 75 % CE can be achieved with use of a telescopic chute, however as there will be no free fall of coal a 99 % CE is assumed.
Davis. W.T (ed.) 2000

The sources of fugitive emissions identified above for Project operation and maintenance were incorporated into the dust dispersion model. The dust dispersion modelling was carried out for TPM, PM_{10} and $PM_{2.5}$ using AERMOD, version 7.5. Details pertaining to the model inputs (terrain data, receptor grid, meteorological data, emission factors, *etc.*) are provided in Appendix H.

The predicted ground level concentrations for fugitive releases of TPM for the 24-hour and annual time periods compared to the Nova Scotia Air Quality Regulations are presented in Table 5.1.16.

Table 5.1.16 Maximum Predicted Ground Level Concentrations (GLCs) for TPM

Receptor No.	Predicted 24-Hour GLC (µg/m^3)	Predicted Annual GLC (µg/m^3)
1	70.0	2.14
2	82.3	1.86
3	55.8	1.36
4	64.4	1.64
5	54.5	1.40
6	28.1	0.70
Regulatory Criteria	120	60

The predicted ground level concentrations for fugitive releases of PM_{10} for the 24-hour and annual time periods are presented in Table 5.1.17. There are no provincial regulations or federal guidelines pertaining to ground level concentrations of PM_{10}.

Table 5.1.17 Maximum Predicted Ground Level Concentrations (GLCs) for PM_{10}

Receptor No.	Predicted 24-Hour GLC (µg/m^3)	Predicted Annual GLC (µg/m^3)
1	52.6	1.36
2	61.9	1.26
3	41.9	0.92
4	48.4	1.10
5	41.0	0.94
6	16.4	0.44
Regulatory Criteria	N/A	N/A

The predicted ground level concentrations for fugitive releases of $PM_{2.5}$ for the 24-hour and annual time periods compared to the Canada Wide Standard for $PM_{2.5}$ are presented in Table 5.1.18.

Table 5.1.18 Maximum Predicted Ground Level Concentrations (GLCs) for $PM_{2.5}$

Receptor No.	Predicted 24-Hour GLC (µg/m^3)	Predicted Annual GLC (µg/m^3)
1	1.50	0.042
2	1.70	0.039
3	1.16	0.029
4	1.33	0.034
5	1.12	0.030
6	0.51	0.015
Regulatory Criteria	30	N/A

Contour maps of 24-hour maximum predicted TPM, annual maximum predicted TPM, and 24-hour maximum predicted $PM_{2.5}$ are presented in Figures 4, 5 and 6 in Appendix H.

Under exceptional circumstances where coal is transported off-site via hauling trucks, mitigation outlined in section 5.1.4.1.2 will apply, such that air quality standards at the nearest residence are not exceeded.

The operation and maintenance of the Project will result in fugitive emissions of particulate matter; however, based on the current planned mitigation these emissions will not result in any exceedances of the provincial air quality regulations for TPM or the Canada Wide Standard for $PM_{2.5}$ at the nearest residence.

5.1.4.2 Assessment of Change in Acoustic Environment

5.1.4.2.1 Potential Environmental Effects

During construction of the Project, noise will be emitted as a result of site preparation activities, construction of the mine site infrastructure and underground preparation and construction of the barge load-out facility (including dredging). Engines used to power the heavy construction equipment (*e.g.*, graders, dozers, front end loaders, dump trucks) are sources of noise during the site preparation activities. Diesel generators, compressors and welding teams may also generate noise during the construction of buildings at the mine site. Blasting is not expected.

During operation and maintenance of the Project, sound will be emitted during coal handling and preparation activities (including the operation of conveyors, stackers, dozers, the coal handling and preparation plant, onsite transformers, vehicle and heavy truck traffic, *etc.*), coal and rock waste disposal (including the operation of conveyors, dozers and haul trucks) and marine loading and transportation (including barge loading via a radial stacker, barge transport via tug boats to the transshipment location and vessel loading via a floating crane). While changes in the acoustic environment due to emissions from coal trucking were ranked as a 2 in Table 5.1.13, ground transportation of coal off-site will only occur in exceptional circumstances and will be of short duration. The predominant method of off-site coal transportation will be via the proposed marine terminal.

Each of the above noted activities may result in temporary increases to sound levels within and surrounding the PDA. These temporary increases in sound levels may result in an effect on the acoustic environment that may exceed the identified assessment criteria for a Change in the Acoustic Environment without implementation of specified mitigation and have therefore been ranked as a 2 in Table 5.1.13 and require further assessment.

5.1.4.2.2 Mitigation of Project Environmental Effects

Several mitigation measures for mitigating sound emissions during the construction and operation and maintenance of the Project are planned.

For construction, these measures include, but are not limited to:

- Mufflers on all engines and vehicles – strict vehicle and engine maintenance policies will be enforced to minimize noise emissions from engines and vehicles on-site;
- Scheduling – where possible, noisy construction activities will be restricted to the daytime period to reduce noise environmental effects;
- Dredging activities will only be conducted during the day time, Monday to Saturday; and
- Stockpiles of overburden may be used to provide acoustic shielding between the construction activities and on-site and off-site receptors. During peak operation the product

stockpile will provide some attenuation acting as a noise berm that reduces noise propagation from the CHPP toward the residences to the west.

For operation and maintenance, these measures include, but are not limited to:

- Enclosing conveyors and conveyor transfer points;
- Enclosing all coal washing activities in the CHPP building;
- Vegetation buffer – while vegetation is more of a psychological barrier to noise, the minimization of clearing in the Project area will leave sufficient tree cover to provide a beneficial visual barrier with some reduction in noise;
- Adherence to a comprehensive equipment maintenance program to maintain equipment, and to maximize efficiency and reliability;
- There is a formal complaint reporting and response procedure in place and it will be utilised during the construction and operation and maintenance of the mine and included in the Project EMP. Noise complaints will be investigated and addressed;
- During unusual circumstances where coal is transported off-site via trucking, speed restrictions will be in place for all trucks. Coal hauling trucks will also only be permitted to operate during day time hours; and
- The frequency of hauling trucks will be managed so that noise emissions do not result in an increase of %HA of 6.5%.

5.1.4.2.3 Characterization of Residual Project Environmental Effects

To assess the potential sound levels resulting from the construction and operation and maintenance of the Project, sound pressure level modelling was conducted using Cadna. CadnaA (Computer Aided Noise Abatement) version 4.2.140 is a computer program capable of predicting sound levels at specified receiver positions originating from a variety of sound sources. In this study, Cadna was operated in the mode implementing the ISO 9613-1 and 9613-2 algorithms that have been accepted by Health Canada. Further details on the acoustic modelling can be found in Appendix H.

Construction

The assessment of the construction of the Project was based on a construction equipment list that could be considered typical for this sort of project. The construction equipment and associated sound power levels incorporated into the acoustic modelling are listed in Appendix H. The construction model assumes that there will be no construction activity occurring during the nighttime period.

The predicted sound pressure levels from the operation of typical construction equipment by distance from the Project site (a central point) are provided in Table 5.1.19. The results provided below indicate that the increased sound levels due to these construction activities will have reached background levels at approximately 1.5 km from the source.

Table 5.1.19 Predicted Sound Pressure Levels (dBA) by Distance for Project Construction

Distance (m)	Predicted Sound Pressure Level (dBA)
200	64
400	56
600	53
800	51
1000	49
1500	47

Dredging, sources of impulse or varying noise (*e.g.*, earthmoving equipment), may take place during the construction of the on-site conveyors and access road to the breakwater, and preparation of the marine infill area.

To assess the potential effect that dredging could have on the acoustic environment Cadna was used to predict sound pressure levels at varying distances from a typical dredging area. For dredging, a sound power level of 118 dBA was used (Environmental Protection Department 1998). As dredging is a source of impulsive or varying noise a 5 dB penalty was added to their associated sound power levels, as per presented above. The predicted sound pressure levels by distance for dredging (assuming typical equipment) is presented in Table 5.1.20.

Table 5.1.20 Predicted Sound Pressure Levels by Distance – Dredging

Distance (m)	Dredging – Sound Pressure Level (dBA)
200	67
400	61
600	58
800	55
1000	53
1500	48

Dredging can be a nuisance sound if it is near receptors, such as in a channel near receptors on shore because it can have sounds that are repetitive, tonal, or impulse, depending on the type of technology employed on the dredge. Attenuation by distance, as is afforded by this project layout, will limit the sound levels on shore and be acceptable for the temporary nature of the activity.

Based on the effects assessment presented above, the effects of Project construction on the acoustic environment are predicted to be low in magnitude, limited to the LAA, rare in frequency and short-term in duration.

Operation and Maintenance

Sound emissions during the operation and maintenance of the Project will result from coal handling and preparation, coal and waste disposal and marine loading and transportation. To predict the resulting sound pressure levels from these activities acoustic modelling was conducted using Cadna. The operation and maintenance of the Project was divided into three scenarios for modelling purposes, including:

- Scenario 1 - land based mining activities (Phase I/II disposal site) and barge load-out;
- Scenario 2 - land based mining activities (Phase III disposal site) and barge load-out; and
- Scenario 3 - marine based activities (vessel loading at the transshipment location).

Land based mining activities may occur up to twenty-four hours a day seven days a week. During the first few years of Project operation and maintenance, prior to the completion of the barge load-out facility, product coal will be stockpiled on site, and there will be no barge loading or marine transport. The acoustic modelling carried out for the land based mining activities and barge load-out scenario's is representative of full Project operation and maintenance including barge loading.

To accommodate the long-term life of the Project and the accumulation of reject material, two designed coal waste disposal sites have been proposed for the Project. The locations of these sites are provided in Figure 3 in Appendix H. The current plan will be to use the east disposal site first (approximately 13 years of storage; Phase I/II), and move on to the west site (Phase III). The two land-based acoustic modelling scenarios incorporate the activity associated with disposing of this material (*i.e.*, truck traffic, reject unloading, site dozing and grading) at each site.

During product transfer at the transshipment site product coal will be transferred from the barge, which is to be loaded at the barge load-out facility and transported to the transshipment location via a tug and a helper tug, to the larger ocean going vessel via a mobile crane. Sound emissions during this activity will result from the operation and maintenance of the mobile crane and the idling of the tug boats and ocean going vessel. The transshipment location is to be located off Cape Morien and there are no identified residential receptors within 2.3 km.

A summary of all noise generating equipment and their associated sound power levels incorporated into the three operation noise models as discussed above is provided in Appendix H. The summary of the predictive noise analysis is presented below.

The existing sound pressure levels, the predicted sound pressure levels from land based and barge loading activities using the east disposal site (Phase I/II) and the cumulative sound pressure levels at the nearest residential receptors are presented in Table 5.1.21. All identified receptors are along the arterial road along the west side of the Donkin Project. These receptors and the predicted sound pressure levels resulting from the above noted Project activities are also mapped in Figures 7 and 8 in Appendix H.

Table 5.1.21 Cumulative Predicted Sound Pressure Levels Associated with Project Operation Scenario 1 (Land Based Mining Activities – Phase I/II Disposal Site and Barge Load-out)

Receptor No.	Background Sound Levels (dBA)		Predicted Operation Sound Levels (dBA)		Cumulative Project Operation Sound Pressure Levels (dBA)	
	Day	Night	Day	Night	Day	Night
1	48	43	51	51	53	52
2	48	43	51	51	53	52
3	48	43	47	46	51	48
4	48	43	51	51	53	52
5	48	43	47	46	51	48
6	48	43	41	39	49	44

Table 5.1.22 below provides a comparison of the $L_{dn,}$ percent HA, and change in percentage HA for the existing acoustic environment surrounding the PDA to that calculated from the cumulative (project plus background conditions) scenario (Scenario 1) presented above in Table 5.1.21. The Health Canada guidance criteria for operation have also been included in Table 5.1.22.

Table 5.1.22 Baseline and Cumulative Predicted Operation (Scenario 1) L_{dn} and % HA Compared to Health Canada Criteria

Receptor No.	Background Sound Levels		Project Cumulative		Change in %HA	Health Canada Criterion Met
	L_{dn} (dBA)	% HA	L_{dn} (dBA)	% HA		
1	51	2.43	59	6.50	4.07	Yes
2	51	2.43	59	6.50	4.07	Yes
3	51	2.43	55	4.14	1.71	Yes
4	51	2.43	59	6.50	4.07	Yes
5	51	2.43	55	4.14	1.71	Yes
6	51	2.43	52	2.68	0.25	Yes

As shown in Table 5.1.22, the operation of the land based mining (Phase I/II) and barge load-out activities will result in increased sound pressure levels at the nearest residential receptors. These increased sound pressure levels result only in a nominal change in the percent HA; and these predicted changes do not exceed 6.5 percent, Health Canada's guidance criterion for assessing noise in Canadian Environmental Assessments (Health Canada 2010).

The existing sound pressure levels, the predicted sound pressure levels from land based and barge loading activities using the west disposal site (Phase III) and the cumulative sound pressure levels at the nearest residential receptors are presented in Table 5.1.23. The cumulative L_{dn} and percent HA are also presented in this table. The predicted sound pressure levels resulting from the above noted Project activities have also been mapped as Figures 9 and 10 in Appendix H.

Table 5.1.23 Cumulative Predicted Sound Pressure Levels Associated with Project Operation Scenario 2 (Land Based Mining Activities – Phase III Disposal Site, and Barge Load-out)

Receptor No.	Background Sound Levels (dBA)		Predicted Operation Sound Levels (dBA)		Cumulative Project Operation Sound Pressure Levels (dBA)	
	Day	Night	Day	Night	Day	Night
1	48	43	55	51	56	52
2	48	43	58	51	58	52
3	48	43	55	47	56	48
4	48	43	58	51	58	52
5	48	43	58	47	58	48
6	48	43	43	39	49	44

Table 5.1.24 below contains results to compare the L_{dn} and percent HA for the existing acoustic environment surrounding the PDA to that calculated from the cumulative (Project plus background conditions) scenario (scenario 2) presented above in Table 5.1.23. The Health Canada guidance criterion for operation has also been included in Table 5.1.24.

Table 5.1.24 Baseline and Cumulative Predicted Operation (Scenario 2) L_{dn} and % HA Compared to Health Canada Criteria

Receptor No.	Background Sound Levels		Project Cumulative		Change in %HA	Health Canada Criterion Met
	L_{dn} (dBA)	%HA	L_{dn} (dBA)	%HA		
1	51	2.43	59	7.06	4.63	Yes
2	51	2.43	60	7.68	5.25	Yes
3	51	2.43	57	5.24	2.81	Yes
4	51	2.43	60	7.68	5.25	Yes
5	51	2.43	58	6.04	3.61	Yes
6	51	2.43	52	2.68	0.25	Yes

As presented in Table 5.1.24 the operation of the land based mining (Phase III) and barge load-out activities will result in increased sound pressure levels at the nearest residential receptors.

These increased sound pressure levels will not, however, result in a change in the percent HA of greater than 6.5, Health Canada's guidance criteria for assessing noise in Canadian Environmental Assessments (Health Canada 2010).

In exceptional situations where coal is transported off-site via hauling trucks, mitigation outlined in Section 5.1.4.2.2 will apply, such that sound levels for receptors along the trucking route do not result in a %HA increase of 6.5%.

The acoustic modelling of the operation of the transshipment location (scenario 3) resulted in predicted sound pressure levels of 48 dBA at the nearest land.

Based on the effects assessment presented above for scenarios 1 and 2, the effects of Project operation and maintenance on a Change in the Acoustic Environment are predicted to be moderate in magnitude, limited to the LAA, and occur continuously throughout the life of the Project.

5.1.4.3 Assessment of Change in GHG Emissions

5.1.4.3.1 Potential Environmental Effects

Project construction will result in GHG emissions (CO_2, CH_4 and N_2O) from the combustion of diesel fuel in heavy earth-moving equipment and equipment used in the erection of facilities. Given that construction activities will be conducted in areas that have been previously partially developed, and construction is expected to last 15 months, GHG emissions from construction will be minimal compared to annual operational emissions. Similarly, the quantity of vegetation that will be removed by site preparation will result in a negligible change to GHG sinks in the region.

During Project operation and maintenance, GHG emissions (CO_2, CH_4 and N_2O) will result from the combustion of diesel in mining equipment and marine vessels, and from fugitive methane emissions. Emissions from mining equipment will occur throughout the lifetime of the Project. As the marine transportation vessels travel from the barge load-out facility to the transshipment site, emissions will be spread both spatially and temporally between these two locations. It is expected that marine transportation and associated emissions will continue throughout the lifetime of the Project.

In addition to the direct sources of GHG emissions during operation and maintenance, the use of electricity to power equipment on-site will result in indirect GHG emissions. These emissions result from the combustion of fossil fuel at an electricity generating station, and hence are not under the direct control of the Donkin Mine.

The greatest source of GHG emissions from the Project will be the fugitive emissions of methane that is trapped in the coal-bed. Because of the high multiplier between the mass emission of methane and the mass emission of carbon dioxide, these methane emissions, if uncontrolled, would result in the Project being classified as a “high emitter” of GHGs as per CEA Agency guidance (CEA Agency 2003). Recognizing the growing importance of GHG issues, XCDM has been reviewing GHG control technologies.

5.1.4.3.2 Mitigation of Project Environmental Effects

XCDM has considered a number of GHG control methods in prefeasibility studies that may be applicable to this Project. The coal industry must make safety the prime objective in its operations; this has been addressed in part by providing sufficient ventilation air for the dilution of methane below flammable limits. This ventilation approach safely dilutes the air, but also results in a composition of air exiting the mine that does not directly sustain combustion, and cannot be easily flared without providing additional fuel gas to promote combustion. Directly discharged ventilation air would result in the discharge of methane to the atmosphere.

To reduce the amount of methane that is available for release, the most promising technology is that of degasification of the coal before extraction in specific areas of the deposit. Degasification involves draining the methane from the coal seam in concentrations that, unlike ventilation air concentrations, are potentially useful for energy recovery and power generation. A second approach is to use thermal or catalytic oxidation technology to combust the methane at the ventilation exhaust from the mine, forming carbon dioxide, which is 21 times less effective as a GHG than methane. This approach still operates on the exit ventilation exhaust, and that is the airstream that is diluted for safety reasons. As a result, the oxidation technology, and the potential energy recovery are more difficult and expensive. It is yet to be commercially realised.

For degasification, vertical wells (or horizontal boreholes) can be drilled down to the underground mine preceding the commencement of mining operations. Ideally, captured methane can be injected into a pipeline and burned in a gas turbine, steam boiler or flared off. Enhanced degasification systems can draw on lower-quality methane gas that must first be cleaned before applying its use as a fuel.

Degasification systems result in higher gas concentrations than ventilation air. In the US, as of 2008, less than ten percent of active underground coal mines have methane capture projects (EPA 2008). Industry hurdles to methane capture include financial constraints for capital investment, limited pipeline infrastructure or capacity for delivering captured methane fuel markets, and technological limitations.

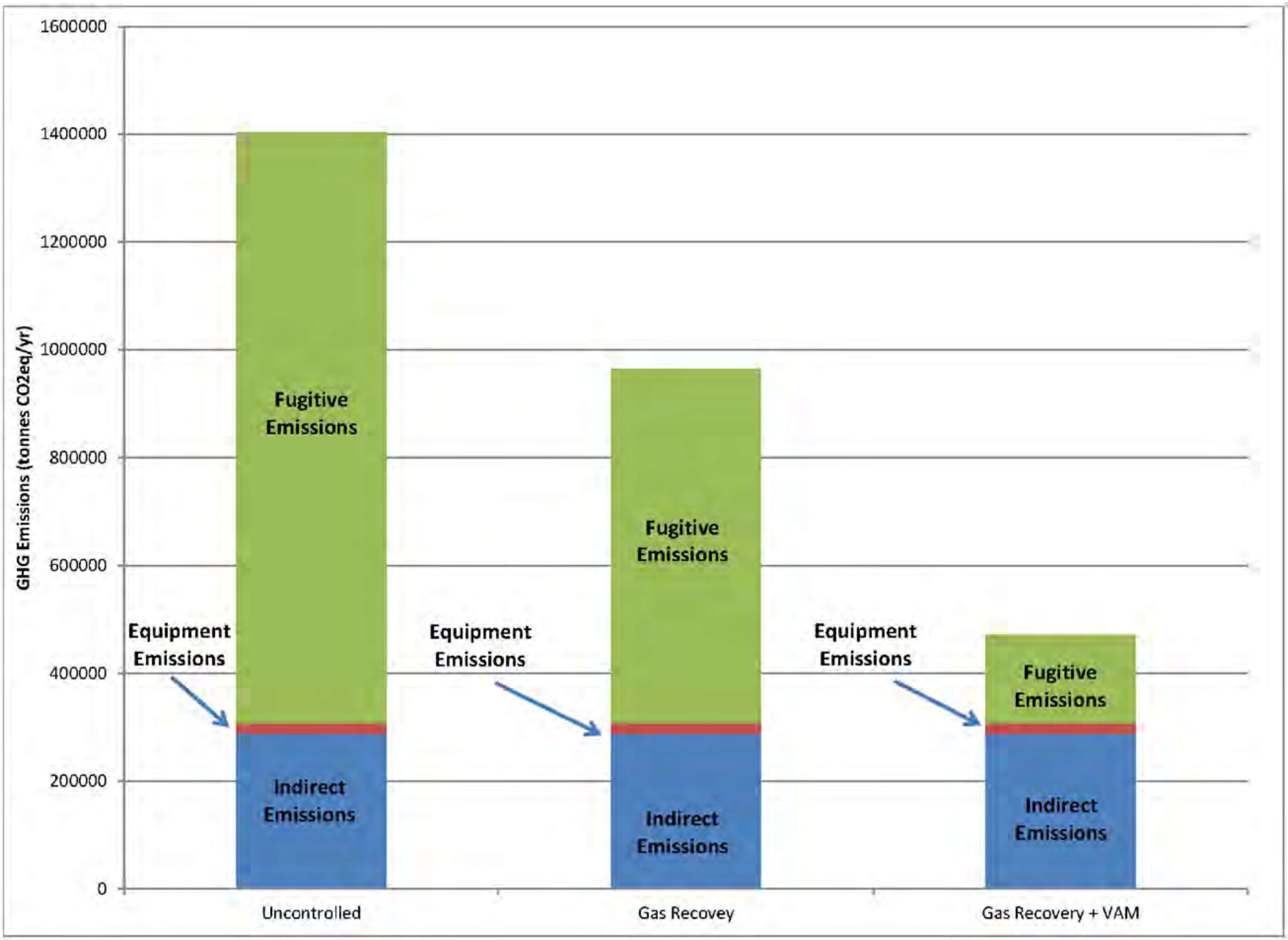
In terms of technological limitations, for example, thermal or catalytic flow-reversal oxidizers can be utilized with the heat-release of oxidized ventilation air methane (VAM) supporting the auto-oxidation process with no supplementary fuel input needed. However, VAM concentrations must be monitored to establish a threshold of availability to determine feasible applications in processing technologies.

Flaring can operate at 25 percent methane concentration. Flaring is preferable to direct venting of methane, but would only work on the drained methane, or as an oxidation mechanism for ventilation air with supplemented fuel gas to maintain combustible concentrations.

Xstrata continues to research the opportunities for methane recovery and destruction, and commits to developing a Greenhouse Gas Management Plan to address the methane emissions. At this time, pre-drainage of the working section and use of a high ventilation rate are identified as viable options. The objective of the GHG Management Plan will be to reduce the GHG emissions as much as is economically feasible, and to recover energy from the coal-bed methane resource where it is technically and economically feasible to do so.

XCDM is developing a Gas Utilization Strategy as a major component of Project pre-design planning. The options within the Strategy will be assessed against Xstrata Coal's Marginal Abatement Cost Curve Analysis and Project criteria to determine the preferred approach. Advances have been made in consideration of two schemes, with further analysis and data acquisition necessary before a full assessment can be made. The ventilation air can be treated using an approach where the methane is abated by passing it through a reverse flow thermal reactor (VAM), and is oxidized with some potential for heat recovery. This approach is proven in the small scale; a commercial scale development at Donkin would represent significant engineering challenge to achieve a world-class, best available control technology (BACT) approach. The second part of the approach would be the collection of the more concentrated methane gas at the production panels with subsequent use for energy recovery. The energy recovery could be substantial, as the gas could be used to generate electrical power. The estimated potential power capture from this energy source is estimated as 11 MWMe. This generation would result in a GHG intensity (level of GHG emission per unit electrical power) of 564 g/kWh. This is well below the provincial average of 828 g/kWh, and, therefore would be a positive effect of the Project Gas collection with energy recovery is technically proven at a commercial scale.

With reference to direct source emission scenarios in Table 5.1.25, a gas collection/energy recovery can be applied to provide a 40 percent reduction in the direct GHG emissions, provided that the engineering and cost analysis of the feasibility yields an economically viable result. Similarly, a combined approach of VAM and gas collection/energy recovery can be applied to provide an 85 percent reduction in the GHG emissions, provided that the engineering and cost analysis of the feasibility yields an economically viable result. GHG emissions and potential control options are summarized in Figure 5.1.1.



PREPARED BY: M. Huskins-Shupe	Donkin Export Coking Coal Project	FIGURE NO.: 5.1.1
REVIEWED BY: C. Shupe		DATE: Apr 25, 2012
CLIENT: xstrata coal	**GHG Emissions and Potential Control Options**	Stantec

File Path: V:\1215\active\121510xxx\121510478-Donkin Mine Enviro Assessment\geomatics\mapping\mxd\EA_Final\ST_NS_121510478_020_GHG_Graph.mxd

In addition to fugivitive analysis, the GHG Management Plan will also look into possible energy efficiency opportunities which may include:

- use of high efficiency electrical motors throughout the Project;
- use of variable speed drive pumps with high-efficiency linings at the coal handling and preparation plant;
- regular monitoring of the compressed air circuit so that leaks are repaired in a timely manner, as this maximises the operating efficiency of the compressor;
- maintaining light fittings to maximise light delivery;
- installing light-sensitive switches on road lights so that lights do not operate during the day;
- An energy efficiency audit during the detailed design phase;
- Installation of energy saving devices, where practical; and
- Low emission/cleaner fuel alternatives to conventional fuels where practical.

A carbon tax contingency of two dollars per tonne of coal produced has also been factored into potential carbon liabilities for the Project (Martson 2011). This contingency is based on Xstrata Coal's approach to the carbon tax regime in Australia.

5.1.4.3.3 Characterization of Residual Project Environmental Effects

The activities associated with construction and operation and maintenance of the Project will result in the release of GHG emissions to the atmosphere. The environmental effect is the recognized contribution to changes in local and global climate conditions. However, the environmental effect of the GHG emissions from any specific facility on global climate change cannot be measured (CEA Agency 2003). Nevertheless, the Change in Greenhouse Gas Emissions associated with the Project can be quantified in an absolute sense and compared with provincial, national, and global GHG emissions, as well as with other comparable industries (industry profile).

To assess the residual project environmental effects on a Change in Greenhouse Gas Emissions during Project operation and maintenance detailed emission inventories of Project-related GHG emissions were prepared with details provided in Appendix H.

Construction

An emissions inventory for the construction phase of the Project was not prepared as details pertaining to the type, quantity and amount of fuel consumed and various pieces of construction equipment that would be in use was not available. However, emissions of GHGs during construction including site preparation and the construction of mine infrastructure, the underground mine and the barge load-out facility will be temporary and are expected to be small relative to emissions during operation and maintenance.

Therefore, the effects of Project construction on a Change in the Greenhouse Gases are predicted to be low in magnitude, will occur at on a regular basis throughout the construction of the Project for a relatively short duration. The geographic extent of a Change in GHG Emissions is provincial, national and global.

Operation and Maintenance

The major sources of emissions of GHGs from the operation of an underground coal mine and associated land and marine based activities include:

- Combustion sources (including mining equipment, heavy haul trucks, dozers, graders, tug boats and ocean going vessels) releasing CO_2, CH_4 and N_2O; and
- Fugitive releases of GHGs (CH_4) as coal-bed methane.

A summary of the releases of GHGs from the operation of mobile mining combustion equipment, fugitive emissions coal mining, and marine transportation is provided in Table 5.1.25. Details regarding the typical equipment and emission factors used to develop this inventory are provided in Appendix H.

Table 5.1.25 Estimated GHG Emissions from Project Operation – Direct Sources

Source Type	tonnes CO_{2e}/year
Mobile Equipment	14,693
Marine Vessels	5,286
Fugitive Methane	1,095,967(→657,580→143,520)*
Total Direct Emissions	1,115,946 (→677,829→163,499)*

*The lower figures (in brackets) assumes implementation of the (1) gas recovery and (2) combined gas recovery and VAM mitigation options.
Note: All table values are approximate and subject to refinement

A number of pieces of equipment associated with the operation and maintenance of the Project use electricity. Indirect GHG emissions associated with this electricity use were estimated based on the energy required by the equipment and a GHG emission intensity provided by Nova Scotia Power (NSPI 2011). A summary of the indirect Project emissions of GHGs by Project activity is provided in Table 5.1.26.

Table 5.1.26 Indirect Project Emissions of GHGs

Facility	t CO_{2eq}/year
Main Equipment	37,223
Connected Power Requirements	211,613
Raw Coal Handling	5,453
Coal Handling and Preparation Plant	25,414
Product Handling	1,220
Loadout	2,150
Reject Handling	1,194
General	2,870
Total	**287,136**
Note: All table values are approximate and subject to refinement	

Table 5.1.27 shows the comparison of the estimated Project GHG emissions (direct emissions) to the provincial, national and global GHG emission totals as presented in Section 5.1.2.

Table 5.1.27 Comparison of Estimated Project Direct and Indirect GHG Emissions to Provincial, National and Global Estimates

Type of Emission	GHG Emissions (Mt CO_{2eq})	% of Total Emissions[3]
Project Direct[1]	1. 11 (→0.678→0.163)	**-**
Project Direct + Indirect[1]	1. 40 (→0.965→0.451)	-
National Industry Profile (2010)[2] + Project	2.4 (→2.0 → 1.5)	58% (→49%→31%)
Provincial	20.4[4]	6.4 % (→4.5%→2.2%)
National	692	0.20 % (→0.14%→0.07%)
Global	44,153[5]	0. 003 % (→0.002%→0.001%)

[1]The lower figures (in brackets) assumes implementation of the (1) gas recovery and (2) gas recovery and VAM options for methane abatement
[2] Includes predominantly surface mines
[3] % of total emissions are based on Project direct and indirect emissions
[4] Environment Canada 2012
[5] Herzog 2010
Note: All table values are approximate and subject to refinement

As illustrated in Table 5.1.27, the GHG emissions resulting from the operation and maintenance of the Project will represent approximately 2.2 to 6.4 percent of the provincial total reported emissions, 0.07 to 0.20 percent of the national GHG emissions and 0.001 to 0.003 percent of global GHG emissions, the lower end of the range of values representing successful implementation of the mitigation options. The estimated GHG emissions from the Project is a substantial part of the total reported for this industry in 2009 by Environment Canada

(Environment Canada 2011b); but it is important to note that this industry total has been reduced by a factor of three in recent years, and currently represents a number of surface mines that have essentially vented methane to the atmosphere. With control of the fugitive methane emissions of the Project, the direct GHG contributions are reduced by approximately a factor of about 6, and the numbers in brackets in the table represent the mitigated contributions.

As per the CEA Agency guidance (2003) the Project would be considered to be a "high" emitter, without control of fugitive emissions, and a "medium" emitter with control of fugitive emissions. GHG emissions are not localized in their effect, but contribute to a global burden of greenhouse gas in the atmosphere; however, the contribution of an individual project to the change in global climate cannot be predicted (CEA Agency 2003).

5.1.4.4 Summary of Project Residual Environmental Effects

Table 5.1.28 summarizes the residual environmental effects of the Project on the Atmospheric Resources.

Table 5.1.28 Summary of Project Residual Environmental Effects: Atmospheric Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Change in Air Quality										
Construction	• Dust suppression program. • Covered conveyor and transfer points. • Equipment maintenance program. • Particulate monitoring plan. • Rain Bird-type dust suppression system at open coal stockpiles. • Dust hoods on radial stackers. • Dust collection system at transfer point from overland conveyor to barge stacker. • Misting sprays at outlet of raw and product coal conveyors. • Stockpile design to minimize risk of spontaneous combustion. • Covered trucks (if coal trucking required). • Use of barges with movable covers or higher coamings around cargo to control dust and protect coal cargo. • Good management practices and sound operator training to reduce operator error and promote careful cargo loading.	A	M	L	ST	S	R	D	N	• Particulate monitoring program for Project construction and operation as per likely conditions of approval.
Operation and Maintenance		A	M	L	LT	C	R	D	N	
Decommissioning and Reclamation		A	M	L	ST	S	R	D	N	

Table 5.1.28 Summary of Project Residual Environmental Effects: Atmospheric Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Change in Acoustic Environment										
Construction	• Use of mufflers on all applicable equipment. • Limited construction activities to daytime. • Enclosed conveyor and transfer points. • Enclosure of all coal washing activities in CHPP building. • Adherence to equipment maintenance programs. • Maintaining a vegetation buffer between the Project and the nearest residents. • Limit activity occurring in disposal sites (dozers) to daytime. • If coal trucking required, speed limits applied and truck hauling during daytime hours	A	L	L	ST	R	R	D	N	• Sound pressure level monitoring during construction and operation and maintenance as per likely conditions of approval.
Operation and Maintenance		A	M	L	LT	C	R	D	N	
Decommissioning and Reclamation		A	L	L	ST	R	R	D	N	
Change in GHG Emissions										
Construction	• Implementation of GHG Management Plan, assuming capture and oxidation of methane gas from mine	A	L	G	ST	R	R	D	N	• Annual monitoring of GHG emissions and reporting to Environment Canada.
Operation and Maintenance		A	L	G	LT	C	R	D	N	
Decommissioning and Reclamation		A	L	G	ST	R	R	D	N	

Table 5.1.28 Summary of Project Residual Environmental Effects: Atmospheric Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		

KEY

Direction:

- P Positive: condition of the Atmospheric Resources is improving in comparison to baseline conditions and trends
- A Adverse: condition of the Atmospheric Resources is worsening in comparison to baseline conditions and trends
- N Neutral: no change in the condition of the Atmospheric Resources compared to baseline conditions and trends

Magnitude:

- L Low: effect occurs that is detectable but is within normal variability of baseline conditions (for GHG emissions < 10^5)
- M Moderate: effect occurs that would cause an increase with regard to baseline but is within regulatory limits and objectives (for GHG emissions >10^5 <10^6)
- H High: effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries (for GHG emissions > 10^6)
- N Negligible: no measurable adverse effect anticipated

Geographic Extent:

- S Site: effect restricted to the PDA
- L Local: effect restricted to the LAA
- G Provincial, National and Global (GHG Emissions only)

Duration:

- ST Short term: effect occurs for less than three years
- MT Medium term: effect occurs for between 3 and 20 years
- LT Long term: effect persists beyond 20 years

Frequency:

- O Once: effect occurs once
- S Sporadic: effect occurs at sporadic intervals
- R Rarely: effect occurs on a regular basis and at regular intervals
- C Frequently: effect occurs continuously throughout the Project life

Reversibility:

- R Reversible: effect ceases when Project operations cease
- I Irreversible: effect continues after Project operations cease

Environmental Context:

- U Undisturbed: effect takes place within an area that is relatively or not adversely affected by human activity
- D Disturbed: effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present
- N/A Not Applicable

Significance:

- S Significant
- N Not Significant

5.1.5 Assessment of Cumulative Environmental Effects

In association with the Project environmental effects discussed above, an assessment of the potential cumulative environmental effects was conducted for other projects and activities that have potential to interact with the Project. Other projects and activities considered in the cumulative effects scoping are discussed in Section 4.2.4. Table 5.1.29 below presents the potential cumulative environmental effects to Atmospheric Resources, and ranks each interaction with other projects as 0, 1, or 2 with respect to the nature and degree to which important Project-related environmental effects overlap with those of other projects and activities.

According to the CEA Agency (2003), the contribution of an individual Project to climate change cannot be measured. Therefore, given that climate change is global and not a local issue, a cumulative effects assessment for increase in GHG emissions is not required.

Table 5.1.29 Potential Cumulative Environmental Effects to Atmospheric Resources

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Change in Air Quality	Change in Sound Quality	Change in GHG Emissions
Lingan and Point Aconi Power Stations	1	0	NA

KEY

0 = Project environmental effects do not act cumulatively with those of other projects and activities.
1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of project-specific or regional mitigation.

The cumulative interaction of the operation of both the Lingan and Point Aconi Power Stations with the proposed Project for a Change in Air Quality has been ranked as a 1. The operations of these power stations result in emissions of CACs that could overlap cumulatively with CAC emissions from the operation of the proposed Project. The proposed Project however, is not considered to be a major emitter of air contaminants such as SO_2, NO_x, CO and there are a number of controls proposed to mitigate dust emissions. The Project is also located approximately 20 - 40 km from the power stations and both power stations currently operate under provincial permits and within regulatory limits. The proposed Project would also be subject to provincial permitting once operational.

5.1.6 Determination of Significance

Change in Air Quality

During the construction of the Project, emissions of CACs will increase primarily due to the combustion of diesel fuel during the operation of various pieces of construction equipment. Based on professional experience these activities will not result in emissions that exceed NS air quality regulations or national objectives

To determine the effect of Project operation and maintenance on a Change in Air Quality, dust modelling was conducted and the results compared to local air quality regulations and national ambient air quality objectives, where applicable. The residual effects of a Change in Air Quality during Project operation and maintenance were assessed to result in an increase in CACs above baseline conditions but be within regulatory limits and objectives and to be restricted to the LAA. The residual effects are expected to persist continuously during the life of the Project.

With the proposed mitigation and environmental protection measures incorporated into the assessment, the residual environmental effect of a Change in Air Quality is predicted to be not significant.

Change in Acoustic Environment

During the construction of the Project existing sound levels within and surrounding the PDA will increase due to the operation of various pieces of construction equipment and dredging. The increased sound levels due to these activities will have reached background levels at approximately 1.5 km from the source. As the nearest residences are located approximately 1.5 km away from the existing mine site and with incorporating the proposed mitigation measures the residual environment effect on a Change in the Acoustic Environment is considered low in magnitude and limited to the LAA. As Project construction is anticipated to last 15 months, the effect will be short term.

To determine the magnitude of the effect of Project operation and maintenance on a Change in Acoustic Environment sound pressure level modelling was conducted to predict changes in sound levels at the nearest residents and compare those results to Health Canada criteria. The modelling showed that the operation and maintenance of the Project will result in increased sound pressure levels at the nearest residents, however with appropriate mitigation these increases would not result in an exceedance of the Health Canada criteria. The residual environmental effect on a Change in the Acoustic Environment was therefore assessed to be moderate in magnitude and local in geographic extent. The effect will occur continuously over the life of the Project.

With the proposed mitigation and environmental protection measures incorporated into the assessment, the residual environmental effect of a Change in the Acoustic Environment is therefore predicted to be not significant.

Change in GHG Emissions

Emissions of GHG have been assessed in terms of their contribution to provincial and national GHG emission totals. During the construction of the Project, increases in GHG emissions will result from the combustion of fuel in various pieces of construction equipment. The residual environment effects on a Change in GHG Emissions during Project construction are anticipated to be low in relation to provincial and national emission totals.

During the operation and maintenance of the Project GHG emissions will be released through the operation of various types of mining equipment, trucks and marine vessels; however the majority of the emissions will result from the underground mining of coal and the subsequent CH_4 releases. To determine the magnitude of an environmental effect on a Change in GHG Emissions a GHG emissions inventory for Project operation and maintenance was prepared. The GHG emissions of this Project are substantial without mitigation; however, the Project continues to investigate the opportunities for methane recovery and destruction, and commits to develop a Greenhouse Gas Management Plan to address the methane emissions. The objective of the GHG Management Plan will be to reduce the GHG emissions as much as is economically feasible, and to recover energy from the coal-bed methane resource where it is technically and economically feasible to do so. The project is subject to Xstrata Coal's Marginal Abatement Cost Curve Analysis, a tool that allows the group to focus on specific projects to target maximum carbon emission reduction; Xstrata continues to integrate the challenges of global warming into business decisions.

It was determined that with complete implementation of the gas recovery with or without the VAM option for methane abatement the Project would not contribute substantially to Provincial and National totals and would be considered a medium emitter under CEA Agency guidance (CEAA 2003). Continued planning and assessment will allow the Project to determine actual target efficiencies for GHG abatement and GHG emission rates.

With the proposed mitigation and environmental protection measures incorporated into the assessment, the residual environmental effect of a Change in GHG Emissions is therefore considered to be not significant.

Cumulative Effects

The majority of the current and planned projects (refer to Section 4.2.4) will not act cumulatively with the Project to result in a cumulative environmental effect on Atmospheric Resources. The operation of both the Lingan and Point Aconi power stations will interact cumulatively with the Project for a Change in Air Quality; however, the interaction is not expected to exceed regulatory limits. Therefore cumulative environmental effects on the Atmospheric Resources are considered to be not significant.

The Project will be considered a medium emitter of GHG emissions, provided the fugitive methane releases are captured and oxidized to CO_2. A GHG Management Plan will be prepared and implemented to mitigate Project related effects of GHG emissions.

Summary

In summary, given the planned mitigation, and the analyses presented in this assessment, the potential Change in Air Quality, Change in Acoustic Environment, a Change in GHG Emissions on the Atmospheric Resources as a result of the Project during all phases, including cumulative environmental effects, are rated not significant.

5.1.7 Follow-up and Monitoring

An air (*e.g.*, particulate monitoring program) and noise monitoring plan (if required) will be developed in consultation with regulatory authorities prior to the start of construction as part of the Project EMP. A noise and dust complaint follow-up and response procedure will also be developed as part of the EMP.

Emissions of GHGs will be monitored and quantified on an annual basis and reported to Environment Canada through their GHG Reporting program.

5.2 WATER RESOURCES

Water Resources, as considered in this document, includes quality and quantity of surface water and groundwater resources that could be potentially affected by the Project. Since water resources have high potential to be affected by the Project during the construction, operation and maintenance, and reclamation and decommissioning phases they were included in the EIS Guidelines and were selected as a VEC. Water resources concerns relate to the potential for on-site release of hazardous materials and potential contamination associated with mine and process water management, as well as the possible lowering of the water table. These, in turn, have potential for effects on surface water/groundwater interactions, wetlands, and associated fish habitat.

Water Resources are closely linked to the discussion of Freshwater Fish and Fish Habitat (Section 5.6) and Wetlands (Section 5.4). The discussion of Water Resources is limited primarily to freshwater surface and groundwater; marine waters are addressed in the context of Marine Environment (Section 5.7) of this EIS.

5.2.1 Scope of Assessment

5.2.1.1 Regulatory Setting

Specific water resources issues to be considered have been defined by the Project specific EIS Guidelines issued by the CEA Agency. Provincial legislation applicable to the assessment of water resources includes the Activities Designation Regulations of the *Environment Act* as related to alterations to watercourses, stormwater management, wastewater management, and industrial processes, as well as Water and Wastewater Facility Regulations of the *Environment Act.* The federal *Fisheries Act*, Section 36(3) – Deleterious Substances is applicable to any effluent discharge. Specific legislation applicable to groundwater includes *the Water Resources Protection Act*, as well as Emergency Spill Regulations and Well Construction Regulations (under the *Environment Act*).

5.2.1.2 Influence of Consultation and Engagement on the Assessment

No specific issues or concerns were raised during public and stakeholder consultation regarding Water Resources for the Donkin Export Coking Coal Project. Public and stakeholder consultation feedback during the Donkin Underground Exploration Project largely helped to shape the planning and engineering of various aspects of Project design including the design of the existing tunnel dewatering program.

5.2.1.3 Selection of Environmental Effects and Measurable Parameters

The environmental assessment of Water Resources is focused on the following environmental effects:

- Change in Surface Water Resources including: changes to surface water levels and flow rates (which will affect the water balance) and changes to surface water quality;
- Changes to Groundwater Resources including: changes to site physical hydrogeology (water levels), potential effects on domestic well users and municipal supply, and changes to groundwater quality.

The measurable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 5.2.1.

Table 5.2.1 Measurable Parameters for Water Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Surface Water Resources	• Water levels and flow rates • Water quality	Modification to the current surface hydrologic regime can be measured by change in water levels and flow rates. XCDM currently has three Nova Scotia provincial approvals (Environmental Assessment Approval [for Exploration Phase], Storage of Water Approval, and Approval to Construct and Operate – Underground Mine) all of which have water monitoring requirements which are addressed as part of the water monitoring program. Current surface water monitoring is based on the baseline monitoring program that was initiated in 2006 and involves eight surface water sampling locations (sites at Baileys Wetland and DEVCO settling pond).

Table 5.2.1 Measurable Parameters for Water Resources

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Groundwater Resources	• Groundwater levels • Groundwater quality • Extent of aquifers • Potable water resources • Proximity of private or municipal drinking water wells	Changes in groundwater quantity are typically associated with the lowering of the water table in water supply wells. Therefore, monitoring of water levels in water wells (or specifically installed monitoring wells) adjacent to a major excavation that intersects the water table is an appropriate measure for the assessment of the potential Project-related environmental effects on groundwater quantity. As required under the existing provincial approvals (see above), current groundwater monitoring is focused on the baseline monitoring program that was initiated in 2006 and involves nine groundwater monitoring locations. The proximity of drinking water wells will determine potential interactions with local groundwater users.

5.2.1.4 Temporal and Spatial Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Water Resources include the periods of construction, operation and maintenance, and reclamation and decommissioning. Other temporal considerations that will affect the assessment of water resources includes natural seasonal and annual variations in precipitation and evaporation at the site and resultant hydrological changes.

The spatial boundaries for the environmental effects assessment of Water Resources are defined below.

Project Development Area (PDA): The PDA includes the area of physical disturbance (*i.e.*, “footprint” for the Project including infrastructure for the mine site as well as stockpiles, coal waste disposal piles, conveyor system, 138 kV transmission line, and trucking routes. The PDA also includes the barge load-out facility and transshipment mooring and vessel route between the two.

Local Assessment Area (LAA): The LAA is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur. For Water Resources, the LAA is defined as the Donkin Peninsula plus the transmission line route.

Regional Assessment Area (RAA): The RAA is limited to and includes the LAA as described above, and the portion of the watersheds which encompass the LAA, and extend to the west of Long Beach Road. The RAA is the area within which cumulative environmental effects for Water Resources may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects.

5.2.1.5 Residual Environmental Effects Description Criteria

Terms that will be used to characterize residual environmental effects for Water Resources are presented in Table 5.2.2.

Table 5.2.2 Characterization Criteria for Residual Effects on Water Resources

Criterion	Description
Direction	**Positive:** condition is improving compared to baseline water quality and quantity **Neutral:** no change compared to baseline water quality and quantity **Adverse:** negative change compared to baseline water quality and quantity
Magnitude	**Negligible:** no measurable adverse effects anticipated **Low:** affecting the available quantity or quality of water resources in the shallow or deep aquifer, at levels that are indiscernible from natural variation **Moderate:** limiting the available quantity or quality of water resources, such that these resources are occasionally rendered unusable to current users for periods up to two weeks at a time **High:** limiting the available quantity and quality of water resources, such that these resources are rendered unusable or unavailable for current users during the life of the Project or for future generations beyond the life of the Project
Geographical Extent	**Site-specific:** effects restricted to habitat within the PDA **Local:** effects extend beyond PDA but remain within the LAA **Regional:** effects extend into the RAA
Frequency	**Once:** effect occurs once **Sporadic:** effect occurs more than once at irregular intervals **Regular:** effect occurs on a regular basis and at regular intervals **Continuous:** effect occurs continuously
Duration	**Short-term:** measurable for less than one month **Medium-term:** measurable for more than one month but less than two years **Long-term:** measurable for the life of the Project
Reversibility	**Reversible:** effects will cease during or after the Project is complete **Irreversible:** effects will persist after the life of the Project
Ecological Context	**Disturbed:** effect takes place in an area that has been previously adversely affected by human development or in an area where human development is still present **Undisturbed:** effect takes place in an area that has not been adversely affected by human development

5.2.1.6 Threshold for Determining the Significance of Residual Environmental Effects

A **significant adverse residual environmental effect** on Water Resources is defined as a Project-related environmental effect that results in effects to groundwater or surface water quantity or quality that adversely affect aquatic life, potable water resources, or recreational areas and are not compensated. Such adverse effects will generally be of a moderate to high magnitude, occur at regular or continuous intervals over the medium to long-term, and extend beyond site-specific boundaries.

5.2.2 Existing Conditions

The description of existing groundwater and surface water conditions at the LAA is based on previous work done by Dillon Consulting Limited (2005) and CBCL Limited (2008). In addition, surface water and groundwater quality has been monitored at various locations since 2008 by XCDM on a monthly and/or semi-annual basis (see Figure 5.2.4). As a result of the available information, no new hydrogeological or hydrological investigations were carried out.

5.2.2.1 Climate and Climate Normals

Climate data (total monthly precipitation and average monthly temperatures) were obtained from Climate Normals included in the Environment Canada National Climate Data and Information Archive online (2012). According to the station index, the meteorological station at the Sydney Airport (Sta.8205700) is the closest to the study area (approximately 15 km to the west from the PDA). Climate Normals, which are calculated by averaging 30 years of climatic data (1971-2000) were used to represent the average conditions present at the Donkin Mine site. Refer to Table 8.2.1 in Section 8.0 for a summary of relevant climate data as well as monthly total precipitation and monthly average temperature that were used in the water balance model.

According to Environment Canada (1999), Sydney is located within the Atlantic Maritime Ecozone, which is characterized by a cool, moist maritime climate with moderate temperatures. The monthly average temperature for Sydney varies from -6.5 ºC in February to 17.7 ºC in July and August, with an annual average temperature of 5.5 ºC. The extreme maximum and minimum temperatures over the 30 year period were 35.5 ºC and -27.3 ºC recorded in August 2001 and February 1994, respectively.

The annual average total precipitation for the area is 1504.9 mm of which 1212.9 mm is in the form of rain and 298.3 cm as a snow equivalent.

The annual average wind speed reported at the Sydney Airport is 18.6 km/h and the available record shows that the prevailing wind directions transition from the west/northwest in the winter to the south/southwest in the summer. The maximum monthly average wind speeds occur in January with average speeds of 21.3 km/h and the minimum monthly average speeds occur in August with an average of 15.1 km/h. The average monthly wind speeds are generally higher in the winter than in the summer. Maximum monthly wind gusts measured over the 30-year period ranged from 161 km/h to 87 km/h.

5.2.2.2 Watershed Delineation

A watershed delineation exercise was conducted for all areas that contribute to surface runoff within the RAA. Four major catchment areas or sub-watersheds were identified following the information provided by CBCL (2008) as well as GIS layers including available elevation contours, waterbodies, streams, wetlands and updated project components. The sub-watersheds were labelled as SW1 to SW4 and are shown in Figure 5.2.1. The main physical characteristics of four sub-watersheds are shown in Table 5.2.3.

Table 5.2.3 Main Characteristics of the Sub-watersheds that Contain the RAA

Watershed	Area (km^2)	Max. Channel Length (m)	Average Slope (%)	Stream Order
SW1	3.33	4050	0.86	3
SW2	0.79	1450	1.03	1
SW3	0.85	675	2.22	1
SW4	0.43	n\a	n\a	n\a

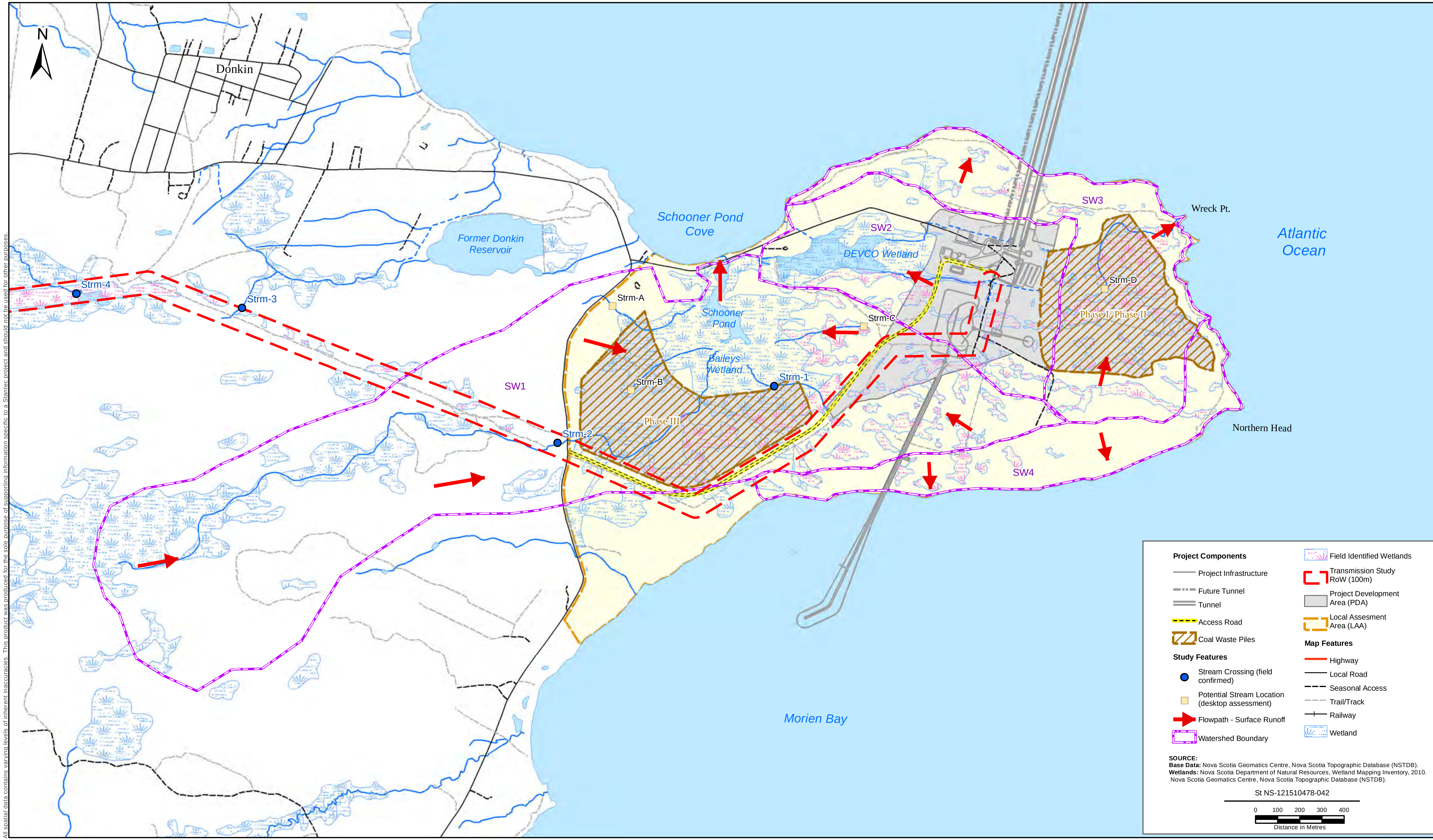
Sub-watershed SW1 is the largest of the four within the RAA and extends to the east of the peninsula and to the west inland towards the headwaters of a large unnamed wetland located approximately 5 km southeast from the PDA. This sub-watershed contains project components including access roads and the proposed Phase III coal waste disposal pile. Baileys Wetland, which is an important ecological area, is located at the exit of sub-watershed SW1. The proposed Phase III coal waste disposal pile will cover 14 percent of the sub-watershed area and potentially affect four streams that feed to Baileys Wetland.

