



**HALIFAX REGIONAL MUNICIPALITY
FUTURE SERVICED COMMUNITIES**

**FINAL REPORT
VOLUME 5: MORRIS LAKE STUDY AREA
REPORT – LAND SUITABILITY ANALYSIS**

January 14, 2024

Prepared for:
Halifax Regional Municipality

Prepared by:
Stantec Consulting Ltd

Project Number:
160410459

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Appendix C	Wildlife Observations
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3 Land Suitability Analysis

Stantec Consulting Ltd. (Stantec) completed a land suitability analysis of four potential Future Serviced Communities (FSC) within HRM: Sandy Lake, Highway 102 West Corridor, Morris Lake Expansion, and Westphal. The land suitability analysis included an evaluation of select biophysical characteristics, a contaminated sites review, and an archaeological and cultural study for each Study Area. The objective of the land suitability analysis was to determine what portions of each Study Area are potentially suitable for new housing development based on these limited characteristics. This analysis, along with other factors, will contribute to informed decision-making regarding future community planning work.

This section discusses the work completed in the Morris Lake Study Area (MLSA; Figure 3.1). The terms “MLSA” and “Study Area” are used interchangeably in this section; both refer to the Study Area indicated on Figure 3.1. Note that not all areas within the Study Area (Figure 3.1) are being considered for future development (e.g., if they are privately owned and/or are already developed).

There are many possible ways to evaluate biophysical characteristics and the roles they play in the landscape. The land suitability analysis described in this report is one approach to evaluate biophysical components and the impact they could have on development, and vice versa, and needs to be considered in the context of climate change. Results of the landscape suitability analysis are intended to be considered alongside other study components (e.g., watershed nutrient load modelling, stormwater modelling, transportation studies and engagement activities) to inform the decision-making process for future community planning work. Additional work may be undertaken to further understand the biophysical components of the Study Area.

Land suitability analysis is an evaluation of the current landscape and environmental features within that landscape to be able to suggest areas that may be relatively more or less conducive to development considering a wide range of factors. It is acknowledged that climate change may affect some of these factors regarding land suitability in the future. For example, changes in precipitation rates and distribution related to future climate change could, over time, result in changes to surface water hydrology and wetlands and the habitats they support. It could also result in changes to the distribution of rare or uncommon species due to changes to natural habitats and migration patterns. Modelling these changes and related timeframes in localized candidate development areas would be challenging and is beyond the scope of this analysis.



3.1 Overall Study Approach

The land suitability analysis for the MLSA included both desktop and field components. Information was also gathered through targeted stakeholder engagement efforts. The desktop component involved a review of existing data for the MLSA, including information gathered through previous studies provided by HRM. Desktop sources included:

- Atlantic Canada Conservation Data Centre (AC CDC) data for a 5 km radius around the MLSA
- Nova Scotia Department of Natural Resources and Renewables (NSDNRR) Forest Inventory data
- NSDNRR Wetland Inventory data (and the Nova Scotia Environment and Climate Change [NSECC] Wetlands of Special Significance [WSS] layer)
- Wet Areas Mapping (WAM) data (Forest Watershed Research Centre 2012)
- Boreal felt lichen habitat model (Cameron and Neily 2008)
- Aerial imagery and LiDAR data
- The Halifax Green Network Plan (HGPN)

In addition to the desktop review, Stantec completed a variety of field surveys (spring-fall 2023) to collect further information on environmental components and evaluate the potential for areas of cultural significance.

The land suitability analysis addresses the following components:

- Wetland Habitat
- Watercourses and Water Quality
- Forest Habitat and Species at Risk
- Landscape Connectivity
- Surficial and Bedrock Geology
- Topography
- Contaminated Sites
- Areas of Cultural Significance

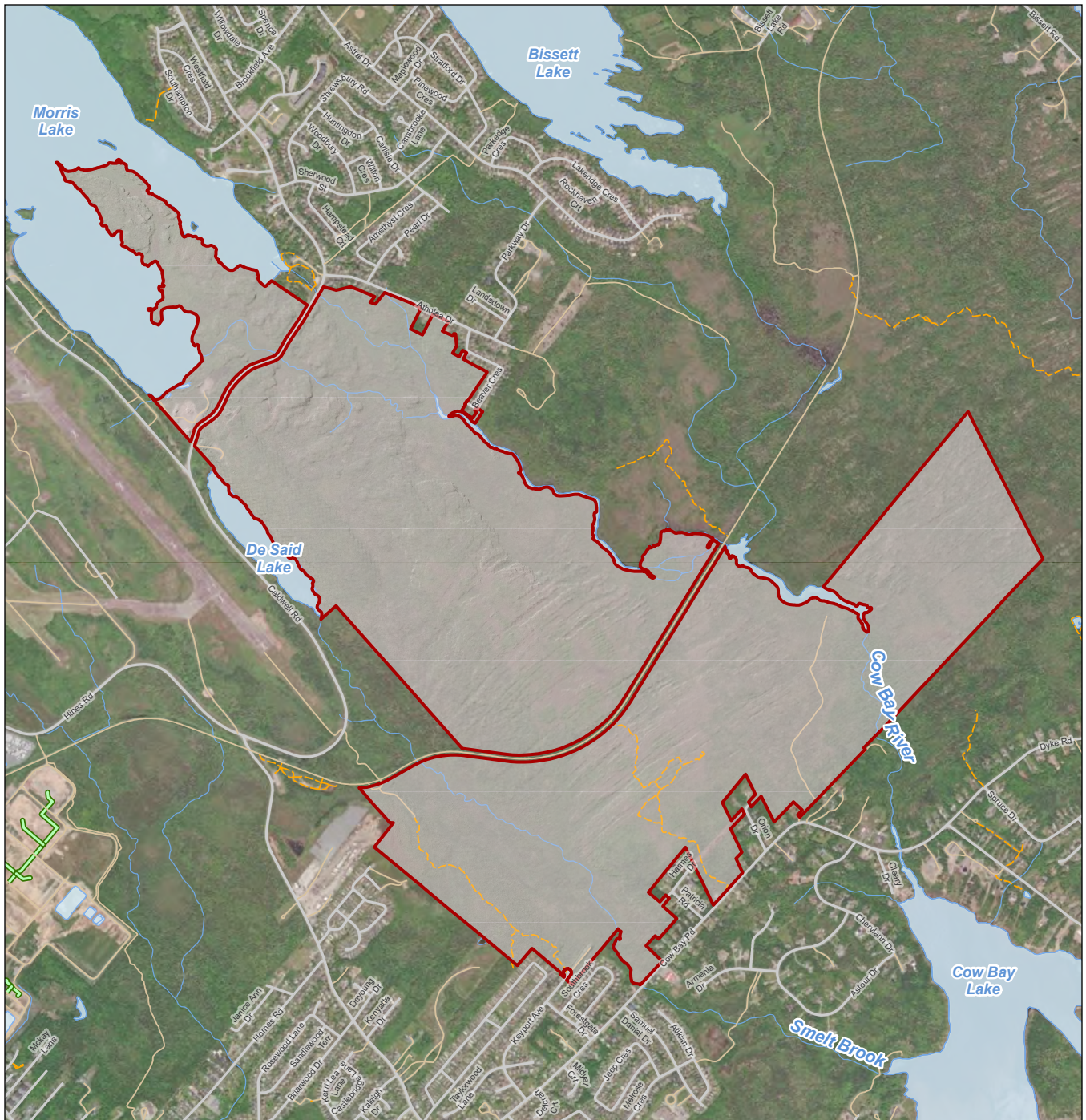
Sections 3.2 through 3.8 describe desktop and field results followed by details about how each environmental component was evaluated from a land suitability perspective. Suitability for development was generally ranked as follows:

- a score of 1 indicates low suitability for development
- a score of 2 indicates moderate suitability for development
- a score of 3 indicates high suitability for development

Lower scores generally correspond to areas with higher ecological function, making them generally more suitable for conservation purposes and potentially less suitable for development. Conversely, higher scores indicate lands that are potentially less desirable for conservation efforts and potentially more suitable for development. It is important to note that many factors, in addition to those addressed in this section, contribute to suitability for development and/or conservation, including views expressed by members of the public, other stakeholders and Indigenous groups. Therefore, the information presented here should not be viewed in isolation.



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- Study Area
- Utilities
- Pipeline
- Transportation
- Road
- Resource / Seasonal Road
- Trail

- Other Features
- Waterway
- Waterbody

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Nova Scotia

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Background Studies

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Figure No.

3.1

Title
**Morris Lake Expansion Study Area
(MLSA)**

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Government of Nova Scotia,
Department of Service Nova Scotia and Internal
Services
3. Background: Government of Nova Scotia,
Department of Service Nova Scotia and Internal
Services

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3.2 Wetland Habitat

The objective of the wetland evaluation was to determine where wetland habitat exists within the MLSA and determine if any Wetlands of Special Significance (WSS) are present. Having a general understanding of where the wetland boundaries are within the MLSA will support development planning and guide future wetland evaluations required to support permitting.

Wetland conservation in Nova Scotia is guided by the Nova Scotia Wetland Conservation Policy and supported by regulation under the provincial *Environment Act* and Activities Designation Regulations. The goals of the policy are to have no loss of WSS and to prevent net loss in area and function for other wetlands (Government of Nova Scotia 2011).

Current NSECC guidance indicates that wetland evaluation (i.e., delineation and functional assessment) should be completed in the same year (within 12 months) of permitting application submissions. Considering this guidance and the current stage of planning, wetland evaluation to support permitting applications was not proposed as part of the current scope of work. To inform planning, Stantec instead completed a desktop review and identified potential wetland areas. Subsequent field surveys helped to refine these boundaries.

3.2.1 DESKTOP AND FIELD SUMMARY

The wetland areas presented on Figure 3.2 were developed based on a combination of desktop and field information. Prior to field surveys, preliminary wetland areas were interpreted using LiDAR and aerial imagery. During field surveys, boundaries of these preliminary wetland areas were verified as they were encountered or adjusted as necessary. Any additional wetlands encountered during field surveys (i.e., that had not been identified through desktop review) were noted. Wetlands in the MLSA were categorized by class and type following the Canadian Wetland Classification System (CWCS). Wetland function was evaluated using the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC) method, which consists of both field and office forms (NBDELG 2018). Twenty-six wetlands were identified within the MLSA, and thirteen were evaluated using WESP-AC (Table 3.1).

Multiple extreme weather events throughout the 2023 field season (i.e., wildfires and floods) resulted in some unsafe and/or inaccessible areas within the MLSA, and access to all properties within the MLSA had not been attained prior to field surveys. Therefore, due to these operational constraints, not all wetlands were evaluated using WESP-AC in 2023, although attempts were made to evaluate as many as possible. Wetlands not evaluated using WESP-AC are among the smallest wetlands on site (except for WL16). As per NSECC guidance, further wetland evaluation (i.e., delineation and functional assessment) will be required (prior to construction) to support permitting applications.



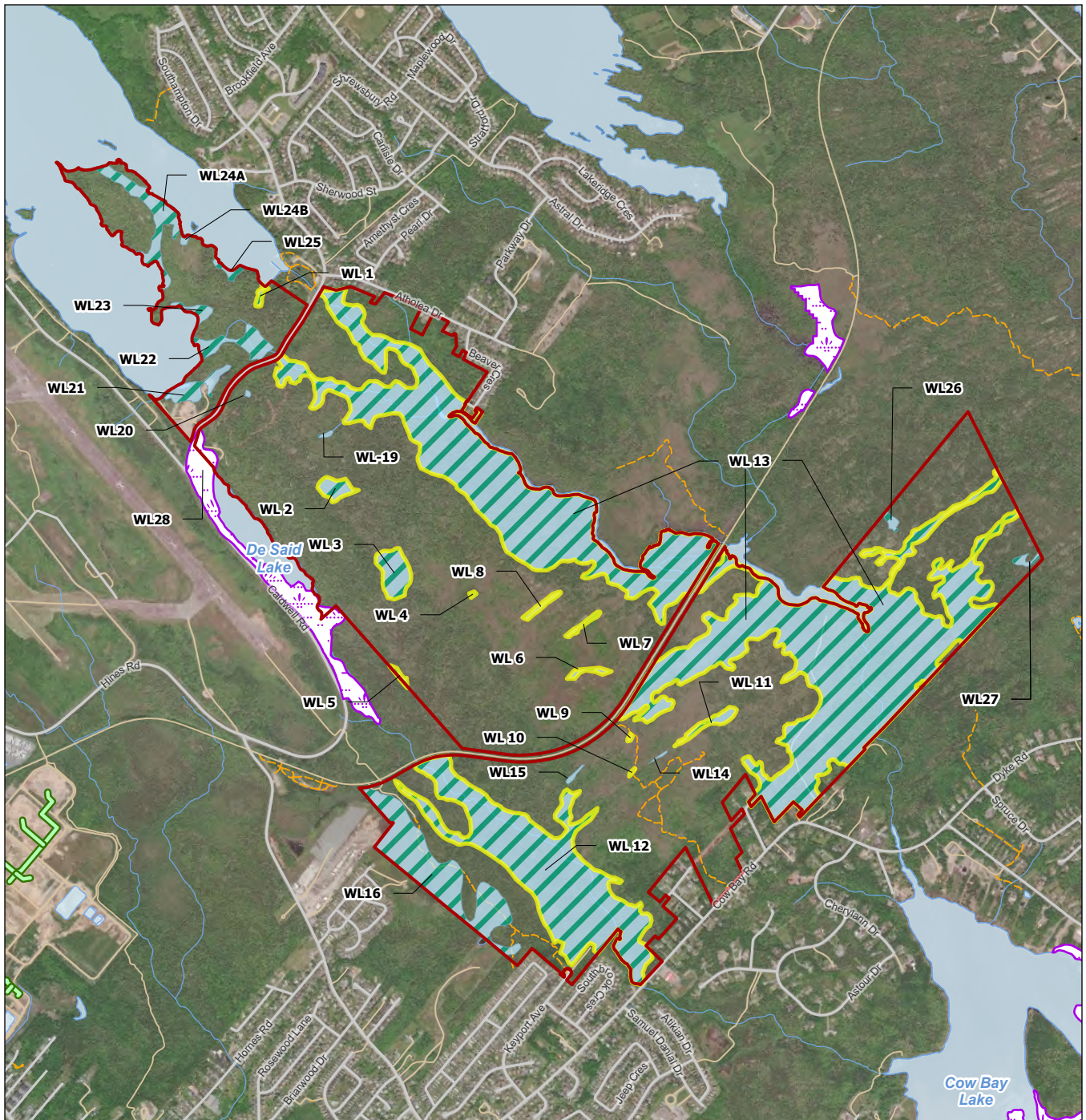
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Table 3.1 Summary of Wetland Evaluation Results

Wetland ID	Wetland Class and Type	Approximate Wetland Area (ha)	Evaluated using WESP-AC	WSS¹
WL1	Fen, Mixedwood Treed Swamp	0.20	Yes	No
WL2	Fen	0.96	Yes	No
WL3	Coniferous Treed Swamp, Mixedwood Treed Swamp	2.10	Yes	No
WL4	Coniferous Treed Swamp	0.04	Yes	No
WL5	Coniferous Treed Swamp	0.18	Yes	No
WL6	Fen	0.29	Yes	No
WL7	Slope Fen	0.21	Yes	No
WL8	Mixedwood Treed Swamp, Tall Shrub Swamp	0.33	Yes	No
WL9	Low Shrub Swamp	0.04	Yes	No
WL10	Low Shrub Swamp	0.03	Yes	No
WL11	Coniferous Treed Swamp, Low Shrub Swamp	0.74	Yes	No
WL12	Coniferous Treed Swamp, Tall Shrub Swamp, Plateau Bog	27.56	Yes	No
WL13	Coniferous Treed Swamp, Tall Shrub Swamp, Bog, Mixedwood Treed Swamp	101.57	Yes	No
WL14	Coniferous Treed Swamp, Low Shrub Swamp	0.06	No	NA
WL15	Mixedwood Treed Swamp	0.14	No	NA
WL16	Coniferous Treed Swamp, Low Shrub Swamp	10.59	No	NA
WL19	Mixedwood Treed Swamp	0.10	No	NA
WL20	Mixedwood Treed Swamp	0.06	No	NA
WL21	Mixedwood Treed Swamp, Coniferous Treed Swamp, Fen	1.49	No	NA
WL22	Mixedwood Treed Swamp, Fen	1.96	No	NA
WL23	Low Shrub Swamp, Mixedwood Treed Swamp	0.62	No	NA
WL24	Low Shrub Swamp, Mixedwood Treed Swamp, Fen	3.43	No	NA
WL25	Coniferous Treed Swamp	0.38	No	NA
WL26	Coniferous Treed Swamp	0.29	No	NA
WL27	Coniferous Treed Swamp	0.30	No	NA
WL28	Swamp ²	0.70	No	Yes
Notes 1 – As indicated in the Nova Scotia Wetland Conservation Policy, a wetland can be considered a WSS based on a variety of factors. The information in this column for wetlands 1-28 is based on the results of the WESP-AC functional WSS interpretation tool. Further surveys, observations, and/or evaluation could result in any of these wetlands being considered a WSS. Note that WL28 is considered a WSS based on the provincial WSS layer. 2 – According to the NS Provincial Landscape viewer WL – Wetland NA – Not Assessed				



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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec; Service Nova Scotia NSTDB; Government of Nova Scotia Environment and Climate Change
3. Background: ESRI 2023

- Study Area
 - Wetlands (Stantec, 2023)
 - Wetlands Evaluated Using WESP-AC (Stantec, 2023)
 - Wetland of Special Significance (NSECC)
- Transportation**
- Road
 - Resource / Seasonal Road
 - Trail
- Utilities**
- Pipeline
- Other Features**
- Waterway
 - Waterbody

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Future Serviced Communities
Background Studies

Fig ID: 160410459_011a

Figure No.