Sub-watershed SW2 contains the bulk of the existing and proposed mining facilities as well as the former DEVCO settling pond which ultimately discharges to the ocean. Available mapping shows two drainage features within this watershed that are linear suggesting artificial drainage channels. Sub-watershed SW2 also contains 14 percent of the proposed Phase I/II coal waste disposal pile. Several wetlands were identified within this sub-watershed.

Sub-watershed SW3 contains the majority of the proposed Phase I/II coal waste disposal pile which will cover approximately 38 percent of the total sub-watershed. There are several wetlands covering this sub-watershed and most of them will be affected by the construction of the coal waste disposal pile as well as an unnamed stream that is identified in the available GIS layers.

Sub-watershed SW4 contains limited Project components, mostly the access road to the barge load-out facility and a small portion of the east coal waste disposal pile (approximately 4 percent of the total area). This sub-watershed has terrain with steep slopes draining to the ocean. Mapping does not indicate any major streams within the sub-watershed.

Potential effects on surface water streams and wetlands by the proposed Project components, especially the coal waste disposal piles include changes in the hydrologic regime of the PDA, disruption of wetlands and surface streams, a decrease in catchment area that contributes to the wetlands and possibly an increase in surface runoff from Project components that must be collected and treated accordingly before being discharged.



PREPARED BY: C. Shupe

REVIEWED BY: M. Huskins-Shupe

CLIENT: xstrata coal

Donkin Export Coking Coal Project

Watershed Delineation

FIGURE NO.: 5.2.1

DATE: Apr 25, 2012

Stantec

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5.2.2.3 Soils and Infiltration

According to Baechler (1986), predominant soil types within the PDA are described as dark yellowish brown compact, non-calcareous, stony, sandy silt to silty sand basal till. The predominant particle size distribution includes fine sand to silt. The thickness of the overburden ranges between 3 m to 6.5 m for the area.

The Soil Survey Map of Cape Breton Island (NSDA 1981), indicates that the predominant soil type within the Donkin area is a pale brown to sandy loam till with poor drainage characteristics. The total infiltration amount for the Donkin area has been estimated by Kennedy *et al.* (2010) and it ranges between 260 mm/y to 300 mm/y.

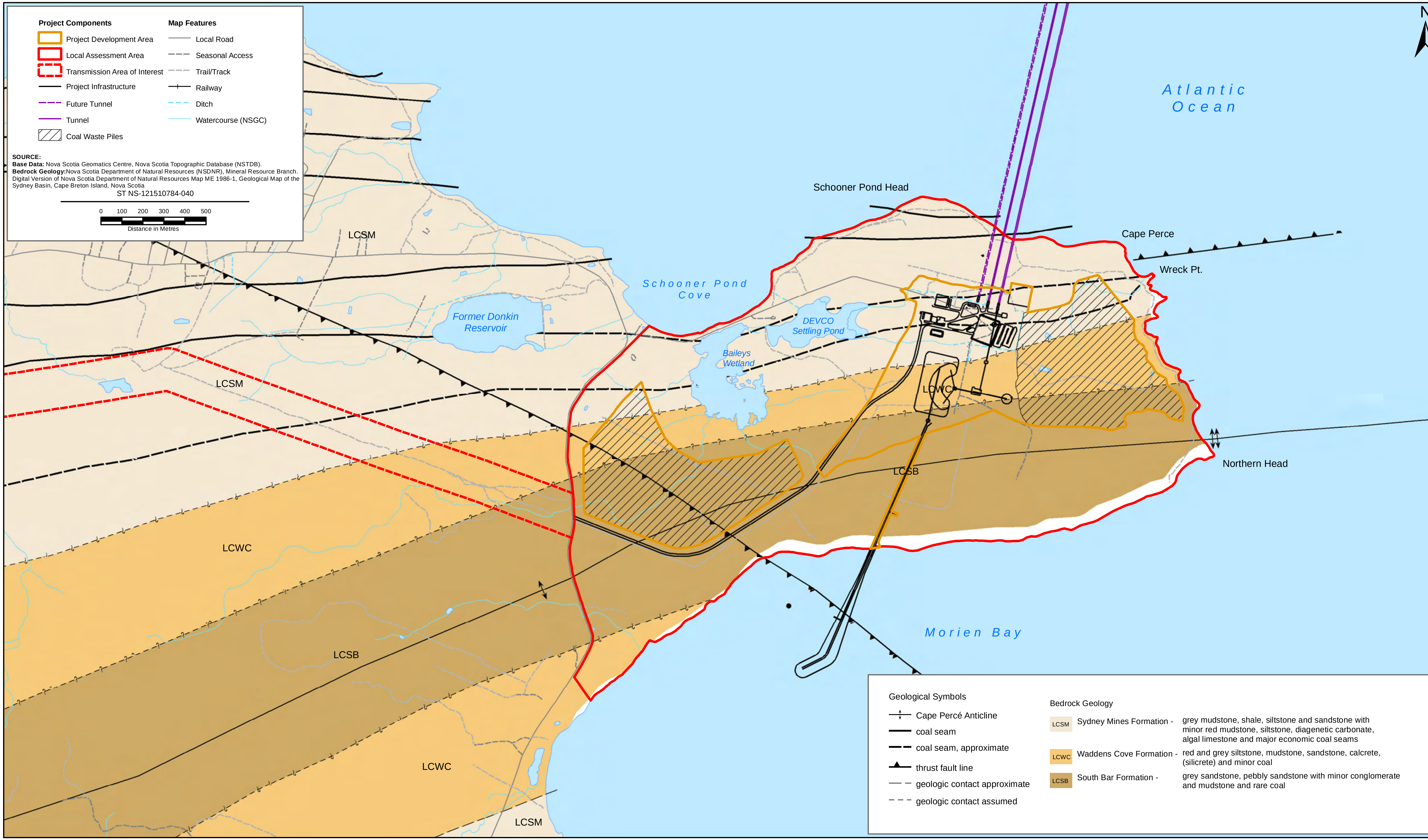
5.2.2.4 Geology

The geology of the Donkin Peninsula generally consists of wetlands soil and till underlain by bedrock. More specifically, previous investigations and geological mapping (see Figures 5.2.2 and 5.2.3) have indicated the following:

- Organic soils (rootmat and peat) to depths of 0.3 to 1.0 m below ground surface (mbgs). These are primarily associated with surface water features (streams, ponds and wetlands). In the area of the historical and present mining operations, fill materials have been identified, to depths of 0.5 to 2.5 m, consisting primarily of coarse sand and gravel, with some silt.
- Till (typically a combination of sandy silt, gravelly silt and/or clayey sandy silt) to depths of 2.0 to 6.5 mbgs. In some locations the till is not present (*i.e.*, organic soils or fill overlie bedrock directly).
- Bedrock of the Morien Group – Sydney Mines, Waddens Cove and South Bar Formations (mudstone, siltstone, sandstone, limestone, conglomerate, coal)

5.2.2.5 Hydrologic Water Balance

A hydrologic water balance assessment was conducted using the Thornthwaite and Mather (1957) method. The computational procedure outlined in the water balance method was computerized in a model developed by Black (1996) referred to as THORNPRO and used to develop water balance estimates for all four watersheds that contain the PDA. The modelling method and results of this water balance assessment for the RAA is presented in Appendix I.



PREPARED BY: M. Huskins-Shupe

REVIEWED BY: D. Carey

xstrata coal

Donkin Export Coking Coal Project

Bedrock Geology

FIGURE NO.: 5.2.2

DATE: May 09, 2012

Stantec

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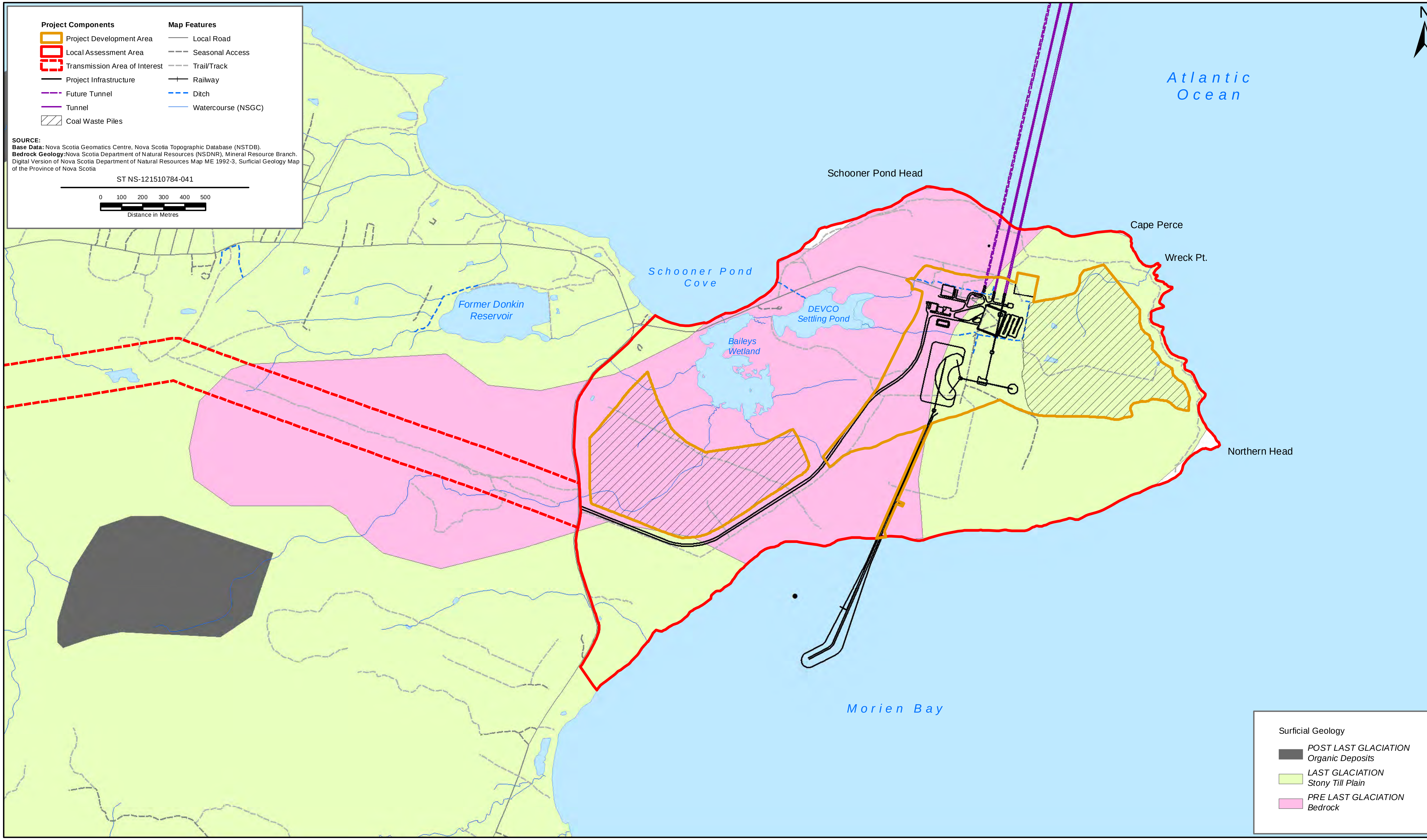
Map Projection: NAD 1983 UTM Zone 20N



PREPARED BY: M. Huskins-Shupe

REVIEWED BY: D. Carey

xstrata coal

Donkin Export Coking Coal Project

Surficial Geology

FIGURE NO.: 5.2.3

DATE: Apr 24, 2012

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Map Projection: NAD 1983 UTM Zone 20N

5.2.2.6 Hydrologic Regimes

The available climate and flow rate data can be used to describe the hydrologic regimes in the streams that are located within the PDA. Several wetlands are directly connected to the streams and affect the hydrologic regime by providing flow attenuation and storage. The modelling method and results of the assessment of hydrologic regimes for the RAA is presented in Appendix I.

5.2.2.7 Hydrology and Water Quality

Donkin Peninsula

Catchment boundaries and known water resources (rivers, streams, and groundwater systems) of the Donkin Peninsula have been identified through previous studies. The RAA watershed is approximately 116 ha in size and drains to the DEVCO settling pond (Figure 5.2.1). Surface runoff flows from east of the current mine yard, and drains to an existing culvert located between the two coal waste disposal piles along the eastern edge (CBCL 2008). This water then drains into the western drainage portion and collects all surface water to the west of the active site including surface flows from the coal waste disposal pile. This area drains into the DEVCO settling pond and discharges to Schooner Pond Cove through an overflow channel located on the northern edge of the DEVCO settling pond. This drainage system was constructed as part of the original site development (CBCL 2008).

The entire mine yard drains towards the drainage ditch and an associated drainage channel that extends south from the middle of the active yard to the drainage ditch. Ditches are also located on either side of the site access road and travel to the west towards the overflow channel that discharges into Schooner Pond Cove (CBCL 2008). Section 2.7.2.1 provides further detail on the system.

Flows and pond levels in the LAA were measured by CBCL from the fall of 2006 to the fall of 2007. Flows along the drainage ditch generally remained below 0.05 m^3/s, while flows at the outlet of the DEVCO settling pond were generally above 0.05 m^3/s, and, on occasion, surpassed 0.10 m^3/s. The flow monitoring data measured by CBCL at the exit of the DEVCO pond for a one year interval is in general agreement and within the same order of magnitude as the mean annual flows included in Table 3 (Appendix I) which are based on long term water balance estimations and long term flow pro-rations.

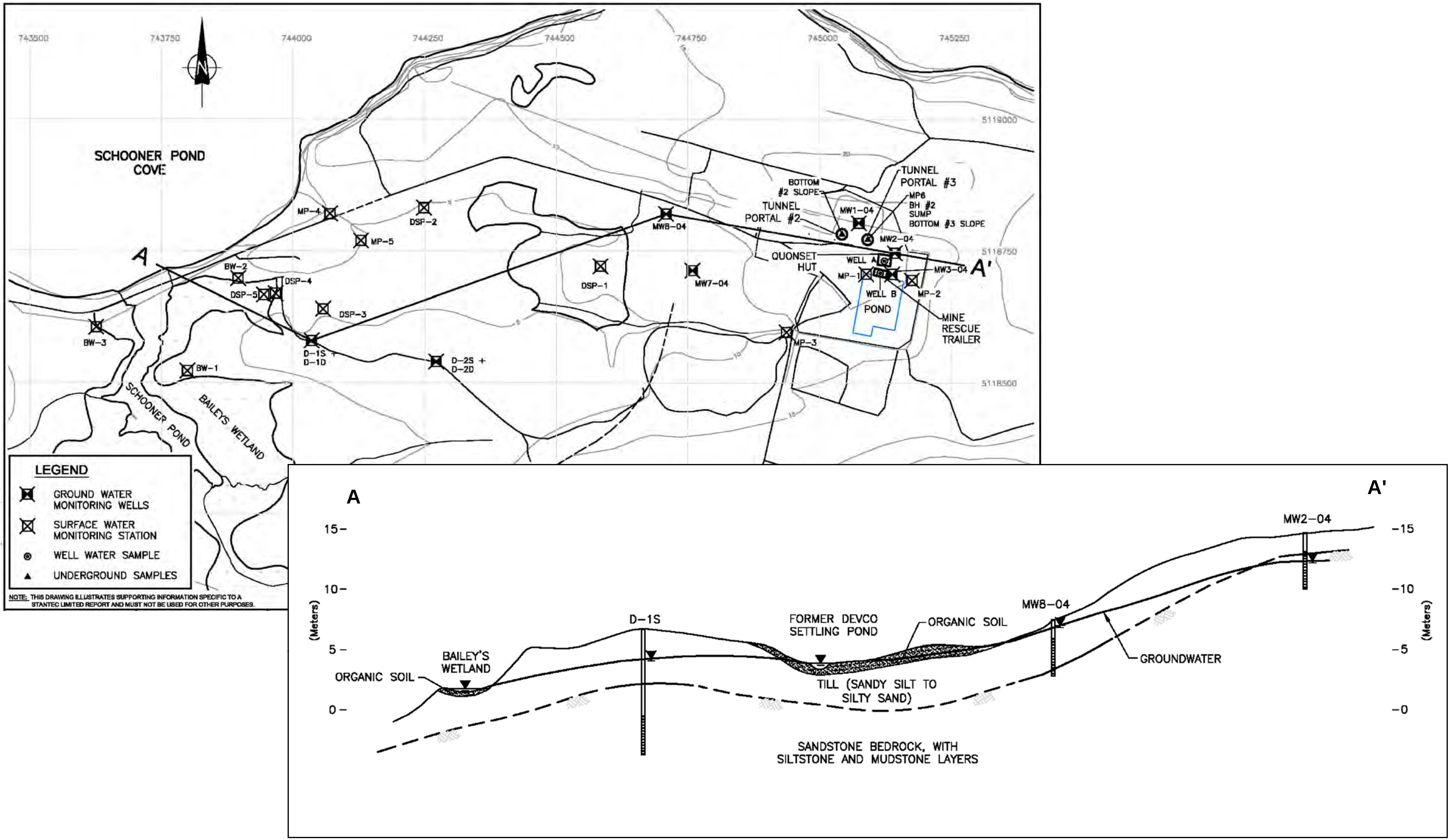
Water quality monitoring associated with the mine tunnel dewatering process has been ongoing since November 7, 2006. Water quality samples, collected semi-monthly at each of the four primary surface monitoring locations. MP1 – inlet to the serpentine pond; MP2 – discharge from serpentine pond; MP3 – middle of the natural wetland; and MP4 – discharge from DEVCO pond to Schooner Pond Cove. Water levels are also monitored within the DEVCO settling pond (DSP) at surface water monitoring location MP-5 (refer to Figure 5.2.4 for monitoring locations). Along with chemistry, flow rates have also been monitored at MP-2 and MP-4. Average monthly flow rates have ranged from 0.003-0.005 m^3/s at MP-2 and 0.004-0.038 m^3/s at MP-4. Water quality trends for key indicator parameters (namely iron, zinc, pH, Total Suspended Solids (TSS), and conductivity) have been tracked since and have been in compliance with water quality conditions of the XCDM approval for the care and maintenance phase of operations. Trends observed in the key indicator parameters have continued to demonstrate that the tunnel water treatment process (based on a comparison of inlet and outlet concentrations) is effective in decreasing the concentrations of iron, zinc, TSS, and conductivity from the tunnel water (see Figures 9 to 13, Appendix I).

Toxicity testing using rainbow trout as the test organism is undertaken on a quarterly basis as required under provincial approval requirements. Water from the DSP is collected and analyzed for toxicity, at MP-4 (outlet from the tunnel water treatment process) on a quarterly basis. To date no samples have been found to be toxic to the test organisms.

As required under existing provincial approvals, current surface water quality monitoring is focused on the baseline monitoring program that was initiated in 2006. This program is currently being undertaken on a semi-annual basis at the locations shown in Figure 5.2.4. The program currently consists of eight surface water sampling locations (BW-1 to BW-3 at Baileys Wetland, and DSP-1 to DSP-5 at DEVCO settling pond). To date this baseline water quality monitoring program has identified elevated metals concentrations as the main parameters of interest. Surface water analytical results are compared to the CCME Fresh Water Aquatic Life (FWAL) and Marine Aquatic Life guidelines, as part of the semi-annual program. It should be noted that these guidelines form a basis for comparison, but are not prescribed standards, for current site activities.

Proposed Power Transmission Line

A total of 20 watercourse crossings are present along the proposed power transmission line. Refer to Table 5.6.4 and Table 5.6.7 in Section 5.6 for a summary of general watercourse characteristics and *in situ* measurements undertaken. The baseline results obtained for water quality confirmed that one of the 19 watercourses sampled is estuarine in nature. Of the other 18 watercourse crossings within the proposed transmission line RoW, eight drain into Big Glace Bay Lake (which is tidally influenced); the remaining 10 freshwater watercourses all are lotic (*e.g.*, drainage channels, brooks, streams or rivers).



PREPARED BY: SJT	Donkin Export Coking Coal Project	FIGURE NO.: 5.2.4
REVIEWED BY: BSP		DATE: Apr 25, 2012
CLIENT: xstrata coal	**Monitoring Wells, Sampling Locations and Cross Section**	Stantec

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5.2.2.8 Surface Water and Groundwater Interaction

Hydraulic gradients in the surface soil of the LAA are generally downward, with infiltrating rainwater passing through the shallow soil into the underlying till, or discharging to local surface water bodies (CBCL 2008). Flow in the till is also downward, recharging the underlying bedrock. The DEVCO settling pond and Baileys Wetland receive much of the shallow groundwater flow from the area of the mine yard (CBCL 2008). Local topographic and drainage conditions indicate that shallow groundwater flow systems to the north, east, and south of the active mine yard are isolated.

The DEVCO settling pond is connected to a fen at its eastern extent, adjacent to the mine site and coal waste disposal piles. Previous alterations to surface drainage patterns in the area, including road construction, the installation of drainage ditches and the construction of the control structure between the DEVCO settling pond and Baileys Wetland have affected the original area of the fen, causing more channelized flow from the upland areas to the DEVCO settling pond, thereby hydrologically isolating the fen.

Monitoring conducted by CBCL (2008) suggests hydraulic connection between the DEVCO settling pond, Baileys Wetland, and shallow bedrock and supports the possibility of flow between the DEVCO settling pond and Baileys Wetland via the shallow bedrock aquifer.

5.2.2.9 Recreational Use of Surface Water Resources

The Donkin Peninsula, Schooner Pond and adjacent cove serve as popular local recreational spots for the communities of Port Caledonia, Donkin and Port Morien. Birdwatchers, hikers and the local Port Morien Wildlife Association frequent the area. Continued access to Schooner Pond Beach and the Donkin Peninsula headlands would be valuable for these recreational uses. Details on recreational uses related to waters on the Donkin Peninsula are provided in Section 5.9.

5.2.2.10 Acid Rock Drainage (ARD)

An ARD Characterization Program was carried out, including a sampling and analysis that targeted the proposed tunnel waste rock source material. A desktop study was conducted to qualify and quantify the acid generation potential of the produced coal waste and associated drainage (Section 2.7.2.3).

Static Acid-Base Accounting (ABA) tests were completed by the Research and Productivity, Council Science and Engineering Laboratory (RPC) in Fredericton, NB, on a total of 28 samples. Elemental analysis (trace and soluble), also completed by RPC, was done for 10 samples. A desktop study was carried out using the surface water quality data compiled over the 2011 period based on chemistry of the water pumped from the mine. In addition, a review of the extensive XCDM database, which includes information pertinent to the Donkin Mine since its development in the early 1980s through the mid-1990s was referenced for applicable source data material.

Based on the analysis of ABA and ICP-Metals test results, in addition to the desktop study of the surface water chemistry data, the existing waste rock piles on-site (from excavation of the existing tunnels) are not considered sulphide bearing materials, therefore are not potentially acid generating.

It was assumed that the future development waste rock from driving of the new tunnel would be similar to the existing development waste rock in both physical and chemical properties. If, at a later date, this is determined to not be the case and the future waste rock is classified as potentially acid generating it would be recommended that the new waste rock be disposed of within the coal waste disposal piles which are expected to be acid generating.

The quantity and chemistry of minewater from future mining operations can be expected to have similar characteristics to the present sources of minewater. The following conclusions and recommendations are related to the disposal of the CHPP reject waste:

1. The coal waste will have a strong potential to generate acid drainage.

2. The acid will be contained in seepage and runoff from the coal waste disposal piles.

3. The prediction of acid generation has been based only on pyrite content and history of acid rock drainage from mines in the Sydney Coalfield. The following site specific tests are recommended to confirm or revise the predictions and to obtain data concerning interactions of pyrite oxidation with other minerals in the CHPP waste, particularly any carbonates and trace metals:

   - Acid Base Accounting
   - ICP Metals Analysis
   - Humidity cell tests and a field scale test with mined reject waste

4. Based on the assumed disposal method where acid generation from the waste is minimised as the stockpiles are constructed and pyrite contents, the coal waste is expected to generate between 3.0 and 7.2 t/d during the lifetime of the mine. Once detailed disposal design has been completed and site specific ABA testing is available, this modeling should be revisited to provide a more precise quantification of anticipated acid generation.

5. Covering of the piles with impermeable liners can be expected to minimize the rate of acid generation to very low levels. Covering will also minimize any seepage, resulting in precipitation of oxidation products within the coal waste disposal piles. This mechanism will further minimize the rates of long term continuing acid generation.

5.2.2.11 Hydrogeology

Proposed Power Transmission Line

Given the nature of the transmission line RoW, it has been considered from a surface water quality standpoint, but not with respect to groundwater. Approximately half of that RoW currently has a transmission line on it, and the remainder follows a former rail bed. The majority of the RoW is in undeveloped areas, with the exception of a few residential areas close to Victoria Junction, and around several road crossings. Given the proposed activity (construction of an above ground electrical transmission system, using standard operating procedures and best management practices which recognize environmental sensitivities), no impacts on groundwater resources are expected.

Donkin Peninsula

Previous work carried out by CBCL Limited (2008) or carried out by others (Dillon and Jacques Whitford) and reported by CBCL, included the installation and monitoring of monitor wells, standpipes and piezometers around and within the expected shallow groundwater discharge zones (Baileys Wetland and the former DEVCO settling pond) in the northwest and north central areas of the LAA. A number of shallow and deep bedrock monitoring wells were also installed previously, and monitored for groundwater. Details of the locations and construction of these monitoring points are provided in the CBCL (2008) report, and on Figure 5.2.4.

The topography of the LAA (see Figure 5.2.1) is such that shallow groundwater flow is expected to be either into the LAA from areas to the west, radially from the LAA into the marine environment, or internal (*i.e.*, discharging into surface water bodies and wetlands within the LAA, which eventually drain to the marine environment). Groundwater flow within the bedrock is also expected to eventually discharge into the marine environment, although there may be flow pathways which affect off-site conditions other than the marine environment, especially along the western boundary of the LAA.

As described by Forrester and Baechler (2007), there are three hydrostratigraphic units on the Donkin Peninsula, corresponding to the geology indicated above. Hydraulic gradients in the shallow soil unit are downward (infiltrating precipitation) and horizontal, and are largely controlled by the surface water features such as minor streams, Baileys Wetland and the former DEVCO settling pond, and by the underlying till or shallow bedrock (see Figure 5.2.4).

There is limited hydrogeological information for the till unit, but it is expected that hydraulic gradients will be primarily downward into the underlying bedrock, which is relatively shallow.

Bedrock flow conditions are more complicated, and can be subdivided into three main zones, as per Forrester and Baechler (2007):

- Land zone – primarily fresh water, recharged by precipitation. This zone would be the main zone that could potentially be impacted by surface operations of the mine.
- Exposed sea bed zone – primarily sea water infiltration. This zone is off-shore and would be potentially affected by underground operations.
- Covered sea bed zone – combination of sea water infiltration and fresh water recharge from the land connections. This zone could also be potentially affected by underground operations.

Vertical hydraulic gradients in the bedrock in the land zone are downward, based on previous monitoring, between the upper weathered bedrock (8 m to 11 m depth) and deeper more competent bedrock (35 m to 40 m depth). Monitoring also suggests a downward gradient between the shallow/surface water in the DEVCO settling pond and the shallow bedrock (at location D-1), indicating a recharge condition. The shallow/surface water elevations in Baileys Wetland are lower than either the DEVCO settling pond or the shallow bedrock at D-1, indicating that groundwater flow from the DEVCO settling pond to Baileys Wetland is likely occurring both through the overburden and through the shallow bedrock.

Information from the NSDNR website indicates that the till and bedrock aquifers have hydraulic characteristics as indicated in Table 5.2.4.

Table 5.2.4 Aquifer Characteristics

Characteristic	Till	Bedrock
Average Apparent Well Transmissivity (m^2/day)	79.9	16.0
Average Long Term Safe Yield (litres per minute – Lpm)	113.9	181.8
Average Well Specific Capacity (m^3/day/m)	82.1	20.4

5.2.2.12 Groundwater Use

Actual or potential users of groundwater resources in the area of the LAA were identified through review of Well Records in the Nova Scotia Environment database, and review of airphoto images for the presence of residences. The properties (including PIDs from the Service Nova Scotia Property On-Line database) identified are listed in Table 5.2.5. These properties and associated structures are shown on Figure 2.3.2.

Table 5.2.5 Well Records With Addresses

PID	Address	Well Record No.	Well Depth (m)	Well Type
Various (XCDM)	-	062164	60.9	Drilled
15277015	878 Long Beach Road	081588	85.3	Drilled
15277023	872 Long Beach Road	None	-	-

Table 5.2.5 Well Records With Addresses

PID	Address	Well Record No.	Well Depth (m)	Well Type
15277049	875 Long Beach Road	None	-	-
15277064	835 Long Beach Road	None	-	-
15277031	936 Long Beach Road	None	-	-

Along with the two well records identified above, the provincial database identified nine other wells in the area of the PDA. Four of these were older wells associated with the Donkin Mine, and five were wells that were listed in the Schooner Pond community, but with georeferences that could not be coordinated with actual residences. Those additional wells are shown in Table 5.2.6.

Table 5.2.6 Well Records Without Addresses

Address	Well Record No.	Well Depth (m)	Well Type
Donkin Mine	800572	60.9	Drilled
Donkin Mine	810543	62.4	Drilled
Donkin Mine	810544	92.9	Drilled
Donkin Mine	810545	114.2	Drilled
Schooner Pond	761489	29.2	Drilled
Schooner Pond	771124	55.7	Drilled
Schooner Pond	910159	68.5	Drilled
Schooner Pond Road (may be 936 Long Beach Road)	962379	74.3	Drilled
Schooner Pond	792553	68.2	Drilled

Most of the 11 wells for which records exist had one to three water bearing fracture zones identified during well construction, with depths of the water bearing fractures ranging from 7.3 to 79.2 m below ground. Most of the fractures were between 33.5 and 79.2 m (11 of 15 fracture zones).

Some of the residences along Long Beach Road may be serviced by dug wells (in the till unit), for which information hasn’t been provided to NSE. However, based on topography, such wells would be receiving groundwater flow from areas to the west, and therefore would not be affected by operations at the mine site.

5.2.2.13 Groundwater Quality

Groundwater quality has been monitored in various monitoring wells around the PDA since 2004. Results of that monitoring are presented in the annual reports prepared for XCDM, and are summarized as follows:

- The measurement of field parameters in groundwater wells on the site (only undertaken in 2011) indicates pH values ranging from 4.77 to 7.80, temperatures ranged from 5ºC to 11.9ºC, conductivity ranged from 40 µs/cm to 3,350 µs/cm, salinity ranged from 0 ppt to 1.8 ppt, and dissolved oxygen ranged from 1.40 mg/l to 7.29 mg/l.
- Analysis of groundwater samples indicates pH consistently below the range set out in the Guidelines for Canadian Drinking Water Quality (GCDWQ) in one shallow well (MW8-04) and two deep wells (D-1S and D-2S). MW8-04 represents groundwater in the till, and D-1S and D-2S represent groundwater in the shallow bedrock (1 to 4 m below the till/bedrock surface). TDS and/or colour are occasionally above the GCDWQ at most sampling locations, and chloride has been above the GCDWQ twice at MW1-04, once at MW3-04, and once at D-1D. All other general chemistry analytes were above the relevant GCDWQ.
- One or more of arsenic, barium, iron, manganese and sodium concentrations exceeding the GCDWQ were identified in all wells (except for MW2-04), with iron and manganese exceedances being the most common. Elevated iron and manganese in excess of the GCDWQ is common in Nova Scotia groundwater. Elevated sodium is also anticipated in groundwater at the site due to potential marine influences.
- Only one of the nine monitor well locations (MW1-04) had benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations in groundwater. Monitor well MW1-04 had an exceedance of the applicable GCDWQ guideline for ethylbenzene (0.0024 mg/L) with a concentration of 0.01 mg/l for both the April and November sampling events in 2011. All other parameters were below the laboratory detection limit and/or the CCME guidelines.
- All polycyclic aromatic hydrocarbons (PAH) concentrations were below the applicable GCDWQ (benzo(a)pyrene limit of 0.01 µg/l), except for shallow monitor well MW3-04, which had a benzo(a)pyrene concentration of 0.02 µg/l in November 2011 and MW7-04 which had a benzo(a)pyrene concentration of 0.02 µg/l in November 2010. Detectable PAH concentrations were measured in all monitor wells during most sampling events, with the most number of detectable analytes and the highest concentrations measured in MW1-04. The highest and most frequent detectable PAH concentrations appear to occur in close proximity to the former mine.

5.2.3 Potential Project-VEC Interactions

Table 5.2.7 below lists each Project activity and physical work for the Project, and ranks each interaction as 0, 1, or 2 based on the level of interaction each activity or physical work will have with Water Resources.

Table 5.2.7 Potential Project Environmental Effects to Water Resources

Project Activities and Physical Works	Potential Environmental Effects	
	Change in Surface Water Resources	Change in Groundwater Resources
Construction		
Site Preparation (incl. clearing, grading and excavation)	1	1
Construction of Mine Site Infrastructure and Underground Preparation	1	1
Construction of 138 kV Transmission Line	1	0
Construction of Barge Load-out Facility (incl. dredging, infilling and habitat compensation)	0	0
Installation of Transshipment Mooring	0	0
Operation and Maintenance		
Underground Mining	0	1
Coal Handling and Preparation (incl. coal washing and conveyance)	2	2
Water Treatment (incl. mine water and surface runoff)	2	2
Coal and Waste Rock Disposal	2	2
Marine Loading and Transportation	0	0
Coal Trucking	0	0
Decommissioning and Reclamation		
Site Decommissioning	1	1
Site Reclamation	2	2

0 = No interaction
1 = Interaction occurs; however, based on past experience and professional judgment, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

5.2.3.1 Surface Water

XCDM has developed, as an integral part of its operating principles, a sophisticated sustainable development framework. To prepare for the surface and underground site works associated with this Project, it will ensure that this framework is used to develop protocols to facilitate the execution of the proposed works in an environmentally responsible and safe manner.

The following activities will have no interaction with Water Resources and have been ranked 0 in Table 5.2.7. During the operation and maintenance phase, underground mining activities will only affect surface water through the discharge of mine water, which is considered separately below. Otherwise there is no interaction with surface water.

Construction of the barge load-out facility (including breakwater infrastructure) on the Donkin Peninsula and the installation of transshipment moorings in deeper waters will interact with marine waters but not freshwater resources; marine waters are addressed in the context of Marine Environment component of this EIS (Section 5.7).

Trucking activities, if they are undertaken, have been determined to not have any measurable effect on the level of service on Donkin Highway/Long Beach Road. They will also have no interaction with surface water.

The following activities will interact with Water Resources but these interactions can be managed through standard operating procedures and best management practices and have therefore been rated as 1 in Table 5.2.7.

Site grading is required to support the installation of the required site facilities, including the coal pad. This work will include the installation of all necessary sedimentation and erosion control measures, including the drainage infrastructure; this work will be done in accordance with Nova Scotia Environment's Erosion and Sedimentation Control Handbook for Construction Sites. Ongoing monitoring will occur under XCDM's existing sustainable development framework. Therefore, site preparation activities can be managed to acceptable levels.

Infrastructure and facility development planned for the Project includes roadways and the construction of site buildings. Since existing infrastructure is presently being managed within the PDA, potential effects from these activities can be managed to acceptable levels, as described above.

Site underground preparation will occur within a currently managed infrastructure, including the passive surface water treatment system which is presently in place and functioning to treat mine water discharge.

The new 138 kV transmission line to the mine site is planned to originate at the Victoria Junction Substation, approximately 25 km from Donkin Mine. Where practical, the line will be installed along existing rights-of-way including power transmission corridors currently used by NSPI for several existing transmission and distribution lines, between Victoria Junction and Glace Bay. Detailed routing and design of the transmission line will be undertaken by NSPI who, it is anticipated, will construct and operate the system. Surface disturbance from these activities will be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices.

The underground mining activities (*i.e.*, the extraction of the coal) occurs in the deeper groundwater regime, namely the Morien Bedrock hydrostratigraphic unit. The existing mine tunnels were excavated through the Portal Sandstone with flow into the tunnels resulting from fracture sets, some of which were created by tunnel development, including drilling. The mine tunnel extends from the Donkin Peninsula to the north (*i.e.*, subsea). Given the fact that the proposed coal extraction will take place at depth and at a considerable distance removed from the Donkin Peninsula, no surface water interaction with the mine workings is anticipated (except for the discharge of mine water, which is covered under Water Treatment).

Accidental releases of hazardous materials, such as fuels, into the environment as a consequence of Project activity may have an adverse effect on surface water resources. Spills are addressed under Accidents and Malfunctions (Section 6).

Site decommissioning activities will include the dismantling of underground facilities and above-ground infrastructure, as well as the removal of liquid and solid wastes. All works to decommission the site will be completed in accordance the Project Mine Closure and Reclamation Plan (See Section 2.5.3 and Appendix D) including surface water controls and treatment. This Plan will comply with all required regulations and industry standards, as well as the Proponent's sustainable development framework. Therefore no significant effects to surface water are predicted.

5.2.3.2 Groundwater

The following activities will have no interaction with Water Resources and have been ranked 0 in Table 5.2.7.

During the construction phase, several activities will not have any interaction with groundwater; construction of the transmission line; construction of the barge load-out facilities; and installation of the transshipment mooring. The load-out facility is primarily in the marine environment and the transshipment mooring is completely in the marine environment; therefore they will not have any interaction with groundwater. Construction of the transmission line will not change the surface conditions, and therefore will not change aquifer conditions or groundwater availability. The effects of surface disturbance, which will be over a limited area in relation to any groundwater recharge zones, will not affect groundwater quality.

Similarly during the operation and maintenance phase, the marine loading and coal trucking activities will not have any effect on groundwater.

The following activities will interact with Water Resources but these interactions can be managed through standard operating procedures and best management practices and have therefore been rated as 1 in Table 5.2.7.

During the construction phase, site clearing, grading and excavation activities will change the surface runoff and infiltration rate, and may intersect shallow groundwater in limited, isolated areas. These changes are expected to remain limited in their amplitude or spatial extent, and through application of best management practices will not result in a significant environmental effect.

The construction of above-ground mining infrastructure will have similar effects to those described above for site grading operations, and will be similarly managed. Therefore no significant environmental effects to groundwater are predicted.

Underground preparations (tunnel rehabilitation, tunnel construction, installation of conveyors, *etc.*) will have localized effects on groundwater (changes in groundwater flow patterns, fracture dewatering, changes in groundwater chemistry due to oxidation exposure, *etc.*). However, given the depths of the majority of that work, and the fact that it is primarily under sea, those changes in groundwater conditions will not affect the potable water users adjacent to the property (along the Donkin Highway), where drilled wells range in depth from 29 m to 85 m, averaging 64 m.

Similarly, during the operations phase, underground mining will only have localized effects on deep groundwater. The only potential effect on shallow groundwater would come from the discharge of mine water to the surface, which is addressed under water treatment below.

Activities undertaken during reclamation and decommissioning will be similar to those during the construction phase and will be similarly managed (*i.e.*, through application of the Mine Closure and Reclamation Plan), therefore no significant environmental effects to groundwater are predicted.

Accidental releases of hazardous materials, such as fuels, into the environment as a consequence of Project activity may have an adverse effect on groundwater resources. Spills are addressed under Accidents and Malfunctions (Section 6).

Thus, in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects of all Project activities and physical works that were ranked as 0 or 1 in Table 5.2.7, on Water Resources during any phase of the Project are rated not significant, and are not considered further in the assessment.

5.2.5 Assessment of Project-Related Environmental Effects

5.2.5.1 Assessment of Change in Surface Water Resources

5.2.5.1.1 Potential Environmental Effects

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions ranked as 2 on Water Resources is provided in Table 5.2.8. Only the interactions ranked as 2 were considered further in the assessment of Project related environmental effects. All other interactions previously ranked as 0 or 1 were rated as not significant.

During Project operations, there will be two primary sources of site generated wastewater: site runoff and mine discharge. These two sources are expected to exhibit similar characteristics (as have been measured to-date), including variable sediment load and metals concentrations, as well as pH concentrations near neutral.

Based on the analysis of Acid-Base Accounting and ICP-Metals test results, in addition to the desktop study of the surface water chemistry data, the existing development waste rock piles are not considered sulphide bearing materials, therefore are not potentially acid generating. It was assumed that the future development waste rock would be similar to the existing development waste rock in both physical and chemical properties.

The coal waste will be a by-product of the coal processing. Disposal of the dry rejects as landfill will provide ideal conditions for the generation of acidity. The pyritic material will be open to the atmosphere and in an area with net precipitation. The coarse grained nature of the waste will allow easy access of atmospheric oxygen and moisture to pyritic mineralization, and flushing of reaction products.

The two materials processes (coal handling and preparation, and coal waste disposal) will be managed, in order to prevent direct discharge of surface water in contact with these materials, (*i.e.* the areas will be lined, and will have water collection and pumping and treatment systems).

Removal of the surface water volumes intercepted by the coal waste disposal piles and their collection systems, will have a potential environmental effect on habitats such as Baileys Wetland.

During mine site reclamation and decommissioning activities will include grading, replacement of topsoil, and vegetation. These activities, which involve land disturbance, have the potential to impact surface water resources through increased soil erosion on a more widespread basis, and fugitive dust emissions. These sources include high sediment load and the presence of heavy metals.

5.2.5.1.2 Mitigation of Project Environmental Effects

Site runoff wastewater will be collected through a series of ditches and culverts and the runoff directed towards the existing serpentine pond on the eastern edge of the site. The underground mine discharge will be piped directly to the serpentine pond. The existing serpentine pond will serve as the treatment system for both mine water and runoff from mine disturbed areas (*i.e.,* site runoff) with a backup chemical feed system included should the mine water chemistry change from alkaline to acidic.

Site runoff wastewater will include storm water and dust suppression flows. These flows will be directed to the serpentine pond for sediment drop out. Once the fines have settled out of the discharge, the wastewater will flow over a weir and into the existing onsite settling pond to be used as recycled mine process and fire-fighting water.

Sewage flows from the administration, amenities, support services and maintenance buildings will be collected by gravity drainage and pumped to a treatment plant. A packaged wastewater treatment plant will be utilized using a circulating sand treatment system or similar. No sewage outfall pipes are planned for the Project.

The following mitigation measures will be instituted to minimize the potential of degradation to surface water quality during the execution of the Project (both during operation and maintenance and reclamation and decommissioning):

- early and efficient installation of erosion and sedimentation control measures and surface water control features, *e.g.*, silt fencing, before earth works within the active yard area and along the new access road are undertaken in accordance with the NSE Erosion and Sediment Control Handbook;
- collection of runoff from the active yard area via drainage ditching to the wastewater treatment system;
- collection of water pumped from the underground tunnels to the same treatment system following its pre-treatment with cascade aeration;
- continuation of a rigorous and defined surface water quality monitoring program throughout the system to maintain an accurate baseline for comparison purposes, to recognize any change occurring in Baileys Wetland and to identify those discrepancies that need to be addressed and managed;
- installation of a truck wash system within the active yard area to ensure that the transportation of sediments and coal fines onto the public road system is minimized;
- tarping of all trucks to minimize the transportation of coal fines during the product's transportation on public roads; and
- spill prevention and response procedures as outlined in Section 6.

Based on the assumed disposal methods and pyrite contents, the coal waste disposal piles are expected to generate a substantial amount of acid per day during the lifetime of the mine. Covering of the piles with impermeable liners can be expected to minimize the rate of acid generation to very low levels. Covering will also minimize any seepage, resulting in precipitation of oxidation products within the piles. This mechanism will further minimize the rates of long term continuing acid generation. All flow collected from lined coal piles and coal waste disposal piles will be directed to an active chemical treatment plant.

In order to mitigate the effect of reduction in direct surface water flow to Baileys Wetland (from the collection of water in the coal waste disposal piles), the collected water will be re-directed, after treatment, to areas upgradient of Baileys Wetland in order to maintain the water levels within the wetland (an important ecological consideration).

A water quality receiving study was completed by CBCL as part of the planning for tunnel dewatering. This study was based upon effluent dispersion rates achieved during the tunnel dewatering operations and worst case monitoring results. The results, based on the measurement of temperature, salinity and density and the modeling undertaken, demonstrated that any discharge from a point on the shore in water depths greater than 10 cm would be completely mixed with the water column. As the proposed treated discharge associated with the Project is estimated to be an order of magnitude less and the installed treatment system more rigorous than that deployed during tunnel dewatering, no adverse effect on marine water quality is predicted.

5.2.5.1.3 Characterization of Residual Project Environmental Effects

The mitigation measures described above will result in surface water quality and quantity which is comparable to baseline water quality and quantity.

5.2.5.2 Assessment of Change in Groundwater Resources

5.2.5.2.1 Potential Environmental Effects

There are two main potential environmental effects to shallow groundwater resources:

- changes in shallow groundwater quality resulting in changes in surface water quality, where the two are connected; and
- changes in shallow groundwater quality and quantity resulting in an effect on potable groundwater resources in the area.

The first effect (*i.e.*, changes to quality of shallow groundwater) has been described above in the context of interactions between surface water and shallow groundwater, and therefore will not be considered further here.

Potable groundwater use is only present as individual domestic use from drilled (and potentially dug) wells along Long Beach Road to the west of the mine site. The main mine operations (underground mining, CHPP, transshipment facility, *etc.*) are more than 1.5 km from the closest domestic well, and therefore will have no effect on these resources. However, the Phase III coal waste disposal pile may be as close as 150 m from domestic wells.

Groundwater quality will not be affected by the presence of the coal waste disposal piles, because all water infiltration through the pile will be collected and directed to a treatment system (the pile will be lined). Groundwater quantity could be affected by this removal of precipitation volume from the footprint of the coal waste disposal pile. However, that effect would be mitigated by the location of the pile in relation to the expected recharge area for the groundwater resource for those domestic wells. For overburden and shallow bedrock groundwater (intercepted by the domestic wells, to a maximum depth of 85 m), the main recharge area is west of Long Beach Road. There is some potential for a lowering of the shallow groundwater table in the area of the western coal waste disposal pile in an upgradient direction (*i.e.*, toward the domestic wells). This could be significant for dug wells, if they are present, but would be unlikely to significantly affect drilled wells.

5.2.5.2.2 Mitigation of Project Environmental Effects

The presence or absence of potable domestic groundwater use from dug wells will be determined, through a well survey of private properties along Long Beach Road. The well survey would also allow collection of pre-disturbance groundwater levels in drilled wells where present. A shallow groundwater monitoring program will also be designed and implemented between the proposed western waste rock disposal location and the domestic wells. This program will provide pre-disturbance data for overburden and shallow bedrock (to 85 m) groundwater levels, and allow monitoring after construction of the coal waste disposal pile begins. This domestic well survey and pre-disturbance monitoring activities at this location will not be required until two years prior to the construction of the Phase III coal waste disposal pile.

If that monitoring identifies significant changes in groundwater levels, which could be affecting the adjacent domestic wells, consideration will need to be given to a number of available options:

- replacement of affected domestic wells with deeper, drilled wells which are unlikely to be affected by the coal waste disposal pile; and/or
- impermeable capping of the coal waste disposal pile, to allow direction of unaffected precipitation away from the collection system and back into the shallow groundwater zone adjacent to the coal waste disposal pile.

5.2.5.2.3 Characterization of Residual Project Environmental Effects

Although the exact effects on groundwater quantity are difficult to predict it is possible that groundwater levels in the vicinity of the western coal waste disposal pile are lowered sufficiently that they affect adjacent domestic groundwater users, particularly if any have dug wells. Any such effects would be local (*i.e.,* restricted to the LAA) and amenable to mitigation.

5.2.5.3 Summary of Project Residual Environmental Effects

Table 5.2.8 summarizes the residual environmental effects of the Project on Water Resources.

Table 5.2.8 Summary of Project Residual Environmental Effects: Water Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Change in Surface Water Resources										
Construction	• Erosion and sedimentation controls, and collection of active yard runoff for direction to the passive treatment system. • Collection of all water pumped from the tunnels, with direction to the passive treatment system. • Collection of active yard runoff for direction to the passive treatment system. • Truck wash system in the active yard.	N	L	S	MT	R	R	D	N	• Continuation of existing monthly and semi-annual monitoring program.
Operation and Maintenance	• Collection (piles are lined) of precipitation infiltration through the coal piles and coal waste disposal piles, with direction to the active treatment system. • Re-direction of a portion of the actively treated water, once the west coal waste disposal pile (Phase III) is constructed, in order to replace the volume of surface water flowing into Baileys Wetland.	N	L	L	LT	C	R	D	N	• Continuation of existing monthly and semi-annual monitoring program.

Table 5.2.8 Summary of Project Residual Environmental Effects: Water Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Decommissioning and Reclamation	• Capping of coal waste disposal piles to minimize volumes of water in contact with coal waste.	A	L	L	P	C	R	D	N	
Change in Groundwater Resources										
Construction	None required.	N	L	S	MT	S	R	D	N	• Continuation of existing monthly and semi-annual groundwater monitoring program.

Table 5.2.8 Summary of Project Residual Environmental Effects: Water Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Operation and Maintenance	• Replacement of any domestic wells that are affected, *i.e.,* caused by a drop in the groundwater level available.	A	H	L	LT	C	R	D	N	• Continuation of existing monthly and semi-annual monitoring program. • Pre-disturbance well survey will be conducted to identify all domestic wells within the RAA, that might be affected. • Installation of a shallow groundwater monitoring network between the west coal waste disposal pile, and monitoring prior to the installation of the pile, to provide pre-disturbance data. • Monitoring of the shallow groundwater network after disposal starts at the west coal waste disposal pile (Phase III), to determine whether there are any effects, particularly with respect to Baileys Wetland.
Decommissioning and Reclamation	• Placement of impermeable caps on the coal waste piles, to reduce or eliminate infiltration.	N	L	L	P	C	R	D	N	• Monitoring of the shallow groundwater network after capping to confirm that conditions return to 'background'.

Table 5.2.8 Summary of Project Residual Environmental Effects: Water Resources

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		

KEY

Direction:

P Positive: condition is improving compared to baseline water quality and quantity

A Adverse: negative change compared to baseline water quality and quantity

N Neutral: no change compared to baseline water quality and quantity

Magnitude:

L Low: affecting the available quantity or quality of water resources in the shallow or deep aquifer, at levels that are indiscernible from natural variation

M Moderate: limiting the available quantity or quality of water resources, such that these resources are occasionally rendered unusable to current users for periods up to two weeks at a time

H High: limiting the available quantity and quality of water resources, such that these resources are rendered unusable or unavailable for current users during the life of the Project or for future generations beyond the life of the Project

Geographic Extent:

S Site: effects restricted to habitat within the PDA

L Local: effects extend beyond Project footprint but remain within the LAA

R Regional: effects extend into the RAA

Duration:

ST Short term: measurable for less than one month

MT Medium term: measurable for more than one month but less than two years

LT Long term: measurable for the life of the Project

P Permanent: effects are permanent

Frequency:

O Once: effect occurs once

S Sporadic: effect occurs more than once at irregular intervals

R Regular: effect occurs on a regular basis and at regular intervals

C Continuous: effect occurs continuously

Reversibility:

R Reversible: effects will cease during or after the Project is complete

I Irreversible: effects will persist after the life of the Project

Environmental Context:

U Undisturbed: effect takes place in an area that has not been adversely affected by human development

D Disturbed: effect takes place in an area that has been previously adversely affected by human development or in an area where human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

5.2.6 Assessment of Cumulative Environmental Effects

In association with the Project environmental effects discussed above, an assessment of the potential cumulative environmental effects was conducted for other projects and activities that have potential to interact with the Project. Table 5.2.9 below presents the potential cumulative environmental effects to the Water Resources, and ranks each interaction with other projects as 0, 1, or 2 with respect to the nature and degree to which important Project-related environmental effects overlap with those of other projects and activities.

Beyond the existing site conditions associated with past DEVCO activities (*i.e.*, the waste rock piles, underground mining facilities, and site infrastructure on the Donkin Peninsula) there are no other known works within the boundary of this assessment that would act cumulatively with this Project to adversely affect surface water and groundwater quantity and quality on the peninsula. The cumulative environmental effects on Water Resources will be mitigated through the appropriate implementation of the mitigative measures and monitoring described above.

Table 5.2.9 Potential Cumulative Environmental Effects to Water Resources

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Surface Water Resources	Change in Groundwater Resources
Historical coal mining and remediation activities	2	2

KEY

0 = Project environmental effects do not act cumulatively with those of other projects and activities.
1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of project-specific or regional mitigation.

5.2.7 Determination of Significance

Surface water effects (quantity and quality) can be mitigated through various site activities (collection and active treatment of water from the coal waste disposal piles, direction of the treated effluent to Baileys Wetland to maintain water levels, direction of general site run-off and mine water through the passive treatment system, *etc.*), and thus will have no residual environmental effects.

The presence of the Phase III coal waste disposal pile will have an effect on the shallow groundwater level, and therefore could have an effect on groundwater quantity available for neighbouring land owners (particularly if any dug wells are present). Mitigation for loss of domestic well yield is available through well replacement, and capping of the coal waste disposal piles.

With the proposed mitigation measures in place, the environmental effect of a decrease in shallow groundwater levels on the western boundary of the Project is predicted to be not significant.

The groundwater conditions on the site are well understood, based on site monitoring over a four year period, as well as more than 20 years of experience with groundwater in the area (same overburden and bedrock geology).

The residual cumulative environmental effect of a change in groundwater level and thus available quantity as a result of past, present, and reasonably foreseeable projects and activities in combination with the environmental effects of the Project during all phases, on Water Resources is rated as not significant. The Project contribution to the cumulative environmental effects on a change in shallow groundwater level and thus available groundwater quantity is also rated as not significant.

It has been determined that the overall potential residual and cumulative environmental effects of the Project on Water Resources is not significant.

5.2.8 Follow-up and Monitoring

A pre-disturbance domestic well survey and monitoring of overburden and shallow groundwater levels in the area between the Phase III coal waste disposal pile and Long Beach Road will be undertaken to determine whether, and to what extent, groundwater levels are being affected by the presence of the coal waste disposal pile, as it is constructed. This will allow determination of optimum mitigation, if necessary. This survey and monitoring at this location will not be required until two years prior to the construction of the Phase III coal waste disposal pile.

A surface water monitoring program will be undertaken for the passive water treatment system treating site runoff and mine water discharge. This program will be defined during the permitting process but it expected to be similar in scope to the approved water quality monitoring program (including toxicity testing and hydrology in Baileys Wetland) currently undertaken as part of XCDM's Industrial Approval for the care and maintenance phase. This monitoring program will be supplemented for discharges from the active treatment system to treat acidic runoff from the coal waste disposal piles. It is expected that groundwater monitoring will continue to be undertaken onsite as it is currently during the care and maintenance phase.

5.3 BIRDS AND WILDLIFE

Birds and Wildlife is selected as a VEC because of potential for interactions between wildlife and Project activities, particularly species that are of conservation interest. Provincial and federal legislation provides protection to designated bird, mammal and herpetile Species at Risk. In addition, most bird species are protected under the *Migratory Birds Convention Act*. The Bird and Wildlife VEC is linked to Wetlands (Section 5.4) which integrates wildlife, vegetation, hydrology, land form, and soils. Relevant information is also provided in Rare Plants (Section 5.5) which incorporates plant community descriptions and mapping that provide information on wildlife habitat.