3.2

Title

Wetlands in the MLSA

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3.2.2 LAND SUITABILITY ANALYSIS – WETLANDS

The WESP-AC functional assessment method is currently the accepted standardized approach for assessing wetland function in Atlantic Canada. WESP-AC generates scores and ratings for a variety of wetland functions (e.g., water storage, carbon sequestration, habitat characteristics – refer to Table 3.5). The scores and ratings that result from the functional assessment can be used to inform decisions about development near wetlands (NBDELG 2018). In Nova Scotia, WESP-AC includes a functional WSS interpretation tool, to help determine if the wetland should be considered a WSS.

The land suitability analysis for wetlands considered the level of ecosystem function each wetland provides based on the WESP-AC functional assessment results. Wetlands were scored using the WESP-AC results for ecological condition, wetland risk, the composite function score, and the WSS interpretation tool (Table 3.2). Taken together, this evaluation system provides a relative ranking of wetland values in terms of conservation and development potential. Higher conservation values generally resulted in a lower ranking for development suitability with lower conservation values generally resulting in higher suitability for development based on this ranking matrix.

As discussed in Section 3.1.2, not all wetlands in the Study Area could be evaluated using WESP-AC. Wetlands that were not evaluated using WESP-AC were not included in the land suitability analysis.

Table 3.2 Wetlands – Land Suitability Ranking Framework

Inputs	Land Suitability Ranking		
	1 - Low suitability for development	2 - Moderate suitability for development	3 - Higher suitability for development
WESP-AC Ecological Condition	Higher	Moderate	Lower
WESP-AC Risk	Higher	Moderate	Lower
Land Suitability Function Score ¹	51-40**	39-29	28-17*
WESP-AC Functional WSS Interpretation Tool	None of the 13 wetlands evaluated using WESP-AC were determined to be a WSS using the WESP-AC Functional WSS Interpretation Tool		
Note: 1 – Derived from the WESP-AC function (composite score) *17 is the lowest possible score if all functions are assigned a 1 **51 is the highest possible score			



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3.2.2.1 Ecological Condition

Wetland ecological condition is determined by the WESP-AC Non-Tidal form for Nova Scotia. It is defined in the WESP-AC Manual as the integrity or health of the wetland determined primarily by its vegetation composition (because that is the only meaningful indicator that can be estimated rapidly). The tool states that non-tidal wetlands in excellent ecological condition often have no invasive plants and at least one species of conservation concern. Equally, they have little bare ground, no strongly dominant herbaceous or shrub species, and may have varied microtopography and no extensive algal blooms. However, many wetlands perceived to be in excellent condition do not have any of these characteristics (NBDELG 2018). Thus, wetlands with higher ecological conditions are prioritized for avoidance for development as they are more likely to support higher biodiversity compared to lower scoring wetlands.

For each of the 13 wetlands assessed using WESP-AC, a value is calculated for ecological condition which is ranked as Lower, Moderate or Higher through a comparison with calibrated wetlands for the region (Table 3.3). This output value is ranked based on the output status and assigned values of 3, 2 or 1. Wetlands with higher ecological function are assigned a lower value for development suitability, compared to wetlands with lower ecological function, which are assigned a higher suitability for development. Wetlands that could not be evaluated using WESP-AC were not provided a score for ecological condition for this land suitability analysis. The majority of the wetlands scored Higher for Ecological Condition, with few scoring Moderate and Lower.

Table 3.3 Ecological Condition Scores

Wetland ID	Ecological Condition Score	Ecological Condition Ranking	Land Suitability Ranking ¹
WL1	7.10	Higher	1
WL2	4.78	Moderate	2
WL3	4.78	Moderate	2
WL4	3.04	Lower	3
WL5	3.04	Lower	3
WL6	4.78	Moderate	2
WL7	8.26	Higher	1
WL8	7.39	Higher	1
WL9	7.39	Higher	1
WL10	7.39	Higher	1
WL11	8.26	Higher	1
WL12	7.10	Higher	1
WL13	8.26	Higher	1
Notes:			
1 - Low suitability for development 2 - Moderate suitability for development 3 - Higher suitability for development			



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3.2.2.2 Wetland Risk

Wetland risk is determined by the WESP-AC Non-Tidal form for Nova Scotia. Wetland risk is defined in the WESP-AC Manual as the average of the wetland sensitivity score and the wetland stressors score. The WESP-AC Manual defines wetland sensitivity as the lack of intrinsic resistance and resilience of the wetland to human and natural stressors (Niemi et al. 1990), including but not limited to changes in water chemistry, shade, frequency and duration of inundation or soil saturation, water depth, biological invasion, habitat fragmentation, and others as described in the USEPA report by Adamus et al. (2001) (NBDELG 2018). Wetland stress is defined as the degree to which the wetland is or has recently been altered by, or exposed to risk from, human-related factors that degrade its ecological condition and/or reduce its capacity to perform one or more of the functions listed in the form (NBDELG 2018). Thus, wetlands with higher risk are relatively more vulnerable to disturbance associated with development and as such should be avoided as areas for development compared to wetlands with more risk tolerance.

For each of the 13 wetlands assessed using WESP-AC, a value was calculated for wetland sensitivity and wetland stressors which were ranked Lower, Moderate or Higher compared to the calibrated wetlands for the region. This output value was ranked based on the output status and assigned values of 3, 2 or 1 (Table 3.4). Wetlands with higher risk (i.e., greater sensitivity) were assigned a lower value (1) for potential development, compared to wetlands with lower risk function. Wetlands that could not be evaluated using WESP-AC were not provided a score for wetland risk for this land suitability analysis. Six of the assessed wetlands scored Higher for wetland risk and were assigned a land suitability ranking of 1 for wetland risk (Table 3.4).

Table 3.4 Wetland Risk Scores

Wetland ID	Wetland Risk Score ¹	Wetland Risk Ranking	Land Suitability Ranking
WL1	5.46	Moderate	2
WL2	8.24	Higher	1
WL3	8.82	Higher	1
WL4	7.87	Higher	1
WL5	5.89	Moderate	2
WL6	6.25	Moderate	2
WL7	7.21	Higher	1
WL8	6.52	Moderate	2
WL9	5.33	Moderate	2
WL10	6.12	Moderate	2
WL11	7.37	Higher	1
WL12	7.55	Higher	1
WL13	6.40	Moderate	2

Notes: 1 - This number is an average of the WESP-AC scores for wetland sensitivity and stressors

1 - Low suitability for development

2 - Moderate suitability for development

3 - Higher suitability for development



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3.2.2.3 Function (Composite Score) Descriptions

The wetland function (composite score) was calculated using the WESP-AC wetland function scores determined by the WESP-AC Non-Tidal protocol developed for Nova Scotia (Adamus 2018). Functions that are considered in the WESP-AC evaluation are presented in Table 3.5.

While the land suitability analysis for wetlands considers the composite function score, scores for individual functions for each wetland could be separately considered if those individual functions are particularly important when considering future development scenarios. For example, the function scores for water storage may be particularly important for certain development scenarios. The scores for each of the assessed wetlands can be viewed in Table 3.7 and the thresholds for function scores are presented in Table 3.6. Using wetland WL12 as an example, Table 3.7 indicates that this wetland scored a 0.96 for water storage, which (according to Table 3.6) is considered low. WL3, on the other hand, scored a 9.54 for water storage, which is considered high.

Table 3.5 Wetland Functions

Function		Description
WS	Water Storage	The effectiveness of a wetland for storing or delaying the downslope movement of surface water for long or short periods. This potentially influences the height, timing, duration, and frequency of inundation in downstream and downslope areas. Many of the region's wetlands can perform this function.
SFS	Stream Flow Support	The effectiveness of a wetland for prolonging surface water in headwater streams during seasonally dry periods. This is important for fish passage and overall ecological support
WC	Water Cooling	The effectiveness of a wetland for maintaining or reducing the water temperature, primarily in headwater streams. Many of the region's wetlands are capable of performing this function.
SR	Sediment Retention	The effectiveness of a wetland for intercepting and filtering suspended inorganic sediments, allowing their deposition, reducing current velocity, resisting erosion, and stabilizing underlying sediments or soil. Many of the region's wetlands are capable of performing this function.
PR	Phosphorus Retention	The effectiveness for retaining phosphorus for long periods as a result of chemical adsorption complexation, or from translocation by plants to belowground zones or decay-resistant peat such that there is less potential for physically or chemically remobilizing phosphorus into the water.
NR	Nitrate Removal	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonia to nitrogen gas, primarily through the microbial process of denitrification, while generating little or no nitrous oxide (a potent "greenhouse gas").
CS	Carbon Sequestration	The effectiveness of a wetland both for retaining incoming particulate and dissolved carbon, and through the photosynthetic process, converting carbon dioxide gas to organic matter (particulate or dissolved). And to then retain that organic matter on a net annual basis for long periods while emitting little or no methane (a potent "greenhouse gas").
OE	Organic Nutrient Export	The effectiveness of a wetland for producing, rapidly cycling, and subsequently exporting organic matter, either particulate (detritus) or dissolved, and including net export of nutrients (C, N, P, Si, Fe) comprising that matter. It does not include exports of carbon in gaseous form (methane and carbon dioxide) or as animal matter (e.g., emerging aquatic insects, fish).



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Table 3.5 Wetland Functions

Function		Description
FA	Anadromous Fish Habitat	The capacity to support an abundance of native anadromous fish for functions other than spawning.
FR	Resident Fish Habitat	The capacity to support an abundance and diversity of native non-anadromous fish. The model described below will not predict habitat suitability accurately for every species, nor is it intended to assess the ability to restore fish access to a currently inaccessible wetland.
INV	Aquatic Invertebrate Habitat	The capacity to support an abundance and diversity of invertebrate animals which spend all or part of their life cycle underwater, on the water surface, or in moist soil. Includes dragonflies, aquatic flies, clams, snails, crustaceans, aquatic beetles, aquatic worms, aquatic bugs, and others, including semi-aquatic species.
AM	Amphibian & Reptile Habitat	The capacity of a wetland to support an abundance and diversity of native amphibians (frogs, toads, salamanders) as well as turtles.
WBF	Waterbird Feeding Habitat	The capacity to support an abundance and diversity of feeding waterbirds, primarily the migratory species present outside of the usual nesting season.
WBN	Waterbird Nesting Habitat	The capacity to support an abundance and diversity of nesting waterbirds.
SBM	Songbird, Raptor & Mammal Habitat	The capacity to support, at multiple spatial scales, an abundance and diversity of songbirds, raptors, and mammals, especially species that are most dependent on wetlands or water.
POL	Pollinator Habitat	The capacity to support pollinating insects, such as bees, wasps, butterflies, moths, flies, and beetles, and also pollinating birds (hummingbirds and perhaps others).
PH	Native Plant Habitat	The capacity to support, at multiple spatial scales, a diversity of native vascular and non-vascular (e.g., bryophytes, lichens) species and functional groups, especially those that are most dependent on wetlands or water.
Reference: NBDELG 2018		

The score of each of the functions presented in Table 3.5 was evaluated using the WESP-AC thresholds, which are described in Table 3.6. The scores were then converted to values of 1, 2 or 3. These values correspond to the output of the WESP-AC model of lower, moderate, and higher, respectively. The sum of these values was calculated for each wetland evaluated by WESP-AC and assigned an overall land suitability function score (Table 3.7). The land suitability function scores were then converted to a land suitability ranking, with higher functioning wetlands scoring lower in preference for development due to the higher contribution of ecosystem functions provided by these wetlands (Table 3.7). All the assessed wetlands scored moderate for development (39-29), except for WL13 which scored a total of 42 which falls in the lower suitability for development category (51-10) (Table 3.7).



**HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES
FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY
ANALYSIS**

Table 3.6 Thresholds for Function Scores

Function	Lower if $\leq$	Higher if $\geq$
Water Storage (WS)	3.80	7.63
Stream Flow Support (SFS)	1.51	4.62
Water Cooling (WC)	2.04	5.29
Sediment Retention & Stabilization (SR)	3.54	6.44
Phosphorus Retention (PR)	3.00	6.67
Nitrate Removal (NR)	2.76	4.62
Carbon Sequestration (CS)	3.22	6.36
Organic Nutrient Export (OE)	0	7.46
Anadromous Fish Habitat (FA)	0.96	2.87
Resident Fish Habitat (FR)	1.30	5.14
Aquatic Invertebrate Habitat (INV)	3.42	5.43
Amphibian & Reptile Habitat (AM)	3.56	6.67
Waterbird Feeding Habitat (WBF)	0	6.43
Waterbird Nesting Habitat (WBN)	2.36	6.55
Songbird, Raptor, & Mammal Habitat (SBM)	0	7.52
Native Plant Habitat (PH)	0	7.95
Pollinator Habitat (POL)	3.57	6.23
Notes: Moderate ranking assigned if value falls between the lower and higher threshold value Threshold values of 0 occur when calibrated wetlands frequently score 0 for a given function From WESP-AC Non-Tidal Form 2021: Nova Scotia Normalization Reference Values		



Table 3.7 Wetland Function Scores

Wetland ID	WESP-AC Normalised Function Scores ¹																	Land Suitability Function Score ²	Land Suitability Ranking ³
	WS	SFS	WC	SR	PR	NR	CS	OE	FA	FR	INV	AM	WBF	WBN	SBM	POL	PH		
WL1	6.56	0.00	8.15	10.0	10.0	10.0	4.88	6.91	0.00	0.00	5.73	2.04	7.35	6.74	8.35	8.12	3.67	39	2
WL2	6.89	0.00	6.65	10.0	10.0	10.0	5.04	8.23	0.00	0.00	6.18	4.60	5.05	6.46	8.68	8.18	3.17	38	2
WL3	9.54	0.00	0.00	7.86	2.40	10.0	8.57	8.32	0.00	0.00	5.61	2.73	0.00	0.00	5.79	7.54	3.25	31	2
WL4	6.05	0.00	6.75	10.0	10.0	10.0	5.39	8.29	0.00	0.00	5.96	3.60	4.61	6.58	6.89	6.92	0.97	37	2
WL5	1.89	5.59	8.15	4.35	3.88	3.02	5.49	10.0	0.00	0.00	5.88	4.86	4.76	6.31	8.45	6.38	3.34	35	2
WL6	6.12	0.00	5.90	10.0	10.0	10.0	4.27	7.91	0.00	0.00	3.91	4.07	4.66	5.68	8.08	7.25	1.88	36	2
WL7	1.39	2.79	7.38	1.68	4.37	1.68	3.59	10.0	0.00	0.00	5.31	3.58	4.58	5.44	6.77	7.72	2.46	30	2
WL8	8.98	0.00	0.00	6.44	4.33	10.0	6.80	8.32	0.00	0.00	7.45	2.52	0.00	0.00	5.67	7.39	3.11	31	2
WL9	6.55	0.00	6.75	10.0	10.0	10.0	0.00	8.12	0.00	0.00	4.47	3.55	3.89	4.13	7.06	8.92	3.28	34	2
WL10	5.78	0.00	6.75	10.0	10.0	10.0	0.47	8.02	0.00	0.00	4.55	2.96	3.99	3.75	6.95	8.11	2.96	34	2
WL11	8.39	0.00	0.00	5.73	1.95	10.0	6.45	9.59	0.00	0.00	7.27	2.17	0.00	0.00	5.28	8.77	3.17	31	2
WL12	0.96	6.69	7.40	3.07	1.05	2.51	2.34	9.65	4.68	5.02	5.72	4.10	4.77	5.72	8.75	9.38	5.24	36	2
WL13	1.79	6.00	5.60	4.53	0.00	3.90	4.00	9.54	6.94	7.82	8.78	6.21	6.96	7.78	7.78	8.23	6.08	42	1
Notes: 1 – The normalised function scores (found in the scores tab of each WESP-AC form) are summarized here for the 19 wetlands evaluated using WESP-AC. The values were categorized as higher, moderate, lower according to the thresholds presented in Table 3.6. 2 – The land suitability function score is the sum of the function scores after they have been converted to higher (1), moderate (2), or lower (3). 3 – The land suitability ranking is based on the land suitability function score.																			
1 - Low suitability for development 2 - Moderate suitability for development 3 - Higher suitability for development																			

**HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES
FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY
ANALYSIS**

3.2.2.4 Summary and Recommendations

Twenty-six wetlands were identified in the MLSA using the approach described in Section 3.2.1. Due to the operational constraints (discussed in Section 3.2.1), thirteen of the twenty-six wetlands in the Study Area were evaluated using WESP-AC and are included in the land suitability analysis. The land suitability analysis for wetlands considered the level of ecosystem function each wetland provides based on the WESP-AC functional assessment results. Wetlands were scored using the WESP-AC results for ecological condition (Table 3.3), wetland risk (Table 3.4), the composite function score (Table 3.7), and the WSS interpretation tool. These results are summarized in Table 3.8 and presented on Figure 3.3.

Table 3.8 Wetlands – Land Suitability Rankings

Wetland ID	Land Suitability Ranking			Average LSA Score ¹
	Ecological Condition	Wetland Risk	Function	
WL1	1	2	2	1.6
WL2	2	1	2	1.6
WL3	2	1	2	1.6
WL4	3	1	2	2
WL5	3	2	2	2.3
WL6	2	2	2	2
WL7	1	1	2	1.3
WL8	1	2	2	1.6
WL9	1	2	2	1.6
WL10	1	2	2	1.6
WL11	1	1	2	1.3
WL12	1	1	2	1.3
WL13	1	2	1	1.3
Notes:				
1 – Average Land Suitability Analysis (LSA) Score is rounded to the nearest decimal				
1 - Low suitability for development 2 - Moderate suitability for development 3 - Higher suitability for development				

Wetlands that were not evaluated using WESP-AC are shown in grey on Figure 3.3. Note that while the WESP-AC functional WSS interpretation tool was included as a component of the analysis, none of the thirteen wetlands evaluated using WESP-AC were determined to be WSS using that method. Wetlands not evaluated using WESP-AC (WL14 to WL27) will require further wetland evaluation if these wetlands are to be considered in the land suitability analysis.



HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY ANALYSIS

Wetlands represent an important constraint for any development in Nova Scotia. Conservation of wetlands in the province is guided by the Nova Scotia Wetland Conservation Policy and supported by regulation under the provincial *Environment Act* and Activities Designation Regulations. The goals of the policy are to have no loss of WSS and to prevent net loss in area and function for other wetlands (Government of Nova Scotia 2011). The policy states that the following are considered WSS:

- 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 SARA or the NS ESA
- wetlands in designated protected water areas as described within Section 106 of the *Environment Act*

Support/approval for alteration of a WSS will only be considered when the alteration is required to maintain, restore, or enhance a WSS, or if the alteration is deemed to provide necessary public function (Government of Nova Scotia 2011). While none of the wetlands in the MLSA evaluated using WESP-AC (i.e., 13 out of 26) were determined to be WSS, there are multiple factors that can result in a wetland being considered a WSS and further work and/or consultation with regulators may result in any of the wetlands within the MLSA being considered a WSS.

The provincial WSS layer is a screening tool to identify potential WSS in the province. According to the predictive layer, the wetland along the edge of De Said Lake (WL28) has potential to be a WSS, due to a historical record of eastern whip-poor-will in 2008 (AC CDC 2023). Further work may be required to evaluate whether this wetland should be considered a WSS. In addition to the historical eastern whip-poor-will record, it is likely that snapping and/or eastern painted turtles could be found in De Said Lake.

As indicated in the Policy, wetland conservation is achieved by considering the mitigative sequence (avoidance, minimization, compensation). This sequence should be considered during the planning and design stage of any development.

The first step in the sequence (and the priority) is avoidance. This option involves avoiding alteration to wetlands, forcing the consideration of alternative options for the project that may result in fewer impacts to wetlands. If no other alternative option exists, minimization is recommended, meaning that any unavoidable impacts to the wetland be managed in such a way that adverse impacts are reduced. This can be accomplished through specific techniques, materials, and/or site choice. Compensation is required for any permanent loss of wetland area or function. Compensation can be in the form of restoration, enhancement, creation and/or expansion of a wetland ecosystem. The amount of compensation necessary is determined by NSECC and ranges from 1 to 4 ha for every 1 ha of wetland altered, depending on the compensation approach and the relative ecological/social value of the disturbed wetland.



HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY ANALYSIS

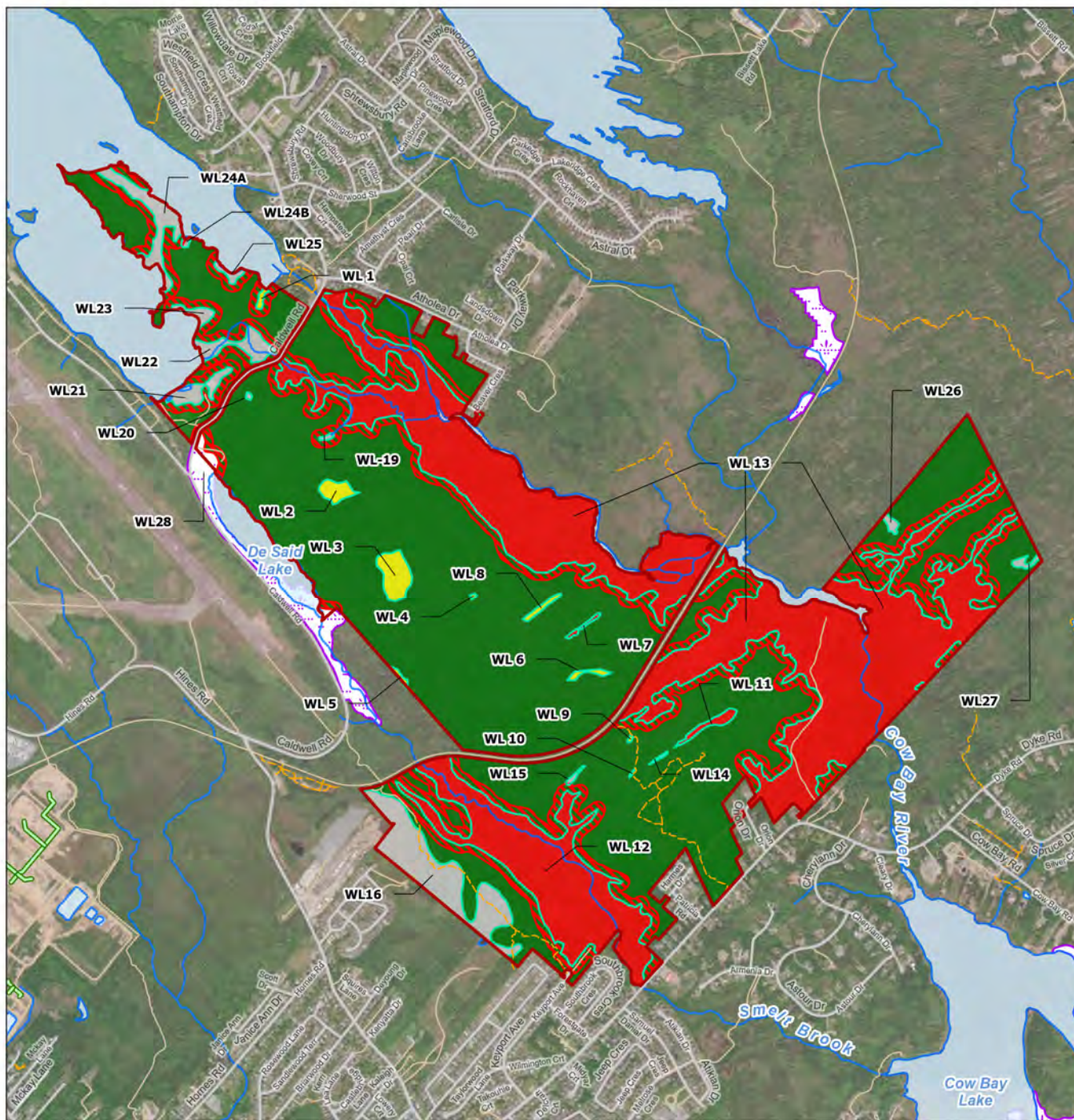
Stantec recommends engaging with NSECC as early as possible to discuss potential wetland impacts (direct or indirect), the permitting process, and compensation requirements (e.g., potential opportunities for wetland restoration, enhancement, or creation).

If a construction timeline has been established, complete wetland evaluations (i.e., delineation and functional assessment) will likely be required to support permitting applications for wetlands that could be impacted by development. NSECC guidance indicates that wetland evaluation should be conducted during the growing season (June 1 to September 30) and within the same year that the application for alteration approval is submitted.

The land suitability analysis for wetlands is based on the WESP-AC results for ecological condition, wetland risk, the composite function score, and the WSS interpretation tool (Table 3.2). As discussed in Section 3.2.2.3, specific wetland functions may need to be considered in more detail depending on proposed development scenarios and results from other studies. When applying the mitigative sequence for decision making (i.e., avoidance, minimization, compensation, discussed above), avoidance should be a priority where larger areas of contiguous wetland habitat have been identified (e.g., WL13). Areas such as this are also considered in landscape connectivity planning (refer to Section 3.5). Additional consideration was taken when scoring wetlands to manually adjust the weighting of policy-protected constraints including established environmental buffers such as a 30m wetland setback for wetlands intersected by watercourses. This is portrayed by the red hatching in Fig 3.3. Per the mitigative sequence, areas outside delineated wetlands are considered to have higher suitability for development, since development in these areas would avoid impacting wetlands.

The land suitability analysis represents one evaluation technique that can help prioritize areas for development and/or conservation. Within Nova Scotia there are regulatory processes and policies in place relating to wetlands and their conservation including the *Activities Designation Regulations* made under Section 66 of the *Environment Act*, Nova Scotia Wetland Conservation Policy and the Federal Policy on Wetland Conservation. These include aspects such as the prevention of a net loss of wetland area and function and the designation of wetlands of special significance based on wetlands that play particularly important roles in providing ecosystem services or functions (e.g., supporting rare or migratory species, protecting drinking water supplies, maintaining watershed health).





Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec, Government of Nova Scotia (Service Nova Scotia and Internal Services, Environment and Climate Change)
3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

- Study Area
- Wetlands (Stantec, 2023)
- Wetland of Special Significance (NSECC)
- Setback on Wetlands Contiguous with Watercourses (30 m)
- Land Suitability Score**
- 3 (High)
- 2
- 1 (Low)
- No Score

- Utilities**
- Pipeline
- Transportation**
- Road
- Resource / Seasonal Road
- Trail
- Other Features**
- Waterway
- Waterbody

0 250 500 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by NWhite on 2024-03-20
Revised by NWhite on 2024-08-29

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Fig ID: 160410469_006

Figure No.
3.3

Wetlands in the MLSA with Required Setbacks – Land Suitability Analysis

3.3 Watercourses and Water Quality

Watercourses are defined in the Nova Scotia *Environment Act* to include “the bed and shore of every river, stream, lake, creek, pond, spring, lagoon, or other natural body of water – whether it contains water or not.” Desktop mapping of watercourses within the MLSA took place in spring 2023, with field verification of select watercourses completed concurrent with the water quality sampling between May and November. Stantec considered an aquatic feature a watercourse if:

- a watercourse was shown on a National Topographic Series (NTS) map;
- recent satellite imagery showed evidence of a watercourse channel; or
- field characteristics such as flowing water and clearly defined physical features such as substrate, bed, banks, aquatic vegetation, or aquatic animals were observed.

The objectives of the watercourses and water quality section of the land suitability analysis was to:

- identify watercourses present within the MLSA using field and desktop methods
- describe the aquatic habitat in the watercourses within the MLSA
- establish baseline water quality using historical and recently collected field data, and
- establish criteria to determine land suitability in relation to watercourses and water quality

3.3.1 DESKTOP AND FIELD SUMMARY

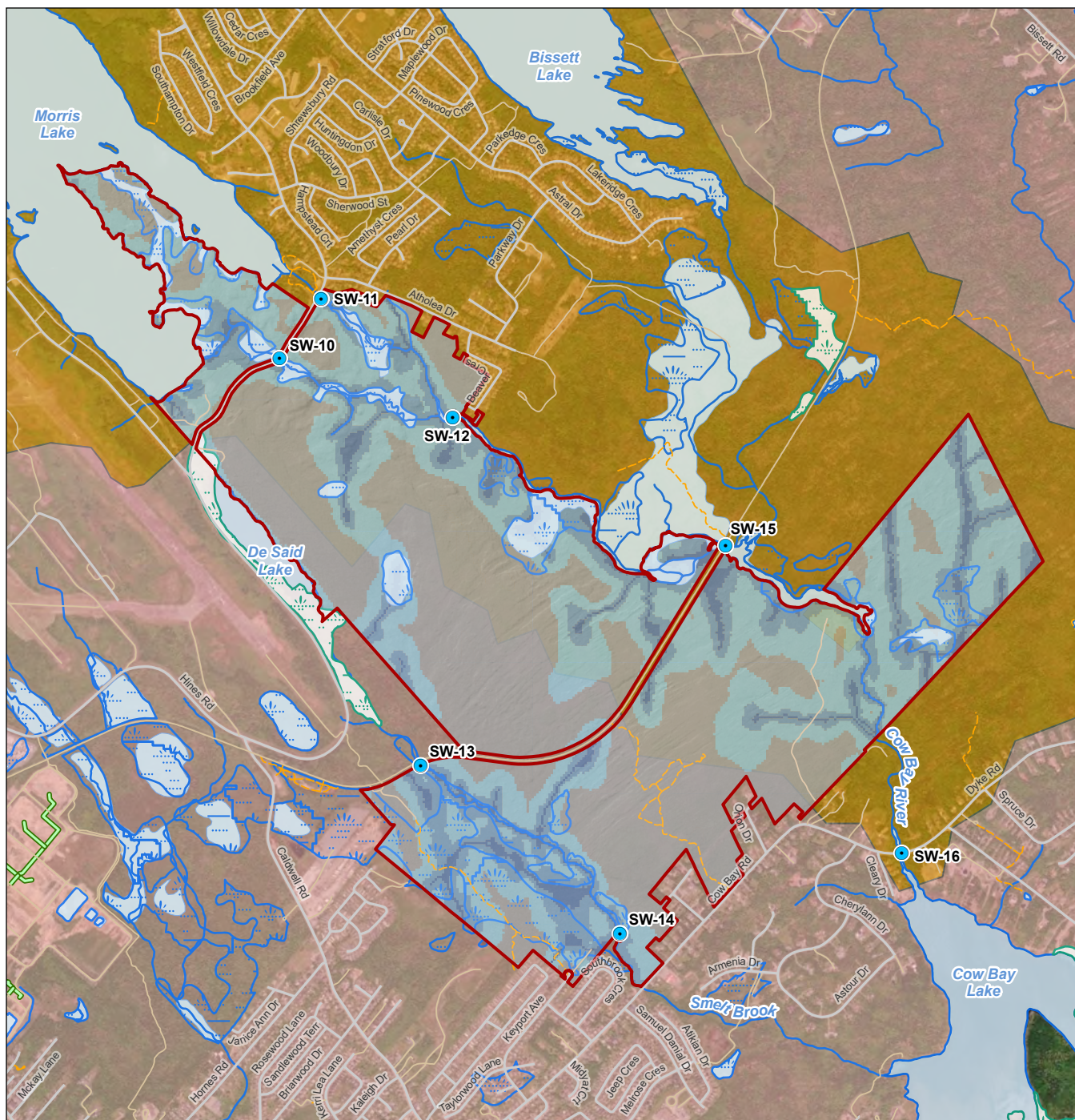
Stantec completed a desktop inventory of watercourses using LiDAR, aerial imagery, and flow accumulation mapping (also known as wet areas mapping; Figure 3.4). The wet areas mapping indicates depth to water table and can be used to predict what areas may accumulate surface water in watercourses and wetlands. Wet areas mapping was used to inform water sampling location only and did not play a direct influence on land suitability analysis due to its lack of accuracy in the data set. Section 3.6.3 provides additional desktop data on existing ground water wells in the area. Figure 3.4 also indicates regional watersheds.

The watercourses in this desktop inventory were verified during field surveys conducted concurrently with the 2024 water quality sampling program. At each location where a watercourse was sampled for the water quality sampling program the following information was collected:

- Channel and wetted width
- Water depth
- Substrate composition
- Bank description
- Functional in-water and riparian vegetation cover



\\Ca0213-pp\ss01\work_group\1214\active\160410459\gis_data\mapping\ArcGIS Pro\HRM_FCM_2022.aprx: HRM_FCM_009 Fig 3.4 Water Quality Locations Revised: 2024-05-14 By: schubbs



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec; Government of Nova Scotia, Department of Service Nova Scotia and Internal Services
3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

- Water Sampling Locations
- Water Table Depth (metres)**
- 0 - 0.10 m
 - 0.11 - 0.50 m
 - 0.51 - 2 m
 - > 2m
- Watershed Context Lands**
- Cow Bay River
 - Shore Direct
- Other Features**
- Waterway
 - Waterbody
 - Designated Wetland of Special Significance
 - Wetland (NSECC)
- Utilities**
- Pipeline
- Transportation**
- Road
 - Resource / Seasonal Road
 - Trail
- Study Area**

0 250 500 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by IPProdrug on 2024-03-06
Revised by Schubbs on 2024-05-14
Reviewed by MB on 2024-03-18

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Figure No.
3.4

Title
Watershed and Wet Area Mapping
in the MLSA

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.3.1.1 Watercourses

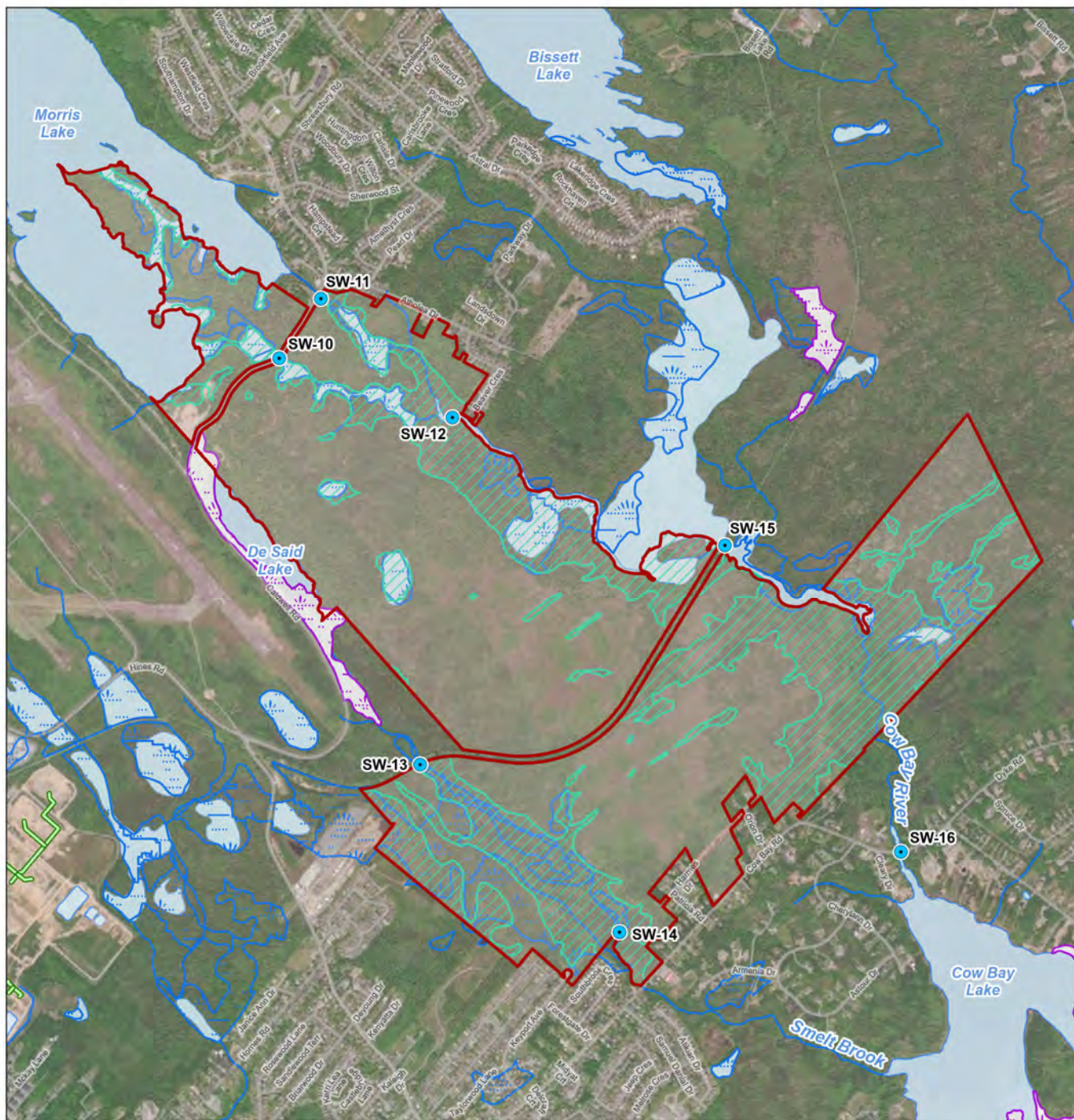
The MLSA is located within the Shore direct and Cow Bay River watersheds. Preliminary mapping identified two mapped watercourses and one mapped waterbody. Both of the mapped watercourses were confirmed during the water quality monitoring program and each contained at least one surface water monitoring station.

Morris Lake is located along the north border of the MLSA. Morris Lake has a surface area of 140 ha and drains into Cow Bay River which flows along the eastern border of the MLSA before flowing into Cow Bay. De Said Lake is located along the northwestern border of the MSA and has a surface area of 6 ha. De Said Lake drains into Smelt Brook which flows along the western side of the MLSA before flowing into Cow Bay.

Water quality station SW-10, SW-11, SW-12, SW-15, and SW-16 are located on Cow Bay River. SW-10 and SW-11 are located at the two separate outlets of Morris Lake which meet at SW-12. SW-15 is located at the confluence of Cow Bay River and the outflow of Bissett Lake which is located outside of the MLSA. SW-16 is located outside of the MLSA at the point where the river flows into Cow Bay.

Water quality station SW-13 and SW-14 are located on Smelt Brook. SW-13 samples the brook as it enters the MLSA and SW-14 samples the brook as it flows out of the MLSA towards Cow Bay.





- Water Sampling Location
- Waterway
- Waterbody
- Wetlands (Stantec, 2023)
- Wetland (NSECC)
- Wetland of Special Significance (NSECC)
- Study Area

- Utilities
- Pipeline
- Transportation
- Road

0 250 500 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by NWhite on 2023-07-19
Revised by NWhite on 2024-07-25

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Fig ID: 160410469_006

Figure No.
3.5

Title
**Watercourse Mapping and Surface
Water Sampling Locations in the
MLSA**

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Government of Nova Scotia,
Department of Service Nova Scotia and Internal
Services.
3. Background: Government of Nova Scotia,
Department of Service Nova Scotia and Internal
Services.

**HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES
FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY
ANALYSIS**

3.3.1.2 Fish and Fish Habitat

Morris Lake is a popular fishing spot for recreational fishers. The lake has previously been host to fishing tournaments. Fish species that are known to be in Morris Lake include white sucker (*Catostomus commersoni*), white perch (*Morone americana*), banded killifish (*Fundulus diaphanous*), American eel (*Anquilla rostrata*), brook trout (*Salvelinus fontinalis*), smallmouth bass (*Micropterus dolomieu*) and chain pickerel (*Esox niger*; DFO1986; DFA 2023). Note that American eel is considered Threatened by COSEWIC and while not currently listed on Schedule 1 of the SARA, is under consideration for addition. This species is not included in the NS ESA.

While fish community surveys were not requested as part of this analysis, potential fish presence was based on watercourse characteristics, including water levels, channel geometry, water quality and connectivity to watercourses downstream with known fish populations. Prior to the development of lands within the MLSA, it is recommended that dedicated fish habitat assessments be conducted to determine the use of habitats by fish and to provide data to fulfill applicable regulatory requirements at the time of construction.

All the watercourses encountered from desktop and field surveys drained into Cow Bay. Connectivity is sufficient to provide fish passage into the drainage areas above Cow Bay; therefore, these watercourses are expected to contain a fish community which contains American eel, white perch, banded killifish, brook trout, American eel and smallmouth bass.

Physical watercourse characteristics were collected during the water quality sampling program. Table 3.9 outlines the results of the watercourse assessments for the seven watercourses confirmed in the field.

Table 3.9 Physical Watercourse Characteristics – MLSA

Station ID (Watercourse)	Channel Width (m)	Wetted Width (m)	Substrate Composition	Riparian Habitat Description
SW-10 (Cow Bay River)	0.8 to 1.5	0.6 to 1.3	Rubble sized rock with smaller amounts of cobble and organics.	Grassy low-lying banks with alders. At points contiguous with wetlands.
SW-11 (Cow Bay River)	5.5 to 7.5	5.0 to 7.0	Rubble sized rock with smaller amounts of cobble.	Grassy low-lying banks with woody shrubs. At points contiguous with wetlands.
SW-12 (Cow Bay River)	9.0 to 14.3	8.0 to 14.0	Fines and organic material	Grassy low-lying banks with woody shrubs. At points contiguous with wetlands.
SW-13	4.2 to 9.6	4.0 to 9.0	Fines and organic material with occasional rubble	Grassy low-lying banks with woody vegetation. Contiguous with wetlands.
SW-14	1.8 to 3.0	1.6 to 2.3	Fines and organic material with occasional rubble	Grassy low-lying banks with woody shrubs. At points contiguous with wetlands.
SW-15 (Cow Bay River)	9.0 to 14.0	8.0 to 12.0	Rubble sized rock with smaller amounts of boulder and cobble.	Grassy low-lying banks with woody shrubs and predominantly deciduous mixed wood forest. At points contiguous with wetlands.



**HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES
FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY
ANALYSIS**

Table 3.9 Physical Watercourse Characteristics – MLSA

Station ID (Watercourse)	Channel Width (m)	Wetted Width (m)	Substrate Composition	Riparian Habitat Description
SW-16 (Cow Bay River)	6.3 to 8.7	6.0 to 8.5	Bedrock with boulders present	Grassy/ baren banks with predominantly deciduous mixed wood forest
Notes: Boulder = >259 mm; Rubble = 100 mm to 250 mm; Cobble = 15 mm to 100 mm; Gravel = 5 mm to 15 mm; Sand = 0.02 to 2 mm; Fines = <0.02 mm				

3.3.1.3 Water Quality

Information on surface water quality for the MLSA was obtained using historical watershed studies, LakeWatchers data from 2022 and 2023 (HRM 2023), as well as field-based data collected monthly since April 2023 by Stantec. The historical water quality for the MLSA is focused on Morris Lake itself; the Stantec water samples from 2023 are the only water quality samples collected within the MLSA.

Water quality sampling began in April 2023 and the final round of sampling was completed in November 2023 at seven locations across the MLSA (Figure 3.5). Water quality samples were submitted under chain of custody protocols to Bureau Veritas Labs in Bedford, NS for laboratory analysis of coliform bacteria, total suspended solids (TSS), Total Phosphorus (TP), turbidity, colour, and chloride. Initial mean water quality results are presented in Table 3-10. Generally averages are used when describing water quality characteristics however in cases where water quality data does not follow a normal distribution (e.g., due to varying pollution sources, natural variation), the median provides a measure of the central tendency within Morris Lake and reflects the typical water quality conditions that most of the watershed experiences and gives an accurate picture of water quality within the watershed.

Water quality across the MLSA is quite variable with pH values ranging from a minimum of 4.79 observed at SW-13 to a maximum of 8.18 at SW-11. The average pH value across the MLSA was determined to be 6.84 which is within the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL) (6.5 to 9.0). Low pH such as 4.79 observed at SW-13 is not uncommon in surface waters near Halifax primarily due to the combination of acidic geology, the legacy of acid rain, organic acids from wetlands, low natural buffering capacity, and human activities that contribute to further acidification. These factors create an environment where surface waters are prone to lower pH levels. Total phosphorus values range from 4 ug/L (SW-15) to 23 ug/L (SW-11, SW-14), with a median concentration of 12 ug/L which is indicative of mesotrophic conditions. Historical sources of phosphorus within the watershed include natural sources such as soil erosion, decomposition of vegetation and organic matter, and wildlife excrement, there are also anthropogenic sources such as septic systems, and animal waste. Chloride concentrations in MLSA range from 7.5 (SW-12) to 91 (SW-11), with median concentration of 62.7 mg/L. All samples were below the CCME CWQG-FAL limit for chloride of 120 mg/L for long term exposure. Total Suspended Solids (TSS) concentrations are generally low for MLSA ranging from 1.0 mg/L (SW- 11, SW-12, SW-14,SW-16) to 12 mg/L (SW-10) with a median value of 1.60 mg/L. The maximum TSS value of 660 mg/L was observed at SW-14; this is considered to be an anomaly due to sediment disturbance during collection from limited flow in the stream at the time of sampling (September 2023). The low TSS concentrations



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suggest that WSA is not significantly affected by erosion within the watershed, while the chloride concentrations reflect anthropogenic influence at levels which results in concentrations below the CCME CWQG-FAL for chronic exposure. The bacteria concentrations in the MLSA were observed to be consistently present in the streams with mean concentrations of 190 CFU/100mL for *E.coli*., and 825 CFU/100mL for total coliforms. Concentrations for MLSA are below the Health Canada Guideline for Canadian Recreational Water Quality for *E.coli* of 235 CFU/100 mL (Health Canada 2024). Summary statistics for water quality are provided in Table 3.10.



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Table 3.10 Water Quality Results from the MSLA collected during Spring/Summer 2023

	Units	Value	SW-10	SW-11	SW-12	SW-13	SW-14	SW-15	SW-16
Microbiological									
Escherichia coli	CFU/100mL	Mean	80	200	190	397	400	187	83
		Median	90	160	130	240	210	165	70
		Max	110	300	680	1100	1500	430	160
		Min	30	140	10	10	20	10	10
Total Coliforms	CFU/100mL	Mean	706	1062	813	1181	1504	690	825
		Median	600	1150	750	980	920	700	625
		Max	1500	2100	1600	2500	5100	1000	1500
		Min	190	210	520	530	500	300	460
Inorganics									
Dissolved Chloride (Cl-)	mg/L	Mean	65	68	58	29	40	63	66
		Median	63	67	56	22	33	54	64
		Max	90	91	89	56	61	86	94
		Min	40	48	7.5	13	24	47	42
Colour	TCU	Mean	46.6	18.5	71	151	120	49	41
		Median	45.5	15.5	17	120	100	28	35
		Max	100.0	34.0	410	250	250	150	82
		Min	14.0	11.0	13	84	57	17	22
Total Phosphorus	mg/L	Mean	0.012	0.012	0.009	0.012	0.015	0.007	0.010
		Median	0.010	0.008	0.010	0.011	0.015	0.008	0.010
		Max	0.021	0.023	0.012	0.015	0.023	0.010	0.018
		Min	0.006	0.006	0.006	0.009	0.006	0.004	0.005
Total Suspended Solids	mg/L	Mean	4.8	1.8	1.6	2.2	166	1.4	1.33
		Median	3.0	2.0	1.2	2.0	1.5	1.4	1.40
		Max	12	2.4	2.6	3.6	660	1.4	1.6
		Min	1.2	1.0	1.0	1.2	1.0	1.4	1.0
Turbidity	NTU	Mean	2.26	1.68	1.2	2.55	5.31	0.93	0.88
		Median	1.65	1.10	1.05	2.40	1.3	0.88	0.83
		Max	5.9	3.7	2.1	4.0	33	1.5	1.6
		Min	0.67	0.56	0.46	1.60	0.36	0.4	0.2



3.3.2 LAND SUITABILITY ANALYSIS – WATERCOURSES AND WATER QUALITY

The land suitability analysis for watercourses and water quality considered that development within watercourses is generally regulated provincially and federally. Provincially, the Nova Scotia *Environment Act* provides the overall authority to protect watercourses. Any activity that changes a watercourse, a water resource, or the flow of water therein requires an approval or a notification in accordance with the Activities Designation Regulations. Before any work can be done, an activity requires either an approval from NSECC or a notification to the Department for minor works.

Fish habitat is a significant and important component of aquatic habitat found in watercourses. In addition to provincial watercourse alteration requirements, Fisheries and Oceans Canada (DFO) is responsible, under the *Fisheries Act* and the SARA, for ensuring protection of fish and fish habitat. The federal *Fisheries Act* defines fish habitat as “water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas.”

Physical works within the watercourses are regulated by provincial and federal acts. Water quality is regulated under the provincial *Environment Act*, as well as the federal *Fisheries Act* where there are prohibitions against pollution, specifically termed deleterious substances. Within the *Fisheries Act* a deleterious substance “can be any substance that, if added to any water, would degrade or alter the water quality such that it could directly or indirectly harm fish, fish habitat, or the use of fish by humans.” Stormwater discharges are also managed in accordance with the Halifax Stormwater Management Standards for Development Activities (Halifax Regional Municipality 2020). Setbacks from watercourses are provided in the Eastern Passage / Cow Bay Land Use By-Laws and proposed policies of the draft Regional Plan (Halifax Regional Municipality 2023).

To protect aquatic ecosystems, the land suitability analysis considered riparian zones in addition to the bed and banks of the watercourse. Riparian zones are areas adjacent to watercourses, which are ecologically and geomorphologically diverse landscapes. Riparian zones provide a buffer that protects the watercourse from the impacts of adjacent development. In urban environments riparian zones also reduce the severity of flooding on adjacent lands.

Considering the ecological value associated with watercourses and their riparian habitats, values were assigned to the lands within the Study Area based on distance to the watercourse and termed ‘ecological zones’ (Table 3.11). Areas located within 30 m of a watercourse were considered to have low suitability for development. Areas between 30 m and 100 m from a watercourse were considered to have moderate suitability for development while areas greater than 100 m from a watercourse were considered to have higher suitability for development.



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The objective of establishing these ecological zones was to provide suitable areas for development while retaining watercourse function and potential habitat quality for fish. The ecological zones were established based on watercourse setbacks and a buffer of 30 m established in the Eastern Passage / Cow Bay Land Use By-Laws and proposed policies of the draft Regional Plan (Halifax Regional Municipality 2023). Wider buffers are more effective at filtering contaminants, encouraging infiltration and providing diversity of habitat (Collison and Gromack 2022). Buffer widths beyond the minimum standard should be evaluated on a case-by-case basis taking into account local site conditions and community needs.

Considering the effective width of the setback varies with soil type, slope, watercourse size, ecological habitat function and vegetative cover, the Eastern Passage / Cow Bay Land Use By-Laws and draft Regional Plan setbacks are considered the minimum criteria levels and additional buffer width may be implemented during the Planning or Subdivision Approval process.

The land suitability analysis seeks to conserve the following ecological functions of watercourses:

- aquatic habitat which considers the value watercourses play in providing habitat for fish and other aquatic species
- water quality which has two aspects: the provision of suitable habitat for aquatic species and the intrinsic value for local residents

Areas immediately surrounding watercourses provide the greatest amount of riparian and aquatic habitat. Land within 30 m of mapped and field identified watercourses is considered to have low suitability for development. Land 30 m to 100 m from a watercourse is considered to have moderate suitability for development. Land with higher suitability for development is considered to be greater than 100m from watercourses as developing these areas would protect the greatest amount of riparian and aquatic habitat and therefore have a higher suitability for development (Table 3.11).