5.3.1 Scope of Assessment

The Donkin Peninsula provides important bird habitat. It is part of the Northern Head/South Head Important Bird Area (IBA). The IBA program is an international conservation initiative coordinated by BirdLife International. IBA sites are areas of international significance for the conservation of birds and biodiversity. The IBA program identifies areas that support threatened birds, large groups of birds or birds restricted by range or by habitat. The designation of an area as an IBA site does not confer legal protection to the site; however, federal and provincial regulators recognize that IBA sites represent ecologically sensitive areas and take them into consideration during the environmental assessment process. The Northern Head/South Head site has been declared an IBA primarily as a result of the presence of a large seabird colony at the eastern end of the peninsula. At one time (1992), this colony supported 6.7 percent of the North American population of Great Cormorants (IBA Canada 2010). The Donkin Peninsula juts out into the Atlantic Ocean from the northeastern corner of Cape Breton Island. This location makes the Donkin Peninsula attractive to migrant bird species. As birds approach the coast, the Donkin Peninsula is one of the first landforms to come into view making it an attractive landfall for south bound migrants. It is particularly attractive to birds that have been blown out to sea by storms. As a result of this geography, the Donkin Peninsula receives a disproportionately large number of vagrant birds that are far from their normal ranges. This in turn has made the Donkin Peninsula a popular area for birding. Note that scientific names for bird species discussed in the EIS are included in Appendix J.

5.3.1.1 Regulatory Setting

Migratory birds are protected federally under the *Migratory Birds Convention Act, 1994* which states that "no person shall disturb, destroy or take a nest, egg, nest shelter, either duck shelter or duck box of a migratory bird" without a permit. The Act includes prohibition of "incidental take" of migratory birds or their nests as a result of activities such as those required for the proposed Project. Under the current *Migratory Birds Regulations*, no permits can be issued for the incidental take of migratory birds or nests caused by development projects or other economic activities. Furthermore, Section 5.1 of the *Migratory Birds Convention Act* describes prohibitions related to deposit of substances harmful to migratory birds: "No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area" and "no person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds." Other bird species (and other wildlife) not protected under the federal act, such as raptors and cormorants, are protected under the provincial Wildlife Act.

Wildlife species that are protected federally under the *Species at Risk Act* (SARA) are listed in Schedule 1 of the Act. As defined in SARA, "wildlife species" means a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. The purpose of this Act is to protect wildlife Species at Risk and their critical habitat. SARA is administered by Environment Canada, Parks Canada Agency, and DFO. Those species listed as "Endangered" or "Threatened" in Schedule 2 or 3 of SARA may also be considered as Species at Risk, pending regulatory consultation.

Certain wildlife species are also protected under the Nova Scotia *Endangered Species Act* (NS ESA). Species identified as seriously at risk of extinction in Nova Scotia are identified by a provincial status assessment process through the Nova Scotia Endangered Species Working Group. Once identified, they are protected under the NS ESA. The conservation and recovery of species assessed and legally listed under the NS ESA is coordinated by the Wildlife Division of the NSDNR. There is also a provincial General Status assessment process that serves as a first alert tool for identifying species in the province that are potentially at risk. Under this process, species are assigned to one of four categories that designate their population status in Nova Scotia. These include "Secure", "Sensitive", "May be at Risk", and "At Risk". Although species assessed under this process are not granted legislative protection, the presence of species ranked as "Sensitive", "May be at Risk" and "At Risk" is an indication of concern by provincial regulators.

5.3.1.2 Influence of Consultation and Engagement on the Assessment

During the stakeholder and public engagement process, the main issue raised by stakeholders and community members with respect to birds and wildlife was the continued use of the peninsula as a public recreational birding area.

5.3.1.3 Selection of Environmental Effects and Measurable Parameters

The environmental assessment of Birds and Wildlife is focused on the following environmental effects:

- Change in Wildlife Habitat; and
- Change in Mortality Risk.

The measureable parameters used for the assessment of the environmental effects presented above and the rationale for their selection is provided in Table 5.3.1

Table 5.3.1 Measurable Parameters for Birds and Wildlife

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Wildlife Habitat	• Fragmentation of habitat • Loss of habitat including interior habitat and wildlife corridors • Introduction of physical or chemical hazards • Sensory disturbance • Change in sound pressure levels (dBA)	Habitat loss or alteration can lead to changes in wildlife behaviour and/or species mortality and breeding success. The *Migratory Birds Convention Act*, SARA and Nova Scotia *Endangered Species Act* afford protection to habitat for species of migratory birds and/or species of conservation concern. Sensory disturbance to wildlife through noise and/or light emissions can result in potential change of behaviour including wildlife attraction or habitat avoidance and potentially lead to changes in species populations over time, particularly for species of conservation concern. Federal and provincial legislation prohibit harassment of species, including but not limited to, disturbance to nesting migratory birds.
Change in Mortality Risk	• Loss of species of conservation interest • Loss of individuals attributable to the Project	Various species are afforded legal protection through the *Migratory Birds Convention Act*, SARA and/or the Nova Scotia *Endangered Species Act*. Baseline wildlife and habitat surveys identify presence of species of conservation interest and inform prediction of potential effects on species populations.

5.3.1.4 Temporal and Spatial Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Birds and Wildlife include the periods of construction, operation and maintenance, and decommissioning and reclamation. Temporal considerations for Birds and Wildlife include periods of sensitive life stages for species including migration, breeding and other seasonal activities.

The spatial boundaries for the environmental effects assessment of the Birds and Wildlife VEC are described below.

Project Development Area (PDA): The PDA includes the area of physical disturbance (*i.e.*, “footprint” for the Project including infrastructure for the mine site as well as stockpiles, coal waste piles, conveyor system, 138 kV transmission line, and trucking routes. The PDA also includes the barge load-out facility and transshipment mooring and vessel route between the two.

Local Assessment Area (LAA): The LAA for Birds and Wildlife is defined as the Donkin Peninsula (east of the Long Beach Road) for the mine component of the Project. The marine component of the LAA includes the 1 km^2 area surrounding the barge load-out wharf and the barge swing circle; a 500 m wide corridor following the barge route between the barge load-out wharf and the transshipment location; and a 1 km^2 area surrounding the transshipment location. The geographic extent of the LAA is presented in Figures 5.3.1 and 5.7.1.

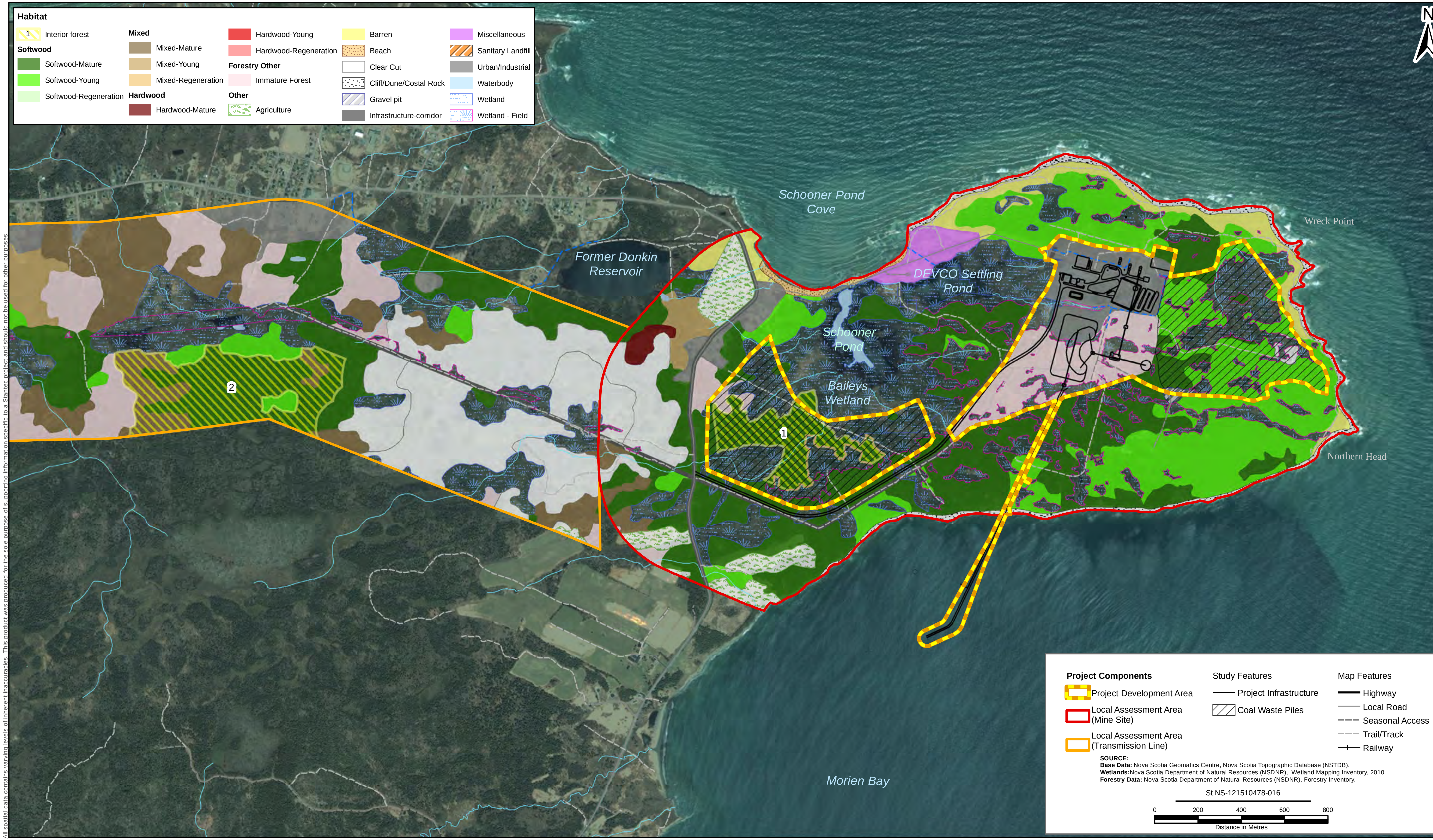
Regional Assessment Area (RAA): The RAA is limited to and includes the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts, as defined by Neily *et al.* (2003). The RAA is the area within which cumulative environmental effects for birds and wildlife may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects.

5.3.1.5 Residual Environmental Effects Description Criteria

Terms that will be used to characterize residual environmental effects for Birds and Wildlife are presented in Table 5.3.2.

Table 5.3.2 Characterization Criteria for Residual Effects on Birds and Wildlife

Criterion	Description
Direction	**Positive:** condition is improving compared to baseline habitat or population status **Neutral:** no change compared to baseline habitat or population status **Adverse:** negative change compared to baseline habitat or population status
Magnitude	**Negligible:** no measurable adverse effects anticipated **Low:** effect is detectable but only on a few individuals **Moderate:** effect on many individuals **High:** effect occurs at the population level
Geographical Extent	**Site-specific:** effects restricted to habitat within the PDA **Local:** effects extend beyond PDA but remain within the LAA **Regional:** effects extend into the RAA
Frequency	**Once:** effect occurs once **Rarely:** effect occurs monthly **Frequently:** effect occurs daily
Duration	**Short-term:** measurable for less than one month **Medium-term:** measurable for more than one month but less than two years **Long-term:** measurable for the life of the Project
Reversibility	**Reversible:** effects will cease during or after the Project is complete **Irreversible:** effects will persist after the life of the Project
Ecological Context	**Disturbed:** effect takes place in an area that has been previously adversely affected by human development or in an area where human development is still present **Undisturbed:** effect takes place in an area that has not been adversely affected by human development



PREPARED BY: M. Huskins-Shupe

REVIEWED BY: K Keizer

CLIENT: xstrata coal

Donkin Export Coking Coal Project

Interior Forest Overview (Map 1 of 4)

FIGURE NO.: 5.3.1 a

DATE: Apr 25, 2012

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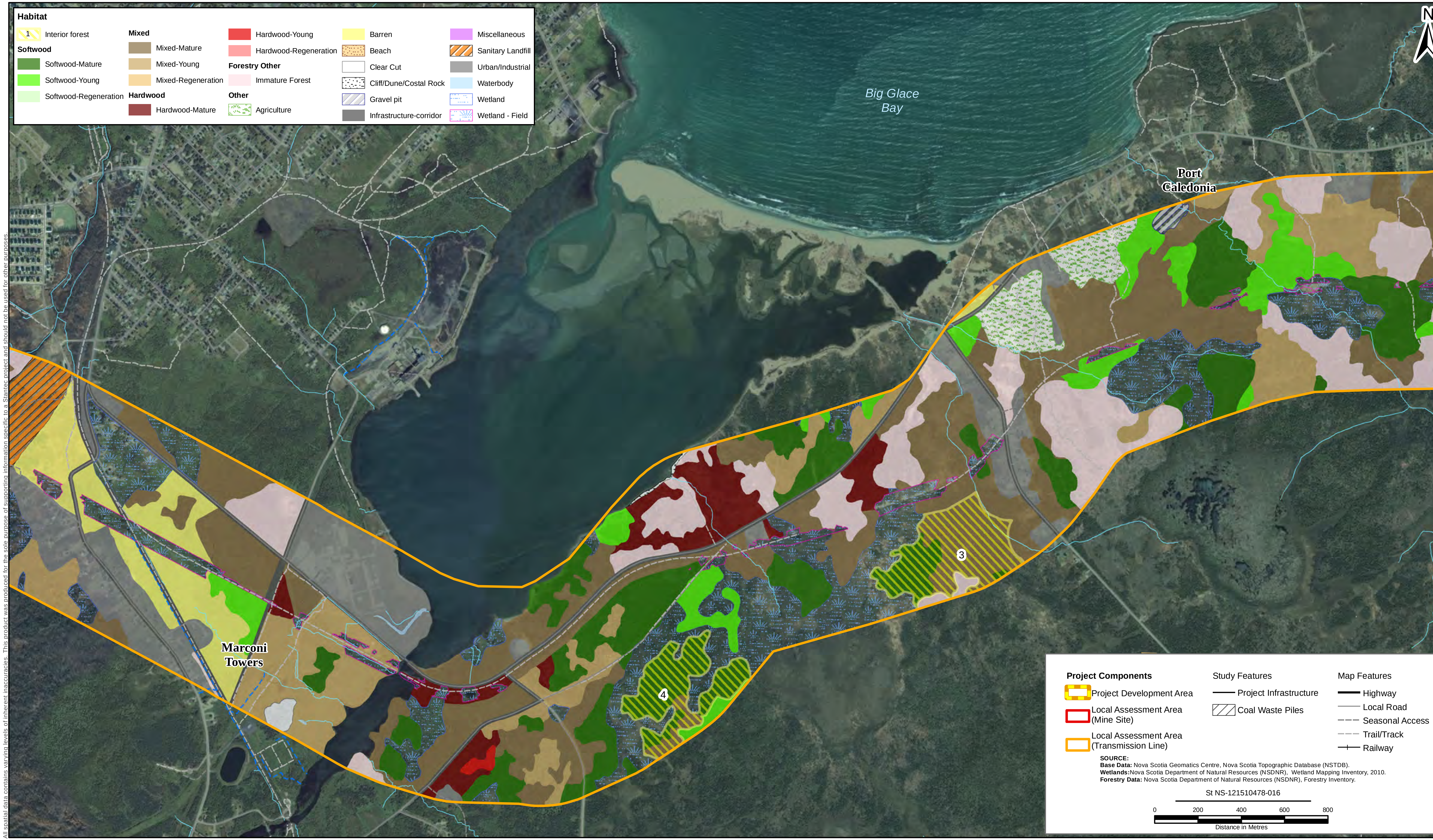

PREPARED BY: M. Huskins-Shupe	Donkin Export Coking Coal Project	FIGURE NO.: 5.3.1 b
REVIEWED BY: K Keizer		DATE: Apr 25, 2012
CLIENT: xstrata coal	**Interior Forest Overview (Map 2 of 4)**	Stantec

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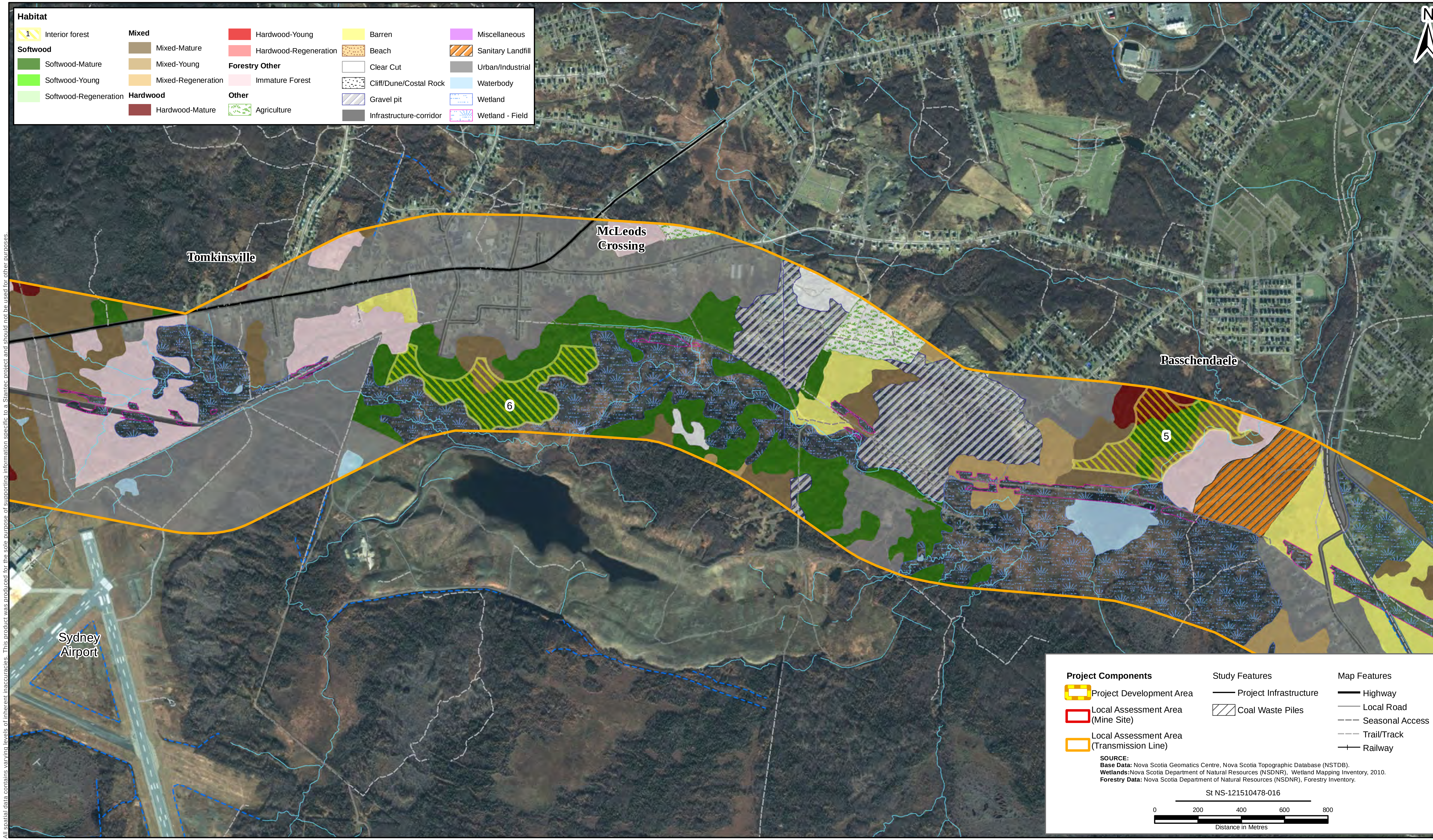

PREPARED BY: M. Huskins-Shupe

REVIEWED BY: K Keizer

CLIENT: xstrata coal

Donkin Export Coking Coal Project

Interior Forest Overview (Map 3 of 4)

FIGURE NO.: 5.3.1 c

DATE: Apr 25, 2012

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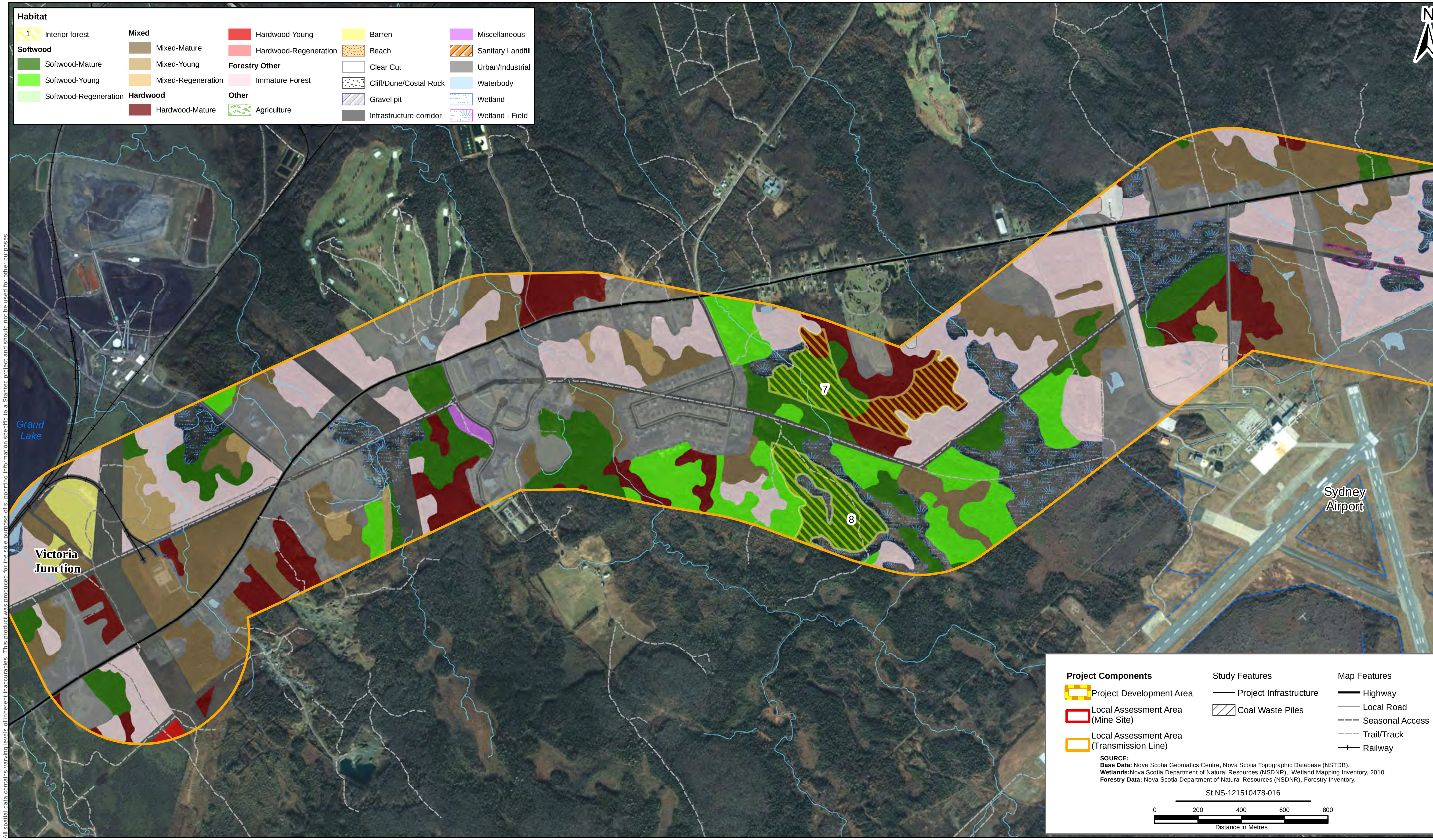

PREPARED BY: M. Huskins-Shupe	Donkin Export Coking Coal Project	FIGURE NO.: 5.3.1 d
REVIEWED BY: K Keizer		DATE: Apr 25, 2012
CLIENT: xstrata coal	**Interior Forest Overview (Map 4 of 4)**	Stantec

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5.3.1.6 Threshold for Determining the Significance of Residual Environmental Effects

SARA and NS ESA afford levels of protection to Species at Risk and Species of Conservation Concern, according to species rarity rankings. For example, only those species currently listed in Schedule 1 of SARA are protected by that Act. SARA listed species designated as "Special Concern" are not protected by the prohibitions of Sections 32-36 of SARA, but require that provincial or regional management plans are developed to protect the species. Additionally, Section 79 of SARA is applicable to all wildlife species listed by the act (including those designated to be of "Special Concern") and states that "every person who is required by or under an Act of Parliament to ensure that an assessment of the environmental effects of a project is conducted must, without delay, notify the competent minister or ministers in writing of the project if it is likely to affect a listed wildlife species or its critical habitat". Furthermore, "the person must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans".

Also, there are multiple agencies that provide lists of "Species of Conservation Concern" that are not protected by an Act, but require special consideration for the purpose of environmental assessment. As a result, multiple significance criteria are required to accommodate the different levels of protection afforded by these various acts, agencies and listings. Definitions of rarity ranks referred to in the significance criteria are summarized in Appendix J. The term "Species of Conservation Interest" is used as an all-encompassing term in this EIS to refer to species at risk and species of conservation concern as a single unit.

Species at Risk

A **significant residual adverse environmental effect** on all wildlife species listed in Schedule 1 of SARA as "Extirpated", "Endangered" or "Threatened" is:

- One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of SARA, or in contravention of any of the prohibitions stated in Section 3 of the Nova Scotia *Endangered Species Act*; or
- One that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts, is substantially reduced as a result.

Species of Conservation Concern

A **significant residual adverse environmental effect** on listed wildlife species not under the protection of SARA or the Nova Scotia *Endangered Species Act* (*i.e.,* listed as "Special

Concern” in Schedule 1 of SARA; listed in Schedule 2 or 3 of SARA; or ranked as S1, S2, or S3 by Atlantic Canada Conservation Data Centre (ACCDC); and/or ranked “At Risk”, “May Be At Risk” or “Sensitive” by NSDNR (2007c)) is:

- One that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Bras d’Or Lowlands and Cape Breton Coastal Ecodistricts, is substantially reduced as a result; or

- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure wildlife population(s) within the Bras d’Or Lowlands and Cape Breton Coastal Ecodistricts,is substantially reduced as a result; or

- In the case of wildlife species of “Special Concern” listed in Schedule 1 of SARA, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of SARA) that are in place at the time of relevant Project activities.

Secure Species

A **significant residual adverse environmental effect** on all secure wildlife species (including those ranked S4 or S5 by ACCDC, and/or designated as “Secure” by NSDNR) is:

- One that affects wildlife (*e.g.,* direct mortality, change in migratory patterns, habitat avoidance) or wildlife habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Bras d’Or Lowlands and Cape Breton Coastal Ecodistricts, and natural recruitment may not re-establish the population(s) to its original level.

5.3.2 Existing Conditions

5.3.2.1 Overview of Regional Assessment Area

The Project is located within the Bras d'Or Lowlands Ecodistrict of the Northumberland Bras d’Or Lowlands Ecoregion, as defined by Neily *et al.* (2003). This ecodistrict encompasses the lowland areas around the Bras d’Or Lakes and the Sydney coalfield, Boularderie Island and the portion of the Salmon River Valley on the east side of the East Bay Hills. The climate of this district is moderated by its proximity to the Bras d’Or Lakes as well as adjacent upland regions, and mean annual precipitation ranges between approximately 1100-1400 mm. Black and white spruce (*Picea mariana* and *P. glauca*, respectively) represent the predominant species throughout much of its area, although balsam fir (*Abies balsamea*) is also common, particularly due to its establishment in areas which have been disturbed by harvesting or by natural causes (Neily *et al.* 2003). Stands of red spruce (*P. rubens*) and eastern hemlock (*Tsuga canadensis*) are present in the valleys and along some watercourses coming off the uplands. Eastern white pine (*Pinus strobus*) may also be found and some well-drained hills support sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*). The clearing of land by early settlers and then subsequent abandonment of the fields and pastures has given rise to large areas of old field white spruce. Wind represents the most prominent natural disturbance regime within the ecodistrict, with blowdown being particularly evident along exposed lakes and coasts (Neily *et al.* 2003).

Owing to the location of the Donkin Peninsula on the northeastern coast of the province, the site strongly reflects characteristics of the adjacent Cape Breton Coastal Ecodistrict. In this ecodistrict, the influence of the Atlantic Ocean overwhelms the effect of other environmental characteristics such as the composition of the underlying geology (Neily *et al.* 2003). As is typical of coastal forests throughout Nova Scotia, the dominant stand type within the Cape Breton Coastal Ecodistrict is comprised of a mixture of white spruce, balsam fir and black spruce, with red maple (*Acer rubrum*) and paper birch (*Betula papyrifera*) being found in association. Wind is the most important disturbance mechanism and results in both stand level disturbances and/or small gap disturbances (Neily *et al.* 2003).

Soils of the peninsula and along the transmission line are predominantly comprised of poorly drained sandy loam till of the Economy Soil Series and are generally level and moderately stony (Agriculture Canada 1963). Pockets of peat are common along the transmission route as well as at the peninsula and are associated with poorly drained depressions. Although not present on the Donkin Peninsula, the western section of the transmission route does cross some sections of the Shulie Soil Series. These soils are well drained sandy loam tills associated with a undulating to gently rolling topography, and are moderately stony (Agriculture Canada 1963).

The Donkin Peninsula is recognized to be part of an IBA by the Canadian co-partners of BirdLife International (Bird Studies Canada and Nature Canada). The IBA program is an international conservation initiative that identifies discrete sites that support specific groups of birds: threatened birds, large groups of birds, and birds restricted by range or by habitat. IBA designations do not have any regulatory or legal status but they have been used to design conservation reserve networks, prioritize lands for acquisition, and have been used by governments for assessing impacts and establishing guidelines for proposed development projects. The Northern Head and South Head IBA (NS053), in which the peninsula is located, is considered to be “Globally Significant” as a result of supporting relatively large congregations of nesting Great Cormorants. As of 1992, the Northern and South Head IBA supported 6.7 percent of the North American population of Great Cormorants. This IBA is also noted for the presence of a large colony of Black-legged Kittiwakes and the occasional presence of Harlequin Ducks, a federally endangered species in adjacent coastal waters during the winter months. (IBA Canada 2010). Disturbance and hunting are considered by IBA Canada to be potential or ongoing threats to avifauna within this IBA. Additionally, the Donkin Peninsula is approximately 5 km from the Big Glace Bay Lake IBA and 17 km from the Scatarie Island Main-a-Dieu IBA. The coastal lagoon and barrier beach of the Big Glace Bay Lake IBA is considered to be continentally significant for congregatory species (particularly Canada Goose as well as ducks, shorebirds and terns) and is designated as a federal Migratory Bird Sanctuary (IBA Canada). The Scatarie Island Main-a-Dieu IBA is regarded as nationally significant for threatened species (*i.e.*, Bicknell's Thrush) and congregatory species.

Beyond the federal and provincial regulatory context, all Xstrata-managed operations, including Donkin Mine, are expected to implement a biodiversity conservation plan to protect species and landscape functions throughout their life cycle. Part of Xstrata's target is the prevention of the loss of any International Union for Conservation of Nature (IUCN) red list/endangered species from the sites of any Xstrata managed operations (Xstrata 2010) and to review biodiversity conservation and land management plans annually. Because the criteria used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for the assessment of species' status are based on IUCN Red List criteria, and are applied at the national rather than international scale, IUCN rankings are generally covered by those assigned by COSEWIC.

5.3.2.2 Study Methods

Data Sources

Information regarding use of the Project Area by wildlife was derived from several sources including field surveys and reviews of existing data sources. Field surveys were conducted during spring and fall of 2010 and during late winter, spring and late summer of 2011. During these surveys, information was collected regarding the presence of birds, mammals and herpetiles (amphibians and reptiles).

Existing sources of data were also consulted. An ACCDC data search was conducted to determine if any rare or sensitive wildlife species have been recorded in the LAA. The ACCDC data were also incorporated into a wildlife model to determine the likelihood of the presence of rare or sensitive wildlife species within the LAA.

Reference sources such as a breeding bird survey conducted in the Project Area in 2002 (McCorquodale 2002), extensive bird records compiled by local birders (MacLaren 2007), Maritime Breeding Bird Atlas (MBBA 2011) records, the Gazetteer if Marine Birds in Atlantic Canada (Lock *et al*. 1994), and the Amphibians and Reptiles of Nova Scotia (Gilhen 1984) were also used.

Specific survey methods are discussed below under each wildlife category.

Birds

Information regarding use of the Project Area by birds was derived from several sources including field surveys and reviews of existing data sources. Field surveys conducted for this Project included:

- a breeding bird survey conducted on June 14 and 15, 2010;
- seabird colony survey conducted on June 14, 2010 and June 29, 2011;
- fall bird migration stop over surveys conducted on 13 occasions between September 8 and November 28, 2010, and two occasions between August 11 and August 25, 2011;
- late winter/early spring coastal surveys conducted on March 4 and 28, 2011;
- Common Nighthawk surveys conducted on June 28 and 29, 2011; and
- Boat-based Peregrine Falcon nest survey on June 14, 2010 and June 29, 2011.

Existing sources of data were also consulted. The Donkin Peninsula is a popular birding area so there is a substantial body of information regarding the use of the peninsula by birds. These records have been recorded by local naturalists Alan and Cathy Murrant and have been compiled by MacLaren (2007). Data from annual Christmas Bird Counts was also reviewed for information on the frequency and abundance of Harlequin Ducks within the area. In addition, a breeding bird survey was conducted on the peninsula as part of the environmental assessment for a proposed wind farm site (McCorquodale 2002). Information available for the Northern Head and South Head IBA was also reviewed (IBA Canada 2010). Maritime Breeding Bird Atlas data was compiled for the breeding bird atlas square in which the study area is situated. The Breeding Bird Survey (BBS) data base was consulted to determine if there were any nearby BBS survey routes. None are present near the LAA so this data source was not used.

An ACCDC data search was conducted for the LAA and surroundings. All records of birds of conservation concern were requested for a 100 km radius around the PDA. The ACCDC data were incorporated into a wildlife model to determine the likelihood of the presence of rare or sensitive wildlife species within the LAA. As part of the modeling exercise, all records of wildlife species listed by NSDNR as “At Risk” (“Red” listed) or “Sensitive” to human activities or natural events (“Yellow” listed) (NSDNR 2007) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the habitat descriptions compiled for the LAA to determine if suitable habitat was present for these species. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present and the suitable habitat in the LAA was identified as a target for field surveys.

Terrestrial Breeding Bird Surveys

Breeding bird surveys were conducted on the Donkin Peninsula on June 14 and 15, 2010 and along portions of the proposed transmission line corridor on June 22, 23 and 25, 2010. The breeding bird surveys were conducted between the hours of 05:30 and 12:00. During the breeding bird surveys all habitat types found within the survey area were visited by birders experienced in conducting auditory breeding bird surveys. All birds detected by sight or sound from the survey area were recorded. For each observation, the species, number of individuals observed, habitat in which the bird was encountered, location (geo-referenced), and evidence of breeding activity were observed. The breeding status of each species recorded was determined using the method employed by the Atlas of Breeding Birds of the Maritimes program (Erskine 1992). Species identified but not exhibiting signs of breeding (such as flyovers) were classified as non-breeders. Species observed or heard singing in suitable nesting habitat was classified as possible breeders. Species exhibiting the following behaviors were classed as probable breeders:

- Courtship behaviour between a male and female;
- Birds visiting a probable nesting site;
- Birds displaying agitated behaviour; and
- Male and female observed together in suitable nesting habitat.

Species were confirmed as breeding if any of the following items or activities were observed:

- Nest building or adults carrying nesting material;
- Distraction display or injury feigning;
- Recently fledged young;
- Occupied nest located; and
- Adult observed carrying food or faecal sac for young.

The population status of each species was determined from existing literature. Lists of provincially rare or sensitive birds were derived from the ACCDC (2011) General Status Ranks, General Status of Wildlife in Nova Scotia (NSDNR 2010a) and Species at Risk in Nova Scotia (NSDNR 2009) while nationally rare species were derived from COSEWIC (2010) and the SARA.

Seabird Colony Survey

Seabird colony surveys were conducted from boat and from land. The boat based surveys were conducted on June 14, 2010 and June 29, 2011.

During the 2010 survey, an area from Wreck Point to approximately 1.5 km west of Northern Head was investigated; a distance of approximately 2.5 km. Observations were made from an open boat traveling parallel to the shore line. During the survey all seabirds present on the cliffs, on the water or flying near the cliffs were recorded. Birds sitting on nests were counted separately from birds that were not incubating. Incubating or roosting birds were not obviously disturbed by the presence of the boat and remained on nests at the approach of the boat.

In order to minimize errors associated with miscounting seabird nests, the survey was repeated twice using two different observers. In addition, a section of cliff at Northern Head that could be surveyed effectively from the land was surveyed separately as a subsample of the total seabird nest count. This area was visited several hours after the completion of the boat based survey and this subsample of nests was counted from the land by two observers. The land based counts could be conducted more accurately than the boat based counts and were used to help account for observer errors in the boat based survey.

During the 2010 survey, it was not possible to differentiate Great Cormorants and Double-crested Cormorants due to the boat survey limitations (*e.g.*, distance from shore). As such, Great Cormorants and Double-crested Cormorants were lumped together under Cormorant spp.

The 2011 seabird survey was conducted in a similar manner to the 2010 survey although there were some differences. The total length of shoreline covered in this survey was 4.75 km extending from Schooner Cove on the north side of the Donkin Peninsula around the peninsula to the proposed barge load-out facility site on the southern side. The seabird colony survey was combined with a search for possible Peregrine Falcon nests on the cliffs of the peninsula. Winds were very light on the day of the 2011 seabird colony survey and it was possible to approach the shore much closer than was possible in 2010. At the closer distances, it was possible to distinguish Great Cormorants from Double-crested Cormorants.

Fall Migration Stop Over Survey

Six, 500 m long transects were established in various habitat types on the Donkin Peninsula. The goal was to collect data in key habitats where migrating land birds, shorebirds, and seabirds tend to congregate including beach, coastal barrens, coniferous forest, krumholtz, old field, and alder thicket. Each transect was sampled 13 times between September 8 and November 28, 2010. Surveys were conducted twice weekly between early September and mid-October, weekly from mid-October to the end of October and once every two weeks during the month of November. An additional two surveys were conducted in August 2011 (August 11 and 25) to collect information during the early stages of migration.

During each survey, each transect was walked slowly and all birds observed or heard were recorded. The distance of the bird from the transect (perpendicular to the closest part of the transect), habitat the bird was using or if not whether the bird was flying over were recorded. At least 30 minutes were spent searching for birds along each transect during each survey. On each transect mobbing calls (*e.g.,* Black-capped Chickadee, Eastern Screech Owl (*Otus asio*), White-throated Sparrow, Barred Owl) were played at least twice to attract passerines. Binoculars (8 x 42) were used for all observations. Along the coast this meant that virtually all birds within 500 m of shore were identifiable and the larger obvious species (*e.g.,* Northern Gannet, Great Black-backed Gull) were identifiable from much further. Flying ducks or gulls that were not identified to species beyond 1 km were not recorded.

Late Winter/Early Spring Coastal Surveys

Coastal birds were surveyed twice in late winter/early spring, on March 4 and 28, 2011 by walking transects 4, 5 and 6 from the Autumn Migration Surveys. A specific target of these surveys was the headland near Cape Perce where Harlequin Duck has been recorded in the early winter on the Glace Bay Christmas Bird Counts.

Peregrine Falcon Nest Survey

During the 2010 breeding bird surveys, a bird tentatively identified as a Peregrine Falcon was observed on the Donkin Peninsula near Northern Head. The presence of a Peregrine Falcon near suitable nesting habitat (coastal cliffs) suggested that this species could potentially nest in the area. A Peregrine Falcon nest survey was conducted on June 14, 2010 and June 29, 2011 in conjunction with the seabird colony survey to determine if this species was nesting on the Donkin Peninsula. During these surveys, sea cliffs along the Donkin Peninsula were observed from a boat traveling between 40 and 150 m from the shoreline. The length of shoreline searched in 2010 was 2.5 km extending from Wreck Point to approximately 1.5 km west of Northern Head. The 2011 survey route was 4.75 km long and extended from Schooner Cove on the north side of the peninsula to the proposed barge load-out facility on the southern part of the peninsula.

Common Nighthawk Surveys

The disturbed habitat at the existing mine site provides suitable nesting habitat for Common Nighthawk, a species recently listed under SARA. Common Nighthawks are most active at dawn and dusk and may be difficult to detect during regular breeding bird surveys. Dedicated Common Nighthawk surveys were conducted on June 28 and 29, 2011. The surveys were conducted during the period from one hour before sunset to one hour after sunset.

5.3.2.3 Survey Results

Habitat

This section provides a brief description of the terrestrial habitat in the LAA as well as a description of how the existing habitat has been affected by past and ongoing anthropogenic activities. Figure 5.3.1 presents the distribution of habitats within the LAA including both the mine site (Donkin Peninsula) and the transmission line route. The abundance of each of the habitat types in the LAA is presented in Table 5.3.3. More detailed descriptions of the terrestrial habitats present on the Donkin Peninsula, including information on corresponding vegetation types described by Nova Scotia's Forest Ecosystem Classification (FEC) (NSDNR 2011b), are presented in Sections 5.4 and 5.5.

Table 5.3.3 Abundance of Each of the Habitat Types in the Mine Site and Transmission Line LAA

Habitat Type	Land Cover Type	Mine Site LAA		Transmission Line LAA		Total LAA
		Area (ha)	Percent of Total Area	Area (ha)	Percent of Total Area	Area (ha)
Forested	Mature Softwood	113.0	24.5	292.0	13.0	405.0
	Young Softwood	87.4	19.0	87.4	3.9	175.0
	Mature Mixedwood	3.5	0.8	328.0	14.7	332.0
	Young Mixedwood	4.4	0.9	97.2	4.3	102.0
	Mature Hardwood	2.2	0.5	89.4	3.9	91.6
	Young Hardwood	0.0	0.0	1.81	0.08	1.8
	Immature Forest	24.5	5.3	265.0	11.8	289.0
	Clear-cut	16.5	3.6	73.9	3.3	90.4
Non-forested	Barrens	15.5	3.4	51.2	2.3	66.7
	Cliff, Dune, Coastal Rock	10.3	2.2	0.4	0.02	10.7
	Beach	1.9	0.4	0.0	0.0	1.9
	Agriculture	14.8	3.2	25.3	1.1	40.1
	Gravel Pit	0.7	0.2	51.8	2.3	52.5
	Infrastructure-Corridor	7.8	1.7	107.0	4.8	115.0
	Sanitary Landfill	0.0	0.0	15.7	0.7	15.7
	Urban	23.5	5.1	394.0	17.6	417.0
	Miscellaneous	6.7	1.4	1.4	0.06	8.1
Wetland	Wetland	126.0	27.3	344.0	15.4	469.6
Aquatic	Waterbody	2.4	0.5	12.2	0.5	14.6
Total		**461.0**		**2237**		**2699**

Terrestrial habitat on the Donkin Peninsula is composed largely of mature softwood forest, immature softwood forest and wetland. Mature forest is restricted to the western, landward end of the peninsula and consists entirely of mature softwood forest dominated by various mixtures of black spruce (*Picea mariana*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), and American larch (*Larix laricina*). Forests at the eastern seaward edge of the peninsula are classed as immature softwood forest. These stands are probably similar to the mature softwood stands in age but are stunted by exposure to high winds and sea spray.

Most wetlands on the peninsula are coniferous treed swamps, however some large areas of freshwater marsh and shallow water wetland are also present in the vicinity of Schooner Pond and the DEVCO settling pond. Both active and abandoned agricultural lands are present in the LAA. Abandoned agricultural land is present in the vicinity of Schooner Pond. Active agricultural land in the form of pasture and hay fields is present mostly at the southern base of the Donkin Peninsula. Human habitation is restricted to the margins of the Long Beach Road along the base of the Donkin Peninsula. There is a large disturbed area near the center of the Donkin Peninsula near the Donkin Mine portals. This area is characterized by a stony till composed of waste rock that is sparsely vegetated.

The Donkin Peninsula is moderately fragmented as a result of past and ongoing mining activities, past and ongoing agricultural activities and wind energy development. Edge-producing features include abandoned agricultural land, several small active hay fields, roads and pads cleared to establish a meteorological tower for a proposed wind development, as well as a number of roads, electrical transmission lines, cleared pads, and earth works associated with the Donkin coal mine. There are also a number of hiking trails present on the peninsula. Most of the peninsula is forested, and most of the edge-producing features are relatively narrow and infrequently used by humans making them relatively weak barriers to the movement of wildlife. There is one patch of forest interior habitat present on the Donkin Peninsula (Figure 5.3.1). The total area of this forest interior habitat patch is 13.4 ha which is 3.3 percent of the terrestrial habitat within mine site portion of the LAA. Forest interior habitat for the purpose of this report is defined as mature forest that is free of edge and is greater than 10 ha in size (D. Busby, pers. comm. 2006). The distribution of mature forest habitat in the LAA was determined using NSDNR forest inventory mapping. The amount of forest interior habitat in the LAA was determined by establishing 100 m buffers around edge producing features such as existing highways and streets, electrical transmission lines, railroads, heavily disturbed non-forested habitat, borrow pits, quarries, woods roads and recent clear-cuts and large areas of recent windthrow. Areas remaining after buffering these features were classed as forest interior habitat.

The portion of the LAA associated with the transmission line route is considerably larger than the portion of the LAA at the mine site. This area is also more diverse with respect to the vegetation types present. This is attributable to several factors including, the size of the area, its presence inland away from the coast, as well as a varied history of past land use that has launched plant succession on a number of different trajectories. Mixedwood and hardwood forest stands are much more common along this portion of the LAA. This is attributable to a combination of the fact that this portion of the LAA is located inland from the cooler coastal area and has been subjected to more heavy disturbance events which favors the establishment of intolerant hardwoods such as trembling aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*) and grey birch (*Betula populifolia*). The transmission line portion of the LAA is also characterized by a much higher abundance of anthropogenic features such as residential areas, gravel pits, mine sites, and old landfills. The abundance of anthropogenic features increases from the eastern end of the transmission line route to the western end as the route gets closer to more urban areas. There is less relative abundance of wetland in the transmission line portion of the LAA; however, this is probably mostly attributable to the fact that a more extensive wetland inventory has been conducted in the mine site portion of the LAA than in the transmission line portion of the LAA.

The transmission line portion of the LAA is heavily fragmented. This is largely attributable to the large amount of residential development along the route that has resulted in the development of large numbers of roads and buildings. This area has also been subjected to various industrial developments including mines and gravel pits that have created large areas of sparsely vegetated habitat. Other edge producing features that are common in the transmission line portion of the LAA include electrical transmission lines and abandoned railroad lines. The Sydney airport is also partially present in the LAA and contributes to habitat fragmentation.

Although the transmission line portion of the LAA is heavily fragmented, there are seven patches of forest interior habitat present. The total area of these forest interior habitat patches is 123 ha which is 4.5 percent of the terrestrial habitat within the transmission line portion of the LAA.

Terrestrial Breeding Birds

Donkin Peninsula

Appendix J (Table 1) lists the bird species that have been recorded on the Donkin Peninsula during the breeding season (late spring through early summer) along with their breeding status and population status. A total of 118 species of bird have been recorded on the Donkin Peninsula during the breeding season. Evidence of breeding activity was collected for 88 of these species (those encountered during breeding bird surveys). The remaining 30 species were not recorded during breeding bird surveys and no evidence of breeding activity is available for these species. Of the 88 species encountered during the two breeding bird surveys, 33 were confirmed as breeding in the Project Area, 22 were classed as probable breeders, 21 were classed as possible breeders and no evidence of breeding activity was found for 12 species.

Thirty-seven bird species of conservation interest have been recorded on the Donkin Peninsula during the breeding season (Appendix J, Table 2). Twenty-four of these species have been recorded during breeding bird surveys conducted on the site. The remaining 13 species have been recorded during recreational birding trips to the area. Three species currently listed under the federal SARA and/or the NS ESA have been recorded in or near the study area during the breeding season. These include American Peregrine Falcon (*anatum* subspecies), Olive-sided Flycatcher, and Canada Warbler (Table 5.3.4).

Table 5.3.4 SARA and NS ESA Listed Species Recorded During the Breeding Season Surveys

Species	Status	Comments
American Peregrine Falcon (*anatum* subspecies)	Threatened (SARA), Vulnerable (*NS ESA*)	One bird observed during 2010 breeding bird survey (no evidence of nesting). No nests were encountered during dedicated Peregrine Falcon nest survey conducted in 2010 and 2011.
Olive-sided Flycatcher	Threatened (SARA)	Recorded during the breeding season approximately 2 km west of PDA. Suitable nesting habitat present in wetland habitats surrounding Schooner Pond and the Baileys Pond and DEVCO settling pond.
Canada Warbler	Threatened (SARA)	Recorded during the breeding season approximately 5 km west of PDA. Potential nesting habitat present in wetland habitats surrounding Schooner Pond and the Baileys Pond and DEVCO settling pond.

An American Peregrine Falcon was observed hunting near the cliffs during the 2010 breeding bird survey. The coastal sea cliffs would provide suitable nesting habitat for this species. American Peregrine Falcons typically nest on cliffs ranging from 50 to 200 m tall. No evidence of American Peregrine Falcon nesting was encountered during two American Peregrine Falcon surveys suggesting that the bird observed during the 2010 breeding bird survey was likely a non-breeding juvenile.

Canada Warbler and Olive-sided Flycatcher are listed as threatened under the SARA. Although no Canada Warblers or Olive-sided Flycatchers were encountered during either the 2002 or 2010 breeding bird surveys there is some potential for these species to be present in the treed swamp habitat near Schooner Pond. Olive-side Flycatchers were recorded along the transmission corridor in 2010 approximately 2 km west of the Donkin Peninsula. Canada Warblers were also recorded along the transportation corridor approximately 5 km to the west of the Donkin Peninsula.

Common Nighthawk has recently been listed as a Threatened species under SARA. Although this species has not been recorded on the Donkin Peninsula during the breeding season, suitable nesting habitat is present at the existing mine site and this species has been observed approximately 3 km to the southwest of the peninsula during the breeding season. Suitable breeding habitat on the Donkin Peninsula consists of poorly vegetated disturbed habitat near the mine portals. A dedicated Common Nighthawk survey was conducted in June to determine if this species was nesting on the peninsula. No Common Nighthawks were recorded during the survey suggesting that this species was not nesting in this area in 2011.

Rusty Blackbird is listed as a species of Special Concern under SARA. Rusty Blackbird was not recorded during the 2002 breeding bird survey but was recorded during the 2010 survey. In

2010 a single bird tentatively identified as a Rusty Blackbird was observed flying at a relatively high altitude over the Donkin Peninsula. No evidence of breeding activity was noted and the bird was not observed to interact with any of the habitats on the peninsula. Murrant and Murrant (as compiled in MacLaren 2007) have recorded Rusty Blackbird on the Donkin Peninsula but no evidence of breeding activity was noted. Suitable nesting habitat for Rusty Blackbird is present in Baileys Wetland that surrounds Schooner Pond. Most of this area was not surveyed during the 2010 breeding bird survey so it is possible that Rusty Blackbirds nest there.

Bobolink (*Dolichonyx oryzivorus*), a species listed as of Threatened under COSEWIC, has been reported to nest in the abandoned pasture near Schooner Pond Cove. This species was not encountered during either the 2002 or 2010 breeding bird surveys. This may be attributable to invasion of the abandoned pasture by low shrubs such as narrow-leaved meadowsweet (*Spiraea alba*) and Virginia wild rose (*Rosa virginiana*) which has made this area less suitable as nesting habitat for Bobolink.

The remaining bird species of conservation concern are considered to be rare or sensitive at the provincial level (Appendix J, Table 2). Six of these species are listed as May be at Risk by NSDNR. These include Common Loon, Blue-winged Teal, Purple Martin, Bank Swallow, Gray Catbird, and Pine Grosbeak. Barn Swallows have also recently been designated as “Threatened” by the COSEWIC (COSEWIC 2011) but are not currently listed under SARA. Suitable breeding habitat is present on the Donkin Peninsula for all of these species with the exceptions of Common Loon and Purple Martin.

Schooner Pond and the DEVCO settling pond are too small to support a breeding pair of Common Loons. It is likely that non-breeding juvenile Common Loons are present in the coastal waters around the Donkin Peninsula during the breeding season.

Purple Martins now only nest in man-made nesting boxes. There are no suitable nesting structures on site and the nearest known Purple Martin colony is in Oxford, Cumberland County. It is likely, the Purple Martin observed in the Donkin area during the breeding season was a non-breeder.

Blue-winged Teal and Pine Grosbeak have been recorded on the Donkin Peninsula but not during either of the two breeding bird surveys. As such, there is no evidence indicating whether these species nest in the area. Blue-winged Teal prefer nesting around open fertile marshes. The DEVCO settling pond could provide suitable nesting and brood rearing habitat for this species.

Pine Grosbeaks typically nest in areas of cool boreal forest. In 2011, this species was encountered in several locations between 1 and 4 km southwest of the Donkin Peninsula during the breeding season. It is quite possible that this species nests in areas of mature coniferous forest in the Donkin Peninsula. However, it was not detected in either of the breeding bird surveys conducted on site and is considered unlikely to be a common or regular breeding bird in the area.

Bank Swallow was present during both breeding bird surveys and was confirmed as nesting in the LAA during the 2002 survey. During the 2010 breeding bird survey a flock of Bank Swallows was observed on the road that separates Schooner Pond from Schooner Pond Cove. Suitable nesting habitat for this species is found along eroded banks of the peninsula with the best habitat present near Schooner Pond Beach. This area is close to good nesting habitat as well as good foraging areas at Schooner Pond and the DEVCO settling pond.

Gray Catbird was listed as a probable nester during the 2002 breeding bird survey but was not recorded during the 2010 survey. The dense alder thickets along the old mine access road near the DEVCO settling pond would provide the best nesting habitat for this species. Dense alder thickets are also found near the mine portal site and may also provide suitable nesting habitat for this species.

Twenty-seven species recorded in or near the LAA are listed as Sensitive species by NSDNR (Appendix J, Table 2). Most of these species are listed as uncommon (S3) to fairly common (S4) by ACCDC. For the sake of brevity they have been grouped according to habitat preferences for discussion purposes.

Most of the Donkin Peninsula is covered by coniferous forest or coniferous treed swamp. Ten bird species of conservation concern that are associated with these habitats were found on the Donkin Peninsula during the breeding season including Black-backed Woodpecker, Yellow-bellied Flycatcher, Gray Jay, Boreal Chickadee, Golden-crowned Kinglet, Ruby-crowned Kinglet, Cape May Warbler, Bay-breasted Warbler, Blackpoll Warbler , and Pine Siskin. These species were widely distributed on the Donkin Peninsula and Golden-crowned Kinglet was the second most common terrestrial bird encountered during the 2010 breeding bird survey.

Three passerine species of conservation concern associated with brushy or open habitats have been reported on the Donkin Peninsula during the breeding season including Tennessee Warbler, Wilson’s Warbler and Eastern Kingbird. None of these species have been recorded during either the 2002 or 2010 breeding bird surveys so there is no evidence to indicate whether or not they likely nest on the peninsula. Wilson’s Warbler and Tennessee Warbler can be expected to occur in brushy habitat around the existing mine site and along the old mine entrance road. Eastern Kingbirds would most likely occur around the margin of the DEVCO settling pond.

Bird species of conservation concern associated with non-forested wetland habitats that have been recorded on the Donkin Peninsula include Pied-billed Grebe, American Bittern, and Wilson’s Snipe. The distribution of these species would be focused on the DEVCO settling pond and Schooner Pond as well as marsh and low shrub swamp habitats surrounding these water bodies.

Several shorebird species of conservation concern have been recorded on the Donkin Peninsula including Spotted Sandpiper, Greater Yellowlegs and Killdeer. Greater Yellowlegs is not expected to nest on the Donkin Peninsula since the large open bogs that it prefers to nest in are not present at this location. Instead, early migrants or failed breeders are often present on the beach at Schooner Pond Cove during the breeding season. Suitable nesting habitat is present for both Spotted Sandpiper and Killdeer. Spotted Sandpipers are listed as a possible breeder and have been observed along the beach at Schooner Pond Cove as well as along the banks of the serpentine pond at the existing mine site. Killdeer are listed as a probable nester on the Donkin Peninsula. The poorly vegetated areas near the existing mine portals provide the only suitable nesting habitat for this species on the Donkin Peninsula.

Two swallow species of conservation concern have been recorded on the Donkin Peninsula including Tree Swallow and Barn Swallow. Tree Swallows are listed as a possible nester in the Project Area while Barn Swallows are confirmed as breeding there. Tree Swallows nest in a variety of habitats including residential areas, wetlands and forested areas. They require either tree cavities or artificial nest boxes for nesting sites. The best nesting habitat for Tree Swallows in the LAA would be around the DEVCO settling pond and Schooner Pond where large numbers of rotten snags provide many potential nest sites adjacent to good feeding habitat. Barn Swallows nest entirely on man-made structures such as buildings and bridges. Buildings at the existing mine site may provide suitable nesting sites while open waterbodies such as the DEVCO settling pond and Schooner Pond provide ideal foraging habitat.

In addition to those species identified as being of special conservation concern due to their provincial and/or federal rankings, colonies of Great Blue Heron are known to be sensitive to human disturbance during the breeding season and therefore have potential to be an issue of concern for regulatory authorities. Ten Great Blue Herons were recorded on the Donkin Peninsula during the 2010 breeding bird survey. Most of these birds were observed flying over the LAA. No evidence of nesting activity was noted during the breeding bird survey. No Great Blue Herons were observed during the 2002 breeding bird survey. Traditionally, there has been a colony of this species on South Head, which is approximately 5 km to the south of the Donkin Peninsula. Colonies often move around and may be in one place for 5-10 years and then another nearby, but these herons have not been known to roost near the mine for many years. Although there is some potential nesting habitat on the Donkin Peninsula, other locations such as South Head have been preferred, presumably because they are subject to less amounts of human disturbance and because there are limited feeding opportunities on or near the Donkin Peninsula. Although Great Blue Heron individuals are known to forage at Schooner Pond Beach, their numbers are very few compared to other areas, such as Morien Bar and the estuary.

Transmission Line Corridor

The breeding status and population status of each bird species recorded during the breeding bird surveys along the proposed transmission line corridor is presented in Appendix J, Table 3.

The number of each bird species encountered during the field surveys recorded by habitat type in which they were found is presented in Appendix J, Table 4. A total of 1,364 birds of 78 species were recorded during the breeding bird surveys. The most abundant species in descending order of abundance were Red-eyed Vireo (6.3 percent of all birds recorded), Black-capped Chickadee (5.9 percent), White-throated Sparrow (5.1 percent), American Robin (4.9 percent), Common Yellowthroat (4.7 percent), American Goldfinch (4.6 percent), Ovenbird (4.5 percent), Song Sparrow (4.4 percent), Common Grackle (4.0 percent), and Alder Flycatcher (3.9 percent). Together these species accounted for 48 percent of the total number of birds recorded during the survey. Of the 78 species recorded during the breeding bird surveys, 26 species were confirmed as breeding on the site, 17 were listed as probable breeders, 25 were listed as possible breeders, and no evidence of breeding activities were found for 10 species.

Table 5 in Appendix J presents information regarding bird species of conservation concern that were encountered along the transmission line corridor.

One of the bird species recorded during the field surveys, Common Nighthawk is listed as Threatened under the NS ESA. Three species listed under SARA were recorded during the field surveys. These included Common Nighthawk, Canada Warbler and Olive-sided Flycatcher, all of which are listed as Threatened under the SARA. The remaining species are not listed under either the federal SARA or the NS ESA but are listed as Sensitive or May be at Risk under the NSDNR General Status. These species include Common Loon and Black-crowned Night-heron which are listed as May be at Risk. The remaining 12 species including American Bittern, Spotted Sandpiper, Wilson's Snipe, Barn Swallow, Tree Swallow, Bay-breasted Warbler, Boreal Chickadee, Gray Jay, Yellow-bellied Flycatcher, Eastern Wood Pewee, Golden-crowned Kinglet, and Ruby-crowned Kinglet are listed as Sensitive by NSDNR.

The species of most concern are the three species (Canada Warbler, Common Nighthawk and Olive-sided Flycatcher) that are listed under the SARA and NS ESA. Common Nighthawk and Olive-sided Flycatcher were found only at the eastern end of the transmission line corridor. The Common Nighthawk was heard flying over the transmission line in August and was likely a migrant. The Olive-sided Flycatcher was heard singing approximately 200 m south of the transmission line route. Canada Warbler was more widely distributed and was found near Big Glace Bay Lake, Grand Lake Road and Gardiner Road. Only the Canada Warbler recorded near Big Glace Bay Lake was found in close proximity to the proposed transmission line route. This bird was heard singing in a mixedwood treed swamp that is crossed by the proposed transmission line corridor. The other two Canada Warblers were heard well to the north of the proposed transmission line corridor.

Seabird Colonies

Northern Head supports a large seabird colony that is used by Black-legged Kittiwakes, Great Cormorants, Double-crested Cormorants, Razorbills, and Black Guillemots (*Cepphus grylle*). Razorbill, Black-legged Kittiwake and Great Cormorant are listed as Sensitive species by

NSDNR. These three species reach the southern limit of their distribution in Nova Scotia. Razorbills occur in small numbers at a few seabird colony sites in Nova Scotia and are listed as very rare (S1) by ACCDC.

Black-legged Kittiwakes occur mainly on the northern shore of Cape Breton. They occur in relatively large colonies and their numbers have been increasing since they were first recorded in Nova Scotia in 1951. It is listed as rare (S2) in Nova Scotia by ACCDC.

Great Cormorants were heavily persecuted in the past and by 1900 the North American population was reduced to a few colonies on Anticosti Island, Quebec. Persecution of Great Cormorants has been greatly reduced and their numbers have increased to the point where they have now established nesting colonies on both Cape Breton and mainland Nova Scotia. The Great Cormorant is considered to be uncommon (S3) in Nova Scotia by ACCDC. The Donkin Peninsula (Northern Head) and South Head approximately 5 km to the south form the Northern Head and South Head Important Bird Area (IBA). This area has been declared an IBA mainly because in 1992 it supported approximately 6.7 percent of the total population of Great Cormorants in North America. The presence of nesting Black-legged Kittiwakes and Razorbills as well as the presence of Harlequin Ducks during the winter are other reasons for declaring this area an IBA.

Table 5.3.5 presents the results of the seabird colony survey. Black-legged Kittiwakes were the most abundant species at the colony followed by Great Cormorants and Double-crested Cormorants. Razorbills were the least abundant seabird species at the colony site. The counts of kittiwake nests for each year are presented in Table 5.3.5.

Table 5.3.5 Seabird Colony Breeding Pair Counts on the Donkin Peninsula 2010 and 2011

Species	2010 Count (Number Observed)	2011 Count (Number Observed)
Black-legged Kittiwake (on nests)	328	296
Black-legged Kittiwake (non-nesting)	18	54
Great Cormorant (on nest)	No data	82
Great Cormorant (non-nesting)	No data	245
Double-crested Cormorant (on nests)	No data	56
Double-crested Cormorant (non-nesting)	No data	66
All Cormorant (on nests)	153	138
All Cormorant (non-nesting)	4	311
Razorbill (on nests)	0	2
Razorbill (non-nesting)	4	0
Black Guillemot (on nests)	0	1
Black Guillemot (non-nesting)	59	48
Herring Gull (on nests)	No data	17
Herring Gull (non-nesting	11	31

Table 5.3.6 presents breeding pair abundance data for colonial and semi-colonial seabird species that have been recorded as breeding on the Donkin Peninsula from 1971 to the present.

Table 5.3.6 Population trends for Nesting Seabirds on the Donkin Peninsula

Species	Year					
	1971	1987	2002	2007	2010	2011
	Source					
	IBA Canada 2010	Lock *et al.* 1994	McCorquodale 2002	MacLaren 2007	Stantec 2010	Stantec 2011
	Abundance (Breeding Pairs)					
Black-legged Kittiwake	No Data	87	150+	200	328	296
Great Cormorant	188	147	200+	150	No Data	82
Double-crested Cormorant	No Data	0	20+	100	No Data	56
All Cormorants	188	147	220+	250	153	138
Razorbill	No Data	0	1 - 3	4	4 - 5	2
Black Guillemot	No Data	No Data	90+	35	59	48

The Black-legged Kittiwake colony at Northern Head appears to be steadily increasing in size over time although the number of nesting birds dropped from 328 to 296 between 2010 and 2011. However, the total number of Black-legged Kittiwakes present at the colony site was essentially the same in 2010 (346 birds) and 2011 (350 birds). Black-legged Kittiwakes nested in a section of coastal cliff extending approximately 600 west from Northern Head. The densest aggregation of Black-legged Kittiwake nests was located in a small cove immediately west of Northern Head (Figure 5.3.2). This species nested on the tallest cliffs with nests placed on small rock outcrops or narrow ledges.

The abundance of nesting cormorants has varied somewhat over time fluctuating between 138 and 250 pairs of Great Cormorants and Double-crested Cormorants. The abundance of Great Cormorants appears to have declined since 2002 while Double-crested Cormorant abundance has declined since 2007. Cormorant nests were found at the western end of the Black-legged Kittiwake colony (Figure 5.3.2) and covered approximately 300 m of coastal cliff. Cormorants tended to nest on wide ledges with Great Cormorants nesting mainly on the lower ledges and Double-crested Cormorants nesting on the higher ledges. At the eastern end of the cormorant colony, the cliff face was used by both kittiwakes and cormorants with cormorants occupying the wide ledges and kittiwakes occupying narrow ledges and angular rock projections. The area occupied solely by kittiwakes to the east was characterized by a lack of wide ledges which may have made it poor nesting substrate for cormorants.

PREPARED BY: M. Huskins-Shupe

REVIEWED BY: E. Hickey

xstrata coal

Donkin Export Coking Coal Project

Seabird Survey - 2011

FIGURE NO.: 5.3.2

DATE: Apr 25, 2012

Stantec

File Path: V:\1215\active\121510xxx\121510478-Donkin Mine Enviro Assessment\geomatics\mapping\mxd\EA_Final\ST_NS_121510478_023_Seabird_Distribution.mxd

Map Projection: NAD 1983 UTM Zone 20N

The number of Razorbills present at the Donkin Peninsula has not increased substantially over the past 10 years. Although no nests were observed in 2010, between 4 and 5 Razorbills were observed flying near the cliff faces suggesting that nesting was probably occurring since this species is normally highly pelagic, foraging far out to sea. It is assumed that each of the birds observed represents one adult of the nesting pair. In 2011 two Razorbill nests were found during the survey. Razorbills nest either in rock crevices or on ledges. The Razorbill nests found during the seabird nest survey were located at the interface between the kittiwake colony and the cormorant colony (Figure 5.3.2). Both nests were situated in rock crevices.

Black Guillemots typically nest in boulder piles or crevices making it difficult to find nests. They nest in loose aggregations rather than dense colonies. The number of Black Guillemots varied substantially between years ranging from 35 to 90 + birds. Given the difficulty in detecting Black Guillemot nests large fluctuations in abundance are not unexpected. The low numbers of Black Guillemots recorded in 2011 relative to 2010 may be attributable to differences in survey methods between years. Black Guillemots occurred in two loose aggregations along the coast. These aggregations were typically associated with preferred nesting sites such as large boulder piles or crevices in cliffs. The first aggregation is found to the north of Northern Head (Figure 5.3.2). The second aggregation extends from the western edge of the cormorant colony approximately 800 m to the west (Figure 5.3.2). The distribution of Black Guillemots noted during the 2010 and 2011 surveys corresponds well to the distributions noted by MacLaren (2007). MacLaren noted that the largest numbers of Black Guillemots were associated with the Northern Head aggregation. A similar pattern of abundance was observed in 2010 (Stantec 2010); however, in 2011 more Black Guillemots were observed in the western aggregation than in the Northern Head aggregation.

The seabird colony also contains 17 active Herring Gull nests. These nests were scattered throughout the seabird colony but were most frequently encountered at the western end of the colony to the west of the cormorant colony (Figure 5.3.2).

Information from the Gazetteer of Marine Birds in Atlantic Canada (Lock *et al*. 1994) indicate that the number of vulnerable pelagic seabirds during summer (July to September) surrounding the Donkin Peninsula and throughout Morien Bay is estimated to be approximately 1.00 to 9.99 birds/km. Similar concentrations are reported elsewhere along the Atlantic side of the Cape Breton coast as well as further offshore, although estimates do vary from as low as 0.10 to 0.99 vulnerable birds/km to as much as 10.00 to 99.99 birds/km (Lock *et al*. 1994).

Migration

A total of 261 bird species have been recorded on or near the Donkin Peninsula during spring and fall migration (Appendix J, Table 1). As noted above, the number of species is high because the Donkin Peninsula is attractive to migrants due to its geographic position as a prominent landform near the easternmost edge of Cape Breton. Another reason for the large number of species recorded from the Donkin Peninsula during spring and fall migration is the fact that it is a popular birding site. As such, there are ample bird records for this area.

Migration stopover surveys were conducted in the fall of 2010 and late summer of 2011 to provide quantitative data regarding the use of the Donkin Peninsula by migrating birds. Tables 5.3.7 and 5.3.8 summarize the results of these surveys. The most abundant terrestrial bird migrants in descending order of abundance included American Crow, American Goldfinch, Black-capped Chickadee, Yellow-rumped Warbler, Song Sparrow, Blue Jay, and Dark-eyed Junco (Table 5.3.7). Together, these species accounted for 62 percent of the 2,244 terrestrial birds recorded during the migration surveys. No large influxes of migrants were noted during the field surveys. This may have been attributable to weather conditions during the survey period which were not conducive to large influxes of migrating terrestrial birds. Another factor affecting the numbers of birds recorded was the presence of relatively large numbers of raptors hunting on the peninsula. The raptor species most frequently encountered were Northern Harrier, Sharp-shinned Hawk, Merlin, and Bald Eagle. The presence of these species would tend to keep small terrestrial birds in dense cover making it more difficult to detect them.

Table 5.3.7 Most Frequently Recorded Terrestrial Birds in the Autumn of 2010 and Late Summer 2011

Species	Total Observed	Number of Surveys Observed	Transects where Observed	Main Habitat where Observed	Earliest Observation	Latest Observation
American Crow	343	15	All	Disturbed	Aug. 11	Nov. 28
American Goldfinch	239	15	All	Shrubs	Aug. 11	Nov. 28
Black-capped Chickadee	227	14	All	Shrubs	Aug. 11	Nov. 28
Yellow-rumped Warbler	185	14	2,3,4,5,6	Shrubs	Aug. 11	Nov. 27
Song Sparrow	157	14	1,2,4,5,6	Shrubs	Aug. 11	Nov. 27
Blue Jay	117	12	All	Shrubs	Aug. 11	Oct. 29
Dark-eyed Junco	115	13	1,2,3,4,5	Shrubs	Aug. 11	Nov. 11
European Starling	78	2	1,2,3	Fly Over	Oct. 20	Oct. 29
Savannah Sparrow	63	10	1,2,4,5,6	Disturbed	Aug. 11	Oct. 20
Bohemian Waxwing	59	3	2,3,5	Fly Over	Oct. 29	Nov. 28
White-throated Sparrow	59	7	2,3,4,5,6	Disturbed	Sept. 8	Oct. 29
American Robin	51	8	1,2,3,4	Shrubs	Aug. 11	Oct. 20
Common Raven	50	15	All	Barrens	Aug. 11	Nov. 28
American Robin	47	6	1,2,3,4	Shrubs	Sept. 19	Oct. 20
Boreal Chickadee	44	9	All	Conifers	Aug. 25	Nov. 12
Cedar Waxwing	43	5	2,3,4,6	Conifers	Aug. 11	Sept. 24

The most abundant waterbirds recorded during the migration stopover survey in descending order of abundance were Northern Gannet, Common Eider, Double-crested Cormorant, Herring Gull, and Dovekie (Table 5.3.8). Together, these species represented 72 percent of the 6,260 waterbirds recorded during the migration surveys. The list of waterbird species for the migration stopover survey is notable in that many of the more abundant waterbirds are pelagic seabird species that rarely enter nearshore waters except during the breeding season. Pelagic seabirds recorded at the Donkin Peninsula during the migration stopover surveys included Northern Gannet, Dovekie, Murres, Razorbills, and Black-legged Kittiwakes. The presence of these species is largely attributable to the geography of the peninsula which sticks farther out into the Atlantic Ocean than other nearby landforms. It would be one of the first landfalls made by pelagic seabirds blown to the west or south by storms and would be a cue for them to fly out to sea. Although these pelagic species were fairly abundant, they were present infrequently. The majority of pelagic seabirds detected during the survey were encountered following a single storm event on November 11, 2010.

In addition to the data collected from the Donkin site, information from the Gazetteer of Marine Birds in Atlantic Canada (Lock *et al*. 1994) indicate that the abundance of coastal waterfowl during fall and early winter (October to December) around the Donkin Peninsula and adjacent areas (*e.g.*, Morien Bay) are relatively high at 4.00 to 133.7 waterfowl/km, compared to other areas along the Atlantic coast of Cape Breton. Although the abundance of vulnerable pelagic birds in waters surrounding the Donkin Peninsula are not provided for this time period, survey blocks immediately to the north and south of the peninsula were estimated to contain <0.01 and between 0.10 and 0.99 vulnerable birds/km, respectively (Lock *et al*. 1994).

Table 5.3.8 Most Frequently Recorded Waterbirds in the Autumn of 2010 and Late Summer of 2011

Species	Total Observed	Number of Surveys Observed	Transects where Observed	Habitats where Observed	Earliest Observation	Latest Observation
Northern Gannet	1774	14	1,4,5,6	Fly Over	Aug. 11	Nov. 28
Common Eider	932	13	1,4,5,6	Ocean	Sept. 8	Nov. 28
Double-crested Cormorant	722	13	1,4,5,6	Shore	Aug. 11	Oct. 29
Herring Gull	694	15	All	Shore	Aug. 11	Nov. 28
Dovekie	360	1	4,6	Fly Over	Nov. 11	Nov. 11
Whimbrel	236	2	1,5	Shore	Aug. 11	Sept. 23
Semipalmated Sandpiper	197	9	1,4,6	Shore	Aug. 25	Oct. 9
Great Cormorant	158	12	1,4,5,6	Shore	Aug. 11	Nov. 12
Mallard	154	14	1,2	Shore	Aug. 11	Nov. 28
American Black Duck	143	12	1,2,5	Shore	Aug. 11	Nov. 27
Large Alcid	140	1	4,6	Fly Over	Nov. 11	Nov. 11

Table 5.3.8 Most Frequently Recorded Waterbirds in the Autumn of 2010 and Late Summer of 2011

Species	Total Observed	Number of Surveys Observed	Transects where Observed	Habitats where Observed	Earliest Observation	Latest Observation
(Murre or Razorbill)						
Great Black-backed Gull	124	13	1,2,4,5,6	Shore	Aug. 11	Nov. 28
Semipalmated Plover	113	9	All	Shore	Aug. 11	Oct. 9
Black Guillemot	64	12	4,5,6	Ocean	Aug. 11	Nov. 11
Black-legged Kittiwake	60	3	4,5,6	Ocean	Sept. 8	Nov. 11

The Donkin Peninsula provides only a limited amount of high quality shorebird habitat. Large numbers of shorebirds were not encountered there during the migration stopover surveys; however, a wide variety of shorebird species have been encountered on the peninsula. Fourteen species were encountered during the migration stopover surveys and 31 species have been recorded during other surveys and site visits (Appendix J, Table 1). Good shorebird habitat is restricted to Schooner Pond Cove Beach and an intertidal bedrock bench near Schooner Pond Head. The bedrock bench is not typical shorebird habitat; however, it is regularly used as feeding habitat by a variety of shorebird species. Shorebirds were regularly observed in unvegetated areas at the mine site in late September and early October. This area serves as a roosting site for migrating Semipalmated Plovers and Semipalmated Sandpipers. The nearby Morien Bar estuary is an important staging area for shorebirds and when the tide is high shorebirds feeding in this area may fly to the mine site to roost. In particular, Morien Bay is known as an important stop-over site for relatively large numbers of Red Knots, White-rumped Sandpipers, Greater and Lesser Yellowlegs, Willets, and other shorebirds (Bird Studies Canada 2012).

The Donkin Peninsula has been noted as an important stopover site for migrating Whimbrel. Large numbers of Whimbrel congregate on the barrens habitat on the coastal headlands during fall migration where they feed on berries (MacLaren 2007). This species is listed as sensitive by NSDNR and uncommon to fairly common (S3S4) by the ACCDC. Although it is not listed under the SARA or NS ESA, Whimbrel is of interest due to the presence of large numbers of this species on the Donkin Peninsula during fall migration. Whimbrel were recorded on two of the 15 fall migration surveys. One Whimbrel was observed on September 23 near Northern Head. Two-hundred and thirty five Whimbrel were observed flying over Schooner Pond Cove on August 11.

Sixty-nine bird species of conservation concern have been recorded in or near the LAA during spring or fall migration (Appendix J, Table 2). These include nine species listed under the SARA including Harlequin Duck, American Peregrine Falcon (*anatum* subspecies), Short-eared

Owl, Common Nighthawk, Chimney Swift, Olive-sided Flycatcher, Bicknell's Thrush, Canada Warbler, and Rusty Blackbird. Most of these species are also listed under the NS ESA including Harlequin Duck, American Peregrine Falcon, Common Nighthawk, Chimney Swift, and Bicknell's Thrush. In addition, Red Knot (*rufa* subspecies) is listed as Endangered under the NS ESA but has not been assigned a status under the SARA.

The project area is unlikely to provide important migration habitat for these species with the possible exceptions of Short-eared Owl, Bicknell's Thrush and Harlequin Duck.

The headland barrens habitat found along the eastern and northern margins of the Donkin Peninsula provide good foraging habitat for Short-eared Owls during migration.

Little is known regarding preferred migration habitat for Bicknell's Thrush. Like most passerines, it is likely that they make use of a much wider range of habitat types during migration than they do on the breeding or wintering grounds. During the breeding season areas of Krumholtz (dense stunted wind pruned stands of spruce and fir) are used as nesting sites by Bicknell's Thrush. It is likely that these areas are also attractive to this species during migration when it is available. Krumholtz habitat is present along the eastern and northern headlands of the Donkin Peninsula.

Harlequin Ducks do not breed in Nova Scotia but forage in areas of rocky high energy shoreline around the coast of Nova Scotia during spring and fall migration, and during the winter. The infrequency of Harlequin Duck observations from the Donkin Peninsula suggest that this area is not used regularly by wintering birds (MacLaren 2007).

Late Winter/Early Spring Birds

Appendix J (Table 1) lists the 89 bird species that have been recorded on or near the Donkin Peninsula during the late winter/early spring. Sixteen of these species are species of conservation concern (Appendix J, Table 2). Two of these species, Harlequin Duck and Short-eared Owl, are listed as species of special concern under the SARA. The Harlequin Duck is listed as an endangered species under the NS ESA.

Twenty-one species of birds were found during the two field surveys (Table 5.3.9). The most numerous were two sea ducks, Common Eider and Long-tailed Duck. The next most abundant was the Iceland Gull. This species migrates to spend the winter in coastal Nova Scotia. A flock of Purple Sandpipers were foraging along the rocky shore. This species nests in the arctic and migrates south to rocky shorelines in Nova Scotia and New England to winter. Several species of coastal birds that nest along the shore of the peninsula were found in moderate numbers including, Great Cormorant, Herring Gull, Black-legged Kittiwake and Great Black-backed Gull. Information from the Gazetteer of Marine Birds in Atlantic Canada (Lock *et al*. 1994) indicate that the abundance of coastal waterfowl during winter (January to March) around the Donkin Peninsula and adjacent areas (*e.g.*, Morien Bay) are relatively low at 0.06 to 1.99 waterfowl/km, compared to other coastal areas of Cape Breton, such as at Scatarie Island where estimates are 7.50 to 66.06 waterfowl/km.

In addition to the data collected on the Donkin Peninsula, CWS completed two surveys of the Maritimes for wintering eiders in February 2006 and March 2012. Preliminary results show approximately 3,000 adult male eiders were using the area between the Donkin Peninsula and the community of Baleine (CWS pers. comm. 2012). Although the data are not yet fully compiled and only the counts of adult males are currently available, CWS expects that as many as six to ten thousand sea ducks may winter in the vicinity of the Project when female and immature Common Eiders, Black Scoters, and White-winged Scoters are included (CWS pers. comm. 2012). Habitats further offshore of the Donkin Peninsula (*i.e*., > 20 km) are primarily recorded to support densities of 1.00 to 9.99 vulnerable birds/km, with some survey cells having densities of 10.00 to 99.99 birds/km (Lock *et al*. 1994). Additionally, data indicate that the number of vulnerable pelagic seabirds during spring (April to June) surrounding the Donkin Peninsula and throughout Morien Bay is estimated to be approximately 1.00 to 9.99 birds/km (Lock *et al*. 1994). Similar values are represented in other coastal survey blocks on the Atlantic side of Cape Breton, with higher abundances of vulnerable birds (10.00 to 99.99 birds/km) being reported approximately 20 km's offshore (Lock *et al*. 1994).

Three Harlequin Ducks, two males and a female, were observed on March 28, 2011 in the surf off Cape Perce (Figure 5.3.2). Although pairs of Harlequin Duck have been observed on the Margaree and Tusket Rivers during the breeding season (CWS pers. comm. 2012), they have not been confirmed to be breeding in Nova Scotia. However, they are known to forage in areas of rocky high energy shoreline around the coast of Nova Scotia during spring and fall migration, and during the winter, with wintering birds often arriving in the fall and staying until early spring. This species often displays high fidelity to wintering sites and can be sensitive to human disturbance. In 1990, the COSEWIC designated the eastern North American population of Harlequin Duck as "Endangered" due to declines in the 20th century but this status was downgraded to "Special Concern" in 2001 to reflect a population increase (Thomas and Robert 2001). A Harlequin Duck Recovery Plan was completed in 1995, with the long term goal of achieve at least 3000 wintering individuals (with at least 1000 adult females) for at least three of five consecutive years by 2010 (Montevecchi *et al*. 1995). Although population levels are increasing (Thomas and Robert 2001), the eastern North American wintering population has still not met the initial goal outlined in the recovery plan. Based on the best available information, a conservative winter population estimate for eastern North America is 2925 individuals, with primary Canadian wintering locations being in the southern and eastern coasts of Nova Scotia (approximately 600 harlequin Ducks being concentrated amongst the Eastern Shore Islands Wildlife Management Area, Prospect and Little Port L'Hebert), the Bay of Fundy (300 Harlequin Ducks), and southern Newfoundland (450 Harlequin Ducks) (Thomas 2010). Population trends at the three key regions for wintering Harlequin Ducks in eastern Canada appears to be variable (Thomas 2010).

In Nova Scotia, numbers on Christmas Bird Counts have ranged from 0 to 87 on 15-20 counts run in the province each year from 2000 to 2010. Wintering birds reported to “Nova Scotia Birds” occur regularly from the Bay of Fundy (*e.g.*, Port George) and Sober Island on the Eastern Shore of Halifax County. The annual counts in Cape Breton at Louisbourg, St. Peters and Strait of Canso record Harlequin Ducks infrequently (a maximum of 2, less than 20 percent of years for each count). The Glace Bay Christmas Bird Count includes the Donkin Peninsula and has been performed eight times since 2003, with one Harlequin Duck being recorded in 2007. The coastline of the Donkin Peninsula is easily accessed via a hiking trail that runs along the extent of the peninsula and is routinely surveyed during the Christmas Bird Count (the entire extent of the coastline is typically surveyed) by an experienced birder (McCorquodale, pers. comm. 2012). Furthermore, because Harlequin Ducks are known to be occasionally sighted off the Donkin Peninsula during winter, they are a priority species during the Glace Bay Christmas Bird Count and efforts are directed as such. Based on these considerations, Glace Bay CBC data is considered to provide a relatively good measure of the use of coastal waters off the Donkin Peninsula by Harlequin Ducks during the winter months. As such, the infrequency at which Harlequin Ducks have been recorded off the Donkin Peninsula during Christmas Bird Counts suggests that they do not regularly use the area for wintering purposes. It is likely that the three birds observed in March 2011 were migrants that had wintered further south and were heading north to nesting grounds. Areas of the Donkin Peninsula with potentially good Harlequin Duck wintering habitat are located around the eastern end of the peninsula.

Table 5.3.9 Abundance of Species Encountered during March 2011 Surveys

Species	Transect(s) where Observed	Number of Surveys Observed	Total Observed
Common Eider	4,5,6	2	473
Iceland Gull	4.5.6	2	36
Great Cormorant	4,5,6	2	33
Purple Sandpiper	6	1	16
Herring Gull	4,5,6	2	16
American Crow	4,5	2	6
Red-breasted Merganser	4,5,6	2	5
Long-tailed Duck	4,5,6	2	162
American Black Duck	5,6	2	4
Great Black-backed Gull	6	2	4
Harlequin Duck	4	1	3
American Robin	5	1	2
Red-throated Loon	6	1	2
Bald Eagle	5,6	1	3
Dovekie	6	1	1
Glaucous Gull	6	1	1
Northern Goshawk	5	1	1

Table 5.3.9 Abundance of Species Encountered during March 2011 Surveys

Species	Transect(s) where Observed	Number of Surveys Observed	Total Observed
Black-legged Kittiwake	5	1	15
Black Guillemot	6,5	1	13
Red-necked Grebe	4	1	1
White-winged Scoter	6	1	1

MBBA and ACCDC Records

Table 6 in Appendix J lists the bird species that have been recorded in the breeding bird atlas square in which the Donkin Peninsula is located (square 21TM81). Seventy-seven species have been recorded in this square, including 21 species that are species of conservation concern in Nova Scotia. All of these 21 species with the exception of Short-eared Owl have been recorded on the Donkin Peninsula during the breeding season and have already been discussed. Although suitable nesting habitat for Short-eared Owls is present on the Donkin Peninsula in the form of coastal barrens, the amount of habitat present is probably not large enough to support nesting. This habitat provides suitable migration foraging habitat and Short-eared Owls have been recorded on the Donkin Peninsula during migration and the winter months.

The ACCDC habitat model identified 19 rare or sensitive bird species as being potentially present in the Study Area (Table 2 in Appendix J). Thirteen of these species could potentially nest on the Donkin Peninsula including Northern Goshawk. Razorbill, Northern Pintail, Gadwall, Bicknell's Thrush, Black Guillemot, Bobolink, Rusty Blackbird, Peregrine Falcon, Common Moorhen, Red-breasted Merganser, Virginia Rail, and Black-legged Kittiwake. Ten of these species have been recorded on the Donkin Peninsula during the breeding season and have been discussed earlier in the text. The three species that have not been recorded on the peninsula during the breeding season include Northern Pintail, Gadwall, and Bicknell's Thrush,

Both Northern Pintail and Gadwall typically make use of fertile fresh marsh or brackish marsh habitat. Suitable habitat is present in the DEVCO settling pond. Schooner Pond would provide marginal breeding habitat for these species since it is surrounded by wetland habitat characteristic of oligotrophic systems rather than rich mesotrophic or eutrophic systems.

The dense krumholtz vegetation that occupies the transition zone between the barrens and coniferous forest habitats near the coastline of the Donkin Peninsula could provide suitable nesting habitat for Bicknell's Thrush as could the dense immature mixedwood forest stands located in the interior of the peninsula just east of the existing mine site. Two breeding bird surveys (one of which included a dedicated Bicknell's Thrush survey) as well as heavy recreational birding activity on the Donkin Peninsula have not revealed the presence of

Bicknell's Thrushes during the breeding season. This species has been recorded on the peninsula during migration.

Six of the rare or sensitive species identified by the model do not nest in Nova Scotia and would occur on the Donkin Peninsula only during migration or the winter months. These species include Red Knot, Purple Sandpiper, Harlequin Duck, Hudsonian Godwit, American Golden-plover, and Whimbrel. All of these species have been reported on the Donkin Peninsula and are discussed earlier in the text.

Mammals

Donkin Peninsula

The mammal species recorded on the Donkin Peninsula are a mixture of species characteristic of forest and wetland habitats. Species recorded during the field surveys included Meadow Vole (*Microtus pennsylvanicus*), Southern Red-backed Vole (*Myodes gapperi*), Muskrat (*Ondatra zibethicus*), American Red Squirrel (*Tamiasciurus hudsonicus*), Eastern Chipmunk (*Tamias striatus*), Snowshoe Hare (*Lepus americanus*), American Beaver (*Castor canadensis*), Bobcat (*Lynx rufus*), Eastern Coyote (*Canis latrans*), Red Fox (*Vulpes vulpes*), Northern Raccoon (*Procyon lotor),* Mink (*Neovison vison*), Northern River Otter (*Lutra canadensis*), Short-tailed Weasel (*Mustella erminea*) and White-tailed Deer (*Odocoileus virginianus*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by ACCDC (2011) or NSDNR (2011).

Bat surveys were conducted on the Donkin Peninsula in 2007 (CBCL 2008). The survey utilized a combination of trapping using harp traps and monitoring of echolocation calls using Anabat detection systems. The trapping program confirmed the presence of little brown myotis (*Myotis lucifugus*) and northern long-eared myotis (*Myotis septentrionalis*). A total of 19 little brown myotis and 6 northern long-eared myotis were trapped. Little brown myotis are habitat generalists that forage in both open and forested habitats. The entire Donkin Peninsula could provide suitable habitat for this species. Northern long-eared myotis is a forest interior specialist that rarely makes use of open habitats. This species would be restricted to forested portions of the peninsula. The echolocation call monitoring revealed relatively high concentrations of bats along the new access road and the DEVCO settling pond. Lactating females and juvenile bats of both species were captured suggesting that maternity colonies were present on the Donkin Peninsula. Interviews with staff at the mine site revealed that bats were not associated with buildings on the site indicating that the maternity colonies were likely located in trees.

Both little brown myotis and northern long-eared myotis are listed as sensitive by NSDNR indicating that the Nova Scotia population is sensitive to anthropogenic activities or natural events. Both species are common in Nova Scotia but are sensitive to disturbance during the late fall, winter and early spring when large numbers of these bats are concentrated into a relatively small number of winter hibernacula. During the rest of the year they are widely distributed over the landscape and are less vulnerable to anthropogenic activities.

Recently, white nose syndrome, a disease of bats caused by the fungus *Geomyces destructans* has been reported in Nova Scotia. This fungus has caused heavy mortality of cave hibernating bat species, including little brown myotis and northern long-eared myotis in other jurisdictions in the northeastern United States and eastern Canada. In February 2012 both little brown myotis and northern long-eared myotis have been listed as endangered by COSEWIC. In response to the establishment of this disease in Nova Scotia, it is likely that the Little Brown Bat will be listed as an endangered species under the Nova Scotia *Endangered Species Act*.

There are no limestone or gypsum deposits in the area so it is unlikely that any solution caves are present in the area that would provide hibernaculum sites for bats such as little brown myotis and northern long-eared myotis. A review of the abandoned mine opening data base (NSDNR 2008) did not reveal the presence of any known abandoned mine shafts on the Donkin Peninsula; however, 14 abandoned coal mines are present within 4 km of the existing Donkin mine site. Nine of these mines have been plugged and would not be available as hibercaculum sites for bats. For five of the mines there is no information indicating that they have been plugged. Three of these are shafts which would not provide good hibernation sites for bats. The remaining two mines are slopes which could provide suitable hibernation habitat if they have not been plugged and are not completely flooded. Both of these mines are located within 2 km of the existing Donkin mine site. A bat hibernaculum was discovered during winter 2012 within boot-leg coal pits (crop pits) associated with both the Schooner Pond Mine and the Acadia Mine (both old legal mines) and is located on the coastal forest area within about 2 km of the Donkin Mine site (NSDNR pers. comm. 2012). The size and extent of use of this hibernaculum is not yet known, nor have the species of bats been confirmed (NSDNR pers. comm. 2012).

An ACCDC data search revealed that six additional mammal species of conservation concern have been recorded within a 100 km radius of the PDA. These include Long-tailed shrew (Sorex *dispar*), Canada lynx (*Lynx canadensis*), American marten (*Martes americana*), fisher (*Martes pennanti*), rock vole (*Microtus chrotorrhinus*) and southern bog lemming (*Synaptomys cooperi*).

Canada lynx is listed as an endangered species under the NS ESA. This species has historically been present throughout Cape Breton with records from as close as Fortress Louisbourg National Historical Park. Completion of the Canso causeway in the 1950’s resulted in the Strait of Canso freezing during the winter allowing Bobcats to colonize Cape Breton Island. The more aggressive bobcats eventually displaced Canada lynx from most of their former range in Cape Breton. This process may have been accelerated by the colonization of Cape Breton by Coyotes in the 1980’s. Canada lynx are now restricted to the Cape Breton Highlands as well as two small disjunct populations on the eastern side of the Bras D’Or Lakes. This area is characterized by deep snow pack in the winter for which the Canada lynx is better adapted than the bobcat. Given the current distribution of Canada lynx in Cape Breton, it is unlikely that the Donkin Peninsula would support a Canada lynx population.

American marten is also listed as endangered under the NS ESA. This species is typically associated with large tracts of mature coniferous and mixedwood forest. It is typically found in areas remote from human habitation. The American marten is currently restricted to the Cape Breton Highlands. Given the current distribution of this species, its association with large tracts of mature forest in remote areas, it is unlikely that American marten would be present on or near the Donkin Peninsula.

Long-tailed shrew is listed as Sensitive by NSDNR while the rock vole is listed as Secure. Long-tailed shrew is listed as S1 by the ACCDC while rock vole is listed as S2. Both long-tailed shrew and rock vole are associated with scree slopes in forested areas. The Donkin Peninsula does not provide this type of habitat so it is unlikely that either of these species would be present in the Project Area.

Fishers are listed as Sensitive by NSDNR. This species, like the American marten, is typically associated with large tracts of remote mature forest. However, it is more tolerant of human modified landscapes and will utilize second growth forests. Within Nova Scotia, fishers are primarily restricted to mainland Nova Scotia, particularly the eastern mainland (centered in Cumberland, Colchester and Pictou counties) with another smaller population in the interior of western Nova Scotia. However, since 2002 they have been caught in legal traps set for other species on Cape Breton (NSDNR pers. comm. 2012).

Southern bog lemming is considered to be secure in Nova Scotia (NSDNR). ACCDC lists this species as uncommon to fairly common (S3S4). Southern bog lemmings are typically associated with bogs and other wetlands that support sphagnum moss. Southern bog lemmings typically establish den sites under sphagnum moss hummocks. Suitable wetland habitat is present at various locations in the LAA, particularly around Schooner Pond and the eastern end of the DEVCO settling pond. As such, there is potential for this species to be present in the LAA.

A review of the NSDNR significant habitat mapping database (NSDNR 2011a) did not reveal the presence of any known rare or sensitive mammal species in the vicinity of the LAA or critical habitat such as deer wintering areas. All of the habitats present in the LAA are commonly encountered throughout the province and are unlikely to provide critical habitat for rare small mammal species.

Transmission Line Corridor

The mammal species recorded along the proposed transmission line corridor are a mixture of species characteristic of forest and wetland habitats. Species recorded during the field surveys included Meadow Vole (*Microtus pennsylvanicus*), Southern Red-backed Vole (*Myodes* *gapperi*), Muskrat (*Ondatra zibethicus*), American Red Squirrel (*Tamiasciurus hudsonicus*), Eastern Chipmunk (*Tamias striatus*), Snowshoe Hare (*Lepus americanus*), American Beaver (*Castor canadensis*), Bobcat (*Lynx rufus*), Eastern Coyote (*Canis latrans*), Red Fox (*Vulpes vulpes*), Northern Raccoon (*Procyon lotor*), Mink (*Neovison vison*), Northern River Otter (*Lutra canadensis*), Short-tailed Weasel (*Mustella erminea*) and White-tailed Deer (*Odocoileus virginianus*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by ACCDC (2011) or NSDNR (2010).

Herpetiles

Donkin Peninsula

Ten herpetile species were encountered during the surveys including Yellow Spotted Salamander (*Ambystoma maculatum*), Redback Salamander (*Plethodon cinereus*), Pickerel Frog (*Rana palustris*), Leopard Frog (*Rana pipiens*), Green Frog (*Rana clamitans*), Wood Frog (*Rana sylvatica*), Northern Spring Peeper (*Pseudacris crucifer*), American Toad (*Bufo americanus*), Common Garter Snake (*Thamnophis sirtalis*) and Smooth Green Snake (*Liochlorophis vernalis*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by ACCDC (2011) or NSDNR (2011).

An ACCDC data search revealed the presence of two species of conservation concern within a 100 km radius of the Donkin Peninsula. These included wood turtle (*Glyptemys insculpta*) and four-toed salamander (*Hemidactylium scutatum*).

The wood turtle is listed as Threatened under Schedule 1 of SARA. Provincially, they are currently ranked as a “Sensitive” species, as well as being listed as “Vulnerable” under the Nova Scotia *Endangered Species Act* (NSDNR 2009).

Wood Turtles are almost invariably associated with streams, creeks, and rivers and the associated rich intervale forest, shrub communities, as well as with the meadows and farmland terrestrial habitat associated with these watercourses. Streams with sand and/or gravel bottoms are preferred, but rocky streams are used occasionally. Wood turtles may wander some distance from watercourses during summer while foraging but characteristically remain within linear home ranges. These home ranges are 1 to 6 ha in size and are centred on a suitable river or stream where non-vegetated or sparsely vegetated sandy beaches and banks are present that serve as nesting sites. Natural nesting sites consist of sandy river beaches but may also include select disturbed sites such as railway grades and roadsides. Some turtles may travel considerable distances up small tributaries that lack suitable nesting sites and hibernacula during the summer months but offer good foraging opportunities. These smaller streams may serve as dispersal corridors between populations on different river systems.

The Donkin Peninsula does not provide good habitat for wood turtles (*e.g.*, large rivers that would provide the core wood turtle habitat). The small streams present in the area do not provide sandy or gravelly banks that would be suitable for wood turtle nesting sites or deep pools that would be suitable hibernation sites. Given these conditions it is highly unlikely that the mine site LAA provides good wood turtle habitat.

The four-toed salamander is listed as uncommon (“S3”) by ACCDC. NSDNR considers this species to be secure in Nova Scotia. Four-toed salamanders are typically found in bogs and swamps and forest habitat surrounding these wetlands. Four-toed salamanders are highly cryptic and are rarely found away from cover. During the breeding season females nest in sphagnum moss hummocks; during the rest of the year this species is present under stones, logs and other cover in forest habitat. They emerge from cover only at night to forage. A study of the distribution of the four-toed salamander in Nova Scotia supported the contention that this species was not as rare as previously thought and was widely distributed (JWEL 2000). The study found four-toed salamanders in more than half of the sites searched and increased the number of recorded nesting sites in Nova Scotia from 20 to 45. Critical habitat requirements for this species are sphagnum moss in which to lay eggs and a semi-permanent or permanent, soft bottomed pond or slow flowing stream adjacent to the sphagnum moss in which the hatched larvae can develop. This species has been found at several sites on Cape Breton. Nest searches (the most effective means of finding four-toed salamanders) have been conducted in areas adjacent to the Donkin Peninsula but not on the peninsula. Nest searches in nearby areas did not reveal the presence of this species. Suitable nesting habitat is present on the Donkin Peninsula. Given the presence of suitable habitat, there is potential for four-toed salamanders to be present on the Donkin Peninsula.

Transmission Line Corridor

Ten herpetile species were encountered during the surveys conducted along the proposed transmission line corridor including Yellow Spotted Salamander (*Ambystoma maculatum*), Redback Salamander (*Plethodon cinereus*), Pickerel Frog (*Rana palustris*), Leopard Frog (*Rana pipiens*), Green Frog (*Rana clamitans*), Wood Frog (*Rana sylvatica*), Northern Spring Peeper (*Pseudacris crucifer*), American Toad (*Bufo americanus*), Common Garter Snake (*Thamnophis sirtalis*) and Smooth Green Snake (*Liochlorophis vernalis*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by ACCDC (2011) or NSDNR (2010).

5.3.3 Potential Project-VEC Interactions

Table 5.3.10 below lists each Project activity and physical work for the Project, and ranks each interaction as 0, 1, or 2 based on the level of interaction each activity or physical work will have with birds and wildlife.

Table 5.3.10 Potential Project Environmental Effects to Birds and Wildlife

Project Activities and Physical Works	Potential Environmental Effects	
	Change in Wildlife Habitat	Change in Mortality Risk
Construction		
Site Preparation (incl. clearing, grading and excavation)	2	2
Construction of Mine Site Infrastructure and Underground Preparation	2	2
Construction of 138 kV Transmission line	2	2
Construction of Barge Load-out Facility (incl. dredging, infilling and habitat compensation)	2	2
Installation of Transshipment Mooring	1	1
Operation and Maintenance		
Underground Mining	0	0
Coal Handling and Preparation (incl. coal washing and conveyance)	1	2
Water Treatment (incl. mine water and surface runoff)	1	1
Coal and Waste Rock Disposal	2	2
Marine Loading and Transportation	2	2
Coal Trucking	2	1
Decommissioning and Reclamation		
Site Decommissioning	2	2
Site Reclamation	2	2

0 = No interaction
1 = Interaction occurs; however, based on past experience and professional judgment, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

One project activity, underground mining, is not anticipated to have any adverse effect on Birds and Wildlife and has been ranked as 0. Underground mining will not result in the direct loss of any wildlife habitat consequently no adverse effect on habitat quality or mortality risk is anticipated.

Several activities are anticipated to have interactions ranked as 1. During the construction phase of the Project, installation of the transshipment mooring will not require any specific mitigation to prevent adverse effects on wildlife habitat or increased risk of wildlife mortality. The transshipment mooring will be deployed in non-critical habitat over a short period of time which may result in temporary displacement of foraging seabirds and sea ducks that would not warrant special mitigation. The mooring buoy and anchor cables may enhance the quality of the area for marine birds (particularly sea ducks) by providing substrate for mussels and other marine plants and animals.

There will be vehicle traffic associated with the operation and maintenance phase of the Project including workers commuting to work, service vehicles visiting the mine site and later in the life of the project, trucks moving coal waste from the mine site to the Phase III coal waste pile. With this traffic, there is some potential for wildlife to be killed in collision with vehicles. The incidence of roadkill is greatly influenced by traffic speed. At speeds of 50 km and under the rate of roadkill is very low. It is assumed that speed limits on the mine site will be maintained at less than 50 km/h as they currently are. Under these conditions the incidence of roadkill will be very low and this interaction has been ranked as 1.

During the operation and maintenance phase of the Project, coal handling and preparation are ranked 1 in regards to change in wildlife habitat. Noise associated with operation of conveyors and other equipment could contribute to disturbance and subsequent degradation of wildlife habitat adjacent to the equipment. Standard mitigation to minimize noise will be employed which will reduce the potential for disturbance of wildlife in adjacent habitats.

Water treatment is also ranked as 1 both in regards to change in wildlife habitat and change in mortality risk. Production of acid rock drainage from the mine, coal piles and coal waste rock disposal sites has been anticipated and standard mitigation measures are incorporated into the design of the facilities to prevent and/or treat any acidic drainage at the mine site.

Thus in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects of all Project activities and physical works that were ranked as 0 or 1 in Table 5.3.10 on Birds and Wildlife during any phase of the Project are rated not significant, and are not considered further in the assessment. The remainder of interactions noted in Table 5.3.10 have been ranked as 2 and are discussed in the following sections.

5.3.4 Assessment of Project-Related Environmental Effects

5.3.4.1 Assessment of Change in Wildlife Habitat

5.3.4.1.1 Potential Environmental Effects

Construction

Wildlife habitat located within the area to be cleared for site preparation will be eliminated during construction. Clearing for site preparation will remove vegetation, reducing the quantity of terrestrial habitat, and will affect the quality of habitat bordering the cleared areas.

Table 5.3.11 presents the amount and types of habitat that will potentially be lost as a result of clearing of the PDA. Over 84 percent of the land area within the PDA of the mine is currently occupied by semi-natural vegetation communities, with the remainder being comprised of anthropogenic habitats associated with the current mining infrastructure. The majority of land-cover types identified for direct disturbance by the Project (*i.e.*, that which is within the PDA) are upland forests and wetlands. Approximately 67 ha of upland forest (~ 51.8 percent of the area of the PDA) are scheduled to be directly influenced by Project activities, with approximately a third each being comprised of mature softwood, young softwood, and immature forest. Estimated disturbance to wetlands is approximately 42.2 ha (~33 percent of the PDA), or 35 percent of the wetland area on the Donkin Peninsula. The large majority of the wetland area within the PDA is associated with the Phase I/Phase II and Phase III coal waste piles; the footprints of the piles being approximately 37.9 ha and 42.6 ha in size, respectively. Wetland habitats within the PDA of the mine are primarily swamps, with lesser amounts of fen being present within a large wetland in the area of the Phase I/Phase II coal waste piles and some encroachment on fen within Baileys Wetland by the Phase III pile also being likely. Disturbances to marsh and shallow water wetland types are expected to be minor, being primarily restricted to those associated with disturbed wetlands located in the central and eastern portion of the peninsula. Approximately 19 ha of the PDA is currently occupied by anthropogenic habitats associated with the existing mine site, including the mine yard and waste rock piles. Project activities will largely avoid coastal habitat types, with approximately 0.8 ha of coastal barrens (a little over five percent of those on the peninsula) expected to be directly disturbed by Project activities. Additional barrens habitat located in association with immature forest to the south of the existing mine yard will also be disturbed. Less than one percent of the area occupied by coastal cliffs is within the PDA for the Project and none of the beach found at Schooner Pond Cove is likely to be directly influenced.

Table 5.3.11 Land Classification within PDA of the Donkin Peninsula

Habitat Type [1]	Land Cover Type	Total Area of Habitat Type in LAA (ha)	Area within PDA (ha)	Percent of Habitat Type within PDA	Habitat Type Area as Percent of PDA
Forested (upland)	Mature Softwood	113.0	25.4	22.4	19.7
	Young Softwood	87.4	19.4	22.2	15.0
	Mature Mixedwood	3.5	0.0	0.0	0.0
	Young Mixedwood	4.4	0.0	0.0	0.0
	Mature Hardwood	2.2	0.0	0.0	0.0
	Clearcut	16.5	0.6	3.9	0.5
	Immature Forest	24.5	21.5	87.7	16.7
Non-forested	Urban (Industrial)	23.5	18.5	78.6	14.3
	Barren	15.5	0.8	5.3	0.6
	Cliff/Dune/Coastal Rock	10.3	0.1	0.7	0.1
	Agriculture	14.8	0.0	0.0	0.0
	Miscellaneous[2]	6.7	0.0	0.0	0.0

Table 5.3.11 Land Classification within PDA of the Donkin Peninsula

Habitat Type [1]	Land Cover Type	Total Area of Habitat Type in LAA (ha)	Area within PDA (ha)	Percent of Habitat Type within PDA	Habitat Type Area as Percent of PDA
	Infrastructure-corridor	7.9	0.1	1.5	0.1
	Beach	1.9	0.0	0.0	0.0
	Gravel pit	0.7	0.4	53.0	0.3
Wetland[3]	Wetland	126.0	42.2	33.5	32.7
Aquatic	Waterbody[4]	2.4	<0.1	<0.1	<0.1
	Total	**461.1**	**128.9**	**28.0**	**100.0**

[1]Land classification data based on NSDNR's Forest Inventory but modified based on results of field surveys and air photo interpretation
[2]Disturbed grassy area immediately east of Schooner Pond Cove
[3]Includes swamp, marsh, shallow water, fen, and bog wetland classes
[4]Values presented are an underrepresentation of the area covered by waterbodies because shallow open water habitats within DEVCO Wetland, Baileys Wetland and several small ponds have been classified as wetland

The areas cleared and grubbed for development of the coal waste storage areas are substantially larger than the areas cleared for the CHPP and are situated on relatively undisturbed sites containing sensitive habitat types such as mature forest and wetland habitat. Six bird species of conservation interest that have been recorded in the Phase I/Phase II coal waste piles including Blackpoll Warbler, Boreal Chickadee, Golden-crowned Kinglet, Ruby-crowned Kinglet, Gray Jay, and Yellow-bellied Flycatcher. Suitable nesting habitat is present for all of these species. No field surveys were conducted in the area of the Phase III coal waste pile because that area was not identified as within the PDA at the time or surveys. However, this area has high potential to provide nesting habitat for several SARA listed species including Canada Warbler and Olive-sided Flycatcher.

The Project will result in the production of more edge area, which can increase predation on birds and small mammals but also has potential benefits related to habitat, and food availability. Construction activities will also cause habitat fragmentation. Small mammal and herpetile populations which have limited dispersal capabilities are particularly susceptible to habitat fragmentation. Populations isolated from other populations in small habitat fragments are more prone to local extirpation since these fragments may be too small to support a population. Fragments may be large enough to support a population, but may not be large enough to provide enough animals to rebuild the population should it be heavily impacted by disease or predators. Isolation of the fragment can also impair the immigration of new animals into an area where a local population has been extirpated. Impaired immigration can also adversely affect populations by restricting gene flow between populations leading to inbreeding.

Habitat fragmentation can also affect highly mobile animals such as birds. During the breeding season some species may be reluctant to cross clearings causing populations to be isolated in resultant habitat fragments. Studies of bird use of forest patches in agricultural areas by the CWS in Quebec found that bird movement between patches decreased with increasing distance between patches (CWS Undated). The CWS determined that the influence of edge environmental effects extended as far as 300 m, from the forest edge. It also observed that 97.7 percent of the movements between habitat patches were concentrated in gaps smaller than 200 m and some species traveled up to three times as far to avoid a gap. Physical isolation of a population combined with the environmental effects of edge may eliminate species in habitat fragments.

One way of measuring the effect of Project-related habitat fragmentation on the LAA is to determine how much forest interior habitat will be lost as a result of the development of the project infrastructure. There is one patch (13.4 ha) of forest interior habitat in the mine site portion of the LAA (Figure 5.3.1). This patch is located almost entirely within the Phase III coal waste disposal pile. Almost all of this patch will be cleared and buried under the coal waste disposal pile. The portion remaining outside of the coal waste disposal pile is less than 10 ha in size and will be affected by adjacent edges.