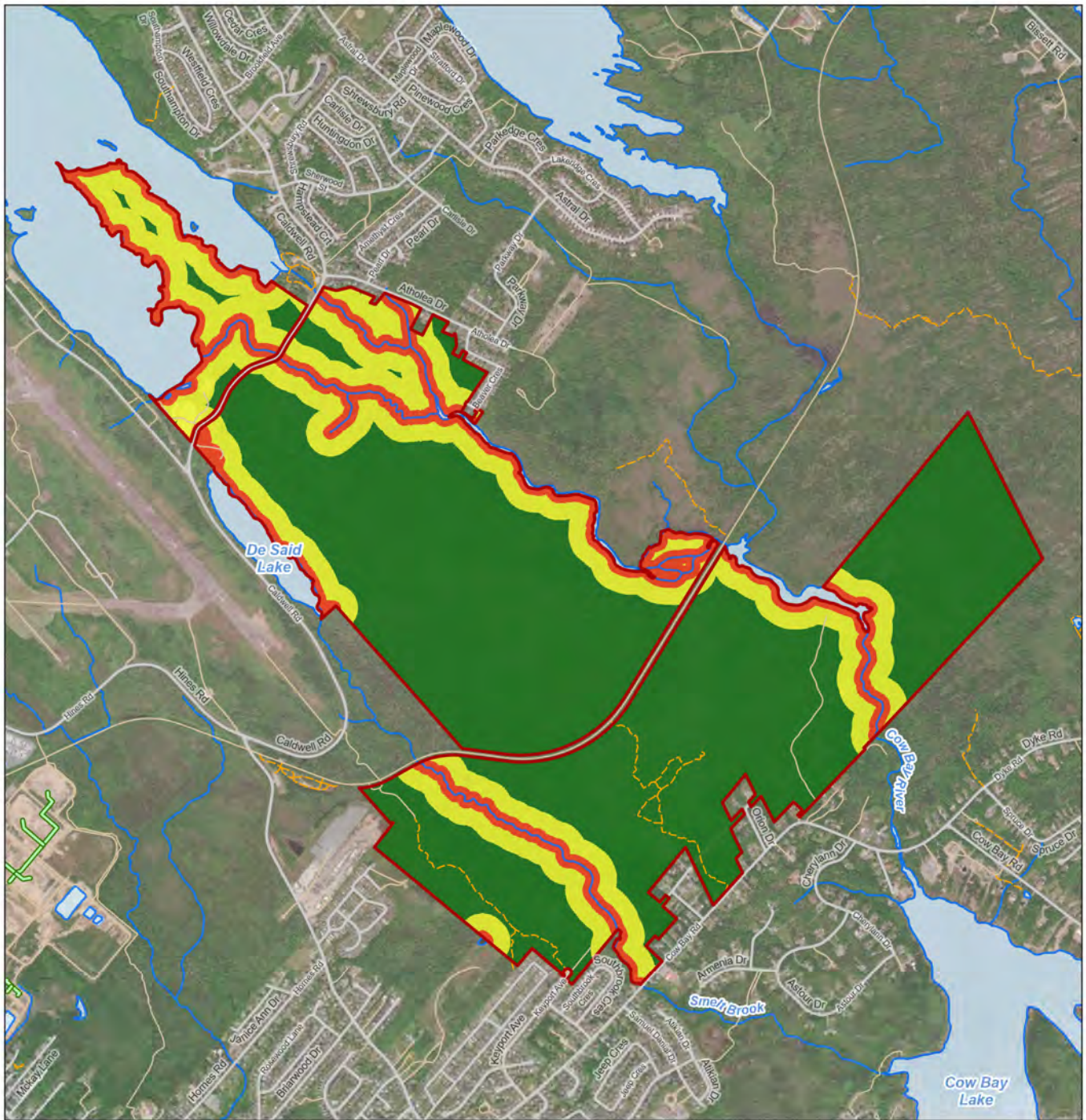
This process culminated in the creation of a map (Figure 3.6) that illustrates development suitability of land as it relates to watercourses. The results allow for the identification of suitable and unsuitable areas, as well as the recognition of potential constraints. A lower score for land suitability for development generally corresponds with higher ecological and social value.

Note that recommendations for landscape connectivity have also considered the location of watercourses in the Study Area (refer to Section 3.5). If construction will impact watercourse bed and banks within the LSA, Stantec recommends additional fish and fish habitat surveys be completed in compliance with the provincial and federal regulations pertaining to watercourse alteration permitting and the alteration of fish habitat.

Table 3.11 Watercourses and Water Quality– Land Suitability Ranking Framework

Layer	Land Suitability Ranking		
	1 - Low suitability for development	2 - Moderate suitability for development	3 - Higher suitability for development
Water-courses	Areas within 30 m of mapped and field identified watercourses	Areas that extend from 30 m to 100 m from a watercourse	Areas that are greater than 100 m from watercourses





Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec; Government of Nova Scotia, Department of Service Nova Scotia and Internal Services
3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

Study Area

Land Suitability Score

- 3 (High)
- 2
- 1 (Low)

Utilities

- Pipeline

Transportation

- Road
- Resource / Seasonal Road
- Trail

Other Features

- Waterway
- Waterbody

0 250 500 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by NWhite on 2024-03-08
Revised by NWhite on 2024-07-09

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Figure No.
3.6

Title
**Watercourses in the MLSA – Land
Suitability Analysis**

3.4 Forest Habitat and Species at Risk

Forest habitat within the MLSA was evaluated using the NSDNRR Forest and Wetland Inventory databases, the Nova Scotia Forest Ecosystem Classification (FEC) system (Neily et al. 2023), and data collected during field surveys (Appendix B).

A desktop review of species at risk (SAR) and species of conservation concern (SOCC) was conducted using data requested from the AC CDC (AC CDC 2023; Appendix A) and the NSDNRR Boreal Felt Lichen predictive habitat layer (Cameron and Neily 2008). The desktop review was supplemented by incidental field observations recorded during field programs (Appendix C).

SAR presence noted within the study area was based on incidental observations, AC CDC data, and the Boreal Felt Lichen Predictive data layer. Though these data sources provide a good baseline understanding, collecting more than one season of field survey data would provide a more complete picture of SAR presence. It is also noted that some AC CDC data is obscured for species safety and access was not requested as part of this analysis. Evaluating individual Vegetation Types (VTs) for likelihood of providing SAR (e.g., boreal felt lichen) habitat was considered out of this study's scope.

Forest habitat and SAR were combined for land suitability analysis. The FEC data (combined with wetland data and field observations) were used to understand what habitat types are present in the Study Area. Once habitat types within the MLSA were identified, they were compared to known habitat preferences of SAR recorded within 5 km of the Study Area to understand the distribution of potential SAR habitat.

Habitat VT types can also provide insight to community climate resilience planning. Some terrestrial VTs and wetland types are recognized to be effective carbon sinks and fire breaks, as well as attenuating stormwater flow. An evaluation of these services should be completed during any ensuing planning processes.

There were limitations of time, scope and resources in the completion of this study. Though useful for preliminary decision-making, this report is not a complete representation of all ecological features present within the study area. Knowledge gaps that should be considered in future studies and planning efforts include Targeted SAR surveys; for example, many VTs identified within the study area are known to be associated with rare plants. Though spot vegetation surveys were completed, it is possible that some rare species remained undetected within the study area.



3.4.1 FOREST HABITAT

The NSDNRR Forest Inventory database is based on air photo interpretation and are not ground-truthed. NSDNRR forest polygons were visited during field surveys in spring and summer 2023 (indicated as ‘field survey sites’ on Figure 3.7a and Fig 3.7b). Vegetation within the polygons was evaluated and then compared with the FEC system, which places forest stands into Forest Groups (FG) that are composed of different VTs with similar site conditions, successional pathways, and species composition (Neily et al. 2023). A patchwork of different forest and plant communities reflect a changing landscape based on disturbance (blowdown, insects, fire, disease, anthropogenic), site conditions and natural successional stages.

The MLSA is located within the Eastern Interior Ecodistrict with the southernmost portion bordering the Eastern Shore Ecodistrict (NSDNR 2017), allowing for a coastal influence on some of the VTs seen with the presence of the Coastal Boreal FG within the MLSA. The Eastern Interior Ecodistrict is mainly underlain by meta-sedimentary rock. This is the largest ecodistrict in the province, stretching from Pockwock Lake (Halifax County) in the west to Chedabucto Bay (Guysborough County) in the east. This expansive tract of upland topography is a rolling till-plain comprised of generally gravelly and stony soils (NSDNR 2017).

This Ecodistrict has three distinct concentrations of drumlins which can be identified roughly by the watersheds of the three rivers that flow through them: Sackville River, Tangier River, and Moser River. Dominant soils are derived from gravelly sandy loam till (Halifax/Danesville soils); gravelly sandy clay loam till containing shale, sandstone, and mudstone (Wolfville/Hantsport soils); shallow and/or very stony sandy loam till high in quartzite (Rockland soils); and gravelly loam to silt loam till high in slate (Bridgewater/Riverport soils) (NSDNR 2017).

The Eastern Interior Ecodistrict has several significant forest ecosystems: a zonal climax black spruce (*Picea mariana*) forest (Spruce Pine Forest Group) that is widely dispersed on dry to moist, nutrient poor soils (28%); a zonal softwood/mixedwood forest of red spruce (*Picea rubens*), eastern hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*) and red maple (*Acer rubrum*) (Spruce Hemlock Forest Group) on fresh to fresh-moist, nutrient medium soils (50%); and a zonal Tolerant Hardwood forest of sugar maple (*Acer saccharum*), yellow birch and red maple on fresh, nutrient medium to rich soils (10%) (NSDNR 2017). The Study Area contains the following FEC FGs:

- Coastal Boreal (CB)
- Intolerant Hardwood (IH)
- Mixedwood (MW)
- Open Woodland (OW)
- Spruce Hemlock (SH)
- Spruce Pine (SP)
- Wet Boreal (WB)
- Wet Coniferous (WC)
- Wet Deciduous (WD)
- Wet-Mixedwood (WM)



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Dominant vegetation was described for 46 forest inventory polygons visited during field surveys (Table 3.13). Unique identifiers were assigned at the point surveyed (PC1-PC54). All plant species were recorded at that point in the tree, shrub and ground vegetation layers as well as site specific details such as drainage class, stand description and estimated stand age (Appendix B). VTs were identified and inventoried based on the overall percent cover of dominant tree and shrub species (Appendix B). Transitions to other VTs were marked and compared to existing data as they were encountered. The FEC classification for each stand is presented in Appendix B. VTs and their typical description can be found below. Many VTs identified within the study area are known to be associated with rare plants. Though spot vegetation surveys were completed, it is possible that some rare species remained undetected within the study area. A list of plants is included in Appendix B.

Table 3.12 Summary of Vegetation Types in the MLSA

Vegetation Type (VT)	FEC VT Code	VT Frequency ¹	Forest Group (FG)
Balsam fir / Foxberry – Twinflower	CB3	1	CB
White birch – Balsam fir/Foxberry – Wood aster	CB4	2	
Red maple / Hay-scented fern – Wood-sorrel	IH8	9	IH
Red spruce – Red maple – White birch / Goldthread	MW2	5	MW
Balsam fir – Red maple / Wood-sorrel – Goldthread	MW7	1	
Black spruce – Red maple / Bracken – Sarsaparilla	MW9	13	
Black spruce / Lambkill / Reindeer lichen	OW2	3	OW
Black Huckleberry Heath	S1	3	S
Mixed Tall Shrubland	S3	1	
Sheep Laurel Highland Heath	S5	4	
Red spruce – White pine / Lambkill / Bracken	SH4	1	SH
Black spruce / Feathermoss	SP5	1	SP
Black spruce – Balsam fir / Blueberry	SP6	2	
Black spruce / Lambkill – Wild raisin – Mountain holly	SP7	2	
Black spruce / Mountain ash / Foxberry / Sphagnum	WB1	2	WB
Black spruce / Cinnamon fern / Sphagnum	WC1	1	WC
Black spruce / Lambkill – Labrador tea / Sphagnum	WC2	6	
Balsam fir / Cinnamon fern – Three seeded sedge / Sphagnum	WC6	1	
Tamarack – Black spruce / Lambkill / Sphagnum	WC7	6	
Black spruce Woodland Bogs	WC11	6	
Red maple / Cinnamon fern / Sphagnum	WD2	2	WD
Red maple – Balsam fir / Wood aster / Sphagnum	WM1	1	WM
Red maple – Black spruce / Lambkill / Cinnamon fern / Sphagnum	WM3	4	
Note: 1 – Frequency is the number of stands of each VT out of 46 total stands with VTs			



3.4.2 FOREST ECOSYSTEM CLASSIFICATION

A total of 10 FGs and 1 barrens type represented the 20 individual VTs and three different shrubland associations noted in Table 3.8. FGs are presented on Figure 3.7a and 3.7b. The following sections describe each VT including successional stage, disturbance, and specific ecological features. For comprehensive information on all FGs and VTs in Nova Scotia, Stantec recommends consulting the provincial FEC guide (Neily et al. 2023). This resource is highly valuable for understanding habitat details and making informed decisions at the stand level.

3.4.2.1 Coastal Boreal

Coastal boreal forest group is unique from Canada's larger Boreal Forest. It is one of two coastal forest groups and is seen along the saltwater coastlines of Nova Scotia. This VT ranges from partial to closed canopy. The canopy is comprised of black spruce, white spruce and balsam fir. Red spruce, sugar maple, beech, eastern hemlock and white pine are not present within this forest group. Coastal forests provide habitat for many migratory birds.

CB3 – Balsam fir / Foxberry – Twinflower

- Succession: Mid to Late
- Typical Disturbance Type: Windthrow, breakage, insect infestation, and harvesting
- Ecological Features: Older stands of this VT provide good habitat for rare epiphytic lichens.

This VT occurs on fresh to fresh-moist, nutrient poor to medium soils. The overstory of this VT is dominated by balsam fir, with components of spruce. The shrub layer is often comprised of regenerating trees, while the herbaceous layer has moderate diversity. The bryophyte layer is extensive with a variety of species present such as bazzania (*Bazzania trilobata*) and Scherber's moss (*Pleurozium schreberi*).

CB4 – White birch – Balsam fir / Foxberry – Wood aster

- Succession: Mid
- Typical Disturbance Type: Windthrow, breakage, insect infestation, and harvesting
- Ecological Features: Older stands of this VT may support boreal felt lichen and other rare cyanolichens.

CB4 occurs on fresh, nutrient medium rich soils. The shrub layer is dominated by regenerating conifers such as balsam fir. The overstory is dominated by white birch (*Betula papyrifera*) and/or heartleaf birch (*Betula cordifolia*) with a large component of balsam fir and white spruce. There is low diversity in the herbaceous layer, but a well-developed bryophyte layer in this VT.



3.4.2.2 Intolerant Hardwood

Intolerant hardwoods (IH) are early to mid-successional closed canopy forest stands that are dominated by red maple, white birch, grey birch (*Betula populifolia*) and aspen (*Populus* spp.) trees. The canopy is closed hardwood, with scattered residuals from previous succession stages. The shrub layer is typically extensive and has woody shrub species (e.g., wild raisin [*Viburnum nudum*] and honey-suckle [*Lonicera canadensis*]). Intolerant hardwood stands are typically short-lived, even-aged forests that result from stand-level disturbance events such as fire, windthrow, or harvesting. These stands provide habitat for deer, moose, and snowshoe hare.

IH8 White birch – Red maple / Lambkill – Huckleberry

- Succession: Early
- Typical Disturbance Type: Insects, disease and windthrow.
- Ecological Features: damp crevices between surface rocks provide great habitat for snakes, amphibians and small rodents. There is also high tree and lichen species richness in this VT.

White birch and red maple are the dominant species in the IH8 vegetation type, with an extensive understory of ericaceous shrubs. Tree growth in this VT is limited by the nutrient poor soils and often has stunted growth in the tree layer. In addition to the abundance of ericaceous shrubs, witch hazel is often present in the shrub layer. The bryophyte layer is typically poorly developed due to restriction by leaf litter.

3.4.2.3 Mixedwood

The characteristics of the mixedwood (MW) group can be quite variable, including both coniferous and deciduous trees, ranging from early to late successional stages. Mixedwood vegetation types can be composed of either shade-tolerant or intolerant canopy species and can be large patch to matrix scale forests with complex canopy structures including softwood or hardwood inclusions or, more commonly, a relatively even blend of both growth forms. Earlier successional MW forests include red maple, white birch, grey birch, aspen(s), and/or balsam fir. In turn, later successional forests are characterized by yellow birch, sugar maple, red spruce, white spruce and/or eastern hemlock.

MW2 Red spruce-Red maple-White birch / Goldthread

- Succession: Mid
- Typical Disturbance Type: Windthrow, harvesting.
- Ecological Features: Increased Forest structural complexity can provide nesting habitat for woodpeckers, owls, and northern goshawks (*Accipiter gentilis*).



This VT is associated with fresh to fresh-moist sites, and is typically dominated by red spruce, red maple, and large-tooth (*Populus grandidentata*) or trembling aspen (*Populus tremuloides*). It is a closed canopy and mid-successional forest, which follows partial disturbances such as harvesting. The shrub layer is mainly composed of regenerating tree species, and the herb layer contains species similar to other mixedwood VTs such as starflower, sarsaparilla and several fern species. MW2 also facilitates nutrient cycling, rapid site revegetation, and the establishment of nurse crops for late-successional species.

MW7 Balsam fir-Red maple / Wood-sorrel – Goldthread

- Succession: Early to Mid
- Typical Disturbance Type: Stand-level disturbances (e.g., windthrow, fire, harvesting).
- Ecological Features: Forms a matrix and has variably-sized patch ecosystems.

MW7 is comprised of shade-intolerant hardwoods, including white birch and aspen. The shrub layer is moderately developed and includes regenerative trees as this VT follows stand-replacing disturbances. MW7 occurs on fresh to moist, nutrient medium soils and is most common in eastern Nova Scotia. It supports rapid site revegetation, nutrient cycling, and establishing nursing crops for later successional stages like red spruce, eastern hemlock, and yellow birch.

MW9 Black spruce – Red maple / Bracken – Sarsaparilla

- Succession: Even-aged, edaphic
- Typical Disturbance Type: Stand-replacing disturbances (e.g., windthrow, fire, harvesting).
- Ecological Features: Occurs in small to large patches on surfaces with high stoniness. Mature forests will develop old man's beard and lichen.