The geography of the Donkin Peninsula makes it an important landfall for migrating birds. Alteration of habitat on the peninsula can potentially alter the movement and well-being of migrants that make landfall on it. Birds may be reluctant to move through large areas of open habitat. Migrant attractants such as the Donkin Peninsula also often attract large numbers of avian predators such as Merlin, Sharp-shinned Hawk and American Peregrine Falcon. A lack of cover may subject newly arrived migrants to higher rates of predation. The various habitats on the peninsula also provide food sources for newly arrived migrants.

Clearing activities can also adversely affect habitat quality as a result of sensory disturbance of birds and mammals in adjacent undisturbed habitat. Wildlife may vacate areas in close proximity to the source of disturbance or important functions such as foraging, breeding or rearing of offspring may be impaired by the activities. These effects can extend several hundred m into the surrounding undisturbed habitat. Terrestrial bird monitoring studies conducted during the construction phase of the Confederation Bridge (JWEL 1998) revealed that bird abundance was reduced by up to 35 percent within 200 m of a road construction site while the number of birds exhibiting evidence of successful breeding activity was reduced by up to 56 percent. This study noted that although the avifaunal community was not substantially changed as a result of exposure to sensory disturbance, certain species were more sensitive to disturbance than others. Species whose abundance decreased substantially following exposure to sensory disturbance included Red-breasted Nuthatch, Boreal Chickadee, Golden-crowned Kinglet, Bay-breasted Warbler, and American Redstart.

In the same monitoring study, the establishment of a fabrication yard adjacent to Nelson’s Sharp-tailed Sparrow habitat resulted in a 30 percent reduction in the number of Nelson’s Sharp-tailed Sparrows per hectare and resulted in the birds shifting their distribution approximately 100 m away from the construction yard.

A study by Reijnen and Foppen (1994) determined that the density of territorial male Willow Warblers (*Phylloscopus trochilus*) 0 to 200 m from the edge of a busy highway was lower (2.1/ha) than in similar habitats at a greater distance (3.3/ha).

Construction of aboveground mine site infrastructure such as the CHPP could potentially affect wildlife as a result of sensory disturbance.

Construction of the 138 kV transmission line can potentially adversely affect wildlife in several ways. Clearing of the RoW will result in the loss of wildlife habitat. The amount of habitat lost to transmission line constructed is relatively small because almost all of the transmission line route is established on a variety of existing linear developments including abandoned railroad, roads and abandoned transmission line. Clearing will consist of the removal of vegetation in areas where these linear features have become overgrown (*i.e.*, the abandoned portion between the mine site and near Glace Bay).

Many of the bird species of conservation concern recorded along the transmission line route are often associated with wetland habitats. These include Canada Warbler, Olive-sided Flycatcher, Black-crowned Night-heron, American Bittern, Spotted Sandpiper, Wilson's Snipe, Tree Swallow, Boreal Chickadee, Gray Jay, Yellow-bellied Flycatcher, Golden-crowned Kinglet, and Ruby-crowned Kinglet. The transmission line LAA crosses or runs adjacent to many wetlands along the route. These habitats are very sensitive to trampling damage which can adversely affect the value of the habitat for these bird species.

Establishment of the transmission line will also contribute to habitat fragmentation. Generally, linear developments such as transmission lines contribute greatly to habitat fragmentation due to the large amount of edge that they produce relative to the area disturbed. However, construction of this transmission line will contribute relatively little to habitat fragmentation along the route because virtually all of the route follows existing linear developments and the area that the transmission line route runs through is already heavily fragmented by industry and urban development.

One way of measuring the effect of Project-related habitat fragmentation on the transmission line portion of the LAA is to determine how much forest interior habitat will be lost. There are seven patches of forest interior habitat in the transmission line portion of the LAA (see Figure 5.3.1). Construction of the transmission line will not affect any of these patches because the transmission line would be built on existing linear developments which are already a source of edge effects to surrounding habitats.

Construction of the barge load-out facility will result in the loss of shallow coastal marine habitat. This habitat is used for foraging by a variety of water birds including Black Guillemots, loons and various seaducks. Construction of this facility will also contribute to sensory disturbance in adjacent terrestrial and marine habitats resulting in reduced utilization of these habitats by wildlife. Of particular concern, is the presence of the seabird colony near Northern Head.

Sensory disturbance can result in abandonment of colony sites or increased mortality of eggs and chicks as a result of inadequate brooding, accidental ejection of eggs or young from the nest by panicked adults, reduced frequency of feeding of chicks, and increased predation by gulls and corvids.

The most sensitive period in regards to colony abandonment is during the early stages of colony establishment in the spring before eggs and chicks are present. Once adults have invested resources and energy in producing eggs and chicks they are less likely to abandon the colony but are still vulnerable to reduced survival of young associated with sensory disturbance.

Incidental observations of seabird reactions to disturbing stimuli were made during the seabird colony surveys in 2010 and 2011. The nesting season for this colony coincides with the lobster season and large numbers of lobster pots were present in close proximity to the colony site with many pots present less than 20 m from the cliff face. Lobster boats were observed tending these pots on a number of occasions. No obvious signs of disturbance such as birds fleeing from the cliffs were observed. During the seabird colony survey in 2011, the distance from the survey boat to the cliff face was recorded. The distance ranged from 48 to 148 with an average distance of 75 m. During the survey the observer kept track of any overt signs of possible stress on birds nesting and roosting on the cliffs such as flushing, neck stretching, and birds focusing their attention on the boat rather than activities around them. This was done to help determine how close the boat could approach the cliffs without risking birds flushing from the colony which would have invalidated the count. During the survey, no overt signs of stress were noted in the birds being observed suggesting that birds in the colony were habituated to the visual stimuli and noise associated with boat traffic.

A review of the literature revealed that the average distance that colonial water birds flushed from colony sites in response to boat traffic ranged from 10 to a 100 m (Burger *et al.* 2010; Rodgers and Smith 1995). Flushing distances varied by species, by type of disturbance stimuli, and by stage of reproduction. Black Guillemots have been shown to be quite sensitive to boat traffic. Ronconni and Cassidy St. Clair (2002) found that the average flushing distance for Black Guillemots in response to the presence of boats was 260 m. The barge load-out facility is situated approximately 200 m west of the western edge of the seabird colony within the range that Black Guillemots are known to react to boats. On the day of the 2011 seabird colony survey three of the 48 Black Guillemots observed were located within 260 m of the proposed barge load-out facility. Ronconni and Cassidy St. Clair (2002) determined that a 600 m set back would be sufficient to mitigate boat disturbance to Black Guillemots under most conditions. In their study, a 600 m set back would reduce the probability of Black Guillemots flushing to 10 percent. During the seabird colony survey, 13 of 48 Black Guillemots were found within 600 m of the proposed barge load-out facility.

The only other seabird species nesting in this portion of the colony is Herring Gull. The nearest Herring Gull nest to the proposed barge load-out facility is approximately 200 m away. This species is very tolerant of humans and the 200 m distance between the nearest nest and the proposed barge load-out facility is considered an adequate setback for this species.

The nests of the other species breeding at the seabird colony are sufficiently distant from the proposed barge load-out facility that activities there should not cause sensory disturbance. The nearest Great Cormorant, Double-crested Cormorant, Black-legged Kittiwake, and Razorbill nests were 900, 980, 1,040, and 1,280 m from the proposed barge load-out facility. From a conservation perspective Great Cormorant, Razorbill and Black-legged Kittiwake are the most important species to protect at the colony. Black Guillemot, Herring Gull and Double-crested Cormorant are all listed as secure by NSDNR.

Operation and Maintenance

Coal and waste rock disposal can potentially adversely affect wildlife in several ways including sensory disturbance and interference with bird migration. Sensory disturbance would be associated with placement of waste rock and coal within the disposal sites either by conveyor or truck traffic as well as the distribution of waste within the disposal areas by bulldozer. Of particular concern is the proximity of the southeastern end of the Phase I waste disposal pile to the seabird colony at Northern Head.

The Phase I/Phase II coal waste disposal piles could interfere with bird migration patterns by removing cover near the coastal barrens. The dense conifer cover at the landward edge of the coastal barrens at the eastern edge of the Donkin Peninsula provides resting and foraging cover for migrating birds that have arrived after long flights over the ocean or birds that are preparing for an oceanic flight. Without this cover, migrants would be more vulnerable to avian predators that gather on the Donkin Peninsula during migration.

Operation of the marine loading and transportation facility can potentially adversely affect wildlife through sensory disturbance and through interference with movement of birds and mammals. The marine loading and transportation facility and the vessel traffic associated with it will be visible from the Northern Head seabird colony. Activities at the facility will also be audible to seabirds at the colony. Noise levels at the seabird colony are predicted to average 50 dB, although momentary levels may approach as much as 60 dB (see Section 2.7.8 and Appendix H). Although the duration of activities that could cause sensory disturbance to nesting seabirds will last much longer during the operation and maintenance phase, they are repetitive, providing a better opportunity for birds to habituate to them.

The conveyor running from the coal stockpile to the barge load-out facility could act as a barrier to the movement of birds and mammals along the length of the Donkin Peninsula. Animals are often reluctant to cross open habitat with little cover. The degree to which open habitat becomes a barrier to wildlife depends on a number of factors including the distance from one side of the clearing to the other, the amount of cover in the clearing and the presence of sources of sensory disturbance within the clearing. In regards to the conveyor system, the distance from one side of the clearing to the other will be relatively small; however, the clearing will contain little cover and animals will have to pass under or over the covered conveyor which will be operating continuously. Most resident wildlife can be expected to eventually habituate to the presence of the linear clearing and the operating conveyor system. However, migrating birds arriving at the Donkin Peninsula may be reluctant to cross the conveyor and may reroute to avoid it.

Noise and visual stimuli associated with coal trucking could result in sensory disturbance to wildlife.

Decommissioning and Reclamation

Activities associated with the dismantling of on-site facilities would produce noise and visual stimuli that could adversely affect wildlife in adjacent habitats.

Site reclamation activities such as capping, contouring and planting of the mine site will produce sensory disturbance that could have adverse effects on wildlife. Once reclamation has been completed there will be a net positive effect on wildlife. Species benefiting from the reclamation practices will depend on the type of plant community that is created by the reclamation process and whether succession towards more natural plant communities is encouraged or discouraged.

5.3.4.1.2 Mitigation of Project Environmental Effects

Construction

Follow-up breeding bird surveys will be conducted in the proposed location of the Phase III coal waste disposal pile. If species at risk are present, it will be necessary to consult with CWS and NSDNR regarding specific mitigation and monitoring planning at that location.

The degree of habitat fragmentation can be reduced by maintaining a corridor of relatively undisturbed habitat around the periphery of the Donkin Peninsula to provide connectivity of remaining habitats for wildlife species. This will allow movement of animals, both resident species and migrants. The corridor should be at least 150 m wide to provide a mix of both coastal barrens and coastal forest habitat for wildlife to move through. This will also ensure that there is adequate cover available for migrating passerines that make landfall to avoid predation by avian predators. The conveyor corridor from the CHPP to the barge load-out facility interrupts the connectivity between the seaward and landward ends of the Donkin Peninsula. The cleared portion of the conveyor corridor will be as narrow as safely possible to reduce the potential for it to become a barrier to the movement of wildlife along the length of the Donkin Peninsula.

Development of the Phase III coal waste pile will result in the loss of all of the forest interior habitat in the LAA. This loss would not occur until after at least 13 years of mine activity after which time progressive development of the Phase III coal waste disposal site would begin. Final design of the Phase III disposal site will be undertaken in consideration of avoidance of watercourses (see Sections 5.2 and 5.6) and other sensitive features such as the patch of interior forest habitat on the Donkin Peninsula. Progressive development and reclamation of coal waste disposal piles will maximize the time that habitats remain available to wildlife.

Project-related setbacks will be established around the seabird colony at Northern Head to minimize the potential adverse effects of construction activities on nesting seabirds. Black Guillemots appear to be the species present in the Northern Head seabird colony that is most sensitive to disturbance as indicated by long flushing distances (average 260 m). Ronconi and Cassidy St. Clair (2002) recommend a 600 m setback to minimize disturbance of Black Guillemots by boats. The barge load-out facility is situated approximately 200 m west of the western edge of the seabird colony. The barge load-out facility is located as far west as it can be situated based on an extensive site selection studies (including consideration of minimizing effects on shoreline erosion/deposition regimes). As such, a 600 m setback around the entire seabird colony is not feasible. Figure 5.3.2 shows the proposed setback. Wherever practical, a 600 m setback will be established around the seaward edge of the colony for Project marine-related transportation activities. At the western end of the colony the setback will be 200 m wide at its narrowest point. No Project-related vessel traffic or other mining related activities will be permitted within the setback. This setback will provide adequate protection for all of the seabird species nesting at the colony with the possible exception of Black Guillemot. Although the birds appear to be tolerant of lobster boats and fishing activity, about a quarter of the Black Guillemots using the colony are within 600 m of the barge load-out facility and may experience some disturbance. A monitoring program will be undertaken to determine whether or not this species is adversely affected by activities at the barge load-out facility. An adaptive management approach, based on the results of the monitoring program, will be implemented to reduce effects on seabird colonies.

Given the presence of mining related activity on the landward side of the seabird colony, it will be necessary to establish a setback on this side of the colony as well. Given the position of the colony low on a cliff face, as well as the presence of a low ridge running parallel to the shore behind the cliff face, activities at the mine site are not visible to birds at the colony. The colony site is also located in a noise shadow that reduces the noise levels that the colony will be exposed to. The projected average noise level at the colony site during the operations phase of the Project, using the current lay out of the mine facilities, is 50 db. Various setbacks have been developed for colonial waterbirds (Burger *et al.* 2010; Rodgers and Smith 1995; Erwin 1989) and range from 100 to 200 m. As such, a 200 m wide setback is proposed to be established on the landward side of the seabird colony in which no habitat alterations related to Project activities will occur without consent from the relevant regulatory agency. The buffer and its perimeter will be filed with relevant regulators in a management plan to help protect seabird nesting habitat.

Seabirds are most sensitive to disturbance at their colony sites during the period when breeding seabirds arrive at the colony site and begin to construct nests. At the Northern Head seabird colony this period would extend from early April to late May. During this period particularly noisy or startling activities such as cutting/ripping of the cliff face will be avoided to the extent feasible.

Operation and Maintenance

Many of the mitigation measures developed to minimize adverse effects of the construction phase of the Project are also applicable to the operation and maintenance phase of the Project. These include:

- Establishment of a setback around the Northern Head seabird colony to minimize the adverse effects of sensory disturbance on nesting seabirds. The setback would remain the same size.
- Provide connectivity of habitats by maintaining an undisturbed corridor at least 150 m wide around the periphery of the Donkin Peninsula.
- Progressive development in the coal waste disposal areas. Areas to be cleared will be cleared only as required and progressive reclamation will be employed to restore some habitat as soon as practical.

In addition to the 600 m marine setback, the following mitigation measures will be implemented to minimize potential effects on seabirds:

- Marine travel will take place at steady speeds, moving parallel to the shore, rather than approaching the colony directly;
- Marine vessels and equipment as well as vehicles and machinery on the barge load-out facility/breakwater will avoid any sharp or loud noises to the extent possible (including horns or whistles) and will maintain constant engine noise levels;
- Marine vessels will not pursue seabirds/waterbirds swimming on the water surface, and avoid concentrations of birds on the water; and
- Oil or waste will not be dumped overboard, as even small amounts of oil can kill birds and other marine life, and habitats may take years to recover.

Periodic clearing will be required to maintain the transmission line RoW during the operation and maintenance phase of the Project. These programs will be conducted outside of the breeding season for most bird species (April 1 to August 15) in order to prevent loss of eggs and young of bird species protected under the *Migratory Birds Convention Act*.

Decommissioning and Reclamation

Several of the mitigation measures developed to minimize adverse effects of the construction phase of the Project are also applicable to the decommissioning phase of the Project. These include:

- Establishment of a setback around the Northern Head seabird colony to minimize the adverse effects of sensory disturbance on nesting seabirds. The setback would remain the same size; and
- The use of progressive reclamation of the coal waste disposal areas.

5.3.4.1.3 Characterization of Residual Project Environmental Effects

The Donkin Peninsula is notable for several features of importance to wildlife including: the Northern Head seabird colony which is a key feature of the Northern Head/South Head IBA; the geography that make it attractive to migrant birds; and records of a number of bird species of conservation concern from the peninsula.

Mining activities could potentially adversely affect the Northern Head seabird colony mainly as a result of sensory disturbance. Establishment of a setback around both the seaward and landward sides of the colony will mitigate the adverse effects of disturbance on most ecologically sensitive seabirds in the colony. There is some potential for black guillemots nesting close to the proposed barge load-out facility to be disturbed by construction and operation of this feature. This species is listed as Secure in Nova Scotia by NSDNR and disturbance of these birds is not expected to have a measureable effect on regional or local populations. The setback established around the seabird colony will have to be maintained for the life of the Project and monitoring of the abundance and distribution of seabirds at the colony will be required for a period to be determined in consultation with applicable regulators pending results of the monitoring program to confirm that the setback is effective.

The area around Wreck Point is occasionally used as winter foraging habitat by small numbers of Harlequin Ducks. Records indicate that this site is not used regularly and is probably used as a stopping point by Harlequin Ducks moving north in the spring. The establishment of a setback of a least 150 m around the margin of the Donkin Peninsula will minimize the potential for disturbance of Harlequin Ducks that stop at this location during migration.

The Donkin Peninsula attracts migrating birds into a small area. As such it is a popular birding area. The coastal margin of the peninsula is an important feature for migrating birds since this is an area where birds arriving from Newfoundland first make landfall and birds leaving for Newfoundland would stage in this area while waiting to fly north. The coastal barrens habitat found along the northern and western margin of the peninsula also provide valuable habitat for some sensitive migrants such as Whimbrel which often congregate in large numbers in this habitat. The margin of the island also acts as a corridor for birds accessing or leaving the peninsula. Mining activity could adversely affect the function of the Donkin Peninsula for migration habitat through both loss of habitat, fragmentation of habitat and through sensory disturbance. Mitigation includes the establishment of a setback of at least 150 m around the outer margin of the island to provide staging, feeding and movement corridors for migrants. This corridor will be breached at one point by the conveyor corridor leading to the barge load-out facility. This corridor could act as a barrier to the movement of birds and mammals along the length of the peninsula. This adverse effect will be reduced by minimizing the width of the corridor to make it less stressful for birds to cross this gap.

A total of thirty-seven bird species of conservation interest have been recorded from the Donkin Peninsula. Of particular concern are three SARA listed species that have been reported including American Peregrine Falcon, Olive-sided Flycatcher and Canada Warbler. An American Peregrine Falcon was observed during the 2010 breeding bird survey; however, no evidence of breeding activity was observed. Subsequent nest searches along the coast in 2010 and 2011 did not reveal the presence of any nests. As such, it is unlikely that this species nests on the Donkin Peninsula.

Both Canada Warbler and Olive-sided Flycatcher have been recorded several kilometres off the Donkin Peninsula but have not been recorded on the peninsula during breeding bird surveys. However; there is potential for these species to nest in the wetland complex to the south of Schooner Pond and follow-up surveys are required to determine the extent of potential effects. The Phase III coal waste disposal pile will be established in this area. Additionally, Rusty Blackbird is listed as a species of Special Concern under SARA and was observed flying over the peninsula during the 2010 breeding bird survey. Although no evidence of breeding activity was recorded for this species, suitable nesting habitat is present in the vicinity of Schooner Pond in the area where the Phase III waste coal disposal area is proposed; and follow-up surveys will be required in this area to determine the extent of potential effects. Furthermore, Bobolink has been recorded as nesting in the abandoned pasture near the DEVCO settling pond but was not recorded during either breeding bird survey. This area will not be affected by mining activities and no adverse effects on this species are anticipated. The Bobolink has currently been assigned a Threatened status by COSEWIC but has not yet been added to SARA.

Six species listed as May be at Risk by NSDNR have been recorded on the Donkin Peninsula including Common Loon, Blue-winged Teal, Purple Martin, Bank Swallow, Gray Catbird and Pine Grosbeak. No suitable nesting habitat is present for either Common Loon or Purple Martin. Suitable nesting habitat is available for Blue-winged Teal, Bank Swallow and Gray Catbird; however, these habitats will not be lost to mining activities.

Some Gray Catbird habitat is located in close proximity to the active mine site resulting in exposure to noise and visual stimuli. This species is quite tolerant of human activities and would probably not abandon the area.

Habitat suitable for Pine Grosbeak nesting will be lost to mining activities, primarily the development of the coal waste disposal piles. This species has been recorded on the Donkin Peninsula but was not recorded during either of the two breeding bird surveys conducted on the peninsula suggesting that this species does not regularly nest on the peninsula.

The remaining 27 species are listed as sensitive by NSDNR and are classed as uncommon to fairly common in Nova Scotia by ACCDC. Ten of these species typically nest in forested habitats that will be affected by mining activities including: Black-backed Woodpecker; Yellow-bellied Flycatcher; Gray Jay; Boreal Chickadee; Golden-crowned Kinglet; Ruby-crowned Kinglet; Cape May Warbler; Bay-breasted Warbler; Blackpoll Warbler; and Pine Siskin. It is likely that habitat currently used by these species will be lost as a result of mine development. Based on professional judgement, the amount of breeding habitat lost as a result of the Project is not expected to have any substantial effect on regional or local populations of these species.

A total of 128 ha of habitat will be directly affected by mining activities on the Donkin Peninsula, most of which consists of coniferous forest in various states of succession and forested wetlands. The total amount of habitat affected is not substantial when compared to the amount of habitat in the region affected by forest harvesting. The habitat predicted to be affected by mining will be reclaimed; however, it will take many decades for natural upland habitats to develop since the sites will be disturbed by construction activities resulting in the loss of top soil and the seed banks contained in them. The development of forest habitat will be discouraged on the coal waste disposal areas which comprise most of the disturbed areas in order to minimize the potential for deep rooted tree and shrub species to penetrate the liners over the coal waste cells that could result in infiltration of water into the coal waste. Wetlands affected by the Project will be replaced to satisfy regulatory requirements for habitat compensation but will probably be constructed off the peninsula.

The Donkin Peninsula contains 13.4 ha of forest interior habitat which represents 3.3 percent of the total area of the peninsula. All of this forest interior habitat will be lost as a result of development of the Phase III coal waste disposal area. The amount of forest interior habitat on the Donkin Peninsula is not high in comparison to the local landscape. In the transmission line LAA, a total of seven patches of forest interior habitat with a combined area of 123 ha were encountered. The amount of forest interior habitat on the Donkin Peninsula is 9.8 percent of the total amount of forest interior habitat in the LAA. Loss of the 13.4 ha of forest interior habitat at the mine site represents only a small proportion of the amount of forest interior habitat in the region.

5.3.4.2 Assessment of Change in Mortality Risk

5.3.4.2.1 Potential Environmental Effects

Construction

Site preparation work can result in direct mortality of animals. Direct mortality could occur mainly to small species such as herpetiles, small mammals and the eggs or flightless young of birds.

Highly mobile small mammals such as little brown myotis and northern long-eared myotis could also be subjected to direct mortality during clearing. Field surveys indicate that natal colonies of both bat species are present on the Donkin Peninsula, probably in hollow trees or crevices in trees. Young bats are flightless for the first three weeks of life and would not be able to escape clearing activities.

During certain project activities used in the site preparation work (*e.g.*, development of third tunnel), there is some potential for mortality of hibernating bats as well. Vibrations conducted through rocks could rouse bats from hibernation. Hibernating bats can expend large amounts of energy rousing from hibernation. If disturbances occur frequently enough, they can result in bat mortality. It is unlikely that bats located more than a kilometre away from the activities would be adversely affected.

The likelihood of bat mortality occurring is dependent on whether or not bat hibernaculum sites (caves or abandoned mines) are located close enough to the areas where these activities occur and how frequently they would occur. The nearest known bat hibernaculum is located approximately 2 km from the proposed mining development (NSDNR pers. comm. 2012) and the closest mine workings which have potential to provide suitable hibernaculum sites are located about 1.7 km from the mine portals. Based on the distance of known and potential bat hibernacula, the likelihood of adverse effects on hibernating bats is considered to be low. Given the recent discovery of white nose syndrome in Nova Scotia and pending changes in the federal and provincial population status ranks for both little brown myotis and northern long-eared myotis it is prudent to take these species into consideration in the assessment of the Project.

Larger species of hibernating mammal could also be affected by direct mortality during the winter months. Most birds and mammals would leave the cleared and grubbed areas and would move to adjacent undisturbed habitats. Indirect mortality could occur to these animals if they are unable to find suitable unoccupied habitat.

Some wildlife species are attracted to open disturbed sites such as those created by clearing. Birds such as Killdeer and Common Nighthawk use habitats such as this for nesting. Subsequent construction of mine site infrastructure on these sites can result in the destruction of the eggs and unfledged young of these species.

Construction of the transmission line could result in direct mortality of small mammals, herpetiles, as well as the eggs and flightless young of birds. During the winter months larger hibernating mammals that would ordinarily leave the area while construction activities are ongoing may be killed by construction activities such as clearing. Animals that are displaced by loss of habitat may eventually succumb if they are unable to establish new home ranges due to a lack of suitable or unoccupied habitat. The amount of direct mortality of wildlife species associated with construction of the electrical transmission line is not expected to be high due to the fact that relatively little clearing will be required. Most of the transmission line RoW is located on previously cleared RoWs for linear developments such as railroads, roads and electrical transmission lines.

Operation and Maintenance

Food waste that is improperly disposed of on-site can lead to wildlife mortality in several ways. The availability of food scraps can attract generalist predators such as American Crows, Common Ravens, Blue Jays, gulls, raccoons and foxes. The presence of elevated numbers of these predators can result in increased predation on wildlife in the area. Attraction of predators and scavengers to the site can also result in the habituation of these species to the presence of humans on the site. Some species such as coyotes may be viewed as a safety issue while others such as raccoons may cause damage to site infrastructure. These species may have to be killed to prevent damage or possible injuries to workers. Animals that are trapped and relocated may also die if there is no available habitat or insufficient resources in the area where they are released.

Site lighting can lead to mortality of migrating birds. The Donkin Peninsula tends to focus migrating birds into a relatively small area. Under certain conditions, such as nights with fog or mist, migrating birds may be attracted to lights. They may collide with the light or structures near the light or they may circle around the light until they become exhausted making them easy prey for predators. Additionally, because the barge load-out facility/breakwater will be constructed in potential staging and wintering habitat for sea ducks, they may be at risk of collisions with Project infrastructure.

Avifauna have potential to collide with transmission line infrastructure. The risks of avifauna collision with transmission lines are dependent on the identity of the species involved, the character of the environment, and configuration and location of the lines. Environmental factors influencing collision risk include the effects of weather and time of day on line visibility, surrounding land use practices that may attract birds, and human activities that may flush birds into lines. Line-related factors influencing collision risk include the configuration and location of the line and line placement with respect to other structures or topographic features (APLIC and USFWS 2005). Species-related factors include habitat use, body size, flight behaviour, age, sex, and flocking behaviour (APLIC and USFWS 2005). Heavy-bodied, less agile birds or those within large flocks may lack the ability to quickly respond to obstacles and they are therefore generally more likely to have collisions with transmission lines. Similarly, birds that are inexperienced or are distracted, such as by territorial or courtship activities, have greater potential for collision. In general, nocturnal migrants (*i.e.,* passerines) are high-flyers and are not prone to collision during flight whereas the flight heights of diurnal migrants' (*i.e.*, waterfowl, waterbirds, raptors) are more varied. However, at least for waterfowl, the species group most susceptible to wire collision (Erickson *et al*. 2001), unless there are distinct features to draw them in (*i.e.*, wetlands, lakes) for staging purposes, they are likely to be flying higher than the height of the transmission lines. Birds will also have potential for collision with transmission lines during local movement. For example, those species that use wetlands (*e.g.*, waterfowl) can be assumed to move among those in close proximity to one another. Where the separation distance between portions of the same or adjacent wetlands are in close proximity, birds typically exhibit low flight behaviours. Similarly, species that occupy both wetlands and adjacent uplands will move between the two habitat types. For such species, separation distances and bird flight behaviours would typically result in low flight heights at these locations and in close association with the height of the trees being flown to, or from.

Birds which are attracted to transmission lines may be electrocuted when there is inadequate separation between energized conductors or energized conductors and grounded hardware. Avian electrocution is typically a greater risk on low voltage transmission systems and distribution systems because clearances between electrical components are smaller, making it possible for birds to contact two conducting elements or one grounded and one conducting element at the same time. Most electrocutions occur on medium-voltage distribution lines (4 to 34.5 kilovolts (kV), in which the spacing between conductors may be small enough to be bridged by birds (APLIC and USFWS 2005). Poles with energized hardware such as transformers can be especially hazardous, even to small birds, as they contain numerous, closely-spaced energized parts. Because dry feathers act as insulation, contact must be made between fleshy parts, such as the wrists, feet, or other skin, for electrocution to occur (APLIC and USFWS 2005).

Spillage during the transhipment process has potential to adversely affect seabirds and shorebirds associated with the coastal waters near the Donkin Peninsula. In particular, the barge load-out facility/breakwater will be constructed in potential staging and wintering habitat for sea ducks and nearby coastal habitats, such as at Morien Bay, are known to support large numbers of migrating shorebirds.

Various factors affect the level of attraction to lights including intensity, spectral characteristics and the manner in which lights are placed in the environment. Typically more intense lights are more attractive to birds (Jones and Francis 2003). White light and red light are far more attractive than green or blue light (Poot *et al.* 2008). Lights that are shielded from above are generally less attractive than those that are visible from above. Strobe lighting is less attractive to birds than continuous lighting since the strobe allows birds that are attracted to the light to disengage (Jones and Francis 2003).

Decommissioning and Reclamation

Site decommissioning could result in the loss of eggs and flightless young of birds. Small mammals may also be inadvertently killed during the disassembly and removal of buildings and other structures. Anthropogenic structures can be attractive to wildlife as nesting or denning sites. Most species avoid close contact with humans and stay away from these structures but some species readily adapt to the presence of humans. Species noted from the Donkin Peninsula that are highly likely to use mine structures for nesting and denning include Barn Swallow, European Starling, Rock Pigeon, raccoon and red squirrel. With the exception of Barn Swallow, these species are common species that are often considered pests around human habitation. Barn Swallows are listed as a Sensitive species by NSDNR. The number of wildlife species using onsite buildings can be expected to increase if there is a delay of several years between closure of the mine and removal of buildings and structures.

Site reclamation will generally have a net positive effect on local wildlife populations but could potentially have adverse short term effects including mortality of wildlife. Activities such as recontouring and capping of coal waste piles can result in the destruction of the nests of ground nesting birds or the dens of mammals. The likelihood of these adverse interactions can be expected to increase if there is a large gap in time between the cessation of placement of coal waste and reclamation of the area that allows birds and mammals to begin using the area as nesting or denning habitat. Of particular concern are ground nesting bird species of conservation interest that frequently nest in highly disturbed areas such as Killdeer and Common Nighthawk.

5.3.4.2.2 Mitigation of Project Environmental Effects

Construction

Clearing activities could result in the loss of eggs or flightless young of bird species protected under the *Migratory Birds Protection Act*. In order to minimize the potential for a violation of the *Act*, Clearing in the LAA will be conducted outside of the breeding season for most bird species (April 1 to August 15). To minimize the amount of wildlife habitat lost to Project infrastructure, only the amount of habitat required for the necessary facility should be cleared and grubbed.

There are a number of species that will nest in young clear-cuts such as White-throated Sparrow, Dark-eyed Junco and Wilson's Snipe. In order to minimize the potential for these species to occupy the newly cleared areas, clearing will be conducted outside of the breeding season. Once the site is cleared and grubbed, the site will be unattractive to most wildlife species; however, there are several species that specialize in nesting in highly disturbed sites including two species of conservation interest, Common Nighthawk and Killdeer. Killdeer have been recorded nesting on the Donkin Peninsula and although recent surveys have not found Common Nighthawks nesting on the Donkin Peninsula, they have been recorded within a few kilometres of the peninsula during the breeding season. In order to minimize the potential for destroying the nests of one of these species, workers will receive training and reference material that will help them to identify if one of these birds is nesting on the site. If workers encounter an agitated bird that they suspect may be nesting on site, an ornithologist or other suitably qualified professional will be brought on site to determine whether or not nesting is occurring and to find the nest. If a nest is found, an appropriate setback will be established around the nest in which no human activities will be permitted until the young fledge and leave the area or until the nest naturally fails (CWS will be consulted to identify appropriate setback distances). Clearing outside of the breeding bird season will also eliminate the possibility of destroying little brown myotis or northern long-eared myotis natal colonies.

Operation and Maintenance

Food waste that is improperly disposed of on-site can lead to wildlife mortality in several ways. The availability of food scraps can attract generalist predators such as American Crows, Common Ravens, gulls, raccoons and foxes. The presence of elevated numbers of these predators can result in increased predation on wildlife in the area. Attraction of predators and scavengers to the site can also result in the habituation of these species to the presence of humans on the site. Some species such as coyotes may be viewed as a safety issue while others such as raccoons may cause damage to site infrastructure. These species may have to be killed to prevent damage or possible injuries to workers. Animals that are trapped and relocated may also die if there is no available habitat or insufficient resources in the area where they are released. In order to reduce the likelihood of generalist predators and scavengers frequenting the mine site, waste materials such as food scraps will be collected and disposed of off-site in a timely manner. Food wastes temporarily stored on site will be stored in scavenger proof containers such as dumpsters. Care will be taken to ensure that lids on dumpsters are closed to limit access by wildlife. As part of their site orientation, employees and contractors will be instructed regarding acceptable waste disposal options on site and why they should refrain from feeding wildlife on the job site.

The Donkin Peninsula attracts large numbers of migrants. Most birds migrate at night and under certain conditions they can be attracted to lights resulting in mortality events. Site lighting for this facility is therefore of greater consequence than for most other facilities. The potential adverse effects of site lighting will be mitigated in several ways. Only the amount of lighting required for safe operation of the mine should be installed. Lights that are not necessary for a particular function will be turned off. Exterior lights should be shielded from above. White or red exterior lighting should be avoided in favor of green lighting which is not as attractive to birds. Interior lights visible through windows should be screened. To the extent feasible, security lighting will be turned on by motion sensors rather than left on all night.

A conceptual lighting plan has been developed for the Project and complies with appropriate engineering standards. A monitoring program will be implemented to determine if site lighting results in mortality events. Areas having elevated potential for light attraction will be visited following weather events conducive to light attraction such as foggy nights or nights with low cloud cover. The species, numbers and locations of dead or grounded birds will be recorded and used to identify particular combinations of structures, lighting and weather that may result in mortality events.

Effects of the transmission line on avifauna (*i.e.*, collisions and electrocutions) will be lessened by the fact that it will be constructed within existing RoWs, including approximately 11.4 km of an abandoned transmission line RoW and 13.8 km within an active transmission line RoW. Furthermore, NSPI will adhere to industry standards and and best management practices outlined in their internal document "Environmental Protection Procedures for Transmission and Distribution Facilities" (NSPI 2009) during construction of the transmission line.

The clearance between grounded and conducting equipment on the proposed transmission infrastructure is likely to be larger than the maximum wing span of birds found within the study area. For example, the shortest distance between two conductive parts or between a conductive part and the bonding surface of the equipment (*i.e.*, the creepage distance) for a typical 138 kV line is typically 2.76 m (*e.g.*, maximum wingspans for Bald Eagle and Osprey are approximately 2.5 m and 2 m, respectively).

Mitigation measures identified for minimizing risk of spills during the transhipment process on waterbirds are outlined in Sections 6.4, 6.5, and 6.6.

Ponds and a water treatment plant will remove sedimentation and heavy metals from mine water and site runoff prior to discharge to the former DEVCO settling pond. However, should the water quality of the ponds deteriorate due to spill or other event, effort will be made to keep birds away.

Decommissioning and Reclamation

Anthropogenic structures can be attractive to wildlife as nesting or denning sites. The likelihood of wildlife being killed during the dismantling of structures on site can be reduced by dismantling structures soon after they become surplus and by keeping window and door openings on buildings closed until the building is dismantled to prevent birds and mammals from entering the structure.

Barn Swallows will nest on both the interior and exterior of buildings. Industrial structures are often quite attractive to these birds since they contain many ledges, overhangs and rough surfaces that provide good sites to build nests. Barn Swallows are protected under the *Migratory Birds Convention Act* so the destruction of an active Barn Swallow nest is a contravention of the *Act.* If buildings are dismantled outside of the breeding season for most bird species (April 1 to August 15) active Barn Swallow nests will not be encountered. If it is not possible to schedule the work during this time, an alternative approach would be to inspect the structure for Barn Swallow nests prior to the commencement of work. If a nest is present, work will have to be delayed until the young have fledged or until the nest fails naturally. If there is ultimately a need to decommission a building or structure used for nesting by Barn Swallows, or other species of migratory birds, CWS will be consulted in a timely manner in advance of any proposed decommissioning activities for species-specific considerations. European Starlings and Rock Pigeons are non-native species that are not protected by the *Migratory Birds Convention Act.* The presence of these species requires no mitigation.

Site reclamation will generally have a net positive effect on local wildlife populations but could potentially have adverse short term effects including mortality of wildlife. Activities such as recontouring and capping of coal waste disposal piles can result in the destruction of the nests of ground nesting birds or the dens of mammals. The likelihood of these adverse interactions can be expected to increase if there is a large gap in time between the cessation of placement of coal waste and reclamation of the area that allows birds and mammals to begin using the area as nesting or denning habitat. Of particular concern are ground nesting bird species of conservation concern that frequently nest in highly disturbed areas such as Killdeer and Common Nighthawk. Additionally, certain species of migratory birds (*e.g.,* Bank Swallows) may choose to nest in piles of overburden. Several methods can be used to reduce the potential for mortality of wildlife during the reclamation process. Firstly, progressive reclamation that begins soon after a coal waste storage cell is filled will reduce the likelihood that wildlife will colonize the unvegetated coal waste disposal area. To the extent feasible, reclamation work will be conducted outside of the breeding season for most bird species (April 1 to August 15) to minimize the possibility of destroying the nests of ground nesting birds such as Common Nighthawks and Killdeer. For a species such as Bank Swallows, the period when the nests would be considered active would include not only the time when birds are incubating eggs or taking care of flightless chicks, but also a period of time after chicks have learned to fly since swallows return to their colony to roost. If this is not feasible, a survey will be conducted within 48 hours of the onset of work to determine if ground nesting birds are present. If nests or adults rearing chicks are found, an appropriate setback (identified in consultation with CWS) will be established around the nest and no work will be conducted within this setback until the young fledge or the nest fails naturally.

5.3.4.2.3 Characterization of Residual Project Environmental Effects

The greatest potential source of mortality for birds associated with the Project is the destruction of eggs and flightless young associated with clearing of the mine site and coal waste disposal sites. This can be effectively mitigated by scheduling clearing activities outside of the breeding season for most birds (April 1 to August 15).

Two sensitive mammal species, little brown myotis and northern long-eared myotis are known from the Donkin Peninsula. Bat surveys conducted on the peninsula indicated that natal colonies of both species are probably present in forest habitat on the peninsula. Scheduling of clearing outside of the breeding season for most birds will prevent mortality of young bats in these natal colonies. Information provided by NSDNR (pers. comm. 2012) indicate that hibernacula are known to occur approximately 2 km from the mine site and additional abandoned mine workings in the Donkin area could potentially provide hibernaculum sites for little brown myotis and northern long-eared myotis. The locations of known abandoned mine workings and bat hibernacula are located far enough from areas where mining activities are likely to occur (more than 1 km) so that disturbance of hibernating bats is not expected.

The presence of food waste can attract generalist predators that can increase predation pressure on wildlife living adjacent to the mine site. These species can also become pests at the site and may need to be killed to prevent damage to mine facilities or possibly danger to mine personnel. Proper disposal of food waste and education of workers and contractors can reduce the attractiveness of the site to these species and reduce mortality of local wildlife.

Site lighting can contribute to bird mortality by attracting birds to light sources where they may collide with structures or become exhausted and fall prey to predators. Light attraction occurs mainly during migration when many bird species are active after dark. It also tends to be weather related and episodic. It is prudent to take steps to minimize mortality of migrants moving through the area. A variety of lighting mitigation measures have been recommended to reduce the likelihood of mortality events occurring. These measures have been demonstrated to help reduce attraction of birds to lighted structures. These mitigation measures will be accompanied by a monitoring program to document any mortality events so that potential problem areas can be identified and corrected.

Implementation of the mitigation measures outlined above will reduce wildlife mortality to acceptable levels and will allow the efficacy of the mitigation to be monitored and improved as necessary.

5.3.4.3 Summary of Project Residual Environmental Effects

Table 5.3.12 summarizes the residual environmental effects of the Project on Birds and Wildlife.

Table 5.3.12 Summary of Project Residual Environmental Effects: Birds and Wildlife

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Change in Wildlife Habitat										
Construction	• Establish a corridor of undisturbed habitat at least 150 m wide around the periphery of the Donkin Peninsula. • The corridor for the coal conveyor will be as narrow as safely possible. • Clear coal waste disposal areas only when and as required. • Minimize damage to wetland habitat along the transmission line route. • Establish and maintain a setback on the seaward and landward side of the Northern Head seabird colony along the shoreline. • Noisy or startling activities such as cutting the cliff face will be scheduled outside of the sensitive seabird colony establishment period (early April to late May) to the extent practical.	A	M	L	LT	F	I	D	N	• Monitor the abundance and distribution of seabirds at the Northern Head seabird colony to determine the efficacy of the setbacks around the colony. • A post-construction bird monitoring program will be developed in consultation with the CWS, based on final design details.

Table 5.3.12 Summary of Project Residual Environmental Effects: Birds and Wildlife

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Operation and Maintenance	• Site specific mitigation at Phase III coal waste disposal area developed in consultation with CWS and NSDNR if Canada Warbler, Olive-sided Flycatcher or other Species at Risk are confirmed breeding there. • Final design of Phase III coal waste disposal area to reduce loss of interior forest habitat on the Donkin Peninsula if possible. • Maintain connectivity of terrestrial habitats around the margin of the Donkin Peninsula. • Progressive development reclamation of coal waste disposal areas. • Vegetation maintenance on the transmission line RoW scheduled to avoid breeding season for most birds (April 1 to August 15).	A	M	L	LT	F	I	D	N	• Conduct breeding bird surveys in the Phase III waste coal disposal area.
Decommissioning and Reclamation	• Use progressive reclamation of coal waste storage areas.	A	M	L	MT	O	R	D	N	

Table 5.3.12 Summary of Project Residual Environmental Effects: Birds and Wildlife

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Change in Mortality Risk										
Construction	• Schedule clearing outside of the breeding season for most birds (April 1 to August 15). • Establish setbacks around ground nesting species if required (June-August). • Store food waste in appropriate receptacles and train employees and contractors regarding wildlife encounters.	A	L	S	MT	R	R	D	N	
Operation and Maintenance	• Train workers to recognize potential ground nesting birds and establish setbacks if required. • Site lighting design to minimize light spill over and attraction to birds.	A	M	L	LT	R	R	D	N	• Monitor structures where light attraction may occur to determine if any mortality events occur.

Table 5.3.12 Summary of Project Residual Environmental Effects: Birds and Wildlife

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		
Decommissioning and Reclamation	• Minimize lag time between retirement of buildings or structures and their disassembly. • Keep retired buildings closed to discourage colonization by wildlife. • Disassemble buildings and structures outside of the breeding season for most birds (April 1 to August 15). Alternatively, inspect buildings or structures just before disassembly to ensure compliance with *Migratory Birds Convention Act*. Also contact relevant authorities prior to site decommissioning (*e.g.*, CWS). • Minimize lag time between completion of coal waste deposition and commencement of reclamation. • Conduct reclamation activities outside of the breeding season for most bird species (April 1 to August 15). Otherwise, perform nest surveys and limit activities until nests are no longer occupied.	A	L	S	ST	O	R	D	N	

Table 5.3.12 Summary of Project Residual Environmental Effects: Birds and Wildlife

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics							Significance	Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		

KEY ***Direction:*** P Positive: condition is improving compared to baseline habitat or population status N Neutral: no change compared to baseline habitat or population status A Adverse: negative change compared to baseline habitat or population status ***Magnitude:*** L Low: effect is detectable but only on a few individuals M Moderate: effect on many individuals H High: effect occurs at the population level N Negligible**:** no measurable adverse effects anticipated ***Geographic Extent:*** S Site: effects restricted to habitat within the PDA L Local: effects extend beyond Project footprint but remain within the LAA R Regional: effects extend into the RAA	***Duration:*** ST Short term: measurable for less than one month MT Medium term: measurable for more than one month but less than two years LT Long term: measurable for the life of the Project ***Frequency:*** O Once: effect occurs once R Rarely: effect occurs monthly F Frequently: effect occurs daily ***Reversibility:*** R Reversible: effects will cease during or after the Project is complete I Irreversible: effects will persist after the life of the Project	***Environmental Context:*** U Undisturbed: effect takes place in an area that has not been adversely affected by human development D Disturbed: effect takes place in an area that has been previously adversely affected by human development or in an area where human development is still present N/A Not Applicable ***Significance:*** S Significant N Not Significant

5.3.5 Assessment of Cumulative Environmental Effects

Section 4.2.4 identified other projects and activities which could potentially interact cumulatively with the Donkin Export Coking Coal Project. Table 5.3.13 below presents the potential cumulative environmental effects to birds and wildlife, and ranks each interaction with other projects as 0, 1, or 2 with respect to the nature and degree to which important Project-related environmental effects overlap with those of other projects and activities.

Table 5.3.13 Potential Cumulative Environmental Effects to Birds and Wildlife

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Wildlife Habitat	Change in Mortality Risk
Historic Coal Mining Activities	0	1
Donkin Coal Exploration Project	1	1
Historic and Ongoing Fishing Activity	1	1

KEY

0 = Project environmental effects do not act cumulatively with those of other projects and activities.
1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of project-specific or regional mitigation.

Activities related to regional shoreline infilling/wharf development, marine shipping operations, Lingan and Point Aconi Power Stations, ECBC remediation work, Port of Sydney Development, and remediation work at Victoria Junction are not likely to interact with the Project to affect Birds and Wildlife. These projects can be expected to have small scale adverse effects on wildlife. These effects are so small and remote from the Donkin mine project that any cumulative effect is indiscernible from normal population fluctuations.

Historic coal mining activities may have cumulative effects in conjunction with the Donkin mine project. The original Donkin mine has altered habitat on the Donkin Peninsula as has the Donkin Coal Exploration Project. The Donkin Coal Exploration Project has resulted in the loss of forest and wetland habitat as has construction of the new access road. Previous mining activity has also benefitted wildlife by providing uncommon habitat types. The DEVCO settling pond has developed into a productive marsh and shallow water wetland complex that provides the best waterfowl habitat on the Donkin Peninsula. The poorly vegetated area around the mine portals provides nesting habitat for Killdeer and roosting habitat for shorebirds. The original mine development will also interact with the proposed Project transmission line corridor. Much of the proposed transmission line follows an old transmission line that serviced the old mine site. Following the old transmission line route will reduce the amount of wildlife habitat affected by construction of the new transmission line.

Ongoing fishing activity will act cumulatively with mining activities in regards to disturbance of nesting seabirds at the Northern Head seabird colony. Mining activities such as construction and operation of the barge load-out facility and deposition and contoring of waste coal at the Phase I/Phase II coal waste disposal piles could also stress seabirds. A setback will be established around the seaward and landward sides of the colony in which no habitat alteration or mining activities are permitted to minimize any adverse effects associated with mining activities. These restrictions will not apply to lobster boats operating around Northern Head. Observations made in 2010 and 2011 suggest that seabirds at the colony are habituated to the presence of lobster boats near the colony so any cumulative effect of the two activities is expected to have little effect on seabird breeding success. A monitoring study will be implemented to determine whether or not this prediction is accurate.

5.3.6 Determination of Significance

All phases of the Project (construction, operation and maintenance, decommissioning and reclamation) are likely to have an adverse effect on Birds and Wildlife. These activities will affect both wildlife habitat quality and risk of mortality. The most important potential adverse effects on wildlife habitat quality are associated with loss of wildlife habitat during the construction and operation and maintenance phases of the Project and sensory disturbance of nesting seabirds at the Northern Head seabird colony. The most important factor potentially affecting risk of mortality is the loss of wildlife habitat through clearing. Other potential sources of increased wildlife mortality risk include attraction of migrants to site lighting and attraction of generalist predators to the mine site.

The largest amounts of relatively undisturbed habitat will be lost as a result of the development of the Phase I, II and III coal waste disposal piles. Much of the habitat affected during the construction phase is habitat that has been modified by previous mining activities. The amount of habitat lost to Project activities is comparable to areas affected by commercial clear-cutting. Effects of the Project on habitat fragmentation are limited by the fact that the Donkin Peninsula is already moderately fragmented. Thirteen hectares of forest interior habitat will be lost as a result of development of the Phase III coal waste disposal pile. Areas affected by mining will be reclaimed following completion of the Project. Adverse effects of the Project on wildlife will be avoided through a number of mitigation measures including, timing restrictions on clearing, establishment of setbacks around the Northern Head seabird colony, establishment of an undisturbed corridor around the margin of the Donkin Peninsula, and site lighting design.

In consideration of the proposed mitigation and environmental protection measures, the environmental effect of changes in Bird and Wildlife habitat quality and risk of mortality is considered to be not significant. The Phase III coal waste disposal area has potential to provide nesting habitat for species at risk. If species at risk are confirmed to be present a site specific mitigation plan for these species will be developed.

The potential for cumulative environmental effects between Project-related residual effects combined with environmental effects from other past, present and reasonably foreseeable projects and activities on Bird and Wildlife is rated as not significant.

In summary, the environmental effect of the Project on Birds and Wildlife, considering Project and cumulative effects, is considered to be not significant.

5.3.7 Follow-up and Monitoring

Follow-up breeding bird surveys will be conducted in the vicinity of Schooner Pond to determine if the Phase III coal waste disposal area provides habitat for species at risk.

A monitoring program will be developed to determine whether the setback identified to minimize sensory disturbance of the Northern Head seabird colony is effective. The abundance and distribution of seabirds at the colony will be monitored during the construction and operation and maintenance phases of the Project.

A monitoring program will be implemented to determine if site lighting results in bird mortality events. Areas having elevated potential for light attraction will be visited following weather events conducive to light attraction such as foggy nights or nights with low cloud cover. Searches will be conducted for dead or grounded birds. The species, numbers and locations of dead or grounded birds will be recorded and used to identify particular combinations of structures, lighting and weather that may result in mortality events.

Additional details regarding the post-construction bird monitoring program will be developed in consultation with the CWS, based on final design details. Adaptive management measures will be implemented in the event that follow-up avian monitoring detects large scale events, adverse effects to colonial nesters or avian species at risk, errors in the conclusions of the EIS, or other significant adverse effects on birds. Details of the monitoring strategy will be clearly laid out prior to Project implementation. These details are proposed to be submitted to CWS and NSDNR in a timely manner for review and comment.

Data on the known distribution of bird Species at Risk along the transmission line route will be communicated to NSPI for their use during construction and maintenance activities.

5.4 WETLANDS

The Wetlands VEC is defined as marshes, swamps, fens, bogs, and shallow water areas that are saturated with water long enough to promote wetland or aquatic processes, and includes coastal wetlands (*e.g.,* salt marshes and eelgrass beds).

Wetlands were selected as a VEC because of the potential for interactions between Project activities and wetlands, and because of their relationship with vegetation and wildlife, as well as other biological and physical environments addressed as VECs in this report. Wetlands are an important feature of the landscape, performing many biological, hydrological, social/cultural, and economic functions. The Federal Policy on Wetland Conservation (Environment Canada 1991) sets a conservation goal of no net loss of wetland function and the Nova Scotia Wetland Conservation Policy provides direction and a framework for the conservation and management of wetlands in Nova Scotia.Globally, wetlands are recognized as unique and valued ecosystems, providing valuable functions on a local (*e.g.*, water quality improvement), regional (*e.g.*, groundwater recharge) and global (*e.g.*, carbon storage) scale (Ramsar Convention Secretariat 2006). They provide habitat for many species of flora and fauna which depend on wetland conditions for their survival. Hydrological functions of wetlands include erosion and flood control, contaminant reduction, and groundwater recharge and discharge. Wetlands support various forms of recreational activity, as well as subsistence production, such as harvesting of plants and other wildlife, and commercial production, such as cranberry bogs, forestry, and peat extraction. Additionally, wetlands are identified as a VEC in the EIS Guidelines for the Project.

5.4.1 Scope of Assessment

5.4.1.1 Regulatory Setting

Wetlands are protected through federal policy, provincial legislation and provincial policy.

Wetland conservation is federally promoted by the Federal Policy on Wetland Conservation (Environment Canada 1991). The objective of this policy is to “promote the conservation of Canada’s wetlands to sustain their ecological and socio-economic function, now and in the future”. The Federal Policy on Wetland Conservation sets a conservation goal of no net loss of wetland function. Wetland function is defined by the Federal Policy on Wetland Conservation (Environment Canada 1991) as:

> *…the natural processes and derivation of benefits and values associated with wetland ecosystems, including economic production (e.g., peat, agricultural crops, wild rice, peatland forest production), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), and soil and water conservation, as well as tourism, heritage, recreational, educational, scientific, and aesthetic opportunities.*

Coordination of implementation of the Federal Policy on Wetland Conservation is the responsibility of Environment Canada, specifically the Canadian Wildlife Service (CWS) and the Environmental Conservation Branch (ECB). Although there is no specific federal legislation regarding wetlands, they may be protected federally under the *Species At Risk Act* (SARA), if they contain critical habitat for Species At Risk, the *Migratory Birds Convention Act* (MBCA) *1994*, if they contain nests of migratory birds, and/or the *Fisheries Act*, if the wetland contributes to an existing or potential fish habitat. Details on the application of the MBCA and SARA for protection of wildlife and fish and fish habitat are provided in Sections 5.3 (Birds and Wildlife VEC) and 5.6 (Freshwater Fish and Fish Habitat VEC), respectively.

Provincially, wetlands in Nova Scotia are protected by the Nova Scotia *Environmental Act* (NS 1995), where “wetland” is defined as:

> *land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.*

In October 2011, Nova Scotia Environment (NSE) released the Nova Scotia Wetland Conservation Policy*.* The policy provides context to legislation, regulations and operational policies designed to protect and guide management of wetlands in Nova Scotia. Most importantly, the policy establishes a specific goal of no loss of Wetlands of Special Significance and no net loss in area and function for other wetlands. The government considers the following to be Wetlands of Special Significance (NSE 2011): all salt marshes; wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Area or lands owned or legally protected by non-government charitable conservation land trusts; intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the Nova Scotia Eastern Habitat Joint Venture; wetlands known to support at-risk species as designated under the federal *Species At Risk Act* or the Nova Scotia *Endangered Species Act*; and wetlands in designated protected water areas as described within Section 106 of the *Environment Act*. Any project with the potential to alter a wetland (filling, draining, flooding or excavating), including direct and indirect effects, requires a Water Approval from NSE, pursuant to the Activities Designation Regulations(NS 2010), prior to starting the work. If alterations exceed two hectares of any wetland, the project is also subject to registration under the Environmental Assessment Regulations.

Prior to any alteration to wetland habitat, a Wetland Alteration Approval must be sought from NSE. Applications for Wetland Alteration Approval must be supported with details of the unavoidable nature of the proposed wetland alterations, the measures to minimize or compensate for wetland alteration, and the character and function of wetlands to be affected. These applications are evaluated in the context of the mitigative sequence. This is typically conducted subsequent to EA approval as part of the permitting phase. The mitigative sequence for decision-making is the foundation for achieving wetland conservation in Nova Scotia. The sequence – avoidance, minimization, compensation – assists proponents in planning and designing project proposals that will be acceptable to NSE. Avoidance is the priority, and requires consideration of project alternatives that would have less adverse effects on the wetland. Minimization requires that the project be designed and implemented using techniques, materials and site locations that reduce or remediate the project effects on the wetland.

Compensation requires that the residual effects on the wetland functions are compensated for by the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss. Any loss of wetland habitat, either through direct or indirect Project effects, requires compensation to replace the wetland functions lost as a result of the wetland alterations.

5.4.1.2 Influence of Consultation and Engagement on the Assessment

During the stakeholder and public engagement process, the main issue raised by stakeholders and community members was potential effects on Baileys Wetland which is used for recreational fishing and bird watching. Concerns have been raised by members of the Port Morien Wildlife Association about the potential loss of Baileys Wetland should the old access road to the mine site, which currently serves as a dam for this wetland, not be maintained in the future.

5.4.1.3 Selection of Environmental Effects and Measurable Parameters

The environmental assessment of wetlands is focused on the following environmental effect:

- Change in Wetland Area or Function.

This environmental effect encapsulates the range of wetland effects that may occur, including direct and indirect effects. Whereas change in wetland area is quantifiable using information on the location and extent of Project components, assessment of loss of wetland functions requires a more qualitative approach. Avoiding the loss of both wetland area and functioning align with regulatory objectives.

The measurable parameters used for the assessment of the environmental effect and the rationale for its selection is provided in Table 5.4.1.

Table 5.4.1 Measurable Parameters for Wetlands

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Wetland Area or Function	• Wetland habitat directly altered (ha) • Change in wetland functioning	Wetland area and function are commonly used in effects assessments and for determining requirements for habitat compensation. The Nova Scotia Wetland Conservation Policy (NSE 2011) aims to achieve no net loss of wetland area and function. The Federal Policy on Wetland Conservation sets a conservation goal of no net loss of wetland function. Whereas change in wetland area is quantifiable using information on the location and extent of Project components, assessment of loss of wetland functions requires a more qualitative approach.

5.4.1.4 Temporal and Spatial Boundaries

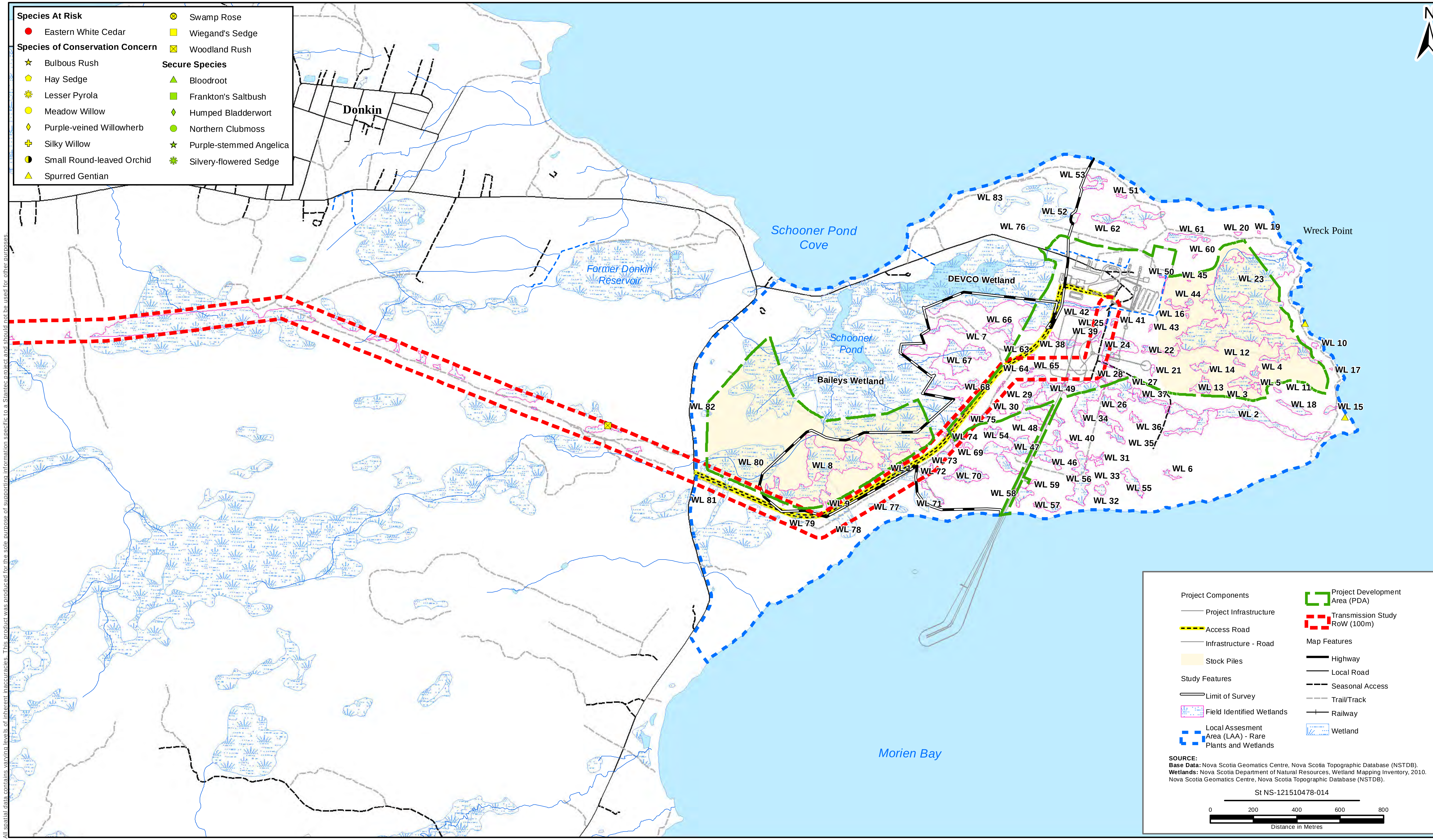
The temporal boundaries for the assessment of the potential environmental effect of the Project on wetlands include the duration of Project, construction, operation and maintenance, and decommissioning, and Project reclamation in perpetuity.

The spatial boundaries for the environmental effect assessment of wetlands are defined below, and are shown in Figure 5.4.1.

Project Development Area (PDA): The PDA includes the area of physical disturbance (*i.e.*, "footprint" for the Project including infrastructure for the mine site as well as stockpiles, coal waste piles, conveyor system, 138 kV transmission line, and trucking routes. The PDA also includes the barge load-out facility and transshipment mooring and vessel route between the two.

Local Assessment Area (LAA): The LAA for the mine component of the Project is defined as the Donkin Peninsula (east of the Long Beach Road) and any adjacent marine wetland habitat. The LAA for the transmission component of the Project is identified as an approximate 100 m wide corridor centered along the length of the proposed line.

Regional Assessment Area (RAA): The RAA is limited to and includes the primary and secondary watersheds within which the wetlands are situated. The RAA is the area within which cumulative environmental effects for wetlands may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects.



PREPARED BY: M. Huskins-Shupe	Donkin Export Coking Coal Project	FIGURE NO.: 5.4.1 a
REVIEWED BY: K Keizer		DATE: Apr 26, 2012
CLIENT: xstrata coal	**Rare Plants and Wetlands Overview (Map 1 of 4)**	Stantec

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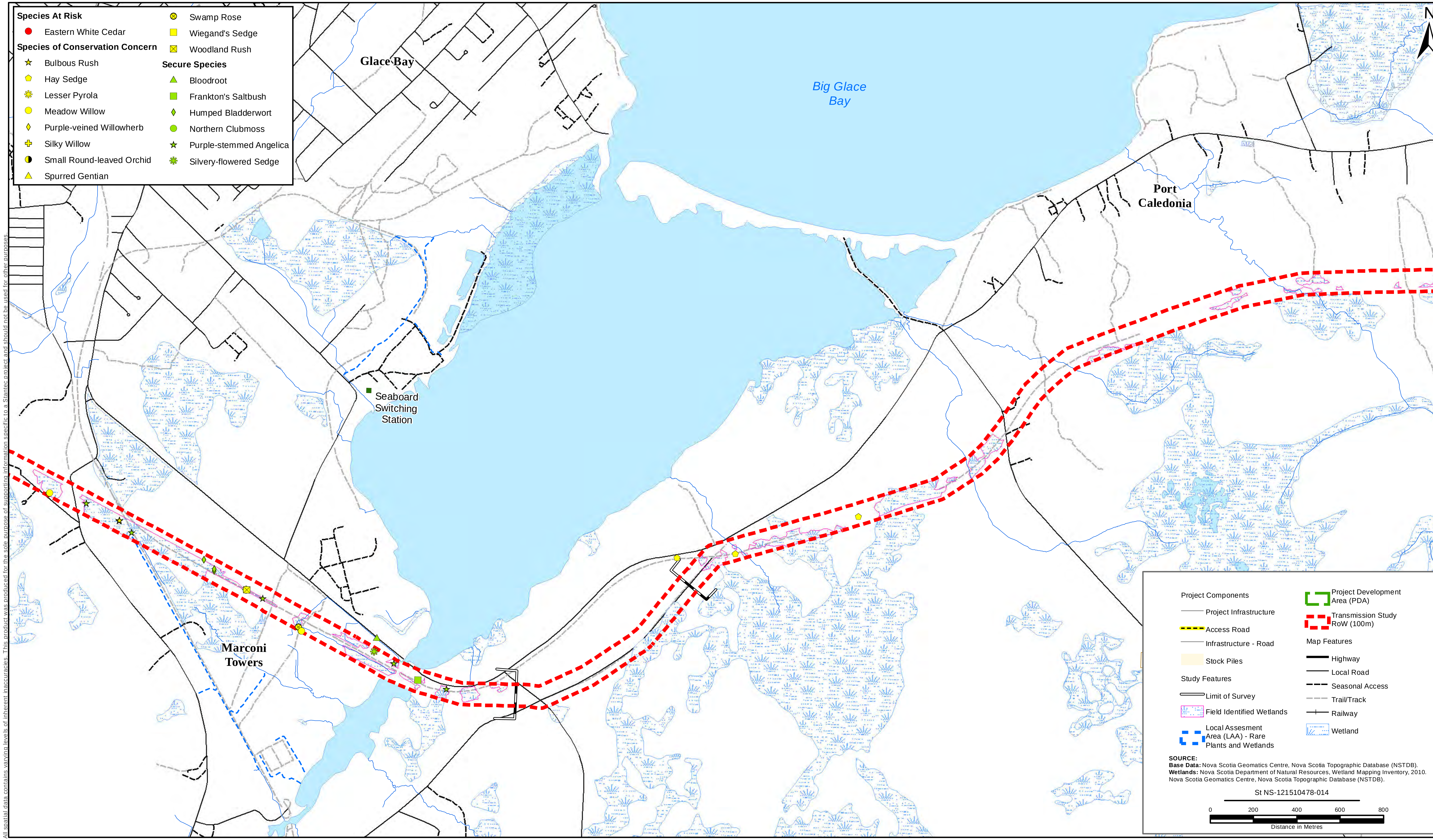

PREPARED BY: M. Huskins-Shupe

REVIEWED BY: K Keizer

CLIENT: xstrata coal

Donkin Export Coking Coal Project

Rare Plants and Wetlands Overview (Map 2 of 4)

FIGURE NO.: 5.4.1 b

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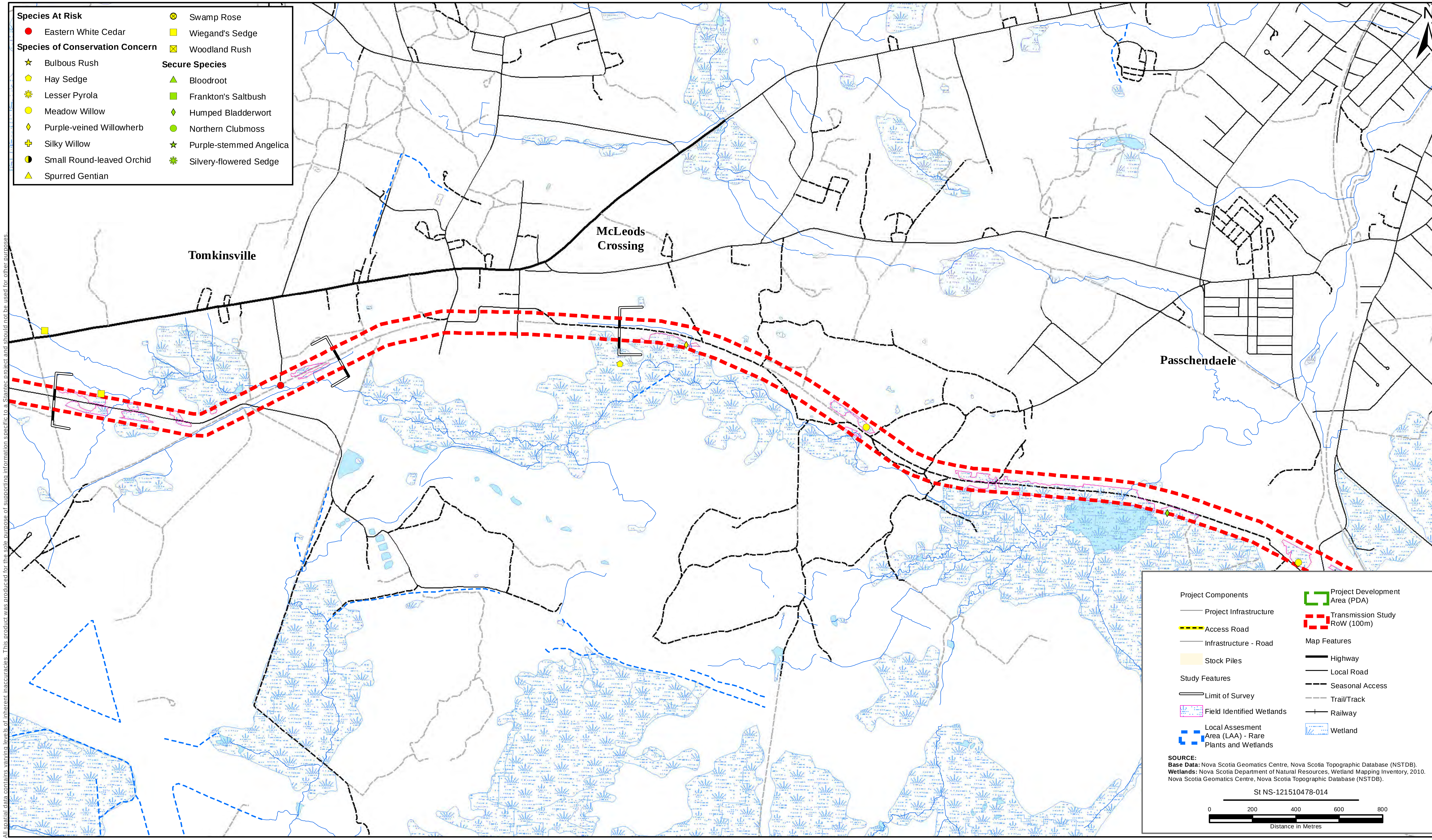

PREPARED BY: M. Huskins-Shupe	Donkin Export Coking Coal Project	FIGURE NO.: 5.4.1 c
REVIEWED BY: K Keizer		DATE: Apr 26, 2012
CLIENT: xstrata coal	**Rare Plants and Wetlands Overview (Map 3 of 4)**	Stantec

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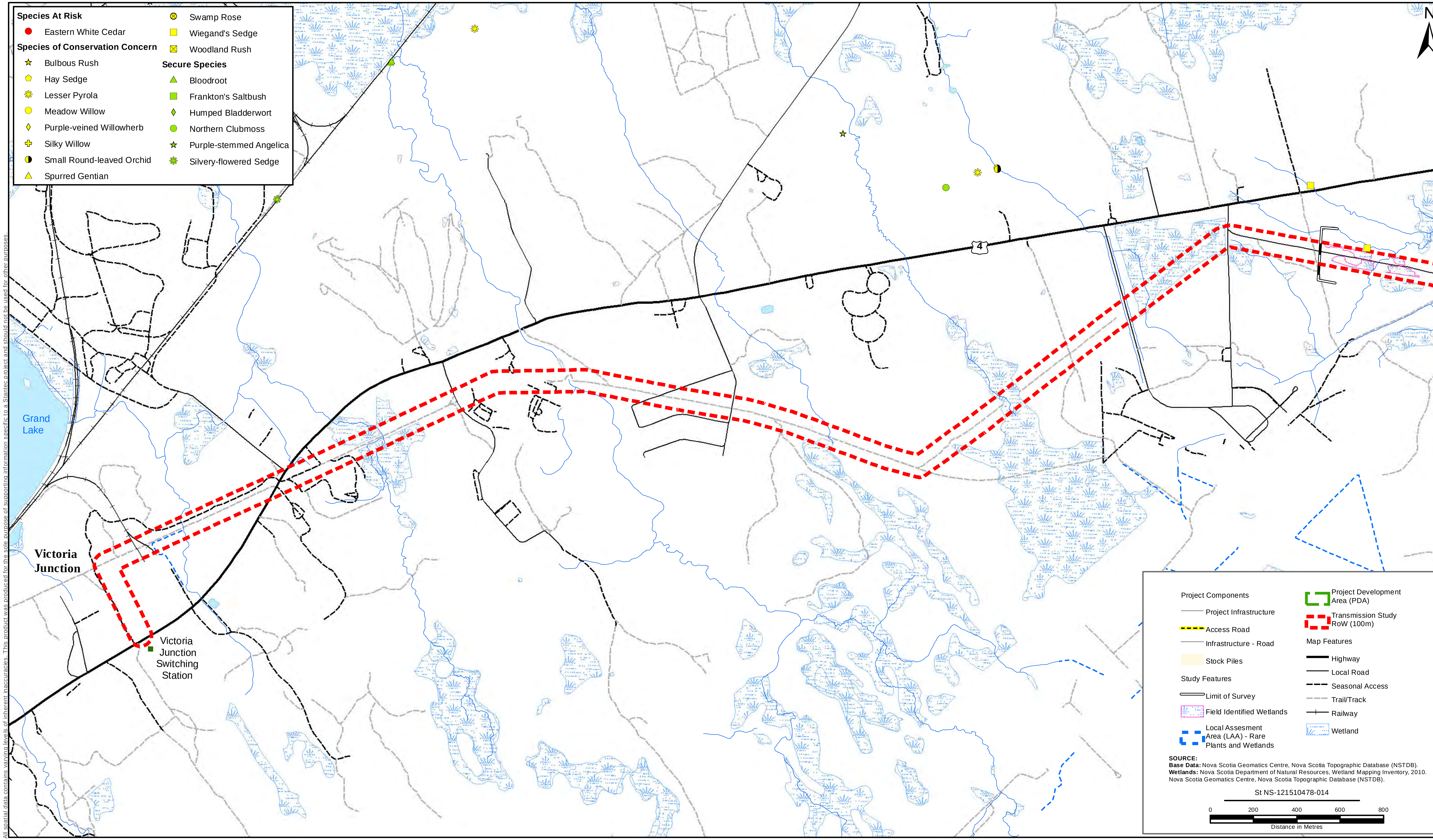

PREPARED BY: M. Huskins-Shupe

REVIEWED BY: K Keizer

CLIENT: xstrata coal

Donkin Export Coking Coal Project

Rare Plants and Wetlands Overview (Map 4 of 4)

FIGURE NO.: 5.4.1 d

DATE: Apr 26, 2012

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5.4.1.5 Residual Environmental Effects Description Criteria

Terms that will be used to characterize residual environmental effects for Wetlands are presented in Table 5.4.2.

Table 5.4.2 Characterization Criteria for Residual Environmental Effects on Wetlands

Criterion	Description
Direction	**Positive:** condition is improving compared to baseline habitat or ecosystem quality **Neutral:** no change compared to baseline habitat or ecosystem quality **Adverse:** negative change compared to baseline habitat or ecosystem quality
Magnitude	**Negligible:** no direct or indirect loss of wetland area or function **Low:**<5% of wetland area within the LAA disturbed or indirectly influenced **Moderate:**5 - 25% of wetland area within the LAA disturbed or indirectly influenced **High:**>25% of wetland area within the LAA disturbed or indirectly influenced
Geographical Extent	**Site-specific:** effects restricted to habitat within the PDA **Local:** effects extend beyond PDA but remain within the LAA **Regional:** effects extend into the RAA
Frequency	**Once:** effect occurs once **Rarely:** effect occurs occasionally (*e.g.*, monthly) **Frequently:** effect occurs regularly (*e.g.*, daily)
Duration	**Short-term:** measurable for less than one month **Medium-term:** measurable for more than one month but less than two years **Long-term:** measurable for the life of the Project
Reversibility	**Reversible:** effects will cease during or after the Project is complete **Irreversible:** effects will persist after the life of the Project
Ecological Context	**Disturbed:** effect takes place within an area that has been substantially influenced by human developments and disturbances **Undisturbed:** effect takes place within an area that is relatively unaffected by human developments or disturbances

5.4.1.6 Threshold for Determining the Significance of Residual Environmental Effects

A **significant adverse residual environmental effect** on Wetlands is defined as a Project-related environmental effect that results in a:

- loss of Wetlands of Special Significance (including changes in the functional attributes of wetlands so that they no longer classify as a Wetland of Special Significance under the Nova Scotia Wetland Conservation Policy); or
- permanent loss of wetland area and/or associated functions.

5.4.2 Existing Conditions

5.4.2.1 Wetland Distribution and Classification

Information on the distribution and classification of wetlands within the Donkin Peninsula and the transmission corridor was obtained through a combination of field surveys and desktop review. Field surveys were performed on the Donkin Peninsula during August and November of 2011 and focused on areas which were expected to have potential interaction with the Project. Similarly, field surveys during August, 2010 were restricted to within an approximate 80 m wide corridor centered along the length of a rail alignment which runs parallel to the proposed transmission line. Within this context, the length of the proposed transmission corridor was surveyed with the exception of approximately 6 km of its western end (which is within a currently maintained transmission RoW, a 1.5 km section near the community of Tompkinville (which is also within a currently maintained transmission RoW), and a 1 km portion on the eastern side of Big Glace Bay Lake (which is within an abandoned transmission RoW). Wetland delineations and assessments were restricted to portions within the 80 m wide corridor although many of the wetlands extended outside of the field survey area. Additional information on the extent and character of wetlands on the Donkin Peninsula and within the transmission corridor was obtained through air photo interpretation and a review of the Nova Scotia Wetland Inventory Database (NSDNR 2007) and the Nova Scotia Geomatics Centre (NSGC 1997). Figure 5.4.1 provides information on the extent of wetlands within the LAA, as obtained through a combination of field surveys and air photo interpretation, with the extent of field delineations being marked by 'limit of survey' points.

The technical approach used for wetland identification and delineation during the surveys was based on principles prescribed in the US Army Corps of Engineers Wetlands Delineation Manual (1987) using vegetation, soil, and hydrology as wetland indicators. Wetlands were classified according to the criteria outlined in the Canadian Wetland Classification System (CWCS). The CWCS is a hierarchical system that incorporates the identities of three general levels of wetland features – class, form, and type (Warner and Rubec 1997). Wetland classes are based on the properties of the wetland that reflect their origin and the nature of the wetland environment. This level may be used to group wetlands at their most general scale, and include bog, fen, swamp, marsh, and shallow water designations. Wetland forms and subforms are subdivisions of each wetland class and are based on their morphology, surface pattern, water type, and the morphological characteristics of the underlying soil. Many wetland forms apply to more than one wetland class whereas others are more specific. Wetland types are further subdivisions of their forms and subforms and are based on the physiognomic characteristics of their vegetation communities (NWWG 1997). All wetlands within the LAA were grouped according to their class.

5.4.2.1.1 Donkin Peninsula

A total of 85 wetlands, accounting for over 120 ha, have been identified on the Donkin Peninsula through a combination of field surveys and desktop analyses. Of these, 74 wetlands were delineated during field surveys, the boundaries of eight were identified through a combination of air photo interpretation and provincial wetland mapping, and the extent of three were estimated using a combination of field and desktop data. All recognized wetland classes are present on the peninsula, including swamp, bog, marsh, shallow water, and fen (Table 5.4.3). Wetland complexes (identified as wetlands which are comprised of two or more wetland classes) comprise over 85 ha, or approximately 69 percent of the wetland area of the peninsula, and include marsh/shallow water, marsh/shallow water/swamp/bog, swamp/fen, swamp/marsh, swamp/fen/marsh, and swamp/shallow water/fen/marsh. The three largest wetlands of the peninsula are: a) Baileys Wetland (~43.0 ha) which is comprised of a combination of swamp, shallow water, fen, and fringing marsh; b) DEVCO Wetland (*i.e.*, DEVCO settling pond, ~18.1 ha) is a wetland modified specifically for Donkin Mine and is primarily comprised of marsh and shallow water classes but also includes fringing swamp and a small section of bog; and c) a swamp/fen in the northeast quadrant of the peninsula which has a relatively small area of marsh located at its western end (~13.4 ha).

Table 5.4.3 Wetland Number and Area on Donkin Peninsula by Class

Wetland Class[1]	Number	Area (ha)	Proportion of Total Wetland Area by Class (%)
Marsh	4	0.4	0.3
Marsh/Shallow Water	1	0.3	0.2
Marsh/Shallow Water/Swamp/Bog[2]	1	18.1	14.8
Swamp	68	37.6	30.8
Swamp/Fen	3	5.6	4.6
Swamp/Fen/Marsh	1	13.4	10.9
Swamp/Marsh	6	3.4	2.7
Swamp/Shallow Water/Fen/Marsh[3]	1	43.5	35.6
Total	**85**	**122.3**	**100.0**

[1]Wetland classification data based on field surveys, air photo interpretation, and wetland inventory from the NSGC and NSDNR
[2]DEVCO Wetland
[3]Baileys Wetland

Swamps occupy the vast majority of wetlands on the peninsula and are distributed throughout its extent. Swamps are mineral wetlands or peat lands and characteristically have tall woody vegetation (NWWG 1997). Their water table is generally at or near the surface of the swamp and is commonly present in the form of either stagnant or flowing pools, or channels. Swamps generally have some internal water movement originating from their margins or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood and other organic material. Swamps on the Donkin Peninsula were primarily dominated by coniferous trees, but shrub-dominated swamps were also present. Marshes are present at the littoral zone of open water bodies (*i.e.*, DEVCO Wetland and Baileys Wetland) and in association with several smaller anthropogenically-influenced wetlands. Marshes are typically mineral wetlands and are periodically inundated by standing or slow flowing water, with water levels that generally fluctuate seasonally. During drier periods, declining water levels may expose areas of matted vegetation or mud flats. The surface waters are typically rich in nutrients. Although their substrate is usually mineral material, well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees (NWWG 1997). Marshes within the peninsula varied in character in conjunction with their hydrological properties, but were typically dominated by graminoids, most notably cattails and grasses.

Shallow water wetlands usually occupy the transitional areas between wetlands that are saturated, either seasonally or permanently, and permanent, deep water bodies, such as lakes. They have standing or flowing water that is <2 m deep during mid-summer but their hydrological character is quite varied. Water levels with shallow water wetlands may be seasonally stable, permanently flooded, or intermittently exposed during droughts, low flows, or intertidal periods (NWWG 1997). This wetland class was found to be associated with marshes of DEVCO Wetland, Baileys Wetland, and several small disturbed basins on the peninsula. These open water habitats are largely non-vegetated, with less than five percent of the area being comprised of submerged and floating aquatic plants.

Fens are minerotrophic peat lands with fluctuating water levels (NWWG 1997). Surface water movement is common within fens and may be observed in channels or pools. Fen vegetation is strongly influenced by water depth and chemistry, and they may be dominated by graminoids, bryophytes, shrubs, and/or trees. Fens occupied the area between treed swamp and marsh/shallow water habitats of Baileys Wetland, and occurred elsewhere on the Donkin Peninsula in association with swamps. The vegetation of fens on the peninsula was varied but their species composition indicated they are relatively acidic and have a poor nutrient status.

The DEVCO Wetland was found to contain an area of bog at its most easterly extent. Bogs are peat wetlands which are raised or level with the surrounding terrain and are unaffected by runoff waters or groundwater from the surrounding mineral soils (NWWG 1997). Water levels are generally at or slightly below the surface of the bog. Because they receive their nutrient and water input from atmospheric deposition, they are typically nutrient poor and have a low pH. They also typically have a well-developed peat layer comprised of peatmoss and the woody remains of shrubs. The area of bog that was encountered on the peninsula was associated was dominated by ericaceous shrubs and peatmoss.

5.4.2.1.2 Transmission Corridor

A total of 101 wetlands, accounting for over 65.2 ha, have been identified within the transmission corridor through a combination of field surveys and desktop analyses (Table 5.4.4). Of these, 91 wetlands were delineated during field surveys, and the boundaries of 10 were identified using provincial wetland mapping. Swamps comprise the majority of wetland habitat within the transmission corridor, but all wetland classes recognized by the Canadian Wetland Classification System (NWWG 1997) are present along the corridor, including bog, fen, shallow water, marsh, swamp, and combinations thereof. The prominence of wetland complexes within the transmission corridor partly reflects the influence of anthropogenic disturbances in recent decades. Anthropogenic activities within and near wetlands can alter wetland hydrology, and fragment wetland habitat, and these localized effects can cause new wetland habitat types to develop.

Table 5.4.4 Wetland Number Area Within Transmission Corridor by Class

Wetland Class[1]	Number	Area (ha)	Proportion of Total Wetland Area by Class (%)
Bog	3	1.3	2.0
Fen	2	2.7	4.2
Marsh	5	2.2	3.3
Swamp	57	27.2	41.7
Bog/Fen	5	2.4	3.7
Marsh/Bog	1	5.7	8.8
Marsh/Shallow Water/Swamp	3	5.6	8.6
Swamp Bog	6	10.9	16.7
Swamp/Fen	3	2.0	3.0
Swamp/Marsh	15	4.8	7.3
Swamp/Shallow Water/Fen	1	0.5	0.7
Total	**101**	**65.2**	**100.0**

[1]Wetland classification data based on field surveys, and wetland inventory from the NSGC and NSDNR

5.4.2.2 Plant Communities

Swamp

The majority of wetland habitat on the peninsula is comprised of tree and shrub dominated swamps, with coniferous treed swamps being particularly prominent. Black spruce is the dominant species throughout these communities but lesser amounts of other trees, particularly balsam fir and paper birch are also sometimes present. The tree canopy varies depending on the topography and moisture regime of the wetlands, being relatively open and comprised of stunted trees towards their centers and comparatively well-developed along the their edges and in association with slopes. A moderate to dense shrub layer is comprised of black spruce along with varying amounts of balsam fir, sheep laurel, mountain holly (*Nemopanthus mucronatus*), and northern wild raisin (*Viburnum nudum*). Peatmoss (*Sphagnum spp*.) provides a prominent cover on the forest floor and is at times punctuated with red-stemmed Schreber's moss hummocks. Cinnamon fern and three-seeded sedge (*Carex trisperma*) are the most indicative herbaceous plants found with coniferous swamps, being a dominant component throughout. However, a number of other forbs and graminoids are also common, including three-leaved false soloman's seal (*Maianthemum trifolium*), bluejoint reed grass, and bunchberry. Although typically associated with drier habitats, bracken fern is also a common component of some treed swamps, being associated with hummocky areas. A number of other forbs comprise a dominant component of the understory vegetation in specific wetlands but are not common throughout, including smooth black sedge (*Carex nigra*), brownish sedge (*Carex brunnescens*), and common tall manna grass (*Glyceria grandis*). Mixedwood treed swamps are similar in structure and composition to their coniferous-dominated counterparts but are represented by a higher prominence of broad-leaved trees and greater representation of certain understory taxa, including common tall manna grass, spinulose wood fern, and goldthread (*Copti strifolia*). The treed swamps of the peninsula would encompass both the “Black spruce/Cinnamon fern/Sphagnum (WC1)” and “Black spruce/lambkill – Labrador tea/Sphagnum (WC2)” vegetation types described by Nova Scotia’s Forest Ecosystem Classification (FEC) (NSDNR 2011b).

Wetlands characterized as mixed shrub swamps represent those that are dominated by a mixture of tall, medium, and low shrubs. Such habitats were found within basins where treed wetland types were regenerating following disturbance from harvesting activities (*i.e.*, immediately south of the mine yard). Although an intermittent tree cover is provided by some black spruce and tamarack (*Larix laricina*), the majority of tree species coverage is restricted to the shrub layer (*i.e.*, < 5 m in height). Black spruce and sheep laurel are the most prominent shrubs, with northern bayberry, common Labrador tea (*Ledum groenlandicum*), mountain holly, and northern wild raisin (*Viburnum nudum*) also being common. Herbaceous vegetation is typically well-developed as a result of the open canopy. Cinnamon fern and tawny cottongrass (*Eriophorum virginicum*) are the most prominent herbaceous species, with other common plants being short-tailed rush (*Juncus brevicaudatus*), bluejoint reed grass, soft rush (*Juncus effuses*), hybrid white panicled American-aster (*Oclemena x blakei*), and three-leaved false Soloman's seal. Peatmoss forms an almost continuous cover throughout.

Tall shrub swamps are associated with basins and are also found in pockets along watercourses and other drainage features. A diffuse tree cover provided by black spruce, tamarack, and balsam fir is sometimes present but this wetland community is dominated by shrubs greater than 1.5 m in height. The composition of the dominant shrubs is varied but northern wild raisin (*Viburnum nudum*), black spruce, alder (*Alnus spp*.), and mountain holly are typically prevalent, with willow (*Salix sp*.), paper birch, and common winterberry (*Ilex verticillata*) also being prominent components. As is characteristic of most swamp habitat throughout the province, cinnamon fern is the most characteristically dominant herb. However, a number of other graminoids and forbs may be dominant, including bluejoint reed grass, common tall manna grass, hairy flat-top white aster (*Doellingeria umbellata*), whorled wood aster (*Oclemena acuminate*), interrupted fern (*Osmunda claytoniana*), dwarf red raspberry (*Rubus pubescens*), and violet (*Viola sp.*).

Marsh

Marsh communities are present at the littoral zone of open water bodies (*i.e.*, DEVCO Wetland and Baileys Wetland) and in association with several smaller anthropogenically-influenced wetlands. The species composition of the marshes varies with respect to their hydrological character, but they are typically dominated by graminoids, with broad-leaved cattail (*Typha latifolia*) being the most typical dominant. In particular, cattails form large swaths of habitat within DEVCO Wetland pond and are also found in association with smaller wetlands which have been subject to disturbances and altered hydrology. For example, fringing areas of cattail marsh were found in association with basins along a cleared corridor running between the existing developments and the southern side of the peninsula (Wetland 56), and a drainageway track located between the mine yard and existing rock waste piles was comprised of a swath of cattail marsh (Wetland 42). These habitats are often comprised exclusively of cattails, though a mixture of other graminoids are also sometimes present, including soft rush, bluejoint reed grass, tawny cottongrass, short-tailed rush (*Juncus brevicaudatus*), star sedge (*Carex echinata*), and nodding sedge (*Carex gynandra*). Some scattered herbs, such as marsh cinquefoil (*Comarum palustre*), curled dock (*Rumex crispus*), New York aster (*Symphyotrichum novi-belgii*), hairy flat-top white aster (*Doellingeria umbellata*), marsh willowherb (*Epilobium palustre*), or three-petaled bedstraw (*Galium trifidum*), were also present. Other graminoid marsh components differed strongly in their composition – for example, broad-leaved cattail was a relatively minor component of some marshes, being restricted to small areas, or mixed in with a number of other dominants, including bluejoint reed grass, soft rush, common tall manna grass, and small-fruited bulrush (*Scirpus microcarpus*). Furthermore, some small areas of wet-meadow habitat were observed in association with swamps in the southern end of the peninsula and were dominated almost exclusively by bluejoint reed grass. Marsh vegetation within Baileys Wetland was limited to a cattail-dominated swath at the location of the drainageway that provides a connection to DEVCO Wetland, and as a narrow fringe around the open water habitats. The composition of the fringing marsh community varied but marsh cinquefoil (*Comarum palustre*) provided an intermittent coverage and small stands of soft-stemmed bulrush (*Schoenoplectus tabernaemontani*) occurred in the shallows.

Shallow Water

Shallow water (*i.e.*, < 2 m in depth) wetland habitats were associated with marshes of DEVCO Wetland, Baileys Wetland, and several small disturbed basins on the peninsula. These open water habitats are largely non-vegetated, with less than five percent of the area being comprised of submerged and floating aquatic plants. Bladderworts (*Utricularia spp*.) were found to be the most characteristic species within small pockets of shallow water associated with disturbed wetlands, such as along the cleared corridor extending from the mine yard to the southern boundary of the peninsula. Open water habitats of Baileys Wetland were observed to be high in tannins and did not support a submersed or floating aquatic plant community, although ribbon-leaved pondweed (*Potamogeton epihydrus*) was observed in a shallow smallpool near the lake's edge. However, the shallow water habitats associated with the

DEVCO Wetland do support a number of aquatic species, particularly pondweeds (*Potamogeton spp*.) and lesser amounts of bladderwort. Additionally, shallow water habitats were encountered in association with puddles along roadways and trails and provided habitat for aquatics, particularly ribbon-leaved pondweed and marsh water-starwort (*Callitriche palustris*).

Fen

Fen is present on the peninsula in association with Baileys Wetland, a large wetland in the northeastern quadrant of the peninsula, and several other small occurrences. Although detailed habitat descriptions were not performed in all occurrences of fen on the peninsula, the structure and species composition of this wetland type was observed to vary considerably. However, graminoid cover was typically high and tree cover was diffuse and stunted (if present). A small occurrence of fen surrounded by coniferous treed swamp within Wetland 57 was observed to be dominated by low shrubs (*i.e.*, < 0.5 m in height), forbs, and graminoids, with peatmoss forming a continuous cover throughout. The community supported a relatively high diversity of herbaceous plants, with soft rush (*Juncus effusus*), smooth black sedge (*Carex nigra*), tawny cottongrass, bog aster (*Oclemena nemoralis*), brown-fruited rush (*Juncus pelocarpus*), boreal bog sedge (*Carex magellanica*), and cinnamon fern being prominent. Shrub cover was provided by low-lying sheep laurel and northern bayberry, as well as the dwarf shrubs large cranberry (*Vaccinium macrocarpon*) and small cranberry (*V. oxycoccos*). Small areas of fen along the coastline, such as found at the drainage outlets of Wetland 2 have a much higher prominence of graminoids, particularly blue-joint reedgrass and sedges. The vegetative composition of the fens that were observed during field surveys suggests that they are relatively nutrient-poor.

Bog

The lone area of bog known on the Donkin Peninsula is located at the eastern end of the DEVCO Wetland and is dominated by ericaceous shrubs, peatmoss, and reindeer lichens (*Cladina spp*.).Sheep laurel and rhodora (*Rhododendron canadense*) are particularly prominent in this habitat, forming an almost continuous low shrub (*i.e.*, < 0.5 m) cover.

5.4.2.3 Wetland Functions and Values

Information on the functional characteristics of wetlands on the Donkin Peninsula was obtained through a combination of field surveys and desktop assessment. Field assessments were conducted during August 2011 within 19 wetlands on the Donkin Peninsula which were considered to have potential to be affected by the mine infrastructure (hereafter referred to as the “Assessed Wetlands”). These functional assessments involved directed surveys of wildlife usage and the collection of hydrological and biogeochemical information. This data was used to inform an evaluation of the potential functions performed by wetlands on the Donkin Peninsula, along with additional information obtained during field surveys conducted on behalf of other Project components by Stantec in 2010-2011 and by CBCL Limited in 2006-2008, as well as recent air-photo interpretation. Data collected during field surveys and through desktop analysis were used to help evaluate the importance of wetlands on the Donkin Peninsula for providing a suite of key hydrogeological, biogeochemical and wildlife-related functions, as well as their social value. Protocols for wetlands and transmission corridors have been established and functional assessments are not required for this component of the Project.

5.4.2.3.1 Hydrologic and Biogeochemical Functions

Data on physical and structural wetland features which can be indicators of potential hydrological and biogeochemical functions and services performed by wetlands was collected during field surveys. The approach taken was based largely on the methods of others (*e.g.*, Tiner 2003; Tiner 2009), with supplemental supporting information from literature review (*e.g.*, Devito *et al.* 1996). The approach distils the indicative features of wetland function down to representative categorical and nominal data that can be interpreted with supplemental desktop data. The analysis provides an overview of the likely potential functions a wetland is performing; however the evaluation of the importance of these functions is left to the judgment of the qualified assessor. These data were used to inform an evaluation of the potential functions performed by wetlands on the Donkin Peninsula, along with other data on wetland type, landscape position or character of sustaining water sources. Hydrological functions evaluated include baseflow maintenance, shoreline erosion control, stormwater management, water storage, groundwater recharge whereas biogeochemical functions include water quality improvement, carbon sequestration, and food chain support. Table 5.4.5 provides a summary of the field assessed wetlands that were attributed with the potential to provide the hydrological and hydrogeomorphological functions, by wetland class. Full evaluation procedures, completed data collection forms and tabulated raw data are provided in Appendix K.

Table 5.4.5 Number and Area (ha) of the Assessed Wetlands which Provide Hydrological and Biogeochemical Functions

Wetland Class	Baseflow Maintenance		Erosion Control		Stormwater Management		Groundwater Recharge		Water Storage		Carbon Sequestration Potential		Water Quality Improvement		Food Chain Support		Total Assessed	
	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area
Marsh	3	0.65	0	0	2	0.58	0	0	2	0.58	0	0	3	0.65	2	0.39	3	0.65
Swamp	8	6.5	0	0	8	3.31	8	6.33	4	1.48	9	6.98	12	7.02	4	0.48	14	7.12
Swamp/ Marsh	2	1.53	0	0	1	1.07	0	0	0	0	2	1.53	2	1.53	1	1.07	2	1.53
Total	13	8.67	0	0	11	4.96	8	6.33	6	2.06	11	8.51	17	9.19	7	1.93	19	9.29

Baseflow Maintenance

Baseflow maintenance is the provision by wetland of a water supply to down gradient areas. Wetlands that provide baseflow maintenance are valued for maintaining flow to downgradient water bodies in dry conditions, thus supporting wildlife habitat and water resources for human use. The potential for a wetland to perform this function was assigned to wetlands that were the source of a stream, were observed to have greater channel outflow than inflow, were very large and had an abundance of saturated organic soil, or wetlands that were observed to be spring-fed.

Baseflow maintenance was attributed to 13 of the 19 Assessed Wetlands, with 8.67 ha of contributing wetland area (Table 5.4.5). Approximately 93 percent of the area of Assessed Wetland (8.67 ha of 9.3 ha) is estimated to provide baseflow maintenance, therefore, it is anticipated that a high portion of the non-assessed wetlands also perform this function. However, baseflow maintenance functioning is limited by their elevation and wetlands that are close to sea level, such as Baileys Wetland, cannot provide down gradient flows.

Shoreline Erosion Control

Wetlands can provide shoreline erosion control, typically through the buffering of erosive forces, such as waves, or water flows, by wetland vegetation. Vegetated riparian wetlands in the LAA have the potential to slow the flow of surface water, stabilize soil and disperse energy in a way that reduces the erosive forces of surface water. All vegetated riparian wetland forms have the potential to provide this function, however none of the Assessed Wetlands were attributed with the potential to perform this function. Other wetlands on the peninsula likely perform this function, particularly those associated with watercourses or near shorelines, such as Baileys Wetland.

Stormwater Management

Wetlands can perform stormwater management by slowing the rate and amount of water flow caused by heavy precipitation events. Wetlands that collect and store surface water during storms and high-water events alleviate flooding and may prevent environmental and property damage associated with high-energy flows. With some exceptions, the potential for a wetland to perform this function was generally assigned to wetlands with indicators of a fluctuating water table (indicators of high and regular water marks), surface water-fed wetlands with basin or floodplain forms, and wetlands fed fully or partially by artificial surface water conveyance features (*e.g.*, drainage ditches).

The potential to perform this function was attributed to 11 of the 19 Assessed Wetlands, contributing a total of 4.96 ha of stormwater management services (Table 5.4.5).Swamps, which typically form in a fluctuating hydrological regime, were found to be the dominant wetland class providing this function (8 of the 11 wetlands). Marshes were also attributed the potential to provide this function.

Approximately 53 percent of the area of Assessed Wetland (4.96 ha of 9.3 ha) is estimated to provide stormwater management, therefore, it is anticipated that approximately half of the non-assessed wetlands, which equates to 61 ha of wetland habitat, could also perform stormwater management. The majority of the wetlands were classified as being swamp, or marsh, or having a component of either class.

Water Storage

The function of water storage (as opposed to stormwater management) is related to the general value of water retained on the surface for wildlife, raising local groundwater tables, local climate moderation, aesthetics, supporting chemical processes and aquatic habitat, agricultural and firefighting uses. Wetlands with a substantial amount of open water retained at the surface during the growing season were identified by direct observation.

Water storage was determined to be provided by six of the Assessed Wetlands, which total 2.06 ha (Table 5.4.5). The wetlands are classified as swamps or marshes, though each has components of shallow water habitat. The wetlands are relatively small, with the exception of Wetland 56, which is a large swamp, with some areas of deeper, open water.

In the non-assessed wetlands, Baileys and DEVCO Wetlands have large areas of open water and have a capacity to store water. The two wetlands are cumulatively estimated to be 61.1 ha in size, which is approximately half the total estimated wetland area on the Donkin Peninsula.

Groundwater Recharge

Depending on landscape position, substrate distribution and morphology, wetlands may have the potential to capture surface flow and precipitation and discharge all or a portion to the groundwater table. This function cannot be determined directly without long term monitoring programs. In the LAA, those wetlands located in elevated portions of a watershed, or wetlands that have greater inflow than outflow, have a high likelihood of performing this function. Wetlands that are hydrologically maintained by springs or watercourses are typically at a position of groundwater discharge in the watershed, rather than recharge, and are therefore not likely to perform this function.

Some of the wetlands in the LAA were identified as spring-fed indicating a general area of groundwater discharge. In the LAA, the shallow surficial materials and confining bedrock can result in a shallow or perched water table in bedrock basins, which has encouraged wetland development. This also suggests a high interaction between groundwater and wetlands in the LAA that may be characterized as both a recharge and discharge relationship depending on the season and precipitation patterns.

The potential for contributing to groundwater recharge was attributed to eight of the 19 Assessed Wetlands, comprising 6.33 ha of wetland area (Table 5.4.5). In one wetland in particular (Wetland 27), surface inflow was observed to be twice that of the surface outflow. Although the wetland also sourced hydrology from seepage, it appears the wetland provides groundwater recharge, given the relatively low amount of surface outflow, compared to the surface inflow. Conversely, in many wetlands the groundwater-wetland relationship may be more of a "flow through" nature, with the active portion of the wetland neither contributing nor drawing from the water table. Swamps were the only class of wetland found to potentially perform groundwater recharge (Table 5.4.5).

It is difficult to determine whether a wetland provides this function or not, therefore it is unknown how many of the non-assessed wetlands would also perform this function.

Water Quality Improvement

Wetlands may support the improvement of water quality through physical processes and chemical and metabolic transformations. Several different wetland hydrogeomorphologies may be attributed this function. Efficient nutrient transformation can occur in wetlands with fluctuating water tables (*i.e.*, alternating aerobic and anaerobic conditions, high primary productivity, and high soil-water interactions). Sediment removal is also efficient in wetlands with fluctuating water tables, indicating that there is retention and slowing of storm flow, particularly those with flow-impeding emergent vegetation or microtopography (hummocks or cross-flow ridges).

Groundwater or spring-sourced wetlands provide high soil-water interaction, which may be particularly valuable in agricultural watersheds (Hill 1991). There is no agricultural land in the LAA on the Donkin Peninsula, so this criterion was not applied.

The location of the wetland within the local environment plays an important role in the extent that a wetland can improve water quality. Riparian wetlands are important sinks for pollutants carried in upland runoff and from upstream areas such as fertilized grass (Gilliam *et al.*1996; Carpenter *et al.* 1998). They are noted for processing large fluxes of energy and materials from upstream sources, and they typically show high primary productivity (Mitsch and Gosselink 2000). Because precipitation-fed systems (such as bogs) are largely isolated from other surface water resources, they typically contribute little to watershed surface water quality (Mitsch and Gosselink 2000).

The potential for performing the function of nutrient transformation and sediment accretion was attributed to 17 of the 19 Assessed Wetlands, comprising 9.19 ha of wetland area (Table 5.4.5).The wetland classes associated with this function among the Assessed Wetlands are swamps and marshes. Given that approximately 99 percent of the area of Assessed Wetlands (9.19 ha of 9.3 ha) provide water quality improvement, it is anticipated that the majority of the non-assessed wetlands would also perform this function within the Donkin Peninsula - particularly wetlands classified as a swamp or marsh, or which have a fluctuating water table.

Carbon Sequestration and Storage

Wetlands may contribute to the mitigation of global climate change if the fixation of atmospheric carbon (carbon dioxide), through photosynthesis, exceeds the release of carbon to the atmosphere through the decomposition of organic material (carbon dioxide, methane), on a long term basis (greater than one year). Individual wetlands vary widely in their annual net carbon balances and year to year variability may result from climate and weather patterns. Wetlands with peat formation and woody vegetation are typically attributed this function, as peat and wood represent long-term storage of sequestered carbon. Wetlands with fluctuating water tables (alternating aerobic and anaerobic conditions) or greater flows and gradients, generally do not promote accumulation of organic matter (Whiting and Chanton 2001).

Many of the Assessed Wetlands were observed to be peat forming swamps (9 of 19 Assessed Wetlands), though two of these swamps have a shallow peat substrate (<0.25 m). Two swamp/ marsh wetland complexes were observed to form peat, though only the swamp portion of the complex contained peat. Nine of the Assessed Wetlands contained substantial peat stores (>0.25 m depth). Four had 0.50 m or more of peat, suggesting a long term carbon storage capacity, comprising approximately 5.86 ha of contributing wetland area. Within the non-assessed wetlands, it is expected that wetlands areas classified as a bog, fen, or swamp will likely contribute to carbon sequestration and storage.

Marshes may also be important for sequestering carbon, although their ability to do so depends on the hydrological regime (Tiner 2003). In particular, wetlands that are saturated throughout the year tend to accumulate peat and act as carbon sinks. In contrast, wetlands with large seasonal water level fluctuations are typically poor at sequestering carbon, since exposure of the substrate to air during drawdown periods promotes rapid decomposition of organic matter deposited in the sediment. The rate of plant decomposition in marshes is often equal to or greater than the rate of plant biological productivity, resulting in minimal to no peat accumulation. Additionally, although carbon is stored in marshes in the form of living plant biomass, the amount of carbon stored over several seasons is likely to remain the same.

Food Chain Support

Through unique metabolic processes and their hydrological connection with the watershed, wetlands can be an important source of nutrients and food to downgradient aquatic habitats. Although the performance of this function is site specific, potential to perform this function can be attributed to all wetlands that are discharging to downgradient environments.

Seven of the Assessed Wetlands discharge to downgradient wetlands through channel flow, comprising 1.93 ha of contributing area. These wetlands discharge down to the watercourse that passes through Wetland 42, before entering the DEVCO Wetland. The wetland classes attributed with the potential for supporting downgradient food chains are comprised of swamps and marshes.

For non-assessed wetlands, the provision of food chain support will depend on the location of each wetland within the local topography. Many of the wetlands on the Donkin Peninsula will be unable to provide this function, as they do not discharge to downgradient wetlands or watercourses. This can partly be attributed to the limited topographic variation within the Donkin Peninsula, and the small watersheds within the LAA.

5.4.2.3.2 Wildlife Functions

The wildlife functional field assessment encompassed surveys of species (including inventories of vascular plants, birds, mammals, reptiles and amphibians) which were observed to inhabit or utilize the wetlands, habitat descriptions and assessments, and evidence of anthropogenic stress to these biodiversity values. Much of the data collected during this evaluation was based on a series of wildlife-related questions outlined in a functional assessment methodology called NovaWET (Tiner 2009; NSE 2011). Further information regarding wildlife within the wetlands of the Donkin Peninsula was obtained from the results of rare plant and breeding bird surveys conducted on the peninsula, as well as air-photo interpretation of their structural character. Information on the use of wetlands by wildlife on the Donkin Peninsula are summarized here according to three key functions: waterfowl and waterbird habitat, fish habitat, and other wildlife usage (including habitat for species of conservation interest).

Waterfowl and Waterbird Habitat

The ability of wetlands to provide habitat for waterfowl and other waterbirds varies according to their position relative to waterbodies and watercourses, the presence and character of open water, and the availability of appropriate vegetation for foraging and nesting opportunities. However, because of relationships to certain habitat features, some wetland types (*e.g.*, salt marshes, lentic marshes, lotic river marshes) are generally associated with providing important waterfowl and other waterbird habitat, whereas others have little or no capacity to provide this function (Tiner 2003; NSE 2011). Marshes found alongside lakes or rivers are generally considered to have high potential to provide waterfowl and waterbird habitat (Tiner 2003, NSE 2011) but the degree to which they may perform this function is dependent on a number of factors. For example, wetlands with vegetation that is interspersed with open water are more likely to support a higher diversity and/or abundance of waterfowl than those with very dense vegetation and no channels or open water areas (NSE 2011).

Of the wetlands on the Donkin Peninsula, Baileys Wetland and that associated with DEVCO Wetland are known to provide high quality habitat for waterfowl and other waterbirds. In particular, the open water and marsh components of these wetlands support a diversity of waterfowl and other waterbirds throughout the year, with adjacent treed habitats also providing important nesting opportunities. Although marshes and shallow water wetland habitats found elsewhere on the peninsula also have some potential to provide habitat for waterfowl and waterbirds, much of their ability to do so is limited by their small size and/or hydrological character (*e.g.*, small areas of marsh that are not regularly inundated and are not adjacent to open water are unlikely to provide this function to any important degree).

Fish Habitat

The value of wetlands for providing fish habitat is generally related to their connectivity with deepwater habitats. As such, wetlands are considered to have high value for fish if they provide spawning/nursery habitat or refuge for native fish species in adjacent estuaries, lakes, rivers or streams (NSE 2011). Additionally, wetlands may intermittently support populations of certain fish species as a result of colonization during flood events and some isolated, but permanently flooded wetlands can support native populations of species such as minnows. Wetlands that are isolated and are not permanently flooded do not generally support fish populations. However, those that do not directly support fish may still be important for maintaining their habitat by improving the quality of downstream water - for example, by providing shade to maintain water temperature in adjacent water bodies or watercourses.