MW9 is an even-aged VT which develops in fresh to moist, nutrient poor soils. There is a mixedwood overstory which has moderate canopy closure supported by herbaceous plants. The shrub layer is co-dominated by lambkill (*Kalmia angustifolia*), velvet-leaf and lowbush blueberry (*Vaccinium myrtilloides*, *V. angustifolium*), and huckleberry (*Gaylussacia* sp.). This VT patches are typically large and found on sites with high amounts of stoniness.

3.4.2.4 Open Woodland

Open woodland (OW) forests are limited by site conditions and natural disturbances (e.g., acidic bedrock soil, windthrow) resulting in limited tree growth and well-developed shrub layers. Common species include pine, black spruce, red maple and red oak, whereas huckleberry, lambkill, and rhodora dominate the shrub layers.

OW2 Black spruce / Lambkill / Reindeer lichen

- Succession type: Early, edaphic
- Typical Disturbance Type: Stand level disturbances (e.g., fire, windthrow)
- Ecological Features: Limited distribution and only exists in Atlantic Canada, creating conservation challenges.



OW2 is a VT found on acidic bedrock and thin glacial soils, with dry to moist, nutrient very poor or stoney soils. Black spruce or pine dominate, and other species are typically uncommon. The understory is woody and has acid-tolerant shrubs (e.g., lambkill), and the herbaceous layer is low in species richness and abundance. This VT only is successful during early successional stages and only exists in the Atlantic provinces in small patches; however, it supports animal, plant, and epiphytic lichen species.

3.4.2.5 Shrubland Associations

The shrubland association is one of three barrens associations in Nova Scotia. These VTs are found in a separate guide to the FEC classifications (Porter et al. 2020). The shrubland associations are distinguished by characteristic shrub presence.

S1 Black Huckleberry Heath

- Succession: N/A
- Typical Disturbance Type: Fire
- Ecological Features: N/A

S1 is the only barrens VT dominated by black huckleberry. It typically occurs on sites with shallow and stony soils, frequently with a cemented or partially cemented horizon. The soils of this association are typically nutrient poor and acidic humus over coarse-grained mineral soils. This association is among the most widespread shrubland associations of Nova Scotia's barrens.

S3 Mixed Tall Shrubland

- Succession: N/A
- Typical Disturbance Type: Fire
- Ecological Features: N/A

S3 barrens association is characterized by a mixture of false holly (*Ilex mucronata*), black chokeberry (*Aronia melanocarpa*), sheep laurel (*Kalmia angustifolia*), wild raisin, rhodora (*Rhododendron canadense*), and/or black huckleberry (*Gaylussacia baccata*). This VT can sometimes support trees and of all the barren types has on average taller vegetation. The soils of this VT are typically thick litter accumulations and thin, poorly developed humus over stony till.

S5 Sheep Laurel Highland Heath

- Succession: N/A
- Typical Disturbance Type: Stand level disturbance (e.g., fire)
- Ecological Features: N/A



S5 is a barren VT, which is dominated by sheep laurel (aka lambkill, *Kalmia angustifolia*) on inland barrens on surficial deposits. This VT typically occurs on sheltered sites with moderate to negligible wind exposure. Trees are present in this association in only one quarter to one third of all sites. The most common tree species present are black spruce and white pine. There is a distinct lichen and bryophyte layer. Physical evidence of fire disturbance is seen in charcoal near the surface in one third of sites. The association also has the presence of exposed woody substrates, surface rock, mineral soil, and humus.

3.4.2.6 Spruce-Hemlock

Spruce-hemlock (SH) VT is a mid- to late-successional group with closed canopy and softwood species, predominantly red spruce, eastern hemlock, and eastern white pine. Mid to late successional stages are typically even-aged, closed canopy, but can develop a multi-age structure as they progress into a later successional stage. Within the well-developed canopies, the mid successional stages usually have a significant balsam fir component along with eastern hemlock, red spruce, and eastern white pine in the overstory. The SH type occurs on soils with a wide range of moisture levels; however, the fertility levels are typically moderate. SH can potentially provide habitat for small mammals and ungulates as well as diverse communities of birds and invertebrates which use these forests for shelter, foraging and/or reproduction

SH4 Red spruce-White pine / Lambkill / Bracken

- Succession: Late
- Typical Disturbance Type: Windthrow or harvesting.
- Ecological Features: Occupies large areas of land and supports old growth development and habitat cover for moose, deer, and fisher.

This VT occurs on dry to fresh, nutrient poor to medium soils. They are closed canopy forests that are dominated by red spruce, and lesser amounts of eastern white pine. The shrub layer is composed of regenerative balsam fir and red spruce. Bracken fern (*Pteridium aquilinum*) is typically the dominant species of the herbaceous layer. SH4 is a large matrix forest and dominates large areas of land. It supports wildlife habitat, including nesting and brood-rearing for avifauna, and overwintering habitat for deer and moose.

3.4.2.7 Spruce-Pine

Spruce-pine (SP) forests are nutrient poor and are often dominated by black spruce and pines with plants in the understory that are tolerant of nutrient poor soils. They are typically associated with sloped environments with bedrock ridges and outcrops. The shrub layer of these stands are often dominated by lambkill, blueberry and black huckleberry (*Gaylussacia baccata*). The herb layer is variable in species composition depending on the amount of light available.



SP5 Black spruce / Feathermoss

- Succession: Edaphic
- Typical Disturbance: Stand replacing events (e.g., fire, harvesting, windthrow)
- Ecological Features: Commonly large-patch matrices which are mature forests that provide wildlife habitat.

SP5 is a closed canopy VT with black spruce which develops on fresh to moist, nutrient poor soils. The understory shrubs and herbs are sparse but there is a well-developed bed of moss. The shrub layer has low species abundance and diversity, and the herb and bryophyte diversity are also generally low. These VTs are large patches and are the end-successional stage for many VTs in the spruce pine forest group. Wildlife species that are associated with SP5 include spruce grouse, olive-sided flycatcher, mourning warbler, star-nosed mole, and amphibians.

SP6 – Black spruce – Balsam fir / Blueberry

- Succession: Early to Mid
- Typical Disturbance: Stand replacing disturbance (e.g. Insects, harvesting and windthrow)
- Ecological Features: SP6 stands provide suitable habitat conditions for many species such as red and flying squirrel, deer, moose, salamanders and other amphibians, songbirds and small mammals.

SP6 is a closed canopy forest with a dominant presence of balsam fir in the overstory. Common associates in the overstory include black spruce, hybrid (red/black) spruce, red maple and white pine. The shrub layer is mostly comprised of regenerating tree species along with velvet-leaf blueberry and lambkill. The herbaceous and bryophyte layers are well developed but with few species. This VT has dry to fresh, nutrient poor soils.

SP7 Black spruce / Lambkill – Wild raisin – Mountain holly

- Succession: Even-aged, edaphic
- Typical Disturbance: Stand replacing disturbances (e.g., fire, harvesting, windthrow)
- Ecological Features: Provides habitat for spruce grouse, olive-sided flycatcher, mourning warbler, star-nosed mole, and amphibians.

SP7 is a closed canopy VT that is comprised of shade-tolerant black spruce, a well-developed shrubby layer, and moist- nutrient poor soils. The shrub layer has species such as lambkill, blueberry, and other ericaceous species. The herb species present will be limited, but include bunchberry, bracken, and goldthread (*Coptis trifolia*). This VT does not shift to other vegetation types after disturbance, will occur as small to large patches in ecosystems comprised of other SP VTs.



3.4.2.8 Wet Boreal

Wet boreal (WB) VTs are small to large patch forests that usually occur within larger wetland complexes and are edaphic climax forests. The canopy can be closed to partially closed and is dominated by black spruce, balsam fir and /or tamarack. The understory is comprised of plants tolerant of wet conditions with a well-developed shrub, herb and bryophyte layers. Sphagnum cover is usually extensive in this FG. The conditions of this FG promote growth of many rare lichens species in the province in older undisturbed stands.

WB1 – Black spruce / Mountain ash / Foxberry / Sphagnum

- Succession: Edaphic
- Typical Disturbance Type: Stand replacing (e.g. windthrow and insects)
- Ecological Features: Conditions support high bryophyte abundance and occurrence of rare lichens species in the province.

WB1 is the most common wet forest type in the Atlantic Coastal ecoregion. It is a moderately closed canopy forest dominated by black spruce in the overstory. The shrub layer is primarily composed of regenerating black spruce and balsam fir and a smaller component of woody shrubs. The herbaceous layer is relatively diverse, and the bryophyte layer is dominated by Sphagnum species. This VT is found on wet, nutrient poor soils.

3.4.2.9 Wet-Coniferous

Wet-coniferous (WC) VTs are wet forest ecosystems that have water at or near the soil surface. The canopy is partially closed and is dominated by softwood species. There is a well-developed understory of plants that are tolerant of wet conditions. The shrub layer of WC VTs is typically characterized by ericaceous species and tall shrubs such as mountain holly (*Ilex mucronata*). These forests create unique landscapes which are important for carbon storage, nitrogen cycling, and often form the headwaters of watercourses so they can be important in flow regulation.

WC1 – Black spruce / Cinnamon fern / Sphagnum

- Succession: Edaphic
- Typical Disturbance Type: Windthrow and uprooting
- Ecological Features: Provides thermal cover for moose and deer.

WC1 is characterized by dominant black spruce in the canopy. The shrub layer is scattered with low cover of ericaceous shrubs and black spruce layering. The herbaceous layer has moderate to high cover. While the bryophyte layer is well-developed and dominated by sphagnum species. It is found on wet, nutrient poor soils and persists as an edaphic climax.



WC2- Black spruce / Lambkill – Labrador tea / Sphagnum

- Succession: Edaphic
- Typical Disturbance Type: Windthrow and uprooting
- Ecological Features: Supports low species richness and limited habitat diversity due to harsh site conditions

This VT occurs on nutrient poor to very poor soils that are poorly drained. The canopy is dominated by black spruce and crown closure is considered low to moderate. The canopy may also be formed by stunted trees. The shrub layer, in instances where the stand is young, is more exposed, or extremely wet. The understory is woody and dominated by lambkill or other species such as Labrador tea (*Rhododendron groenlandicum*), rhodora and mountain holly. These stands are maintained by limiting conditions including soil saturation limiting the rooting potential; however, they can sustain old growth conditions and some plant species of conservation concern.

WC6 – Balsam fir / Cinnamon fern – Three seeded sedge / Sphagnum

- Succession: Early to Mid, Edaphic
- Typical Disturbance Type: Harvest, windthrow and spruce budworm
- Ecological Features: WC6 support some of the highest provincial concentrations of epiphytic cyanolichens.

This VT occurs on poorly to very poorly drained flats or shallow depressions. The canopy is dominated by balsam fir with other associates spruce (red, white and/or black) and/or red maple. The shrubs layer is somewhat developed with low to moderate cover. The herbaceous layer has moderate cover of wet site species. Sphagnum species dominate the bryophyte layer.

WC7 Tamarack – Black spruce / Lambkill / Sphagnum

- Succession: Early to Mid, Edaphic
- Typical Disturbance Type: Harvest, windthrow
- Ecological Features: The only tamarack dominant ecosystem in Nova Scotia found on organic soils. Often contain rare plant species for example black ash (*Fraxinus nigra*).

This VT occurs on poorly to very poorly drained flats or shallow depressions. This semi open canopy forest is characterized by a tamarack overstory, high sphagnum cover and high graminoid diversity. The overstory often contains red maple and black spruce.

WC11 Black spruce Woodland Bogs

- Succession: Edaphic
- Typical Disturbance Type: maintained by site limiting conditions
- Ecological Features: This VT creates a transition zone and creates habitat for species with affinities for wet open coniferous habitat.



WC11 is an open woodland ecosystem that sits on wet (minerotrophic) soils and is characterized by stunted black spruce. This VT has nutrient poor soils that are primarily organics. The tree layer in this VT is limited while the shrub layer can be extensive with stunted black spruce and woody shrubs. The herbaceous and bryophyte layers have low species diversity.

3.4.2.10 Wet-Deciduous

The wet-deciduous (WD) forest group is characterized by water at or near the ground surface for much of the growing season. Canopies are often partly open or closed and are generally dominated by red maple, and occasionally white ash. Vegetation types occur primarily on level to depressional topography or within riparian zones.

WD2 Red maple / Cinnamon fern / Sphagnum

- Succession: Early to mid, edaphic
- Typical Disturbance Type: Windthrow, harvesting.
- Ecological Features: Moderately productive system which can support black ash

WD2 is a widespread maple swamp VT that is found throughout Nova Scotia. The soils are usually organic deposits or poorly drained mineral soils. It has a relatively high percentage of deciduous trees, primarily red maple. Shrub cover is moderate, however it is characterized by low species diversity. It can include regenerative overstory species, as well as other shrub species (e.g., speckled alder [*Alnus incana*]). The herbaceous layer is also characterized by low diversity but can have high vegetation cover. Wildlife species that are associated with WD2 include olive-sided flycatcher and Canada Warbler .

3.4.2.11 Wet-Mixedwood

Wet-mixedwood (WM) vegetation types occur on poorly drained sites where the water table is at or near the soil surface for most of the growing season. Canopies are partly open to closed, and are generally dominated by red maple, spruce, balsam fir, white ash, and yellow birch. WM vegetation types are mid-successional and have fluctuating water levels, wind throw, and insect/disease disturbance. They support both coniferous and deciduous tree species. They exist in small patches that act as a transition ecosystem for forest wetland species.

WM1 Red maple-Balsam fir / Wood aster / Sphagnum

- Succession: Mid, Edaphic
- Typical Disturbance Type: Individual tree mortality and windthrow.
- Ecological Features: Small pools or narrow channels typically are present with slowly moving water, supporting biodiversity features similar to wet deciduous VTs.

This vegetation type is found on wet, poor to medium mineral soils with some level of groundwater and/or surface flow. The canopy is closed and comprised mainly of balsam fir and red maple, with high herbaceous cover and a well-developed bryophyte layer. The crown closure is moderate to high, and the understory supports woody species.



WM3 Red maple-Black spruce / Lambkill / Cinnamon fern / Sphagnum

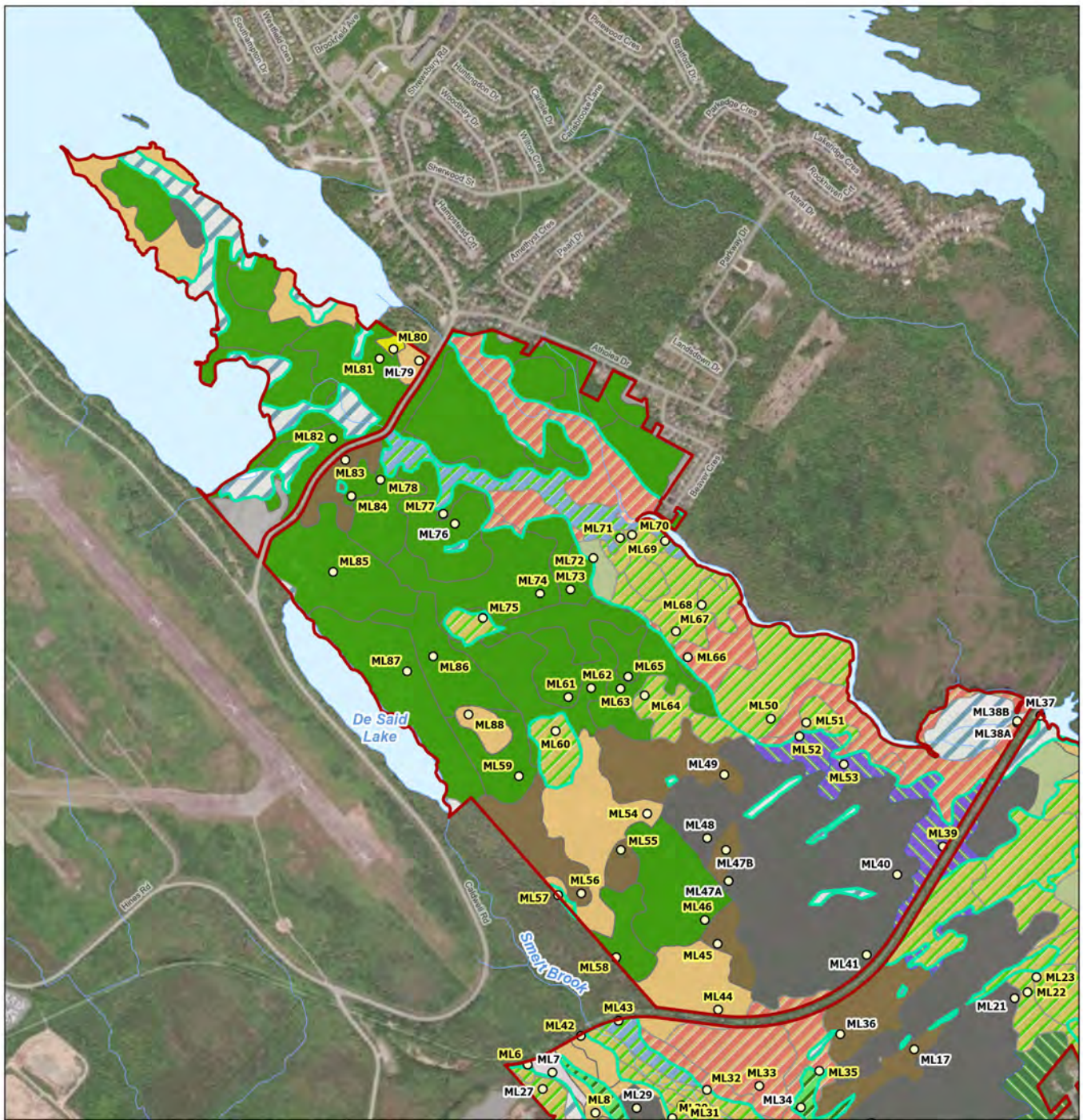
- Succession: Mid, Edaphic
- Typical Disturbance Type: Windthrow and timber harvesting
- Ecological Features: Occupies small areas and acts as a stepping-stone in large forest matrices for wetland dependent species.