The value of wetlands for providing fish habitat was evaluated by assessing the degree to which they were contiguous with a permanent water body or watercourse which was known or suspected of supporting native fish species. Specifically, wetlands were evaluated based on their position to water bodies and watercourses and results of the fish-outs (see Section 5.6 Freshwater Fish and Fish Habitat). Baileys Wetland and DEVCO Wetland are known to contain fish, including banded killifish (*Fundulus diaphanous*), ninespine stickleback (*Pungitius pungtius*), and brook trout (*Salvelinus fontinalis*). Although none were observed during fish-out efforts, watercourses that feed into Baileys Wetland and DEVCO Wetland do have potential to support fish and wetlands associated with these features have some value for maintaining fish habitat quality. Wetlands intersected by the watercourse in the northeast section of the peninsula do not have potential to support fish habitat because the steep cliffs of the shoreline provide a barrier to fish passage.

Other Wildlife Functions

In addition to those wildlife functions previously discussed (*i.e.*, fish, waterfowl, and waterbird habitat), wetlands provide important habitat for a variety of species; including those whose populations are considered either at risk or of conservation concern. Summarized here are the general results of the wildlife surveys conducted within the wetlands. Table 6 in Appendix K provides information on the identities of wildlife species observed in association with wetlands of the Donkin Peninsula during functional assessment surveys in August of 2011.

A total of 192 vascular plant taxa were recorded within wetlands during 2011 functional assessments. In addition, many of the other plant species identified on the peninsula during field investigations are associated with wetlands. Although no plant Species at Risk are likely to occupy wetlands of the Donkin Peninsula, there is potential for them to support species of conservation interest, particularly southern twayblade (*Listera australis*). This small orchid is typically associated with the shaded sphagnum moss of bogs or treed swamps (Zinck 1998) and could potentially be present within wetlands of the Donkin Peninsula (Section 5.5 Rare Plants). Because this species is only visible above ground for several weeks during early summer before it senesces, field surveys would have to be conducted in mid-June to determine its presence and distribution on the peninsula. This species is currently ranked as “May be at Risk” by NSDNR (2011) and “S2” by the ACCDC (2011), and has recently been encountered in nearby Port Morien, located near the Donkin Peninsula. The current status assigned to this species by NSDNR indicates that it should be considered of high conservation concern.

Although only nine species of bird were observed in association with wetlands of the peninsula during August 2011 surveys, the surveys were not performed during the breeding season. However, data from a breeding bird survey conducted on the peninsula indicate that wetland habitats support a variety of passerines, with species such as Yellow-rumped Warbler (*Dendroica coronata*) and Nashville Warbler (*Vermivora ruficapilla*) being relatively common in treed swamps, and Common Yellowthroat (*Geothlypistrichas*), Common Grackle (*Quiscalus quiscula*), and Red-winged Blackbird (*Agelaiusphoeniceus*) being found in association with more open shrub or graminoid-dominated systems. Wetlands of the peninsula are known to support a variety of species which are considered “Sensitive” in the province by NSDNR (2011) – for example, Boreal Chickadee (*Poecile hudsonica*) and Golden-crowned Kinglet (*Regulus satrapa*) were observed within swamps during the functional assessment and breeding bird surveys, respectively. None of the wetlands on the Donkin Peninsula are currently known to support provincially or federally designated Species at Risk. However, areas towards the western end of the peninsula have not been extensively surveyed. Furthermore, treed swamp habitats associated with Baileys Wetland are considered to provide potential habitat for Canada Warblers (*Wilsonia canadensis*) or Olive-sided Flycatchers (*Contopus cooperi*), both of which have been designated as “Threatened” at the federal level (Section 5.3 Birds and Wildlife). Furthermore, both these species were encountered along the transportation corridor during 2010 breeding bird surveys.

Evidence of four species of mammals were encountered within wetlands during field assessments: eastern coyote (*Canis latrans*), red squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), and white-tailed deer (*Odocoileus virginianus*). None of these species are considered of conservation concern within the province and the wetlands do not have potential to provide habitat to any provincially or federally designated Species at Risk.

Three herpetile species were encountered within wetlands of the Donkin Peninsula during field surveys: green frog (*Rana clamitans*), pickerel frog (*Rana palustris*), and wood frog (*Rana sylvatica*). None of these species are considered of conservation concern within the province and the wetlands do not have potential to provide habitat to any provincially or federally designated Species at Risk.

5.4.2.3.3 Socio-economic Values

Wetlands can provide a variety of social benefits, including those relating to educational, scientific, recreational, and economic opportunities. Of the wetlands on the Donkin Peninsula, Baileys Wetland and that associated with the DEVCO Wetland are known to be relatively important for recreational purposes. In particular, these wetlands have high-value waterfowl habitat and are frequently visited by local residents for the purpose of bird watching. Additionally, both are known to support fish and therefore provide recreational fishing opportunities although consultation with the local wildlife association revealed poor road access has hindered recreational fishing in this area. Although no other wetlands on the peninsula are known to be the focus of human activities, those that are intersected by the hiking trail which runs along the perimeter of the headland or are otherwise visible from this vantage point, may also be considered to have recreational value because of the popularity of the peninsula for hiking purposes.

5.4.3 Potential Project-VEC Interactions

Table 5.4.6 below lists each Project activity and physical work for the Project, and ranks each interaction as 0, 1, or 2 based on the level of interaction each activity or physical work will have with wetlands.

Table 5.4.6 Potential Project Environmental Effects to Wetlands

Project Activities and Physical Works	Potential Environmental Effects
	Change in Wetland Area or Function
Construction	
Site Preparation (incl. clearing, grading and excavation)	2
Construction of Mine Site Infrastructure and Underground Preparation	2
Construction of 138 kV Transmission Line	2
Construction of Barge Load-out Facility (incl. dredging, infilling and habitat compensation)	0
Installation of Transshipment Mooring	0
Operation and Maintenance	
Underground Mining	0
Coal Handling and Preparation (incl. coal washing and conveyance)	0
Water Treatment (incl. mine water and surface runoff)	2
Coal and Waste Rock Disposal	2
Marine Loading and Transportation	0
Coal Trucking	1

Table 5.4.6 Potential Project Environmental Effects to Wetlands

Project Activities and Physical Works	Potential Environmental Effects
	Change in Wetland Area or Function
Maintenance of Transmission Corridor	2
Decommissioning and Reclamation	
Site Decommissioning	1
Site Reclamation	2

0 = No interaction
1 = Interaction occurs; however, based on past experience and professional judgment, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

Activities related to the construction of the barge load-out facility and the installation of transshipment mooring are not likely to interact with wetlands. The construction and installation of these Project components involves the dredging and infilling of the marine environment, and will not disturb wetlands associated within the Mine or Transmission Line LAA.

Project activities that are not expected to interact with wetlands during the operation and maintenance phase of the Project include underground mining, coal handling and preparation (including coal washing and conveyance), and marine loading and transportation. These activities do not have potential to interact with wetlands because they are to be contained within areas or structures that are removed from the terrestrial habitats of the Donkin Peninsula. In particular, mining will take place underground, mined coal will be washed in the CHPP, product coal will be transported via an overland and enclosed conveyor, and the transshipment mooring site is located several miles from the coastline.

A potential interaction occurs during trucking of coal during the operation and maintenance phase of the Project. In particular, dust levels from trucking activities have potential to influence the chemical composition of wetland habitats. For example, wetland plants that are associated with relatively acidic environments may not be tolerant of increased pH levels that could result from the input of basic elements. However, this potential interaction has been assigned a ranking of 1 indicating that effect can be managed to acceptable levels using proven dust suppression techniques.

The decommissioning of the mine has also been ranked as a 1 potential interaction with wetlands. The potential effects of this Project phase (*e.g.*, sediment runoff, introduction of invasive plant species) are to be minimized through adherence to the Project's MCRP which will be developed and managed in strict compliance with all applicable municipal, provincial and federal regulatory requirements.

Thus, in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects of all Project activities and physical works that were ranked as 0 or 1 in Table 5.4.6, on wetlands during any phase of the Project are rated not significant, and are not considered further in the assessment.

5.4.4 Assessment of Project-Related Environmental Effects

5.4.4.1 Assessment of Change in Wetland Area or Function

5.4.4.1.1 Potential Environmental Effects

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions ranked as 2 on wetlands is provided in Table 5.4.8. Only the interactions ranked as 2 were considered further in the assessment of Project-related environmental effects. All other interactions previously ranked as 0 or 1 were rated as not significant.

Construction

There are several construction activities related to the Project that have potential to affect wetlands. The most substantive and likely interaction is a change in wetland area and function as a result of site preparation (*e.g.*, clearing, grading and excavation), construction of mine site infrastructure and underground preparation, and construction of the 138 kV transmission line. Clearing and grubbing during site preparation will directly remove, infill, or disturb wetland vegetation and soils. In addition, a number of indirect effects can result from these site preparation activities, particularly hydrological changes to wetlands located either down or up-gradient of construction activities. For example, site preparation activities have the potential to introduce sediment or silt into wetlands and this could have an adverse effect on their vegetative character and functioning. The erosion of uplands as a result of vegetation removal and deposition of sediments in wetland habitat has potential to alter wetland habitat beyond the confines of the PDA. Similarly, the construction of the mine site infrastructure and the 138 kV transmission line may also involve disturbance to wetlands and have potential to indirectly influence adjacent wetland habitats. In particular, Canada Warbler and Olive-sided Flycatcher were encountered within wetland habitats along the transmission corridor and the ability of wetlands to support these species may be compromised by vegetation clearing activities.

Operation and Maintenance

Activities associated with the operation and maintenance phase of the Project which have potential to interact with wetlands are coal and waste rock disposal, and maintenance of the access road and transmission corridor. The coal waste disposal pile located on the eastern portion of the peninsula (Phase I and Phase II) is scheduled to cover an area of approximately 37.9 ha. The second pile is planned to start approximately 13 years after the start of mining (*i.e.*, Phase III) and proposed to be approximately 42.6 ha in size and to be located to the southwest of Schooner Pond. Wetlands and adjacent habitats within the footprint of the coal waste piles will be infilled. Additionally, mine water and surface runoff have potential to negatively affect wetlands by changing their hydrological character and chemical composition.Untreated wastewater generated as a result of mine discharge and site runoff will exhibit similar characteristics of high sediment load, relatively low pH and a presence of heavy metals.Surface runoff from coal waste piles may initiate changes to wetland vegetation and function if they result in higher than baseline additions, promote increases in the fluctuation of water levels, or if waters contain materials that promote changes to their nutrient status or pH. Additionally, the presence of coal waste piles may negatively affect wetlands if they block drainage to downstream resources or if their runoff is not contained. Acid Rock Drainage (ARD) is an especially important consideration for both water treatment and coal and waste rock disposal because it is known to have potential to cause important changes in down-gradient systems.

Wetland vegetation within the transmission corridor will be managed and infrastructure will be periodically maintained. Vegetation control during operations represents a disturbance to wetland habitats, and may affect their functional characteristics – for example, by adversely influencing their ability to provide habitat for rare species which are associated with more intact habitats. Vegetation management will consist primarily of mechanical control of vegetation, although the use of herbicides may be considered where undesirable species persist. The use of herbicides in source water areas for wetlands has the potential to affect the survival and composition of the botanical community and wetland fauna. Furthermore, the release of sediment into wetlands during maintenance activities could affect their character and functional attributes.

The use of road salts for de-icing during the winter is a concern for wetlands as salt can enter into the environment (surface water, groundwater and soil) during their storage and application. Environment Canada (2001) cites a number of studies attributing vegetation damage and changes in plant community composition to road salt application. In particular, road salt applications can damage plants located immediately adjacent to roadways and increase the salinity of soils. The effects of road salt are generally observed within 10 m of the edge of the road, although salt related effects on vegetation have been detected at distances of up to 80 m from the road. Damage to vegetation includes osmotic (*i.e.*, concentration induced dehydration) injuries as well as direct chloride ion toxicity. Salt deposited on soils can adversely affect plant growth by changing the structure of soil (development of salt crusts) or reducing soil fertility (replacement of calcium and potassium ions by sodium ions). Between five and ten percent of trees within 30 m of highways have been reported to have salt damage in some areas (Transportation Research Board 1991).

Decommissioning and Reclamation

The Site Reclamation phase of the Project also has potential to interact with wetlands. Whereas physical disturbances during site reclamation may interact with wetlands, this phase of the Project may also cause indirect effects to wetlands. If applied in hydrological source areas for wetlands, hydroseeding applications have the potential to increase nutrient levels in wetlands, which could affect their biological process (*e.g.*, nutrient uptake by plants, decomposition rates, *etc.*). Although hydroseeding efforts will use an approved seed mix, these are typically comprised of non-native species and therefore have potential to influence the composition of wetland communities. Construction activities also increase the susceptibility of wetland habitats to non-native and invasive plants through increased disturbances, proximity to anthropogenic infrastructure, and by promoting their dispersal.

5.4.4.1.2 Mitigation of Project Environmental Effects

Construction

A mitigative sequence has been adopted as the approach to prevent a net loss of wetland habitat as a result of the Project. The mitigative sequence is a step-wise approach that provides a foundation for the decision making process. It achieves wetland conservation through the application of a hierarchical process of alternatives as follows: 1) avoidance of impacts; 2) minimization of unavoidable impacts; and 3) compensation for residual impacts that cannot be minimized. Within the context of the mitigative sequence, approvals will be sought for unavoidable wetland alterations.

Due to the limitations of other technical and environmental constraints, avoidance of impacts on the Donkin Peninsula is very difficult. Furthermore, the abundance of wetlands on the peninsula constrains the ability of the Project to avoid alteration of wetland habitat. However, disturbance to wetlands during construction of the 138 kV transmission line will be minimized by selecting power pole placements in uplands and limiting the extent of disturbances. A Blanket Water Approval issued by NSE to Nova Scotia Power Incorporated (NSPI)(Approval # 2002-030721-A01) allows NSPI to work within wetlands without obtaining a Wetland Alteration Approval, as long as they are altering less than 25 m^2 of a wetland. Additional best management practices to be adhered to by NSPI for the purpose of minimizing disturbances to wetlands are outlined in their internal document titled "Environmental Protection Procedures for Transmission and Distribution Facilities" (NSPI 2009). Adherence to this document is referenced in a condition of the aforementioned approval. In addition to the mitigative measures outlined by this document, vegetation clearing activities along the transmission line will be conducted outside of the breeding bird season to avoid disturbance to avifauna. To assist in the avoidance and minimization of effects to wetlands along the transmission corridor, NSPI will be informed of the location of wetlands prior to construction activities.

Effects to wetland habitat as a result of erosion and sedimentation may occur during all Project phases but have potential to be most serious during site preparation activities, which include the clearing, grubbing, and infilling of upland and wetland habitat. A number of sediment control measures will be taken to prevent the release of material into wetlands during construction activities. Erosion control systems will be in place to manage runoff from the construction areas. The approach taken will be to prevent erosion rather than the capture of sediment prior to its release in watercourses and wetlands by minimizing the time, slope and area of exposed soil. Erosion control measures will be identified in the Environmental Protection Plan (EPP) and also include erosion control fencing, check dams, use of mulch (possibly from shrubs and trees removed during clearing) and sedimentation control ponds. Contingency Plans will be developed and emergency resources will be available on site to react to unforeseen events. Sediment and erosion control will be carried out according to all applicable standards, regulations, the EPP, and site specific terms and conditions of government approvals, authorizations and letters of advice.

Under the provincial wetland policy (NSE 2011), any loss of wetland habitat, either through direct or indirect Project effects, requires compensation to replace the wetland functions lost as a result of the wetland alterations. As such, losses of wetland area and function as a result of Project activities will be compensated through the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss. To offset unavoidable wetland alteration, a wetland compensation plan will be developed in consultation with NSDNR and NSE prior to wetland disturbance (refer to Section 5.4.7 and Appendix G). The objective of the compensation plan will be to ensure no net loss of wetland area or wetland function as a result of Project activities. However, due to agreements between NSE and NSPI, minor losses of wetland area or function as activities within the transmission corridor will not likely require compensation. In particular, infrastructure works by NSPI along transmission line (*e.g.*, pole replacement) that impact less than 25m^2 of wetland habitat are currently not considered alterations by NSE.

Wetland habitat on the Donkin Peninsula will not be disturbed without a Wetland Alteration Approval from NSE. In accordance with the Activities Designation Regulations which specifies the requisite information to support an application for Wetland Alteration Approvals, site specific plans for minimization of wetland alteration will be developed. It is understood that Wetland Alteration Approvals may be contingent on the fulfillment of compensation obligations to ensure “no net loss” of wetland habitat as a result of Project activities on the Donkin Peninsula.

Operation and Maintenance

The potential for indirect hydrological affects to wetlands as a result of the generation of coal waste piles will be minimized during final Project planning and design. In particular, the proposed location of the future coal waste pile that would overlap with the upper reaches of Baileys Wetland will be positioned to minimize disturbance to watercourses which feed it. Sections 5.2 (Water Resources) and 5.6 (Freshwater Fish and Fish Habitat) discuss measures to manage water flow around proposed coal waste piles.

The potential for interaction between wetlands and wastewater generated as a result of mine discharge and site runoff will be minimized through a combination of passive and active water treatment systems. Mine water and site runoff is currently treated through a passive water treatment system which consists of an existing serpentine pond for sediment settling. Once the fines settle out of the discharge, the wastewater flows over a weir and into the existing onsite settling pond. The existing serpentine pond will continue to serve as the treatment system for both mine water and runoff from disturbed areas and will include a backup chemical feed system in the event that water chemistry change from alkaline to acidic. In recognition of the potential change to acidic water conditions from runoff from coal waste piles as the Project proceeds to the production phase, additional water treatment systems will be required. Although detailed design has not yet been initiated, it is anticipated that new drainage channels will direct site drainage to a new holding pond likely to be located in the vicinity of the serpentine pond. A water treatment plant will neutralize the acidic water and treated water would then flow into the serpentine pond. In addition, ongoing water quantity, quality and toxicity testing is part of the water quality monitoring programs on the site to confirm that environmental effects are minimized and natural resources are protected from adverse effects. Untreated water is not likely to interact with wetlands.

Road salt applications can adversely affect wetland vegetation growing near the roadway edge. The overall salt loading will be minimized by following a salt management procedures, employee environmental awareness training prior to commencement of operation and maintenance activities (*e.g.*, salt and sand application during winter), and increased vigilance and inspection of permanent erosion and sediment control structures, particularly in areas identified as being sensitive (*e.g.*, those adjacent to wetlands). Techniques that reduce the amount of road salt include the pre-wetting of salt and the use of anti-icing systems such as brine solutions to minimize the amount of salt required. These techniques would benefit other VECs, including groundwater and surface water quality and freshwater aquatic life.

Potential interactions between maintenance activities within the transmission line corridor and wetlands will be minimized by NSPI by adherence to the best management practices outlined in their internal document titled "Environmental Protection Procedures for Transmission and Distribution Facilities" (NSPI 2009). In addition to the mitigative measures outlined by this document, vegetation clearing activities along the transmission line will be conducted outside of the breeding bird season to avoid disturbance to avifauna. To assist in the avoidance and minimization of effects to wetlands along the transmission corridor, NSPI will be informed of the location of wetlands prior to construction activities.

Decommissioning and Reclamation

The potential effects of site reclamation on wetlands and other VECs are to be minimized through adherence to the Project's MCRP which will be developed and managed in strict compliance with all applicable Municipal, Provincial and Federal Acts and Regulations. Site reclamation would be carried out progressively and would be designed to manage the drainage, stability and erosion effects on freshwater resources and wetlands. Potential adverse effects of surface drainage from the coal waste stockpiles on wetlands will be minimized through the ongoing treatment of water. Seed mixtures free of noxious weeds will be used to minimize affects to wetland habitats that could result as a result of competitive interactions amongst species.

5.4.4.1.3 Characterization of Residual Project Environmental Effects

The Project is estimated to result in the direct disturbance of 37 wetlands throughout its lifespan, accounting for approximately 42.2 ha, or 35 percent of the wetland area on the Donkin Peninsula (Table 5.4.7). The large majority of the wetland area within the PDA is associated with the Phase I/Phase II and Phase III coal waste disposal piles, which are approximately 37.9 ha and 42.6 ha in size, respectively. Wetland habitats with the PDA of the mine are primarily swamps, with lesser amounts of fen being present within a large wetland in the area of the Phase I/Phase II coal waste disposal piles and some encroachment on a fen within Baileys Wetland by the Phase III pile also being likely. Disturbances to marsh and shallow water wetland types are expected to be minor, being primarily restricted to wetlands located in the central and eastern portion of the peninsula where these wetland types were minor components that were primarily found in association with disturbed areas. Disturbance to wetlands on the Donkin Peninsula will be met with corresponding loss to the functions which they provide. However, loss of wetland function will be compensated through the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss.

Table 5.4.7 Wetland Number and Area Within PDA of Donkin Peninsula by Class

Wetland Class[1]	Number of Wetlands within PDA		Area of Wetlands within PDA	
	Number within PD	Proportion Affected (%)	Area (ha)	Proportion Affected (%)
Marsh	2	50.0	0.4	91.6
Marsh/Shallow Water	1	100.0	0.3	100.0
Marsh/Shallow Water/Swamp/Bog[2]	1	100.0	1.5	8.3
Swamp	28	41.2	14.0	37.1
Swamp/Fen	0	0.0	0.0	0.0
Swamp/Fen/Marsh	1	100.0	11.9	89.1
Swamp/Marsh	3	50.0	1.7	50.6
Swam /Shallow Water/Fen/Marsh[3]	1	100.0	12.4	28.6
Total	**37**	**43.5**	**42.2**	**34.5**

[1]Wetland classification data based on field surveys, air photo interpretation, and wetland inventory from the NSGC and NSDNR
[2]DEVCO Wetland
[3]Baileys Wetland

The effects of construction, operation and maintenance of the 138 kV transmission line on wetlands are difficult to quantify at this time. However, the effects of the transmission line construction on wetlands are likely minimal given that it will be constructed within existing RoWs (including approximately 11.4 km of an abandoned transmission line RoW and 13.8 km within an active transmission line RoW), and implementation of previously described mitigative measures.

In summary, all phases of the Project (construction, operation and maintenance, decommissioning and reclamation) are likely to have an adverse effect on wetlands. Reflecting the amount of habitat likely to be directly disturbed, the magnitude of the effects of the operation and maintenance phase of the Project is ranked as High, construction as Moderate, and decommissioning/reclamation as Low. As a result of mitigative measures being employed to avoid indirect effects, influences of the Project on wetlands are primarily expected to be restricted to within the PDA. However, because the capacity of a wetland to provide habitat for wildlife species or to provide recreational services (dependent on aesthetic values) will be altered beyond the immediate footprint of disturbance activities, effects have been ranked as extending into the LAA for all phases. Effects are considered “long term” because they will be measurable for the life of the Project (and beyond) and are generally irreversible. Of exception, some effects of maintenance activities on wetlands within the transmission corridor may be considered reversible because successional development will re-establish much of the vegetative composition and structure following cessation of disturbance activities. Similarly, effects of the Project on wetlands are expected to occur once with the exception of ongoing vegetation management activities, which are likely to continue on a near-annual basis.

5.4.4.2 Summary of Project Residual Environmental Effects

Table 5.4.8 summarizes the residual environmental effects of the Project on wetlands.

Table 5.4.8 Summary of Project Residual Environmental Effects: Wetlands

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics: Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context	Significance	Recommended Follow-up and Monitoring
Change in Wetland Area or Function										
Construction	• Compensation for loss of wetland habitat. • Avoid placing power poles within wetlands along transmission line, where possible. • Avoid operation of machinery in wetlands along transmission line, where possible. • Vegetation clearing to be performed outside the breeding bird season. • Implementation of erosion and sediment control procedures. • Adherence to "Environmental Protection Procedures for Transmission and Distribution Facilities" (NSPI 2009) during construction of the transmission line.	A	M	L	LT	O	I	D	N	• Develop wetland compensation plan in consultation with NSE and NSDNR. • Field surveys to obtain more information on the functional attributes of wetlands which are likely to be disturbed by the Project (*e.g.*, Baileys Wetland), including plant and wildlife surveys • Monitoring to confirm the extent and location of direct effects to wetlands (*i.e.*, infilling) on the Donkin Peninsula for both site infrastructure and waste rock disposal. • Vegetation monitoring within wetlands of the Donkin Peninsula which have potential for indirect hydrological effects. • Communication with NSPI regarding occurrence of wetlands along the transmission line route. • Monitoring of wetland compensation project

Table 5.4.8 Summary of Project Residual Environmental Effects: Wetlands

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics: Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context	Significance	Recommended Follow-up and Monitoring
Operation and Maintenance	• Maintenance of hydrological connectivity to Baileys Wetland through final selection of coal waste pile locations and/or construction of channels. • Treatment of wastewater from mine discharge and surface runoff. • Salt management procedures for site roadways. • Adherence to "Environmental Protection Procedures for Transmission and Distribution Facilities" (NSPI 2009) during maintenance of the transmission line.	A	H	L	LT	R	I/R	D	N	
Decommissioning and Reclamation	• Implementation of the Mine Closure and Reclamation Plan. • Use of seed mixtures free of noxious weeds and use of native species (where available) during site reclamation.	A	L	L	LT	O	I	D	N	

Table 5.4.8 Summary of Project Residual Environmental Effects: Wetlands

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		

KEY

Direction:

P Positive: condition is improving compared to baseline habitat or ecosystem quality

A Adverse: negative change compared to baseline habitat or ecosystem quality

N Neutral: no change compared to baseline habitat or ecosystem quality

Magnitude:

L Low: <5% of wetland area within the LAA disturbed or indirectly influenced

M Moderate: 5 - 20% of wetland area within the LAA disturbed or indirectly influenced

H High: >20% of wetland area within the LAA disturbed or indirectly influenced

N Negligible: no direct or indirect loss of wetland area or function

Geographic Extent:

S Site: effects restricted to habitat within the PDA

L Local: effects extend beyond PDA but remain within the LAA

R Regional: effects extend into the RAA

Duration:

ST Short term: measurable for less than one month

MT Medium term: measurable for more than one month but less than two years

LT Long term: measurable for the life of the Project

Frequency:

O Once: effect occurs once

R Rarely: effect occurs occasionally (*e.g.*, monthly)

F Frequently: effect occurs regularly (*e.g.*, daily)

Reversibility:

R Reversible: effects will cease during or after the Project is complete

I Irreversible: effects will persist after the life of the Project

Environmental Context:

U Undisturbed: effect takes place within an area that is relatively unaffected by human developments or disturbances

D Disturbed: effect takes place within an area that has been substantially influenced by human developments and disturbances

N/A Not Applicable

Significance:

S Significant

N Not Significant

5.4.5 Assessment of Cumulative Environmental Effects

In association with the Project environmental effects discussed above, an assessment of the potential cumulative environmental effects was conducted for other projects and activities that have potential to interact with the Project. Other projects and activities considered in the cumulative effects scoping are discussed in Section 4.2.4. Table 5.4.9 resents the potential cumulative environmental effects to the Wetland VEC, and ranks each interaction with other projects as 1, or 2 with respect to the nature and degree to which important Project-related environmental effects overlap with those of other projects and activities. Other projects and activities which are considered to have no cumulative interactions (*i.e.*, 0 ranking) are not included.

Table 5.4.9 Potential Cumulative Environmental Effects to Wetlands

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Change in Wetland Area or Function
Historic Coal Mining Activities	1
Donkin Coal Exploration Project	1

KEY

0 = Project environmental effects do not act cumulatively with those of other projects and activities.
1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of Project-specific or regional mitigation.

Activities related to historic and ongoing fishing activity, regional shoreline infilling/wharf development, marine shipping operations (including cruise ship traffic), port of Sydney development, Lingan and Point Aconi Power Stations, further ECBC remediation work, and remediation work scheduled for the rail centre at Victoria Junction are not likely to interact with the Project to effect wetlands. Several of these projects are targeted at marine environments and do not have potential to interact the freshwater wetlands identified within the LAA for this VEC (no marine wetlands were identified). Other activities involve remediation work for areas which have been previously disturbed by anthropogenic activities – although the initial developments would have had potential to influence wetlands, restoration activities are not anticipated to result in important adverse effects. Although historic development of the Lingan and Point Aconi Power Stations would have resulted in some disturbance to terrestrial habitats, the spatial extent of these projects and the Donkin Mine are such that an interaction is unlikely.

The Donkin Mine will interact with historic coal mining activities to affect wetlands, including those of the Donkin Coal Exploration Project. Previous activities on the Donkin Peninsula would likely have resulted in the loss of wetland area and corresponding changes to wetland function.

In particular, depth to water table data for the province (NSDNR 2010b) indicate that much of the area within the existing mine yard is likely to have been comprised of wetland prior to original site development. Additionally, the access road for the mine has likely resulted in some loss of wetland habitat on the peninsula and wetlands within the transmission corridor have been partly infilled as a result of the construction of a rail bed that runs through much of its extent, as well as transmission lines. In addition, the character of wetlands on the Donkin Peninsula and within the transmission corridor has been affected by historic coal mining activities. For example, the DEVCO settling pond was created by damming an extant wetland and an artificial outlet has been created to provide drainage to the ocean. Additionally, a remnant swath of cattail marsh which currently occupies the drainageway between the water treatment ponds and the setting pond is highly anthropogenic in character and is likely to have occupied a much larger extent of wetland prior to infilling activities. Furthermore, the hydrology of many wetlands within the transmission corridor has been altered as a result of construction of an old rail bed.

5.4.6 Determination of Significance

All phases of the Project are likely to have an adverse effect on wetlands. The amount of wetland area on the Donkin Peninsula likely to be lost as a result of the Project is highest for the operation and maintenance phase as a result of the areas required for the coal waste piles. However, the construction phase of the Project will also result in loss of wetland habitat on the peninsula. Indirect effects to wetlands will be avoided through a number of mitigative measures, including maintenance of hydrological conditions, treatment of wastewater from the mine discharge and surface runoff, and implementation of sediment control plans. Effects to wetlands are likely to be minimal given the nature of the development and the mitigative measures which have been outlined. Although effects to wetland functions will be largely restricted to within the PDA, the influence of Project activities on some wildlife functions and recreational values will extend beyond the immediate footprint of the Project. Effects will be measurable for the life of the Project and are generally irreversible. However, losses of wetland area and function as a result of Project activities on the Donkin Peninsula will be compensated through the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss.

In consideration of the proposed mitigation and environmental protection measures, including cumulative effects, the environmental effect of a change in wetland area or function is considered to be not significant. Specifically, the Project will not result in:

- a loss of a Wetland of Special Significance - no wetlands of Special Significance are known to exist on the Donkin Peninsula. Although wetlands along the transmission corridor are known to provide habitat for Species at Risk, activities associated with the Project are not expected to result in a loss of this function.

- permanent loss of wetland area and/or associated functions because adverse effects to wetlands on the Donkin Peninsula will be compensated through the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss. Because NSPI activities within transmission corridors are subject to established protocols, minor losses of wetland area or function associated with this phase of the Project are not expected to require compensation.

Historic coal mining activities on the Donkin Peninsula and elsewhere in the RAA have resulted in permanent losses of wetland area and function which have not been compensated for. However, cumulative effects from an interaction with the current Project of interest are considered not significant because the Project itself will not interact with existing or future activities to result in an un-compensated loss of area or function.

There is some uncertainty associated with the determination because functional assessments of wetlands to be affected by the Phase III coal waste disposal pile have not yet been completed.

5.4.7 Follow-up and Monitoring

A detailed wetland compensation plan will be developed in consultation with NSDNR and NSE prior to wetland disturbance. Compensation requires that residual effects on wetlands on the Donkin Peninsula be compensated by the enhancement, restoration, or creation of wetland habitat at an area ratio commensurate with the loss. As such, the objective of the compensation plan will be to ensure no net loss of wetland area or wetland function as a result of Project activities on the Donkin Peninsula. The wetland compensation program is proposed to be developed over time as wetland alteration takes place. For example, wetland alteration associated with coal waste disposal pile Phase III will not take place until approximately 13 years after project initiation. The Project will work with government and conservation stakeholders to identify wetland compensation opportunities focusing on Cape Breton; however, it is realized that province wide opportunities will likely be required. A draft conceptual wetland habitat compensation plan has been developed and is provided in Appendix G.

Wetland Alteration Approvals are required from NSE before wetlands can be altered once the Project has received EA approval. As such, site works that may affect wetlands will not proceed until the requisite approvals are acquired. Approvals will be sought for wetlands that cannot be avoided and for wetlands that may be indirectly affected by the development despite the employment of appropriate mitigation measures. The appropriate application forms (Water Approval) will be accompanied by the requisite information for each site, as outlined in the Operational Bulletin Respecting the Alteration of Wetlands (NSDEL 2006). Additionally, site specific plans for minimization of wetland alteration will be developed in accordance with this bulletin (or relevant policy guidance at the time of application). As part of the wetland functional assessments required for completion of the Wetland Alteration Application, follow-up surveys for rare plant species (scheduled to account for early flowering species) and uncommon communities will need to be conducted in wetland habitats.

Monitoring will be conducted to confirm the extent of wetland alteration (for both site infrastructure and waste rock disposal), the effectiveness of mitigative measures, and the successful completion of compensatory wetland restoration and creation. Efforts will be directed at existing wetlands on the Donkin Peninsula as well as those enhanced, restored, or created as a result of compensatory obligations. Monitoring will be used to assess the status of ecological and hydrological parameters and will be used to guide adaptive management initiatives. A period of five years is expected for the initial monitoring phase after which the data will be used to assess whether ongoing efforts are required to meet the objectives of the mitigative and compensation initiatives. Additionally, functional assessments will be performed within wetlands of the compensation site to determine if they have developed the attributes deemed necessary to compensate for those lost due to the Project. Site specific monitoring plans will be developed through consultations with NSDNR and NSE.

Data on the known distribution of wetlands within the transmission line corridor will be communicated to NSPI for their use during construction and maintenance activities.

5.5 RARE PLANTS

The Rare Plants VEC is identified for inclusion because of the potential for interactions between vegetation and Project activities, particularly species or communities that are of conservation interest. EIS Guidelines for the Project have specified that rare plants and uncommon species assemblages be considered in the EIS. Provincial and federal legislation provides protection to designated plant Species at Risk. Furthermore, wetlands may support rare plants or uncommon species assemblages and provincial policy and permitting processes are directed at preventing loss of important wetland functions. Further discussion of the effects of the Project on wetland vegetation is provided in Section 5.4.

5.5.1 Scope of Assessment

5.5.1.1 Regulatory Setting

There is both federal (SARA) and provincial (NS ESA) legislation for the protection of Species at Risk and Species of Conservation Concern, and there are different levels of protection afforded a species within these Acts according to the species rarity ranking. For example, only those species currently listed in Schedule 1 of SARA are protected by that Act. SARA listed species designated as “Special Concern” are not protected by the prohibitions of Sections 32-36 of SARA, but require that provincial or regional management plans are developed to protect the species. Also, NSDNR and ACCDC assign rankings to species to indicate which are of conservation interest. Although such rankings may not indicate a legislated protective status, they do require special consideration for the purpose of environmental assessments. The occurrence of plant species of conservation interest within wetlands is also of concern with respect to provincial wetland policy and the permitting process (Section 5.4 Wetlands).

Plants have been classified here as “Species at Risk”, “Species of Conservation Concern”, or “Secure Species” based on the different rankings provided by the various acts, agencies and listings, as follows:

- Species at Risk: those listed in Schedule 1 of SARA as “Extirpated”, Endangered” or “Threatened”, or protected under the NS ESA.
- Species of Conservation Concern: listed species not under the protection of SARA or the NS ESA (*i.e.*, listed as “Special Concern” in Schedule 1 of SARA; listed in Schedule 2 or 3 of SARA); assessed by COSEWIC as “Endangered”, “Threatened”, or “Special Concern”; ranked as “S1”, “S2”, or “S3” by ACCDC; and/or ranked “At Risk”, “May Be At Risk” or “Sensitive” by NSDNR.
- “Secure Species”: those whose populations are considered “Secure”, “Exotic”, or have not been assessed by NSDNR, and whose ACCDC rank does not qualify them as a Species of Conservation Concern.

Plant communities have not been similarly classified because there is a current lack of resources for identifying plant assemblages or assessing their conservation status in the province. As such, the identification of “uncommon plant communities” is based on general knowledge of the distribution of vegetation within the province and the occurrence of species assemblages. For the purposes of this assessment, an uncommon plant community is defined as “an area that supports an assemblage of native vascular plants which are not commonly encountered within the province and which occur as a result of unique natural processes and/or environmental conditions”. Examples of uncommon plant communities within the province may include those associated with karst topography, old growth forests, eastern white cedar (*Thuja occidentalis*) stands, rich riparian forests, and alkaline fens.

5.5.1.2 Influence of Consultation and Engagement on the Assessment

No concerns have been raised by community stakeholders with regards to the effects of the Project on rare plant species or uncommon communities. However, EIS guidelines require consideration of rare plants due to protection of species biodiversity and critical habitat and in recognition of SARA and the NS ESA.

5.5.1.3 Selection of Environmental Effects and Measurable Parameters

The environmental assessment of rare plants is focused on the following environmental effects:

- Change in rare species and uncommon communities

The measurable parameters used for assessing these environmental effects are presented in Table 5.5.1.

Table 5.5.1 Measurable Parameters for Rare Plants

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Rare Species and Uncommon Communities	• Number of occurrences of rare plants likely to be directly disturbed • Area of vegetation communities likely to be directly disturbed • Number of occurrences of rare plants that are likely to be indirectly influenced through changes in hydrology, contamination of surface runoff, or competition from non-native species introductions. • Area of vegetation communities likely to be indirectly influenced through changes in hydrology, contamination of surface runoff, or competition from non-native species introductions.	Data on the distribution and abundance of rare plant occurrences will inform the assessment of effects on rare plants by providing a spatial reference to assess potential direct and indirect effects. Similarly, spatial information on the distribution of vegetative communities will inform the assessment of Project activities on these features. Potential changes in the occurrence of rare plants and vegetation through direct interaction (*i.e.*, habitat loss or alteration through disturbance) with Project activities is quantifiable using information on the location and extent of Project components (*e.g.*, infrastructure, coal waste piles, *etc.*). Spatial information on the likely extent of indirect effects (hydrology, water contamination, species interactions) is more difficult to quantify and requires consideration of the efficacy of mitigative measures in concert with expert opinion.

5.5.1.4 Temporal and Spatial Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on rare plants and uncommon communities include the periods of construction, operation and maintenance, and decommissioning and reclamation.

The spatial boundaries for the environmental effects assessment of the Rare Plants VEC are defined below.

Project Development Area (PDA): The PDA includes the area of physical disturbance (*i.e.*, "footprint" for the Project including infrastructure for the mine site as well as stockpiles, coal waste piles, conveyor system, 138 kV transmission line, and trucking routes. The PDA also includes the barge load-out facility and transshipment mooring and vessel route between the two.

Local Assessment Area (LAA): The LAA for Rare Plants is defined as the terrestrial components of the Donkin Peninsula (east of the Long Beach Road) for the mine component of the Project. The LAA for the transmission component of the Project is identified as an approximate 100 m wide corridor centered along the length of the proposed line.

Regional Assessment Area (RAA): The RAA is limited to and includes the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts, as defined by Neily *et al*. (2003). The RAA is the area within which cumulative environmental effects for rare plants and uncommon communities may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects.

5.5.1.5 Residual Environmental Effects Description Criteria

Terms that will be used to characterize residual environmental effects for Rare Plants are presented in Table 5.5.2.

Table 5.5.2 Characterization Criteria for Residual Effects to Rare Plants

Criterion	Description
Direction	**Positive:** improvement compared to baseline status **Neutral:** no change compared to baseline status **Adverse:** negative change compared to baseline status
Magnitude	**Low:** alteration to vegetation within the LAA but no influence on the distribution and abundance of rare plant species or unique communities **Moderate:** alteration to rare plant populations or the distribution of uncommon plant communities, but no loss of rare plant species or unique communities from the LAA **High:** alterations that result in the loss of a rare plant species or uncommon community from the LAA
Geographical Extent	**Site-specific:** effects restricted to habitat within the PDA **Local:** effects extend beyond PDA but remain within the LAA **Regional:** effects extend into the RAA
Frequency	**Once:** effect occurs once **Rarely:** effect occurs occasionally (*e.g.*, monthly) **Frequently:** effect occurs regularly (*e.g.*, daily)
Duration	**Short-term:** measurable for less than one month **Medium-term:** measurable for more than one month but less than two years **Long-term:** measurable for the life of the Project
Reversibility	**Reversible:** effects will cease during or after the Project is complete **Irreversible:** effects will persist after the life of the Project
Ecological Context	**Disturbed:** effect takes place within an area that has been substantially influenced by human developments and disturbances **Undisturbed:** effect takes place within an area that is relatively unaffected by human developments or disturbances

5.5.1.6 Threshold for Determining the Significance of Residual Environmental Effects

Multiple significance criteria are required to accommodate the different levels of protection afforded to rare plants:

A **significant residual adverse environmental effect** on Species at Risk is:

- One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of SARA, or in contravention of any of the prohibitions stated in Section 3 of the Nova Scotia *Endangered Species Act*.

A **significant residual adverse environmental effect** on Species of Conservation Concern is:

- One that alters the habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts is substantially reduced as a result; or

- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts is substantially reduced; or; in the case of species of “Special Concern” listed in Schedule 1 of SARA, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of SARA) that are in place at the time of relevant Project activities.

A **significant residual adverse environmental effect** on Secure Species is:

- One that affects plants (*e.g.,* direct mortality), or their habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative vascular plant species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts, and natural recruitment may not re-establish the population(s) to its original level.

A **significant residual adverse environmental effect** on an Uncommon Plant Community is:

- One that causes a decline in the abundance or distribution of an uncommon plant community such that its long-term persistence within the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts is unlikely.

5.5.2 Existing Conditions

5.5.2.1 Regional Context

The Project is located within the Bras d'Or Lowlands Ecodistrict of the Northumberland Bras d’Or Lowlands Ecoregion, as defined by Neily *et al*. (2003). This ecodistrict encompasses the lowland areas around the Bras d’Or Lakes and the Sydney coalfield, Boularderie Island and the portion of the Salmon River Valley on the east side of the East Bay Hills. The climate of this district is moderated by its proximity to the Bras d’Or Lakes as well as adjacent upland regions, and mean annual precipitation ranges between approximately 1100-1400 mm. Black and white spruce (*Picea mariana* and *P. glauca*, respectively) represent the predominant species throughout much of its area, although balsam fir (*Abies balsamea*) is also common, particularly due to its establishment in areas which have been disturbed by harvesting or by natural causes

(Neily *et al*. 2003). Stands of red spruce (*P. rubens*) and eastern hemlock (*Tsuga canadensis*) are present in the valleys and along some watercourses coming off the uplands. Eastern white pine (*Pinus strobus*) may also be found and some well-drained hills support sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*). The clearing of land by early settlers and then subsequent abandonment of the fields and pastures has given rise to large areas of old field white spruce. Wind represents the most prominent natural disturbance regime within the ecodistrict, with blowdown being particularly evident along exposed lakes and coasts (Neily *et al*. 2003).

Owing to the location of the Donkin Peninsula on the northeastern coast of the province, the site strongly reflects characteristics of the adjacent Cape Breton Coastal Ecodistrict. In this ecodistrict, the influence of the Atlantic Ocean overwhelms the effect of other environmental characteristics such as the composition of the underlying geology (Neily *et al*. 2003). As is typical of coastal forests throughout Nova Scotia, the dominant stand type within the Cape Breton Coastal Ecodistrict is comprised of a mixture of white spruce, balsam fir and black spruce, with red maple (*Acer rubrum*) and paper birch(*Betula papyrifera*) being found in association. Wind is the most important disturbance mechanism and results in both stand level disturbances and/or small gap disturbances (Neily *et al*. 2003).

Soils of the peninsula and along the transmission line are predominantly comprised of poorly drained sandy loam till of the Economy Soil Series and are generally level and moderately stony (Agriculture Canada 1963). Pockets of peat are common along the transmission route as well as at the peninsula and are associated with poorly drained depressions. Although not present on the Donkin Peninsula, the western section of the transmission route does cross some sections of the Shulie Soil Series. These soils are well drained sandy loam tills associated with a undulating to gently rolling topography, and are moderately stony (Agriculture Canada 1963).

5.5.2.2 Plant Communities

Information on the occurrence of plant communities within the LAA was obtained from field surveys and provincial forest (NSDNR 2003) and wetland inventory (NSDNR 2007) mapping. Field surveys were conducted by Stantec in 2010-2011 and by CBCL Limited in 2006-2008 (Table 5.5.3) and documented the types of vegetation communities found at the mine site and along the transmission route. Field surveys were restricted to the Donkin Peninsula and within an approximate 80 m wide corridor centered along the length of a previously considered rail alignment which runs parallel to the proposed transmission line for much of its extent. Within this context, the length of the proposed transmission corridor was surveyed with the exception of approximately 6 km of its western end (which is within a currently maintained transmission RoW), a 1.5 km section near the community of Tompkinville (which is within a currently maintained transmission RoW), and a 1 km portion on the eastern side of Big Glace Bay Lake (which is within an abandoned transmission RoW). Although all encountered habitat types were surveyed, particular attention was directed at wetlands because of their relative high potential to support species of conservation interest and unique plant communities, in addition to there being strong environmental policy and permitting requirements related to their disturbance.

Table 5.5.3 Survey Effort for Rare Plant Species and Habitats

Project Component	Timeframe	Nature of Investigation
Donkin Peninsula	July 17-19th, 2006.	Vascular plant survey and habitat assessments (CBCL)
Donkin Peninsula	July 2006 - August 2007	Additional botanical investigations (CBCL)
Transmission Corridor	Spring and summer of 2008	Vascular plant survey and habitat assessments along previously-considered rail alignment (CBCL) (parallel to proposed transmission line)
Transmission Corridor	June 22nd - 25th and August 16-25th, 2010	Vascular plant survey and habitat assessments along previously-considered rail alignment (parallel to proposed transmission line), focused effort on wetlands (Stantec)
Donkin Peninsula	August and November, 2011	Vascular plant survey within specifically targeted wetlands, habitat assessments, and additional botanical observations (Stantec)

The terrestrial habitats of the Donkin Peninsula reflect its location at the northern extent of the Bras d'Or Lowlands Ecodistrict, its coastal position, the influence of human disturbances, the imperfect and poorly drained characteristics of its soils, and low nutrient availability. Over half of the peninsula is comprised of upland forest, with young and mature stands of conifer being predominant and a regenerating area being located towards its center (Figure 5.3.1 (Birds and Wildlife), Table 5.5.4). The forest becomes stunted and wind swept towards the edge of the peninsula and grades into a band of coastal barrens, which is particularly extensive in the northern part of the site. Wetlands comprise an important component of the Donkin Peninsula, accounting for approximately 30 percent of its overall area. Particularly large contiguous areas of wetland habitat are associated with the DEVCO settling sond (*i.e.*, DEVCO Wetland), Schooner Pond (*i.e.*, Baileys Wetland), and the northeastern extent of the peninsula. Schooner Pond, DEVCO settling pond, and several small ponds on the western side of the peninsula provide open water habitats. Coastal cliffs with a relief of over 40 m occupy the periphery of the peninsula whereas a beach is present at Schooner Pond Cove. In addition to the relatively “natural” habitats which are present, approximately 10 percent of the peninsula is currently occupied by anthropogenic developments, including that associated with the mine yard and coal waste piles, residential developments, infrastructure-corridor, a gravel pit, agriculture lands, and other disturbed habitats (Figure 5.3.1 (Birds and Wildlife), Table 5.5.4).

Table 5.5.4 Land Classification Within Donkin Peninsula

Habitat Type[1]	Land Cover Type	Area (ha)	Percent of Total Area
Forested (upland)	Mature Softwood	99.4	24.8
	Young Softwood	88.2	22.0
	Immature Forest	24.3	6.1
Non-forested	Urban (Industrial)	21.8	5.4
	Barren	12.8	3.2
	Cliff/Dune/Costal Rock	10.3	2.6
	Agriculture	9.3	2.3
	Miscellaneous[2]	6.7	1.7
	Infrastructure-corridor	3.4	0.8
	Beach	1.6	0.4
	Gravel pit	0.7	0.2
Wetland[3]	Wetland	120.5	30.0
Aquatic	Waterbody[4]	2.3	0.6
Total		401.2	100.0

[1]Land classification data based on NSDNR's Forest Inventory but modified based on results of field surveys and air photo interpretation
[2]Disturbed grassy area immediately east of Schooner Pond Cove
[3]Includes swamp, marsh, shallow water, fen, and bog wetland classes
[4]Values presented are an underrepresentation of the area covered by waterbodies because shallow open water habitats within DEVCO Wetland, Baileys Wetland and several small ponds have been classified as wetland

For the purposes of characterizing the diversity of communities that are present on the Donkin Peninsula, they are organized into five general habitat types: upland forest, barrens, waterbodies and wetlands, coastline, and disturbed areas. Of these habitat types, the coastal barrens have been identified to support a unique plant assemblage. More detailed information on the character of vegetation communities of the Donkin Peninsula is provided in the following sections.

Upland Forests

The composition and structure of forests on the Donkin Peninsula vary according to moisture regime, age, exposure to wind, and the influence of tree harvesting activities. However, they are generally boreal-like in character, being largely comprised of spruce, balsam fir and intolerant hardwoods. The majority of upland forests on the peninsula are comprised of mature and young coniferous stands, estimated to account for approximately 25 and 22 ha of the peninsula, respectively (Table 5.5.4, Figure 5.3.1 (Birds and Wildlife)). However, a large forested area towards the center of the peninsula is currently regenerating following previous disturbance activities and small pockets of mature mixedwood are also present. Additionally, patches of recent blow-down were observed.

Mature and young conifer stands are predominantly dominated by black spruce and balsam fir with lesser amounts of paper birch being interspersed throughout. Shrub cover within these stands is limited and comprised primarily of coniferous saplings and seedlings, with a low to moderate cover of sheep laurel (*Kalmia angustifolia*) also typically being present. Due to low light availability, ground vegetation is typically dominated by moss cover, with herbaceous vegetation comprising a low percentage of the overall cover, except in areas where openings in the forest canopy are more conducive to understory vegetation development. Red-stemmed Schreber's moss (*Pleurozium schreberi*) provides the majority of ground cover but broom moss (*Dicranum spp*.), three-lobed bazzania (*Bazzania trilobata*), stairstep moss (*Hylocomium splendens*), and feathermoss (*Ptilium crista-castrensis*) are also present. Herbaceous vegetation is primarily comprised of forbs, with bunchberry (*Cornus canadensis*), wild lily-of-the-valley (*Maianthemum canadense*), twinflower (*Linnaea borealis*), bracken fern (*Pteridium aquilinum*), and northern starflower (*Trientalis borealis*) being characteristic. Stands of young and mature coniferous forests on the peninsula reflect characteristics of the "Black spruce/False holly/Ladies' tresses sphagnum (SP7)" and "Black Spruce/Lambkill/Bracken (SP5)" vegetation types identified by the FEC for the province (NSDNR 2011b).

Conifer stands dominated by white spruce are also present on the peninsula, and reflect both the coastal nature of the site and the influence of past land-use practices. The presence of white-spruce dominated stands along the northern side of the peninsula reflects the tolerance of this species to the wind and salt coming off the Atlantic. These stands become increasingly stunted and tight towards the forest edge and form a narrow band of krummholz that grades into the adjacent coastal heath. Whereas little or no understory development (besides white spruce) is found near the edge of these stands due to extreme shading, areas farther back from the coastline support a moderately well-developed understory comprised of species such as twinflower (*Linnaea borealis*), mountain cranberry (*Vaccinium vitis-idaea*), and goldthread (*Coptis trifolia*). These coastal communities approximate the "White spruce – Balsam Fir/Foxberry – Twinflower (CO2)" and the "Black crowberry Headland variant (CO2a)" vegetation types identified by the province's FEC (NSDNR 2011b). White spruce stands that are removed from the immediate influence of the coastline and which may be classified as the "White spruce/Aster – Goldenrod/Shaggy moss (OF1)" vegetation type (NSDNR 2011b) also occur on the peninsula. These stands represent an early successional vegetation type following land clearing practices and regeneration on abandoned agricultural lands (such as have occurred in association with an old homestead at the southern side of the peninsula). Due to a closed forest canopy, such stands are typically dominated by mosses and have a high cover of needles on the forest floor.

Small pockets of mature mixedwood are present on the peninsula in association with imperfectly drained soils, such as seepage areas. Tree cover within the mature mixedwood stands is of paper birch, balsam fir, and black spruce. A well-developed herbaceous layer is present within the understory, being predominantly comprised of spinulose wood fern (*Dryopteris carthusiana*) and mountain wood fern (*Dryopteris campyloptera*), along with common wood sorrel (*Oxalismontana*), twinflower, and northern starflower. Shrub cover is limited, with regenerating paper birch being the most common component; and a moderate amount of moss cover is provided by three-lobed bazzania, broom moss, and other species. These patches of mixedwood reflect characteristics of the “Balsam fir – Black spruce/Blueberry (SH9)”, “Balsam fir – Red maple/Wood sorrel – Goldthread (MW4)”, and “Black spruce/lambkill/bracken (SP5)” vegetation types identified by Nova Scotia’s FEC (NSDNR 2011b) but only occur as small pockets within larger conifer-dominated stands.

An area in the center of the peninsula south of the existing waste rock piles is currently in an early successional stage following disturbance from tree harvesting and fire. The character of vegetation within this area varies considerably, having well-developed tree regeneration in some locations and being comparatively devoid of tree cover in others. Green alder (*Alnus viridis*) is common throughout this zone, particularly in association with push-over sites and the edges of old roadways and trails. Immature forest stands are both coniferous and mixedwood in content. Conifer-dominated stands are predominantly comprised of regenerating white spruce, black spruce, and balsam fir, and have an understory comprised of bracken fern, ericaceous shrubs (particularly sheep laurel) and scattered forbs such as bunchberry and starflower. Immature mixedwood stands are dominated by the aforementioned tree species in addition to paper birch. A well-developed herbaceous understory is comprised of spinulose wood fern, whorled wood aster (*Oclemena acuminata*), wavy hair grass (*Deschampsia flexuosa*), and wild lily-of-the-valley (*Maianthemum canadense*). Moss cover is varied but broom moss and feathermoss are typically present. Patches of barrens are found in areas where tree regeneration has been inhibited – such areas are dominated by ericaceous shrubs, bracken fern, reindeer lichens (*Cladina spp*.), and a variety of mosses. In addition to this disturbed portion of the site, aerial photographs suggest that forest near the mine portals, has been harvested within the past 20 years.

Barrens

Coastal barrens occupy a band along the periphery of the northern portion of the peninsula and reflect the prevalence of heavy winds coming off the Atlantic. The width of this vegetation community is variable but averages approximately 100 m wide. The community is dominated by dwarf shrubs and low-lying herbaceous species but it is punctuated by patches of grassy meadow as well as stunted coniferous trees, and grades into a dense thicket of coniferous trees at its inward side. Black crowberry (*Empetrum nigrum*) is particularly dominant throughout the coastal heath, although a number of other species are also common, including three-toothed cinquefoil (*Potentilla tridentata*), late lowbush blueberry (*Vaccinium angustifolium*) lowbush, common juniper (*Juniperus communis*), northern bayberry (*Morella pensylvanica*), and common woodrush (*Luzula multiflora*). Additionally, broom-crowberry (*Corema conradii*) was recorded by CBCL as being abundant on the headland (however, this species was not observed during subsequent site visits by Stantec, although detailed surveys of the barrens were not performed). The Canadian population of broom-crowberry is endemic to Nova Scotia and, although fairly common on the mainland (particularly inland barrens), has not previously been recorded from Cape Breton (Zinck 1998). In addition to the well-drained heathlands, graminoid-dominated environments are found in several exposed areas (such as at the tip of Northern Head) and although the large majority of the coastal heath vegetation type is well-drained, small pockets of imperfectly and poorly drained soils are present. Large cranberry (*Vaccinium macrocarpon*), bluejoint reed grass (*Calamagrostis canadensis*) and other species are prominent in the imperfectly-poorly drained sections, with cinnamon fern (*Osmunda cinnamomea*) also being prevalent in more sheltered pockets found at the forest edge. A well-used hiking trail runs around the headland, and a few non-native and weedy species are found in association with its disturbed tracks.

Patches of barrens were also observed in the interior of the peninsula. In particular, barrens are present within a low-lying area immediately to the west of the existing mine yard as well as in association with the "immature forest" to the south of the existing infrastructure. Both areas are dominated by ericaceous shrubs, reindeer lichens (*Cladina spp*.), and a variety of mosses

Wetlands and Waterbodies

Wetlands are prominent on the peninsula, accounting for over 120 ha (Table 5.5.4, Figure 5.3.1 (Birds and Wildlife)). Swamps comprise the majority of wetland area, but all recognized wetland classes are present on the peninsula, including bog, marsh, shallow water, and fen. The swamps are primarily dominated by coniferous trees, the character of which would encompass both the "Black spruce/Cinnamon fern/Sphagnum (WC1)" and "Black spruce/lambkill – Labrador tea/Sphagnum (WC2)" vegetation types described by Nova Scotia's FEC (NSDNR 2011b). Shrub-dominated swamps are also present on the peninsula, both as a natural occurrence and in areas which are currently regenerating from disturbance from tree harvesting activities. Shallow water wetland habitats have standing or flowing water that is <2 m deep during mid-summer and are found in association with marshes of DEVCO settling pond, Baileys Wetland, and several small disturbed basins on the peninsula. These open water habitats are largely non-vegetated, with less than five percent of the area being comprised of submerged and floating aquatic plants. Marshes are present at the littoral zone of open water bodies and in association with several smaller anthropogenically-influenced wetlands. Those within the peninsula varied in character but were dominated by graminoids, most typically broad-leaved cattail (*Typha latifolia*) or bluejoint reed grass. Several occurences of poor fen are present on the peninsula - the structure and species composition of which varied but was typically comprised of a prominent herbaceous layer formed predominatly of graminioids and a diffuse tree layer. Additionally, an area containing bog was found at the eastern end of DEVCO settling pond, and was dominated by ericaceous shrubs and peatmoss. More detailed information on the vegetative character of wetlands on the Donkin Peninsula is provided in Section 5.4 (Wetlands).

In addition to that provided by wetlands, watercourses on the peninsula provide potential habitat for plants associated with aquatic or poorly drained conditions. However, although several streams are present towards the western end of the peninsula, they did not generally support plant communities within their channels and plant composition along their edges primarily reflected that of adjacent upland and wetland forest stands. However, pockets of aquatic plants such as bur-reed (*Sparganium sp*.) were scattered in association with these features. An engineered channel draining the settling pond into the sea provides a running-water habitat of shallow pools and gentle riffles. Along with broad-leaved cat-tail, the stream was found to support clasping-leaved pondweed (*Potamogeton perfoliatus*), jointed rush (*Juncus articulatus*), harlequin blue flag (*Iris versicolor*), coltsfoot (*Tussilago farfara*), common spikerush (*Eleocharis palustris*), lesser duckweed (*Lemna minor*), and northern water plantain (*Alisma triviale*).

Coastline

Sea cliffs are present along the majority of the peninsula's coastline. The base of the cliffs are comprised of exposed bedrock and large boulders which are continually subject to tidal and wave action of the Atlantic Ocean and which do not support plant growth, although some marine macroalgae (*i.e.*, seaweed) is present. The cliff face along the northern perimeter of the peninsula is largely devoid of vegetation as a result of its steep nature, ongoing erosive action, and exposure to the harsh conditions of the Atlantic Ocean. Although the cliff along the southern side of the peninsula supports vegetated ledges, the composition of these has not been assessed as a result of access limitations. More sheltered coastal habitats are associated with the northern base of the peninsula, where Schooner Pond Beach is located. In this area, a barrier beach has been artificially enlarged to support an access road and separates Baileys Wetland from the ocean. Vegetation associated with features of this area includes species characteristics of coastlines, freshwater habitats, and disturbed areas. The coastal environment contributes northern bayberry, three-toothed cinquefoil, beach wormwood (*Artemesia stelleriana*), rugose rose (*Rosa rugosa*), Scotch lovage (*Ligusticum scothicum*), and orach (*Atriplex spp*.). The freshwater environment contributes broad-leaved cat-tail, rushes (*Juncus spp*.), marsh cinquefoil (*Comarum palustre*), soft-stemmed bulrush (*Schoenoplectus tabernaemontani*), prairie cord grass (*Spartina pectinata*), and Canadian burnet (*Sanguisorba canadensis*). These species are scattered among those typically associated with roadside and wet-meadow habitats, including field sow thistle (*Sonchus arvensis*), harlequin blue flag, blue-eyed-grass (*Sisyrinchium montanum*), wild strawberry (*Fragaria virginiana*), common starwort (*Stellaria media*) and oxeye daisy (*Leucanthemum vulgare*).

Disturbed Areas

Areas surrounding the existing mine infrastructure (*i.e.*, the mine yard) have been graded and compacted by heavy machinery. Vegetation within these areas is comprised of a diversity of both native and exotic herbaceous taxa that are associated with early successional and disturbed conditions. Dry areas within the mine yard were found to be vegetated with Kentucky blue grass (*Poa pratensis*), timothy (*Phleum pratense*) and a variety of old-field species such as grass-leaved goldenrod (*Euthamia graminifolia*), common St. John's-wort (*Hypericum perforatum*), common tansy (*Tanacetum vulgare*), red clover (*Trifolium pretense*) and white sweet clover (*Melilotus alba*). Although the area does not generally support shrubs, green alder (*Alnus viridis*) and other species are prevalent along the edges of the mine yard. Micro-depressions found throughout the mine yard provide habitat for wetland-associated species, including rushes (*Juncus spp*.), common woolly bulrush (*Scirpus cyperinus*), and field horsetail (*Equisetum arvense*). Coltsfoot (*Tussilago farfara*) was also observed to be abundant along the margins of the mine yard. Two large pads created from waste rock are located on the south side of the yard and are composed of unweathered rock and support minimal vegetation.

A grassy area is present on the eastern side of Schooner Pond Cove, being found on the sides of the road and extending up to the sea cliff. The area is comprised of a mixture of both native and exotic weedy taxa, suggesting that it has been influenced by anthropogenic disturbances. Red fescue (*Festuca rubra*) is a dominant grass and is interspersed with forbs such as vetch (*Vicia spp*.), little starwort (*Stellaria graminea*), and hedge false bindweed (*Calystegia sepium*). Seaside goldenrod (*Solidago sempervirens*) is also evident within this area, reflecting the maritime influence on the vegetation. A number of other exotic and weedy species are also present, including common yarrow (*Achillea millefolium*), common plantain (*Plantago major*) and seaside plantain (*P. maritima*). A slope leading from the old mine access road down to the DEVCO settling pond is likely to have been hydro-seeded and is dominated by exotic grasses, notably timothy, meadow fox-tail (*Alopecurus pratensis*) and quack grass (*Elymus repens*); as well as weedy forbs. Additionally, a dense thicket of non-native roses (*Rosa spp*.) in this area provides evidence of a previous habitation.

Although areas of the peninsula beyond the existing mine yard are relatively natural, evidence of anthropogenic disturbance and other activities is prevalent. Much of the forested area is currently in a regenerative to immature successional stage as a result of past forest management practices and old logging roads are present, particularly within the center of the peninsula. In addition to being subject to forest harvesting initiatives, the hydrological character of some wetlands has been altered as a result of human activities. In particular, wetlands which are intercepted by a cleared corridor between the existing mine site and the southern boundary of the peninsula have been highly altered, with areas currently occupied by shallow water and marsh habitats likely being treed swamp communities prior to disturbance activities. Furthermore, the DEVCO settling pond itself is largely anthropogenic; having been created by damming an extant wetland and an artificial outlet drains that pond into the ocean. Additionally, a remnant swath of cattail marsh which currently occupies the drainageway between the water treatment ponds and the setting pond is highly anthropogenic in character and is likely to have occupied a much larger extent of wetland prior to infilling activities. Furthermore, there is evidence of old homesteads on the headland and a hiking trail circumvents the perimeter of the peninsula and is frequently used for recreational purposes.

Plant Communities along the Transmission Corridor

Land within the transmission corridor is predominantly comprised of semi-natural vegetation but anthropogenic land-use types are also prevalent (Table 5.5.5 and Figure 5.3.1 (Birds and Wildlife)).

Over 50 percent of the corridor is covered by naturally regenerating forest at various stages of succession (Table 5.5.5 and Figure 5.3.1 (Birds and Wildlife)). Mature mixedwood and softwood stands are particularly prominent, comprising approximately 14 and 12 percent of the land cover, whereas mature hardwood accounts for less than three percent of the area. Reflecting the influence of forest management practices, immature forest comprises approximately 14 percent of the area within the corridor, with young mixedwood and softwood accounting for approximately 10 percent. Barrens are also present along the proposed transmission line route, and are estimated to account for approximately three percent of the 100 m wide corridor.

Wetlands are prominent within the transmission corridor, estimated to account for up to approximately 20 percent of its area (Table 5.5.5 and Figure 5.3.1 (Birds and Wildlife)). Information on the character of wetlands, obtained from field surveys and NSDNR data, indicate that the majority of wetland habitat within the corridor is comprised of swamp, or complexes which are associated with swamps. However, all wetland classes identified by the Canadian Wetland Classification System (NWWG 1997) are represented along the route, including swamp, bog, fen, marsh, and shallow water. Section 5.4 (Wetlands) provides more detailed information on the character of wetland habitats within the transmission corridor.

Open water habitats include both freshwater and estuarine environments and comprise a relatively small percentage of the area within the transmission corridor at approximately one percent (Table 5.5.5 and Figure 5.3.1 (Birds and Wildlife)). Estuarine waters within the transmission corridor are found in association with the upper reaches of Big Glace Bay Lake, a coastal lagoon enclosed by a barrier beach. A lake and a number of small ponds provide freshwater habitats.

Approximately 25 percent of the transmission corridor is comprised of anthropogenic land-use types, including urban, infrastructure-corridor, gravel pit, sanitary landfill, and agriculture (Table 5.5.5 and Figure 5.3.1 (Birds and Wildlife)). Lands designated as “urban” and “infrastructure corridor” are the most prominent human land use type, accounting for approximately twelve and eight percent of the area within the transmission corridor, respectively.

Table 5.5.5 Land Classification Within 100 m Wide Transmission Corridor

Habitat Type[1]	Land Cover Type	Area (ha)	Percent of Total Area[3]
Forested (upland)	Mature Mixedwood	64.2	14.1
	Immature Forest	63.2	13.9
	Mature Softwood	53.5	11.8
	Young Mixedwood	22.2	4.9
	Young Softwood	20.0	4.4
	Mature Hardwood	10.9	2.4
Non-forested	Urban	53.3	11.7
	Infrastructure-corridor	38.1	8.4
	Barren	15.1	3.3
	Gravel pit	12.5	2.8
	Sanitary Landfill	4.0	0.9
	Miscellaneous	0.5	0.1
	Agriculture	0.2	<0.1

Table 5.5.5 Land Classification Within 100 m Wide Transmission Corridor

Habitat Type[1]	Land Cover Type	Area (ha)	Percent of Total Area[3]
Wetland[2]	NSDNR	58.6	12.9
	Field delineated	33.8	7.4
Aquatic	Coastal Habitat	2.2	0.5
	Waterbody	2.2	0.5
	Total	**454.4**	**100.0**

[1] Land classification data based on NSDNR's Forest Inventory Data except for field-delineated wetlands
[2]Includes swamp, marsh, bog, fen, and shallow water wetland classes
[3] Figure 5.3.1 shows an 800 m wide LAA used for Birds and Wildlife. Calculations for Table 5.5.5 are based on the 100 m LAA for Rare Plants.

5.5.2.3 Species of Conservation Interest

Rare plant modelling exercises were performed to determine the likelihood of presence of rare or sensitive plants within the Mine and Transmission Line LAAs. As part of the most recent modeling exercise, all records of plant species listed by the NSDNR (2011a) to be "At Risk", "May be at Risk", "Sensitive" to human activities or natural events, or ranked as "S1", "S2", or "S3" by the ACCDC (2011) within a radius of 100 km from the center of the transmission line corridor LAA were compiled by means of an ACCDC data search. The habitat requirements of these species were then compared to the range of environmental conditions within the LAAs to determine if suitable habitat was present for these taxa. In instances where appropriate habitat was present for a particular species, that taxon was considered to be potentially present. The phenology and ease of identification of each of the species was also incorporated into the model in order to determine when the rare or sensitive taxa would be best identified. A similar modeling exercise was performed prior to field surveys in 2006.

A total of 223 rare or sensitive vascular plant species have been recorded within 100 km of the LAAs (ACCDC 2011). Based on the results of the habitat model, there is potential for 91 of these species to be found within the study area. In addition, five rare non-vascular taxa have been recorded within the vicinity of the proposed project. The results of the habitat modeling exercise indicated that all of the habitat types present in the LAAs could potentially harbor rare species. However, because many of the rare or sensitive plants were associated with wetlands and the shores of water bodies, these habitats were considered to be most likely to harbor plants of conservation interest. The phenologies of the rare and sensitive vascular plants highlighted by the model suggest that rare plants may be identified at all times during the growing season. Although many of the species have restricted flowering periods, most are readily identified by their seeds and/or general morphological characteristics, such as leaf shape, throughout the growing season. However, confident identification of several species, such as boreal aster (*Symphyotrichum boreale*), can only be made in the fall due to their late development, and other species, such as southern twayblade (*Listera australis*) can only be identified in spring (June). Table 3 in Appendix L lists the vascular species identified by the model as being potentially present, their preferred habitats and their phenology.

Of the vascular plants recorded within 100 km of the LAAs, two are designated Species at Risk within the province. Slender blue flag (*Iris prismatica*) and alpine rush (*Juncus alpinoarticulatus ssp. nodulosus*) are both listed as “Vulnerable” under the NS ESA and have been recorded within approximately 43 and 93 km of the LAAs, respectively. Slender blue flag is generally associated with wet ground near the coast whereas alpine rush is associated with wet shores, marshes, and other similar habitats (Zinck 1998). Both species were considered to have potential to inhabit imperfectly and poorly drained habitats within the study area, such as those found along the margins of Baileys Wetland or the DEVCO settling pond. In addition, one non-vascular Species at Risk was recorded within 100 km - boreal felt lichen (*Erioderma pedicellatum*). This foliose cyanolichen primarily grows on the trunks and branches of balsam fir within moist and mature forest stands (Environment Canada 2007) and is considered “Endangered” by SARA, COSEWIC, and the province of Nova Scotia. ACCDC data indicate that there at least 12 known locations of this species within 46 to 76 km from the center of the LAA.

Information on the occurrence of rare plants on the Donkin Peninsula and within the transmission corridor was obtained from field surveys conducted by Stantec in 2010-2011 and by CBCL Limited in 2006-2008 (Table 5.5.3). Field surveys were restricted to the Donkin Peninsula and within an approximate 80 m wide corridor centered along the length of a previously considered rail line which parallels the proposed transmission line. The length of the proposed transmission line was surveyed with the exception of its western end (where it joins up with an existing transmission line near the airport) and an approximate 1.5 km long section near the community of Tompkinville. Results of the rare plant modelling exercises were used to help identify habitats with high potential to harbor rare plant species. For example, particular emphasis was given to the aquatic and semi-aquatic vegetation around Baileys Wetland and the DEVCO settling pond during 2006 surveys because a number of rare species were identified as being potentially present in association these features. Furthermore, whereas all encountered habitat types were surveyed, particular attention was directed at wetlands because of the their relative high potential to support species of conservation interest, in addition to there being strong environmental policy and permitting requirements related to their disturbance. Although the timing of these surveys would be sufficient for identifying the majority of taxa, they would not be adequate for the identification of all species. In particular, many of the treed swamps on the Donkin Peninsula provide potentially suitable habitat for southern twayblade but past botanical surveys at the mine site were not performed during the specific window (usually a two-week window in early to mid-June) would allow for this particular species to be identified.

All species of vascular plant encountered during the surveys were identified and their population status in Nova Scotia was determined through a review of the species rankings provided by NSDNR (NSDNR 2011c), ACCDC (ACCDC 2011), COSEWIC (2010), and those listed under SARA and the NS ESA. Further information on the results of the field surveys as they relate to the occurrence and distribution of rare plants is presented in the following sections for both the Mine Site and the transmission corridor.

5.5.2.3.1 Mine

A total of 289 vascular plant species were recorded on the Donkin Peninsula, including three Species of Conservation Concern and one additional species which is of conservation interest (Figure 5.4.1 (Wetlands), Table 5.5.6). A complete list of taxa encountered on the Donkin Peninsula during field surveys is presented in Table 1 of Appendix L.

Spurred gentian (*Halenia deflexa*) is associated with exposed headlands, with most records within the province being from Cape Breton (Zinck 1998). This species is regarded as "Sensitive" by NSDNR and is ranked as "S2S3" by the ACCDC indicating that it is rare to uncommon within the province. Patches of spurred gentian were found at the edge of the Donkin Peninsula during both 2006 and 2011 surveys and consisted of approximately 40 individuals each. Both of these patches were growing within 5 m of the edge of the headland (Figure 5.4.1 (Wetlands)) and were associated with open grass-dominated habitats (*i.e.*, not within the dwarf shrub-dominated component of the coastal barrens). ACCDC data indicate 16 records for this species within 100 km, one of which represents the small population near Wreck Point that was confirmed during 2006 field survey efforts. The more southern known occurrence of spurred gentian on the peninsula (*i.e.*, at the tip of Northern Head) represents a new record and there is potential for this species to occur elsewhere on the periphery of the headland.

Kalm's hawkweed (*Hieracium kalmii*) is known to occur on roadsides, rough ground, clearings and thickets of the province (Zinck 1998). It is given a ranking of "S2?" by the ACCDC, indicating that it is expected to be rare within Nova Scotia but that there is considerable uncertainty regarding its population status. Similarly, NSDNR has assigned an "Undetermined" status to this species. Although the current lack of information regarding the distribution and abundance of Kalm's hawkweed species may reflect its uncommonness within the province, the uncertainty regarding this species is largely attributed to recent taxonomic changes and similarity to the common Canada hawkweed (*Hieracium canadense*). Kalm's hawkweed was recorded as being present within the mine yard during 2006 surveys. ACCDC data do not contain any records of this species within 100 km of the LAA.

Pink pyrola (*Pyrola asarifolia*) is known to be scattered throughout the province where it associated with rich, mainly calcareous, woods and thickets (Zinck 1998). Although its population is considered "Secure" by NSDNR, the ACCDC has given a ranking of "S3" to this species indicating that it is uncommon within the province. Two plants were observed on the headland of the Donkin Peninsula during. ACCDC data indicate that there are at least five other occurrences of this species within 100 km of the Project LAA.

Loesel's twayblade (*Liparis loeselii*) has been recorded in association with a variety of habitats in the province, including bogs, peaty meadows, moist ditches, cobbly lake shores, the edges of ponds and wetlands, and behind coastal barrier beaches. The population of this species is considered "Secure" by NSDNR and it is ranked as "S3S4" in the province by the ACCDC indicating that it is uncommon to fairly common. A single occurrence of this species was recorded in the mine yard during a 2006 survey. ACCDC data indicate that there are at least eight other occurrences of this species within 100 km of the Project LAA.

Table 5.5.6 Plant Species of Conservation Interest at the Donkin Peninsula and Information on their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	ACCDC Rank	Known Distribution and Abundance on the Donkin Peninsula
Species of Conservation Concern						
Spurred Gentian	*Halenia deflexa*	na	na	Sensitive	S2S3	Two small populations identified within the coastal heath.
Kalm's Hawkweed	*Hieracium kalmii*	na	na	Undetermined	S2?	Observed in mine yard[1].
Pink Pyrola	*Pyrola asarifolia*	na	na	Secure	S3	Two plants identified on headland[1].
Secure Species						
Loesel's Twayblade	*Liparis loeselii*	na	na	Secure	S3S4	Single plant observed in mine yard.
[1] Coordinates for observations are unknown.						

5.5.2.3.2 Transmission Line

A total of 560 vascular plant species were recorded along the transmission corridor, including one Species at Risk, ten Species of Conservation Concern, and six additional plants that may be of conservation interest (Figure 5.4.1 (Wetlands), Table 5.5.7). A complete list of taxa encountered on the Donkin Peninsula during field surveys is presented in Table 1 of Appendix L.

Table 5.5.7 Plant Species of Conservation Interest Along the Transmission Corridor and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	ACCDC Rank	Known Distribution and Abundance within the Transmission Corridor
Species at Risk						
Eastern White Cedar	*Thuja occidentalis*	na	Vulnerable	At Risk	S1S2	A single garden escape encountered in disturbed area on side of trail.
Species of Conservation Concern						
Hay Sedge	*Carex foenea*	na	na	Secure	S3?	Scattered along old track running adjacent to corridor.
Wiegand's Sedge	*Carex wiegandii*	na	na	May Be At Risk	S1	Observed within two deciduous treed swamps near the Old Airport Road

Table 5.5.7 Plant Species of Conservation Interest Along the Transmission Corridor and Information on Their Population Status

Common Name	Scientific Name	SARA/ COSEWIC	NS ESA	NSDNR Rank	ACCDC Rank	Known Distribution and Abundance within the Transmission Corridor
Purple-veined Willowherb	*Epilobium coloratum*	na	na	Sensitive	S2?	Scattered in swamps.
Bulbous Rush	*Juncus bulbosus*	na	na	Undetermined	S1	Patches observed within Northwest Brook
Woodland Rush	*Juncus subcaudatus*	na	na	Sensitive	S3	Observed to be scattered within two wetlands.
Small Round-leaved Orchid	*Platanthera orbiculata*	na	na	Secure	S3	Few in moist deciduous forest outside of Transmission LAA.
Lesser Pyrola	*Pyrola minor*	na	na	Sensitive	S2	Found on edge of wetlands outside of Transmission LAA but also reported to occur near stream crossing by Port Caledonia
Swamp Rose	*Rosa palustris*	na	na	Secure	S3	Observed at edge of wetland.
Meadow Willow	*Salix petiolaris*	na	na	Secure	S3	Several single observations within wetland habitat.
Silky Willow	*Salix sericea*	na	na	May Be At Risk	S2	One individual observed within a wet habitat off side of ditch.
Secure Species						
Purple-stemmed Angelica	*Angelica atropurpurea*	na	na	Secure	S3S4	Scattered in wetlands, often mixed with *A. sylvestris* and hybrids with this species are likely.
Frankton's Saltbush	*Atriplex franktonii*	na	na	Secure	S3S4	Scattered in salt marsh habitat along estuary.
Silvery-flowered Sedge	*Carex argyrantha*	na	na	Secure	S3S4	Scattered along old track running adjacent to corridor.
Northern Clubmoss	*Lycopodium complanatum*	na	na	Secure	S3S4	Small colony in deciduous woods.
Bloodroot	*Sanguinaria canadensis*	na	na	Secure	S3S4	Large patch on embankment at edge of river; also observed in road ditch.
Humped Bladderwort	*Utricularia gibba*	na	na	Secure	S3S4	Commonly observed in peaty mire ponds.

One of the plants encountered during field surveys, eastern white cedar, is designated as a Species at Risk within the province of Nova Scotia. Native eastern white cedars are considered

"Vulnerable" under the NS ESA and may be found in the Annapolis Valley and in Digby and Cumberland Counties where they are typically associated with the margins of lakes, in swamps, and in old fields (Zinck 1998).However, because this species is also a popular ornamental tree, introduced populations are common throughout the province. A single occurrence of eastern white cedar was encountered growing on the shoulder of a dirt road in association with a number of exotic species, including Jerusalem artichoke (*Helianthus tuberosus*) and colt's foot (*Tussilago farfara*). Given that the occurrence of eastern white cedar is outside of its known distribution in the province and was associated with an anthropogenic habitat, it is best considered a garden escape of non-native stock. As such, the occurrence of this species within the corridor is not of conservation concern.

Ten plant species of conservation concern were encountered during 2010 field surveys (Table 2 of Appendix L). Of these species, the provincial populations of Wiegand's sedge (*Carex wiegandii*) and silky willow (*Salix sericea*) are considered to "May be at Risk" by NSDNR. Three other species are considered to have "Sensitive" populations in the province, including lesser wintergreen (*Pyrola minor*), purple-leaf willow-herb (*Epilobium coloratum*), and woodland rush (*Juncus subcaudatus*). Although the populations of large roundleaf orchid (*Platanthera orbiculata*), swamp rose (*Rosa palustris*), meadow willow (*Salix petiolaris*), and hay sedge (*Carex foenea*) are considered "Secure" by NSDNR, these species have been assigned a ranking of "S3" by the ACCDC indicating they are uncommon within the province. The population status of one species, bulbous rush (*Juncus bulbosus*), is considered "Undertermined" by NSDNR but is given a ranking of "S1" by the ACCDC indicating that it is considered to be rare within the province and vulnerable to extirpation. Figure 5.4.1 provides further information on the known distribution of these species within the transmission corridor.

In addition to the aforementioned species of concern, a number of plants whose populations are considered "Secure" by NSDNR but which are assigned rankings of "S3S4" (*i.e.*, uncommon to fairly common) were found during field surveys, including purple-stemmed angelica (*Angelica atropurpurea*), Frankton's saltbush (*Atriplex franktonii*), silvery-flowered sedge (*Carex argyrantha*), northern clubmoss (*Lycopodium complanatum*), bloodroot (*Sanguinaria canadensis*), and humped bladderwort (*Utricularia gibba*).Information on the locations of these species along the transmission corridor is provided in Figure 5.4.1 (Wetlands).

5.5.3 Potential Project-VEC Interactions

Table 5.5.8 below lists each Project activity and physical work for the Project, and ranks each interaction as 0, 1, or 2 based on the level of interaction each activity or physical work will have with rare plants.

Table 5.5.8 Potential Project Environmental Effects to Rare Plants

Project Activities and Physical Works	Potential Environmental Effects
	Change in Rare Species and Uncommon Communities
Construction	
Site Preparation (incl. clearing, grading and excavation)	2
Construction of Mine Site Infrastructure and Underground Preparation	2
Construction of 138 kV Transmission Line	2
Construction of Barge Load-out Facility (incl. dredging, infilling and habitat compensation)	0
Installation of Transshipment Mooring	0
Operation and Maintenance	
Underground Mining	0
Coal Handling and Preparation (incl. coal washing and conveyance)	0
Water Treatment (incl. mine water and surface runoff)	2
Coal and Waste Rock Disposal	2
Marine Loading and Transportation	0
Coal Trucking	1
Maintenance of Transmission Corridor	2
Decommissioning and Reclamation	
Site Decommissioning	1
Site Reclamation	2

0 = No interaction
1 = Interaction occurs; however, based on past experience and professional judgment, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
2 = Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

Activities related to the construction of the barge load-out facility and the installation of transshipment mooring are not likely to interact with rare plants or uncommon communities. Although the construction and installation of these Project components involves the dredging and infilling of the marine environment, habitats within the LAAs for this VEC are not anticipated to be disturbed.

Project activities that are not expected to interact with rare plants and uncommon communities during the operation and maintenance phase of the Project include underground mining, coal handling and preparation (including coal washing and conveyance), and marine loading and transportation. These activities do not have potential to interact with rare plants and uncommon communities because they are to be contained within areas or structures that are removed from the terrestrial habitats of the Donkin Peninsula. In particular, mining will take place underground, mined coal will be washed in the CHPP, product coal will be transported via an overland and enclosed conveyor, and the transshipment mooring site is located several miles from the coastline.

A potential interaction occurs during trucking of coal during the operation and maintenance phase of the Project. In particular, dust levels from trucking activities have potential to influence the abundance and distribution of plants by the chemical composition of their habitats. For example, plants that are associated with relatively acidic wetland environments may not be tolerant of increased pH levels that could result from the input of basic elements. However, this potential interaction has been assigned a ranking of 1 indicating that effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices such as the paving of the access road.

The decommissioning of the mine has also been identified as having a level 1 potential interaction with rare plants and uncommon communities. The potential effects of this Project phase (*e.g.*, introduction of invasive plant species) are to be minimized through adherence to the Project's MCRP in strict compliance with all applicable municipal, provincial and federal Acts and Regulations.

Thus, in consideration of the nature of the interactions and the planned implementation of known and proven mitigation, the potential environmental effects of all Project activities and physical works that were ranked as 0 or 1 in Table 5.5.8, on rare plants during any phase of the Project are rated not significant, and are not considered further in the assessment.

5.5.4 Assessment of Project-Related Environmental Effects

5.5.4.1 Assessment of Change in Rare Species and Uncommon Communities

5.5.4.1.1 Potential Environmental Effects

A summary of the environmental effects assessment and prediction of residual environmental effects resulting from interactions ranked as 2 on Rare Plants is provided in Table 5.5.8. Only the interactions ranked as 2 were considered further in the assessment of Project related environmental effects. All other interactions previously ranked as 0 or 1 were rated as not significant.

Construction

There are several construction activities related to the Project that have potential to affect rare plants and uncommon communities. The most substantive and likely interactions are a change in habitat quantity or quality and the direct loss of rare plants through Project activities associated with site preparation (*e.g.*, clearing, grading and excavation), construction of mine site infrastructure and underground preparation, and construction of the 138 kV transmission line.Clearing and grubbing during site preparation will directly remove or disturb vegetation whereas infilling of wetlands will cause permanent loss of wetland vegetation. In addition, a number of indirect effects can result from these site preparation activities. Clearing of forested areas can change the quality of the habitat along the edge of the PDA as a result of increased side lighting or drying of what was previously forest interior habitat. This may enable more light-tolerant and disturbance-tolerant species to penetrate into adjacent forest habitat. Similarly, the construction of the mine site infrastructure and the 138 kV transmission line may involve disturbance to plant species and communities and has potential to indirectly influence adjacent vegetation by initiating hydrological changes. For example, construction activities have the potential to introduce sediment or silt into wetlands, watercourses, and surface water and this could have an adverse effect on rare plants and/or uncommon communities.

Operation and Maintenance

Activities associated with the operation and maintenance phase of the Project which have potential to interact with rare plants and uncommon communities are coal and waste rock disposal and maintenance of the access road and transmission corridor. The coal waste pile located on the eastern portion of the peninsula (Phase I and Phase II) is scheduled to cover an area of approximately 37.9 ha. The second pile is planned to start approximately 13 years after the start of mining (*i.e.*, Phase III) and proposed to be approximately 42.6 ha in size and to be located to the southwest of Schooner Pond. Vegetation within the footprint of the coal waste piles will be directly disturbed, although no rare plants or uncommon species are currently known to occur in these areas. Additionally, mine water and surface runoff have potential to negatively affect rare plants and uncommon communities by changing the hydrological character of terrestrial and aquatic habitats, as well as their chemical composition. In particular, surface runoff from coal waste piles may affect vegetation if they result in higher than baseline additions to habitats, promote increases in the fluctuation of water levels, or if waters contain materials that change the nutrient status or pH of downstream environments. Wastewater generated as a result of mine discharge and site runoff will exhibit similar characteristics of high sediment load, relatively low pH and a presence of heavy metals. Such factors may have an adverse effect on plants if they promote environmental conditions that are outside the range of tolerance of species, or which might put them at a competitive disadvantage with other taxa. Similarly, coal and waste rock disposal can negatively affect vegetation in downstream environments if they contribute to hydrological or chemical changes. In particular, the presence of coal waste piles may negatively affect plants if they block drainage to downstream resources or if their runoff is not contained. Acid Rock Drainage (ARD) is an important consideration for both water treatment and coal and waste rock disposal because it has potential to cause important changes in down-gradient systems. Wetland habitats are particularly sensitive to hydrological changes.

Vegetation within the transmission corridor will be managed and infrastructure will be periodically maintained. Vegetation management will consist primarily of mechanical control of vegetation, although the use of herbicides may be considered where undesirable species persist. Vegetation control during operations could pose a hazard to rare plant species, either through direct disturbance or indirectly by modifying their habitat, such as through loss of an overstory canopy and increased competitive pressure from species more adapted to open, disturbed conditions. Furthermore, the release of sediment into watercourses and wetlands during maintenance activities could have a detrimental effect on the survivability of rare plants and uncommon communities in these and adjacent habitats.

The use of road salts for de-icing during the winter is a concern for vegetation as salt can enter into the environment (surface water, groundwater and soil) during their storage and application. Environment Canada (2001) cites a number of studies attributing vegetation damage and changes in plant community composition to road salt application. In particular, road salt applications can damage plants located immediately adjacent to roadways and increase the salinity of soils. The effects of road salt are generally observed within 10 m of the edge of the road, although salt related injuries have been detected at distances of up to 80 m from the road. Damage to vegetation includes osmotic (*i.e.*, concentration induced dehydration) injuries as well as direct chloride ion toxicity. Salt deposited on soils can adversely affect plant growth by changing the structure of soil (development of salt crusts) or reducing soil fertility (replacement of calcium and potassium ions by sodium ions). Between five and ten percent of trees within 30 m of highways have been reported to have salt damage in some areas (Transportation Research Board 1991).

Decommissioning and Reclamation

The site reclamation phase of the Project also has potential to interact with rare plants and uncommon communities. Whereas physical disturbances during site reclamation may interact with vegetation, this phase of the Project may also cause indirect affects by facilitating competitive interactions with exotic or weedy species. However, with the correct seed mix, a negative effect on this VEC by site reclamation activities can be avoided.

5.5.4.1.2 Mitigation of Project Environmental Effects

Construction

Avoidance and compensation measures will be undertaken to mitigate the effects of Project construction activities on vegetation at the mine site. A 150 m buffer in which no habitat alterations or mining activities will occur will be recognized along the majority of the coastline (Figure 5.3.2. (Birds and Wildlife)). As such, construction activities will not take place within the coastal barrens located along the northern periphery of the peninsula and as a result, rare plants associated with this habitat (*e.g.*, spurred gentian and pink pyrola) will not be disturbed. Under the provincial wetland policy (NSE 2011), any loss of wetland habitat, either through direct or indirect Project effects, requires compensation to replace the wetland functions lost as a result of the wetland alterations. As such, wetland vegetation lost as a result of Project activities will be compensated through the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss. A number of sediment control measures will be taken to prevent the release of material into surface water features during construction activities.

Potential effects of the construction of the 138 kV transmission line on rare plants and uncommon communities will be minimized through mitigative measures to be carried out by NSPI. Prior to construction of the transmission line, NSPI will be informed of the occurrence of rare plants along the route, and a qualified biologist will flag their locations for avoidance purposes. Additionally, it is recommended a follow-up survey for rare plants be performed on behalf of NSPI along a portion of the RoW which has not yet been surveyed. Effects to wetland habitats will be minimized by selecting power pole placements in uplands and by avoiding the operation of machinery within wetlands, where possible. A sediment control plan will be implemented to prevent the release of material into surface water features during construction activities.

Operation and Maintenance

The potential for indirect hydrological affects to wetland vegetation as a result of the generation of coal waste piles will be minimized during final Project planning and design. In particular, the location of the proposed coal waste pile that currently overlaps with the upper reaches of Baileys Wetland will be positioned to minimize disturbance to watercourses which feed it. Should total avoidance of watercourses prove impractical, streams will be re-directed to maintain flow connectivity towards Baileys Wetland.

The potential for interaction between vegetation and wastewater generated as a result of mine discharge and site runoff will be minimized through a combination of passive and active water treatment systems. Mine water and site runoff is currently treated through a passive water treatment system which consists of an existing serpentine pond for sediment settling. Once the fines settle out of the discharge, the wastewater flows over a weir and into the existing onsite settling pond. The existing serpentine pond will continue to serve as the treatment system for both mine water and runoff from disturbed areas and will include a backup chemical feed system in the event that water chemistry change from alkaline to acidic. In recognition of the potential change to acidic water conditions from runoff from coal waste piles as the Project proceeds to the production phase, additional water treatment systems will be required. Although detailed design has not yet been initiated, it is anticipated that new drainage channels will direct site drainage to a new holding pond likely to be located in the vicinity of the serpentine pond. A water treatment plant will neutralize the acidic water and treated water would then flow into the serpentine pond. In addition, ongoing water quantity, quality and toxicity testing is part of the water quality monitoring programs on the site to confirm that environmental effects are minimized and natural resources are protected from adverse effects. Untreated water is not likely to interact with rare plants or uncommon communities.

Road salt applications can adversely affect salt sensitive plants growing near the roadway edge. The overall salt loading will be minimized by following a salt management procedures, employee environmental awareness training prior to commencement of operation and maintenance activities (*e.g.*, salt and sand application during winter), and increased vigilance and inspection of permanent erosion and sediment control structures, particularly in areas identified as being sensitive (*e.g.*, those adjacent to wetlands). Techniques that reduce the amount of road salt include the pre-wetting of salt and the use of anti-icing systems such as brine solutions to minimize the amount of salt required. These techniques would benefit other VECs, including groundwater and surface water quality and freshwater aquatic life.

Potential interactions between vegetation management activities within the transmission line corridor and the occurrence of rare plants and/or uncommon communities will be minimized through avoidance, where possible. NSPI will be informed of the occurrence of rare plants along the route, and effects on wetland habitats will be minimized by avoiding the operation of machinery within wetlands, where possible.

Decommissioning and Reclamation

Standard mitigative measures to minimize the environmental effects of site reclamation on rare plants and uncommon communities include the use of seed mixtures free of noxious weeds during site reclamation. Wherever practical, native plants (preferably those native to the general Project area) should be used for site reclamation. In lieu of native species, seed mixes containing naturalized species which are well established in Nova Scotia and which are not aggressive weeds in the wetland and forest plant communities present in the area are to be used for reclamation. Potential adverse effects of surface drainage from the coal waste piles on rare plants and uncommon communities will be minimized through the ongoing treatment of water. Furthermore, site reclamation would be carried out progressively and would be designed to manage the drainage, stability and erosion effects on freshwater resources. As such, vegetative communities would be protected from negative interactions with the coal and waste rock disposal systems during reclamation activities. Additional mitigation measures will be implemented to prevent the introduction of invasive species during Decommissioning and Reclamation, and include:

- cleaning and inspecting construction equipment prior to transport from elsewhere so that no plant matter is attached to the machinery (*e.g.,* use of pressure water hose to clean vehicles prior to transport); and

- regularly inspecting equipment prior to, during and immediately following construction in wetland areas and in areas found to support Purple Loosestrife to ensure that plant matter is not transported from one construction area to another.

Such practices will also be followed during the Construction and Operations and Maintenance Phases of the Project.

5.5.4.1.3 Characterization of Residual Project Environmental Effects

Table 5.3.11 in Section 5.3.4.1.1 presents the amounts and types of habitat that will potentially be lost as a result of clearing the PDA. Over 84 percent of the land area within the PDA of the mine is currently occupied by semi-natural vegetation communities, with the remainder being comprised of anthropogenic habitats associated with the current mining infrastructure. No uncommon plant communities are known to occur within the extent of the PDA. Furthermore, a 150 m buffer in which no habitat alterations or mining activities will occur will be recognized along the majority of the coastline (Figure 5.3.2. (Birds and Wildlife)). The establishment of such a buffer will minimize potential effects on coastal barrens and other coastal vegetation types.

Of the plant species of conservation concern recorded on the Donkin Peninsula, Kalm's hawkweed and Loesel's twayblade are likely to be directly influenced by Project activities. Both of these species were recorded within the existing mine yard during 2006 surveys and therefore have potential to be disturbed by construction, operation and maintenance activities associated with the Project. However, the association of these species to anthropogenically modified habitats suggest that they are tolerant of, and may benefit from, human disturbances. As such, the ongoing modification of terrestrial habitats on the Donkin Peninsula is not necessarily considered to represent an adverse effect to the long-term persistence of these species. Additionally, ACCDC data indicate that there are at least eight other occurrences of Loesel's twayblade within the vicinity of the Project. Known occurrences of spurred gentian and pink pyrola within the LAA are restricted to the barrens along the perimeter of the peninsula and are outside the area identified for direct influence by the Project. Furthermore, the Project is not anticipated to cause any indirect effects to the habitats of these species.

The effects of construction, operation and maintenance of the 138 kV transmission line on vegetation is currently unknown as a result of uncertainties regarding the extent of planned habitat disturbance within the transmission corridor. However, of the species of conservation interest recorded along the previously-considered rail alignment, 14 are located within a 100 m wide corridor centered on the location of the proposed transmission line, suggesting that they have potential to be directly influenced by construction activities and vegetation management initiatives. These species include bloodroot, bulbous rush, eastern white cedar, Frankton's saltbush, hay sedge, humped bladderwort, lesser pyrola, meadow willow, purple-stemmed angelica, purple-veined willowherb, silky willow, silvery-flowered sedge, swamp rose, Wiegand's sedge, woodland rush. Although eastern white cedar is protected under provincial legislation, the individual encountered during field surveys is best considered a garden escape of non-native stock and is therefore not of conservation concern. Effects of this Project component on rare plants species and uncommon communities is likely lessened by the fact that it will be constructed within existing RoWs, including approximately 11.4 km of an abandoned transmission line RoW and 13.8 km within an active transmission line RoW. Furthermore, indirect effects to the occurrence of rare plants or uncommon communities are not expected given previously described mitigative measures.

In summary, all phases of the Project (construction, operation and maintenance, decommissioning and reclamation) are likely to have an adverse effect on vegetation, with the magnitude of these effects predicted to be moderate, indicating that they are unlikely to pose a threat to the continued presence of rare plant species or uncommon communities within the LAA. As a result of mitigative measures being employed to avoid indirect effects to rare plants species or uncommon communities, the influences of the Project are expected to be restricted to within the PDA. However, effects are considered “long term” because they will be measurable for the life of the Project (and beyond) and are generally irreversible. Of exception, the effect of vegetation maintenance activities on rare species within the transmission corridor may be considered reversible because rare plants have potential to re-colonize habitats following cessation of disturbance activities and successional development.

5.5.4.2 Summary of Project Residual Environmental Effects

Although all phases of the Project have potential to adversely influence vegetation, effects on the occurrence and distribution or rare plant species and uncommon communities is likely to be minimal. Project activities are likely to directly disturb two species of conservation concern on the Donkin Peninsula (Kalm's hawkweed and Loesel's twayblade) but both are known to be associated with anthropogenically-modified habitats and their long-term persistence is unlikely to be jeopardized by the Project. Although construction and maintenance activities along the transmission corridor have potential to interact with a number of rare plants, effects are likely to be minimal given the nature of the development and the mitigative measures which have been outlined. Assuming design mitigation to maintain hydrological conditions in down-gradient locations and to treat wastewater from the mine discharge and surface runoff, indirect effects to vegetation are not anticipated to occur. Table 5.5.9 summarizes the residual environmental effects of the Project on Rare Plants.

Table 5.5.9 Summary of Project Residual Environmental Effects: Rare Plants

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics: Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context	Significance	Recommended Follow-up and Monitoring
Change in Rare Species and Uncommon Communities										
Construction	• Avoidance of direct effects to habitats known to support rare plants on Donkin Peninsula (*i.e.*, coastal barrens). • Compensation for loss of wetland habitat. • Avoidance of rare plants along transmission line. • Implementation of erosion and sediment procedures.	A	M	S	LT	O	I	D	N	• Rare plant and uncommon community surveys within Baileys Wetland and other wetlands which are proposed for direct effects by the Project (including directed surveys for southern twayblade). • Vegetation monitoring within wetlands which have potential for indirect hydrological effects. • Communication with NSPI regarding occurrence of rare plants along the transmission line route and recommend rare plant survey along the portion of the abandoned transmission RoW which has not yet been surveyed. • Compensation for loss of wetland habitat.

Table 5.5.9 Summary of Project Residual Environmental Effects: Rare Plants

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Effects Characteristics: Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context	Significance	Recommended Follow-up and Monitoring
Operation and Maintenance	• Maintenance of hydrological connectivity to Baileys Wetland through final selection of coal waste pile locations and/or construction of channels. • Treatment of wastewater from mine discharge and surface runoff. • Salt management procedures for site roadways. • Avoidance of disturbance to rare plants along transmission line during vegetation management.	A	M	S	LT	R	I/R	D	N	
Decommissioning and Reclamation	• Use of seed mixtures free of noxious weeds and use of native species (where available) during site reclamation.	A	L	S	LT	O	I	D	N	

Table 5.5.9 Summary of Project Residual Environmental Effects: Rare Plants

Project Phase	Mitigation/Compensation Measures	Residual Environmental Effects Characteristics							Significance	Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context		

KEY

Direction:
- P Improvement compared to baseline status
- N No change compared to baseline status
- A Negative change compared to baseline status

Magnitude:
- L Low: alteration to vegetation within the LAA but no influence on the distribution and abundance of rare plant species or unique communities
- M Moderate: alteration to rare plant populations or the distribution of uncommon plant communities, but no loss of rare plant species or unique communities from the LAA
- H High: alterations that result in the loss of a rare plant species or uncommon community from the LAA

Geographic Extent:
- S Site: effects restricted to habitat within the PDA
- L Local: effects extend beyond Project footprint but remain within the LAA
- R Regional: effects extend into the RAA

Duration:
- ST Short-term: measurable for less than one month
- MT Medium-term: measurable for more than one month but less than two years
- LT Long-term: measurable for the life of the Project

Frequency:
- O Once: effect occurs once
- R Rarely: effect occurs occasionally (*e.g.*, monthly)
- F Frequently: effect occurs regularly (*e.g.*, daily)

Reversibility:
- R Reversible: effects will cease during or after the Project is complete
- I Irreversible: effects will persist after the life of the Project

Environmental Context:
- U Undisturbed: : effect takes place within an area that is relatively unaffected by human developments or disturbances
- D Disturbed: effect takes place within an area that has been substantially influenced by human developments and disturbances

Significance:
- S Significant
- N Not Significant

5.5.5 Assessment of Cumulative Environmental Effects

In association with the Project environmental effects discussed above, an assessment of the potential cumulative environmental effects was conducted for other projects and activities that have potential to interact with the Project. Other projects and activities considered in the cumulative effects scoping are discussed in Section 4.2.4. Table 5.5.10 presents the potential cumulative environmental effects to the Rare Plant VEC, and ranks each interaction with other projects as 0, 1, or 2 with respect to the nature and degree to which important Project-related environmental effects overlap with those of other projects and activities. Projects and activities which are considered to have no cumulative interactions (*i.e.*, 0 ranking) are not discussed.

Table 5.5.10 Potential Cumulative Environmental Effects to Rare Plants

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects
	Change in Rare Species and Uncommon Habitats
Historic Coal Mining Activities	1
Donkin Coal Exploration Project	1

KEY

0 = Project environmental effects do not act cumulatively with those of other projects and activities.
1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of Project-specific or regional mitigation.

Activities related to historic and ongoing fishing activity, regional shoreline infilling/wharf development, marine shipping operations (including cruise ship traffic), port of Sydney development, Lingan and Point Aconi Power Stations, further ECBC remediation work, and remediation work scheduled for the rail centre at Victoria junction are not likely to interact with the Project to effect rare plants or uncommon communities. Several of these projects are targeted at marine environments and are therefore not anticipated to influence terrestrial habitats; such are addressed by the VEC. Other activities involve remediation work for areas which have been previously disturbed by anthropogenic activities – although the initial developments would have had potential to influence the occurrence of rare plant species and uncommon communities, restoration activities are not anticipated to influence these in any important way. Although historic development of the Lingan and Point Aconi Power Stations would have resulted in some disturbance to terrestrial habitats, the spatial extent of these projects and the Donkin Mine are such that an interaction is unlikely.

The Donkin Mine has potential to interact with some existing projects to affect rare plants or uncommon communities within the RAA, particularly historic coal mining activities, including those of the Donkin Coal Exploration Project. Although historical coal mining activities on the Donkin Peninsula have resulted in disturbance to vegetation (*i.e.*, along the access road and throughout the area occupied by the existing mine yard and infrastructure), the effects of these projects on rare plant species and uncommon communities is unknown. However, the current initiative is unlikely to interact with past disturbances to cause important adverse effects to this VEC. In particular, plant species of conservation interest which are likely to be disturbed by Project activities on the Donkin Peninsula are known to inhabit anthropogenically disturbed habitats. As such, there is potential for both past and present developments, both on the Donkin Peninsula and within the larger RAA, to have contributed to the amount of potentially available habitat for these species. Additionally, no uncommon plant communities are recognized on the Donkin Peninsula, thereby negating the potential for the Project to interact with other developments to adversely influence this biodiversity value. Based on these considerations, the cumulative effect of the Project and others within the RAA on rare plant species and uncommon communities is considered to be not significant and no regional mitigative measures are identified.

5.5.6 Determination of Significance

All phases of the Project (construction, operation and maintenance, decommissioning and reclamation) are likely to have an adverse effect on vegetation but effects to the occurrence of rare plant species and uncommon communities are minimal. Although two plant species of conservation interest on the Donkin Peninsula (Kalm's hawkweed and Loesel's twayblade) are likely to be directly disturbed, the long term survival of their populations within the Bras d'Or Lowlands and Cape Breton Coastal Ecodistricts is unlikely to be jeopardized. That is, both species are associated with anthropogenically-modified habitats and data indicate that there are numerous other records of Loesel's twayblade within the vicinity of the Project. Additionally, although there are uncertainties regarding the extent of habitat disturbance within the transmission corridor, effects to rare plants and uncommon communities are likely to be minimal given the nature of the development and the mitigative measures which have been outlined. Furthermore, indirect effects to vegetation will be avoided through a number of mitigative measures, including maintenance of hydrological conditions, treatment of wastewater from the mine discharge and surface runoff, and implementation of sediment control plans. Although effects are expected to be restricted to the PDA, they will be expressed for the life of the Project.

In consideration of the proposed mitigation and environmental protection measures, the environmental effect of a change in rare plant species or uncommon communities is considered to be not significant.

The characterization of the potential cumulative environmental effects and associated mechanisms, combined with the proposed mitigation measures proposed in Sections 5.5.4.1.2 indicate that the residual cumulative environmental effect of a change in rare plant species or uncommon communities as a result of past, present, and reasonably foreseeable projects and activities that have been or will be carried out, in combination with the environmental effects of the Project during all phases, on rare plants is rated not significant.

The environmental effect of the Project on rare plant species or uncommon communities, considering cumulative effects, is rated to be not significant.

5.5.7 Follow-up and Monitoring

Follow-up surveys for rare plant species and uncommon communities on the Donkin Peninsula will be conducted prior to construction activities. In particular, rare plant surveys will need to be conducted in wetland habitats in support of wetland alteration applications (*e.g.*, Baileys Wetland). Information on the occurrence of rare plants within the vicinity of the Project suggest that southern twayblade, a small orchid that is typically associated with the shaded sphagnum moss of bogs or treed swamps (Zinck 1998) could potentially be present within wetlands of the Donkin Peninsula. Because this species is only visible above ground for several weeks during late spring before it senesces, field surveys would have to be conducted in mid-June to determine its presence and distribution on the peninsula. This species is currently ranked as “May be at Risk” by NSDNR and “S2” by the ACCDC, and has been encountered throughout the province by Stantec botanists, including in nearby Port Morien. The current lack of records for this species within the province likely reflects its small stature and the limited time in which it is visible, and it is likely more widespread and abundant than current population status designations indicate. The current status assigned to this species by NSDNR indicates that it should be considered of high conservation concern.

In the event that disturbance to coastal barrens habitat is required, pre-disturbance surveys of the heathland and grassland communities will be conducted. In particular, surveys will document the location, extent, and composition of the coastal grasslands on the Donkin Peninsula and will identify the location and abundance of broom crowberry throughout the coastal barrens. Soil descriptions of the coastal heathland and grassland communities will also be conducted at this time, with particular emphasis being directed at the identification of upland organic folisols.

Vegetation monitoring will be conducted within wetlands because of the potential for indirect hydrological and chemical influences to these environments. In particular, where direct effects (*i.e.*, infilling) of wetlands are proposed, semi-permanent wetland plots will be established in adjacent habitats to determine whether they are adversely influenced by alterations. Specific details regarding the level of monitoring effort will be determined in consultation with NSE following final Project layout. A community-level approach to vegetation monitoring will be adopted, with changes to the integrity of wetland habitats being interpreted using a variety of indicators, including the presence of non-native species.

A wetland habitat compensation plan will be developed in consultation with NSDNR and NSE prior to wetland disturbance. Compensation requires that the residual effects on wetlands be compensated by the enhancement, restoration, or creation of wetland habitat at an area ratio commensurate with the loss. More detailed information on the compensation plan and other mitigative measures related to minimizing the effect of the Project on wetland vegetation is provided in Section 5.4 (Wetland VEC).

Data on the known distribution of rare plants within the transmission line corridor will be communicated to NSPI for their use during construction and maintenance activities. It is recommended that a qualified botanist or similarly qualified professional will be engaged to identify the locations of known rare plant occurrences along the transmission route to assist in their avoidance. Furthermore, it is recommended that NSPI perform rare plant surveys along the portion the portion of the abandoned transmission RoW which has not been surveyed.

5.6 FRESHWATER FISH AND FISH HABITAT

Freshwater Fish and Fish Habitat is included as a VEC because of the potential interactions that both may have with the Project and because both fall under regulatory protection. For these reasons, Freshwater Fish and Fish Habitat were also included in the EIS guidelines. The primary freshwater system with the potential for Project-VEC interactions on the Donkin Peninsula is Schooner Pond (surrounded by Baileys Wetland) and its tributaries. This freshwater system has the potential to be affected by long-term disposal of coal waste as well as the water treatment associated with mining activities. Several additional freshwater systems exist along the transmission line route between the Project site and Victoria Junction.

While surface water quality is being assessed as part of an independent VEC (see Section 5.2), it is also a component of fish habitat. As such, a high-level discussion of water quality as it relates to fish and fish habitat will be included in this section. Freshwater fish and fish habitat are also affected by changes in associated wetlands and hydrology; however, potential interactions between Project activities and these components of the aquatic environment are addressed in Section 5.4 (Wetlands) and Section 5.2 (Water Resources).

In the context of the Freshwater Fish and Fish Habitat VEC, the following definitions apply:

"Fish" is defined in Section 2 of the *Fisheries Act* and includes: (a) parts of fish, (b) shellfish, crustaceans, and any parts of shellfish, or crustaceans, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, and crustaceans.

"Fish habitat" as defined in Section 34(1) of the *Fisheries Act* includes spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes. Fish habitat will be assumed to include the physical (*e.g.*, substrate/sediment, temperature, flow velocity and volumes, riparian vegetation), chemical (*e.g.*, water quality), and biological (*e.g.*, fish, benthic macroinvertebrates, periphyton, aquatic macrophytes) attributes of the aquatic environment that are required by fish to carry out life cycle processes. In this context, surface water quality is described as the chemical, physical (*e.g.*, temperature, clarity), and biological (*e.g.*, bacteria, algae) attributes of surface water as they relate to the protection of aquatic life.