This VT occurs on poorly drained sites that are underlain by wet mineral or organic deposits. It is a closed canopy forest with high shrub and herbaceous cover, and a well-developed sphagnum moss layer. The canopy is dominated by black spruce, red maple, and balsam fir. WM3 is characterized by the lowest nutrient availability of the WM VTs. This type typically consists of small patches found within large matrices. There are often pools of open water and peaty hummocks which provide habitat for amphibians, invertebrates, and avifauna.

3.4.2.12 Forested Wetlands

There are several wetlands within the MLSA, varying in size, type, and complexity. Many of these wetlands are complexes, containing more than one wetland community (e.g., a fen with a tree and shrub swamp halo around the perimeter). Although the Nova Scotia FEC system provides habitat types that are described as 'wet coniferous' or 'wet deciduous' conditions, there isn't a sufficient classification within this system for all wetland types (Section 3.2). Some of the wet forest groups are also not always indicative of wetland conditions and can also include forest mosaics or moist sites. The variation between wet forest groups and wetlands is also difficult to distinguish from digital data sources, therefore they were simply identified as 'wetland' in Figure 3.7a and Figure 3.7b.

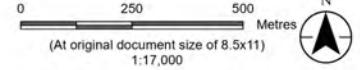




Notes
 1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
 2. Data Sources: Stantec, Government of Nova Scotia, Department of Service Nova Scotia and Internal Services
 3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

- Field Survey Location
- Forest Group**
 - Alder Thicket (AT)
 - Intolerant Hardwood (IH)
 - Mixedwood (MW)
 - Open Woodland (OW)
 - Spruce - Hemlock Forest (SH)
 - Spruce - Pine Forest (SP)
 - Coastal Boreal Forest (CB)
 - Wet Boreal Forest (WB)
- Non-Forest Group**
 - Barrens
 - Urban Other

- Wetland**
 - Wet Mixedwood Forest (WM)
 - Wet Coniferous Forest (WC)
 - Wet Deciduous Forest (WD)
 - Wetland Other
 - Tall Shrub Swamp (TSS)
- Other Features**
 - Waterway
 - Waterbody
 - Wetlands (Stanlec, 2023)
 - Study Area
- Forest Stand Estimated Age**
 - PC18 > 80 Years
 - PC18 30 to 80 Years
 - PC18 < 30 Years



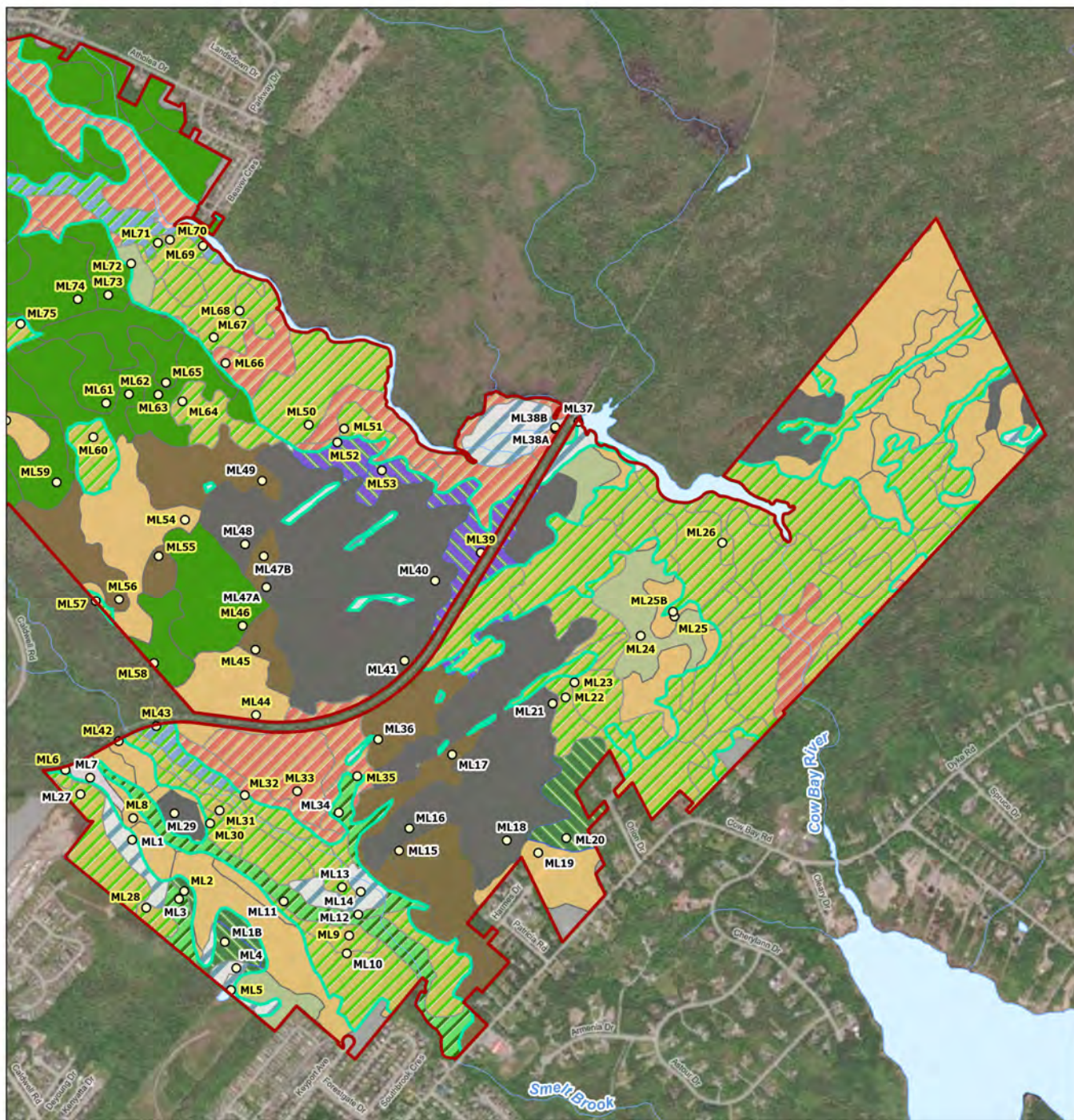
Project Location
 Halifax Regional Municipality,
 Nova Scotia

Client/Project
 Halifax Regional Municipality
 Future Serviced Communities
 Background Studies

Figure No.
3.7a

Title
Forest Groups - MLSA

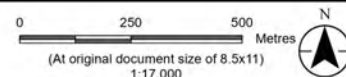
Prepared by NWhite on 2023-07-19
 Revised by NWhite on 2024-08-29
 Fig ID: 160410469_021



Notes
 1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
 2. Data Sources: Stantec; Government of Nova Scotia; Department of Service Nova Scotia and Internal Services
 3. Background: Government of Nova Scotia; Department of Service Nova Scotia and Internal Services

- Field Survey Location
- Forest Group**
- Alder Thicket (AT)
 - Intolerant Hardwood (IH)
 - Mixedwood (MW)
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- Non-Forest Group**
- Berrens
 - Urban Other

- Wetland**
- Wet Mixedwood Forest (WM)
 - Wet Coniferous Forest (WC)
 - Wet Deciduous Forest (WD)
 - Wetland Other
 - Tall Shrub Swamp (TSS)
- Other Features**
- Waterway
 - Waterbody
 - Wetlands (Stanlec, 2023)
 - Study Area
- Forest Stand Estimated Age**
- PC18 > 80 Years
 - PC18 30 to 80 Years
 - PC18 < 30 Years



Project Location
 Halifax Regional Municipality,
 Nova Scotia

Prepared by NWhite on 2023-07-19
 Revised by NWhite on 2024-08-29

Client/Project
 Halifax Regional Municipality
 Future Serviced Communities
 Background Studies

Figure No.
3.7b

Title
Forest Groups - MLSA

3.4.3 SPECIES AT RISK

AC CDC records (AC CDC 2023) indicate that the MLSA and surrounding environment may support a variety of wildlife, including SAR and SOCC. These species can be adversely affected by development in a variety of ways. These include direct loss of habitat as well as indirect habitat loss caused by sensory disturbance which can prevent species from using existing suitable habitat. Fragmentation of habitat can prevent species from accessing suitable habitat patches or may result in the formation of isolated habitat patches that are too small to support species that require large home ranges. Development can also result in increased rates of mortality associated with collisions with automobiles and structures such as windows of buildings or guy wires, exposure to anthropogenic toxins, and predation by domestic pets and generalist predators such as crows, raccoons, coyotes and foxes that are tolerant of the presence of humans,

For the purposes of this report, SAR are defined as any species with a status of Special Concern, Vulnerable, Threatened, Vulnerable, or Endangered by the Nova Scotia *Endangered Species Act* (NS ESA), the Federal *Species at Risk Act* (SARA), or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SOCC are defined as any species with an AC CDC S-rank of S1 (Critically Imperiled), S2 (Imperiled), or S3 (Vulnerable), and not otherwise defined as SAR. Table 3.13 presents species identified in the AC CDC data report (full report provided in Appendix A). The distribution of SAR and SOCC that have been recorded in or near the MLSA either during the field surveys or from existing records are presented on Figure 3.8. Some SAR are considered to be location sensitive since their populations may be placed at risk by illegal collection if their locations were publicly available. AC CDC does not provide location data for these species. For the purposes of this report, location sensitive species were presumed to have been recorded within 5 km of the MLSA in the same manner as SAR for which location data were available. Desktop data sources provide a valuable baseline understanding; however, collecting more than one season of field data would likely provide a more complete picture of SAR presence.

A different method was used to assess the potential presence of boreal felt lichen (*Erioderma pedicellatum*). A predictive habitat model for boreal felt lichen has been developed for Nova Scotia (Cameron and Neily 2008) and is now integral in supporting habitat identification according to Special Management Practices (NSDNR 2018). Less than 20% of known occurrences of the rare boreal felt lichen are located within the modelled habitat (NSDNR 2018), but the model identifies the coarse-scale habitat features of importance to boreal felt lichen across all of Nova Scotia. The model output showing the predicted distribution of boreal felt lichen was compared to the most recent imagery of the MLSA to confirm that suitable habitat was still present. If suitable habitat was still present, boreal felt lichen was considered to be potentially present.



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Table 3.13 SAR and SOCC Within 5 km of the MLSA (AC CDC 2023)

Scientific Name	Common Name	SARA ¹	COSEWIC ²	NS ESA ³	AC CDC ⁴
Birds					
<i>Morus bassanus</i>	Northern Gannet				SHB
<i>Branta bernicla</i>	Brant				S3M
<i>Anas acuta</i>	Northern Pintail				S1B, SUM
<i>Spatula discors</i>	Blue-winged Teal				S3B
<i>Spatula clypeata</i>	Northern Shoveler				S2B, SUM
<i>Mareca strepera</i>	Gadwall				S2B, SUM
<i>Aythya americana</i>	Redhead				SHB
<i>Somateria mollissima</i>	Common Eider				S3B, S3M, S3N
<i>Histrionicus histrionicus</i> pop. 1	Harlequin Duck – Eastern Population	SC	SC	EN	S2S3N, SUM
<i>Bucephala clangula</i>	Common Goldeneye				S2S3B, S5N, S5M
<i>Bucephala islandica</i>	Barrow's Goldeneye	SC	SC		S1N, SUM
<i>Oxyura jamaicensis</i>	Ruddy Duck				S1B
<i>Cathartes aura</i>	Turkey Vulture				S2S3B, S4S5M
<i>Accipiter cooperii</i>	Cooper's Hawk		NAR		S1?B, SUN, SUM
<i>Buteo lagopus</i>	Rough-legged Hawk				S3N
<i>Falco sparverius</i>	American Kestrel				S3B, S4S5M
<i>Gallinula galeata</i>	Common Gallinule				S1B
<i>Fulica americana</i>	American Coot				S1B
<i>Pluvialis squatarola</i>	Black-bellied Plover				S3M
<i>Pluvialis dominica</i>	American Golden-plover				S2S3M
<i>Charadrius semipalmatus</i>	Semipalmated Plover				S1B, S4M
<i>Charadrius melodus melodus</i>	Piping Plover melodus subspecies	EN	EN	EN	S1B
<i>Charadrius vociferus</i>	Killdeer				S3B
<i>Tringa melanoleuca</i>	Greater Yellowlegs				S3B, S4M
<i>Tringa flavipes</i>	Lesser Yellowlegs		TH		S3M
<i>Tringa semipalmata</i>	Willet				S3B
<i>Numenius phaeopus</i>	Whimbrel				S2S3M
<i>Numenius phaeopus hudsonicus</i>	Whimbrel				S2S3M
<i>Limosa haemastica</i>	Hudsonian Godwit		TH		S2S3M
<i>Arenaria interpres</i>	Ruddy Turnstone				S3M
<i>Calidris canutus</i>	Red Knot	EN	EN	EN	S2M
<i>Calidris alba</i>	Sanderling				S2N, S3M
<i>Calidris pusilla</i>	Semipalmated Sandpiper				S3M



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Scientific Name	Common Name	SARA¹	COSEWIC²	NS ESA³	AC CDC⁴
<i>Calidris minutilla</i>	Least Sandpiper				S1B, S4M
<i>Calidris melanotos</i>	Pectoral Sandpiper				S3M
<i>Calidris subruficollis</i>	Buff-breasted Sandpiper	SC	SC		SNA
<i>Limnodromus griseus</i>	Short-billed Dowitcher				S3M
<i>Gallinago delicata</i>	Wilson's Snipe				S3B, S5M
<i>Phalaropus lobatus</i>	Red-necked Phalarope	SC	SC		S2S3M
<i>Phalaropus fulicarius</i>	Red Phalarope				S2S3M
<i>Leucophaeus atricilla</i>	Laughing Gull				SHB
<i>Chroicocephalus ridibundus</i>	Black-headed Gull				S3N
<i>Sterna hirundo</i>	Common Tern				S3B
<i>Uria aalge</i>	Common Murre				S1?B
<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo				S3B
<i>Asio otus</i>	Long-eared Owl				S2S3
<i>Asio flammeus</i>	Short-eared Owl	SC	TH		S1B
<i>Chordeiles minor</i>	Common Nighthawk	SC	SC	TH	S3B
<i>Antrostomus vociferus</i>	Eastern Whip-poor-will	TH	SC	TH	S1?B
<i>Chaetura pelagica</i>	Chimney Swift	TH	TH	EN	S2S3B, S1M
<i>Contopus cooperi</i>	Olive-sided Flycatcher	SC	SC	TH	S3B
<i>Contopus virens</i>	Eastern Wood-Pewee	SC	SC	VU	S3S4B
<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3B
<i>Riparia riparia</i>	Bank Swallow	TH	TH	EN	S2B
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B
<i>Hirundo rustica</i>	Barn Swallow	TH	SC	EN	S3B
<i>Perisoreus canadensis</i>	Canada Jay				S3
<i>Poecile hudsonicus</i>	Boreal Chickadee				S3
<i>Mimus polyglottos</i>	Northern Mockingbird				S1B
<i>Vireo philadelphicus</i>	Philadelphia Vireo				S2?B, SUM
<i>Setophaga tigrina</i>	Cape May Warbler				S3B, SUM
<i>Setophaga pinus</i>	Pine Warbler				S2S3B, S4S5M
<i>Setophaga striata</i>	Blackpoll Warbler				S3B, S5M
<i>Cardellina canadensis</i>	Canada Warbler	TH	SC	EN	S3B
<i>Icteria virens</i>	Yellow-breasted Chat	EN	EN		SNA
<i>Piranga olivacea</i>	Scarlet Tanager				S2B, SUM
<i>Pheucticus ludovicianis</i>	Rose-breasted Grosbeak				S3B
<i>Passerina cyanea</i>	Indigo Bunting				S1?B, SUM



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Scientific Name	Common Name	SARA ¹	COSEWIC ²	NS ESA ³	AC CDC ⁴
<i>Passerculus sandwichensis princeps</i>	Ipswich Sparrow	SC	SC		S1B
<i>Zonotrichia querula</i>	Harris's Sparrow		SC		SNA
<i>Calcarius lapponicus</i>	Lapland Longspur				S3?N, SUM
<i>Dolichonyx oryzivorus</i>	Bobolink	TH	SC	VU	S3B
<i>Euphagus carolinus</i>	Rusty Blackbird	SC	SC	EN	S2B
<i>Molothrus ater</i>	Brown-headed Cowbird				S2B
<i>Icterus galbula</i>	Baltimore Oriole				S2S3B, SUM
<i>Pinicola enucleator</i>	Pine Grosbeak				S3B, S5N, S5M
<i>Spinus pinus</i>	Pine Siskin				S3
<i>Coccothraustes vespertinus</i>	Evening Grosbeak	SC	SC	VU	S3B, S3N, S3M
Mammals					
<i>Myotis and Perimyotis</i>	Bats or Bat hibernaculum†	EN	EN	EN	S1
<i>Lasionycteris noctivagans</i>	Silver-haired Bat		EN		SUB, S1M
<i>Globicephala melas</i>	Long-finned Pilot Whale				S2S3
<i>Megaptera novaeangliae</i>	Humpback Whale				S3
Reptiles					
<i>Chelydra serpentina</i>	Snapping Turtle	SC	SC	VU	S3
<i>Chrysemys picta picta</i>	Eastern Painted Turtle	SC	SC		S4
<i>Glyptemys insculpta</i>	Wood Turtle	TH	TH	TH	S2
Fish					
<i>Anarhichas lupus</i>	Atlantic Wolffish	SC	SC		SNR
<i>Anguilla rostrata</i>	American Eel		TH		S3N
<i>Morone saxatilis</i>	Striped Bass		E, SC		S2S3B, S2S3N
<i>Gadus morhua</i>	Atlantic Cod		E,SC,DD		SNR
Insects					
<i>Danaus plexippus</i>	Monarch	SC	EN	EN	S2?B, S3M
<i>Polygonia comma</i>	Eastern Comma				S1?
<i>Nymphalis l-album</i>	Compton Tortoiseshell				S2S3
<i>Aglaia milberti</i>	Milbert's Tortoiseshell				S2S3
<i>Polygonia interrogationis</i>	Question Mark butterfly				S3B
<i>Bombus terricola</i>	Yellow-banded Bumble Bee	SC	SC	VU	S3
<i>Bombus bohemicus</i>	Gypsy Cuckoo Bumble Bee	EN	EN	EN	S1
<i>Pachydiplax longipennis</i>	Blue Dasher				S1
<i>Somatochlora kennedyi</i>	Kennedy's Emerald				S2S3
<i>Somatochlora forcipata</i>	Forcipate Emerald				S3



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Scientific Name	Common Name	SARA ¹	COSEWIC ²	NS ESA ³	AC CDC ⁴
<i>Pantala hymenaea</i>	Spot-winged Glider				S2?B
<i>Hippodamia perentthesis</i>	Parenthesis Lady Beetle				S3
<i>Naemia seriata</i>	Seaside Lady Beetle				S3
<i>Myzia pullata</i>	Streaked Lady Beetle				S3
Lichens and Mosses					
<i>Erioderma pedicellatum</i>	Boreal Felt Lichen	EN	EN	EN	S1
<i>Elodium blandowii</i>	Blandow's Bog Moss				S3?
Vascular Plants					
<i>Ranunculus sceleratus</i>	Cursed Buttercup				S2
<i>Caltha palustris</i>	Yellow Marsh Marigold				S2S3
<i>Hudsonia ericoides</i>	Pinebarren Golden Heather				S2
<i>Clethra alnifolia</i>	Coast Pepper-bush	TH	EN	VU	S2
<i>Polygala sanguinea</i>	Blood Milkwort				S3
<i>Senecio pseudoarnica</i>	Seabeach Ragwort				S3
<i>Carex swanii</i>	Swan's Sedge				S3
<i>Cypripedium parviflorum</i>	Yellow Lady's-slipper				S3
<i>Neottia bifolia</i>	Southern Twayblade				S3
Notes: Bold common name indicates SAR status. ¹ACCDC includes three species of bats as one unit. These species are the <i>Myotis lucifugus</i> (Little Brown Myotis), <i>Myotis septentrionalis</i> (Long-eared Myotis), and <i>Perimyotis subflavus</i> (Tri-colored Bat). Each has the same status (EN) and the same S-Rank (S1). ² Species at risk in Canada listed under Schedule 1 the federal <i>Species at Risk Act</i> as Endangered (EN), Threatened (TH), or Special Concern (SC) (Government of Canada 2023). ³ Species in Canada assessed by COSEWIC as Endangered (EN), Threatened (TH), Vulnerable (VU), or Special Concern (SC); not at risk species = NAR, Data Deficient = DD (Government of Canada 2023). ⁴ Species at risk in Nova Scotia listed under the provincial <i>Endangered Species Act</i> (NS) as Endangered (EN), Threatened (TH), Vulnerable (VU), or Special Concern (SC; Government of Nova Scotia 2023). ⁴ Species ranked by the Atlantic Canada Conservation Data Centre (AC CDC 2023) and recorded within 5 km of the Project by desktop data source, where: S1: Critically Imperiled – Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences). May be especially vulnerable to extirpation. S2: Imperiled – Imperiled in the province because of rarity due to very restricted range, very few populations (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors. S3: Vulnerable – Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer). S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors (80+ occurrences). S5: Secure – Common, widespread, and abundant in the province. S#S#: A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. SH: Possibly Extirpated (Historical) – Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences. SU: Unrankable – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.					



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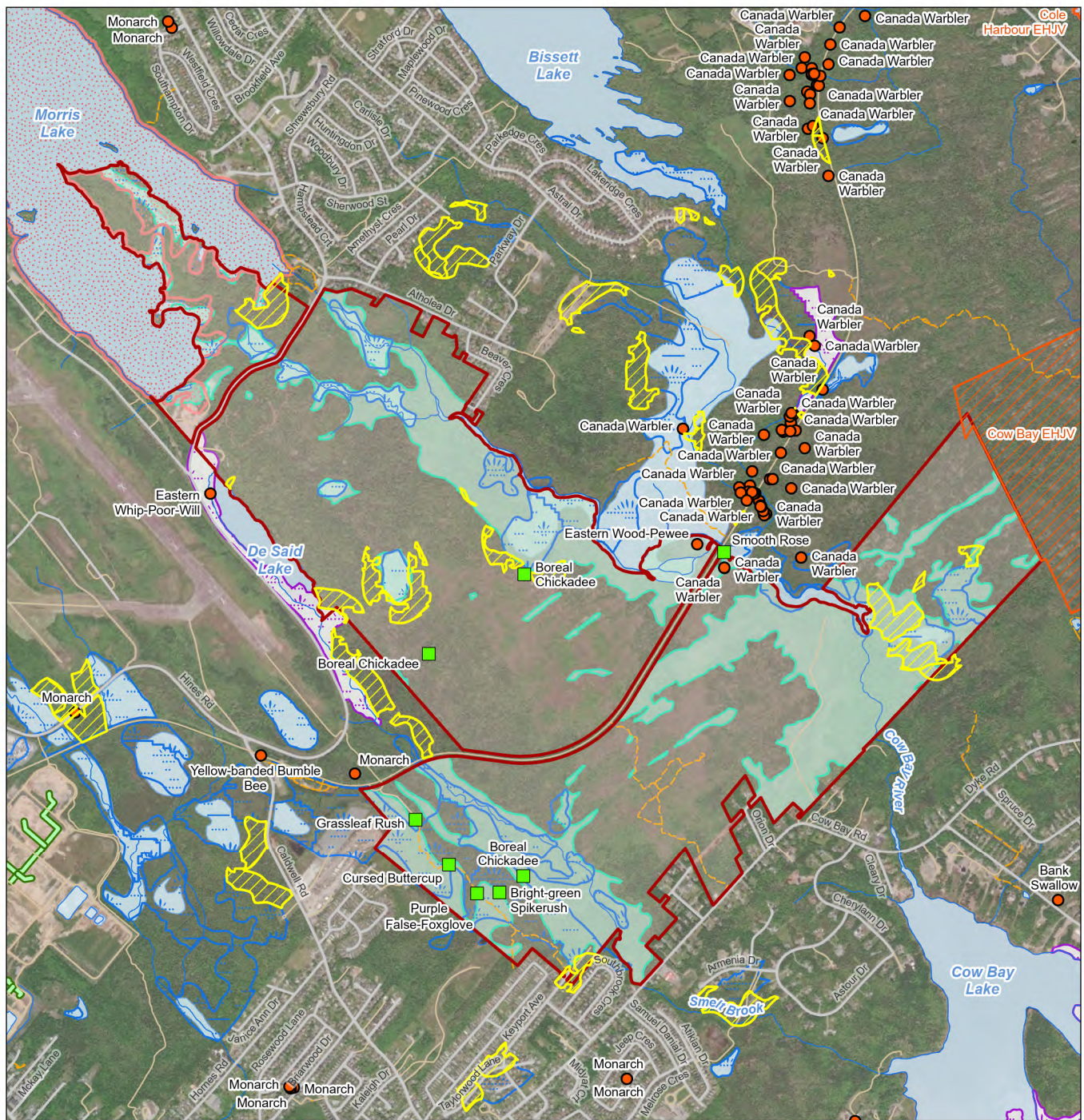
Incidental observations of wildlife and plant species were recorded during wetland, vegetation, water, and archeology field programs. Stantec observed 273 species (33 birds, 4 amphibians, 8 mammals, 3 reptiles and 225 vascular plants) This includes 4 SOCC vascular plant Species in table 3.14. The SOCC species observed in the field are identified in Table 3.14 and shown on Figure 3.8. SAR and SOCC that have been reported by AC CDC near the MLSA are also presented in Figure 3.8. A full list of species observed during field studies is available in Appendix C. No SAR were observed during the field surveys, but this is not definitive proof of their absence in the MLSA. A full list of wildlife species observed during field studies is available in Appendix C.

Table 3.14 Incidental Observations of SAR and SOCC

Scientific Name	Common Name	SARA ¹	COSEWIC ²	NS ESA ³	AC CDC ⁴
Birds					
<i>Poecile hudsonicus</i>	Boreal Chickadee	-	-	-	S3
Vascular Plants					
<i>Ranunculus sceleratus</i>	Cursed Buttercup	-	-	-	S1S2
<i>Rosa blanda</i>	Smooth Rose	-	-	-	S1
<i>Agalinus purpurea</i>	Purple False-foxglove	-	-	-	S2S3
<i>Eleocharis flavescens</i> var. <i>olivacea</i>	Bright-green Spikerush	-	-	-	S3
Notes: Bold indicates SAR status. ¹ Species at risk in Canada listed under Schedule 1 the federal <i>Species at Risk Act</i> as Endangered (EN), Threatened (TH), or Special Concern (SC) (Government of Canada 2023). ² Species in Canada assessed by COSEWIC as Endangered (EN), Threatened (TH), Vulnerable (VU), or Special Concern (SC); not at risk species = NAR, Data Deficient = DD (Government of Canada 2023). ³ Species at risk in Nova Scotia listed under the provincial <i>Endangered Species Act</i> (NS) as Endangered (EN), Threatened (TH), Vulnerable (VU), or Special Concern (SC; Government of Nova Scotia 2023). ⁴ Species ranked by the AC CDC (AC CDC 2023) and recorded within 5 km of the Project by desktop data source, where: S1: Critically Imperiled – Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences). May be especially vulnerable to extirpation. S2: Imperiled – Imperiled in the province because of rarity due to very restricted range, very few populations (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors. S3: Vulnerable – Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer). S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors (80+ occurrences). S5: Secure – Common, widespread, and abundant in the province. S#S#: A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. SH: Possibly Extirpated (Historical) – Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences. SU: Unrankable – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.					



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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Government of Nova Scotia, Department of Natural Resources and Renewables; NS Environment and Climate Change, East Coast Aquatics - Ecological aspects of a local Wood Turtle (*Glyptemys insculpta*) population along the Sackville River, Nova Scotia (Page 17) 2016; Atlantic Canada Conservation Data Centre, 2023
3. Background: Government of Nova Scotia Department of Service Nova Scotia and Internal Services; Nova Scotia Department of Natural Resources and Renewables

- Species of Conservation Concern (Incidental Observation)
- Species at Risk and Species of Conservation Concern (ACDC)
- Pipeline
- Road
- Resource / Seasonal Road
- Trail
- Waterway
- Waterbody
- Wetland (Stantec, 2023)
- Wetland (NSECC)
- Designated Wetland of Special Significance
- Significant Habitat - Migratory Bird
- Boreal Felt Lichen Predicted Habitat (NSECC, 2010)
- Managed Area (ACDC)
- Study Area

0 250 500 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by IPodrug on 2024-03-07
Revised by NWhite on 2024-03-14
Revised by Schubbs on 2024-05-10

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Figure ID: 007

Figure No.
3.8

Title
SAR, SOCC, and Sensitive Habitats
Identified - MLSA

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.4.3.1 Species at Risk Descriptions

SAR identified in either the AC CDC (2023) report or identified during the field programs are described below. Species are presented in the order they appear in the tables above and information is provided on the species biology, as well as its regulatory status. Species identified during field programs are marked with an asterisk (*). No SAR were observed during the field surveys, but this is not definitive proof of their absence in the MLSA.

Harlequin Duck

The eastern population of the harlequin duck is listed as Special Concern under the federal SARA and Endangered under the Nova Scotia ESA. The harlequin duck is a sea duck that nests along fast flowing streams (COSEWIC 2013a). It does not nest in Nova Scotia and the nearest breeding populations are in northern New Brunswick and in the Gaspé Peninsula of Quebec. Harlequin ducks spend the winter months in coastal waters. Wintering birds are typically found on exposed, rocky coastline. This species has high site fidelity for wintering sites. The AC CDC data report indicates that harlequin duck has been recorded once within a 5 km radius of the Study Area. The record is from South East Passage, 4.7 km east of the MLSA. No suitable harlequin duck wintering habitat is present in the MLSA.

Barrow's Goldeneye

Barrow's goldeneye is listed as Special Concern under the federal SARA but is not listed under the NS ESA. The federal ranking was first assigned in 2003, and was reevaluated, with no changes made, in 2011 (COSEWIC 2000; 2011a). Barrow's goldeneye is a medium sized diving duck residing in Canada and the United States. Most Barrow's goldeneyes are found west of the Rocky Mountains; however, a small population is present in Quebec and the Atlantic provinces (COSEWIC 2011a). In eastern Canada Barrow's goldeneyes nest in Quebec in the boreal forest along the north shore of the St. Lawrence River. This species does not nest in Nova Scotia; however, small numbers of Barrow's goldeneyes winter in nearshore coastal waters of Nova Scotia where they feed on mussels and other aquatic invertebrates. There is one record of Barrow's goldeneye within 5 km of the MLSA. This record was from South East Passage, 4.8 km west of the MLSA. The Study Area provides neither suitable breeding nor wintering habitat for this species.

Piping Plover

Piping plover is listed as Endangered under both the federal SARA and the NS ESA. In Nova Scotia this species nests on coastal beaches, usually on barrier islands and sand bars (COSEWIC 2013b). The beaches where piping plovers nest are typically wide, sparsely vegetated and have a mix of substrates including sand, pebbles, gravel, and shells.

There are 71 records of piping plover within 5 km of the MLSA. Most of the records are from Rainbow Haven Beach, Cole Harbour, Cow Bay, and McNabs Island. Given the fact that the MLSA contains no coastal beaches, piping plovers would not use the MLSA as habitat.



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Lesser Yellowlegs

The lesser yellowlegs is a medium-sized shorebird that nests in wetlands in the boreal forest of Canada and Alaska. This species is listed as Threatened by COSEWIC (2020a) but is not listed under either the federal SARA or the NS ESA. Lesser yellowlegs do not nest in Nova Scotia but pass through the province during fall migration. In the Maritime Provinces, lesser yellowlegs typically use both freshwater and marine shorelines during migration (COSEWIC 2020a).

There are 75 records of lesser yellowlegs observed within 5 km of the MLSA. Most of these birds were observed at either Cole Harbour or Rainbow Haven Beach, presumably in coastal wetlands and shores. There are also a few records from South East Passage and Devils Island. This species may also use freshwater shorelines. Areas within the MLSA that could provide suitable migration foraging habitat for lesser yellowlegs include the shorelines of Morris Lake and De Said Lake at the western end of the MLSA and Cow Bay River along the northern boundary.

Hudsonian Godwit

The Hudsonian godwit is a large shorebird that nests in the Canadian Arctic and Alaska. This species is listed as Threatened by COSEWIC (2019) but is not listed under either the federal SARA or the NS ESA. Hudsonian godwits do not nest in Nova Scotia but pass through the province during fall migration. This species is noted for its long-distance flights that may take days to complete. Because of these long-distance flights, many Hudsonian godwits fly over Nova Scotia but relatively few interact with habitats in the province. During migration, Hudsonian godwits will forage in coastal marshes and mudflats in Nova Scotia (COSEWIC 2019).

The MLSA does not contain suitable Hudsonian godwit foraging habitat so it is unlikely that this species would make use of habitats in the MLSA. There are 16 records of Hudsonian godwits within 5 km of the MLSA. Most of these records were from coastal habitats at Cole Harbour and Upper Lawrencetown with single records from, Eastern Passage and Devils Island.

Red Knot

The red knot is a medium sized shorebird that nests in barrens habitat in the Arctic. Red knots pass through Nova Scotia during migration with more birds present in the fall than in the spring. In Nova Scotia, red knots are typically found on sandy beaches with adjacent mud flats (COSEWIC 2020b). They may also feed on low-lying meadows after the hay has been cut.

Red knots were recorded on 18 occasions within 5 km of the MLSA with all but two records from Cole Harbour. The remaining two records are from Eastern Passage. Suitable foraging habitat for red knots is not present in the MLSA so this species would not be present.



Buff-breasted Sandpiper

The buff-breasted sandpiper is listed as Special Concern under the SARA but is not listed under the NS ESA. Most buff-breasted sandpipers nest in the Canadian Arctic. During migration, adults move south through the center of the continent while juveniles work their way towards the Pacific or Atlantic Coast and follow the coastline south to their wintering grounds in South America (COSEWIC 2012a). During migration, buff-breasted sandpipers favour open areas with low vegetation cover such as short-grass prairie, grazed pastures, and salt marsh. The MLSA does not provide suitable migration habitat for buff-breasted sandpiper; consequently, this species is not expected to be present.

Red-necked Phalarope

The red-necked phalarope is a pelagic shorebird that is listed as Special Concern under the federal SARA but is not listed under the NS ESA. This species is a circumpolar breeder. Parts of the Canadian and European populations of red-necked phalaropes migrate along the Atlantic coast to their wintering area in the Humbolt Current off the coast of Ecuador, Peru, and Chile (ECCC 2022a). Most birds migrate offshore and are not commonly observed in nearshore waters.

There are three records of Red-necked Phalarope from within 5 km of the MLSA.

These records are from Cole Harbour, Hartlen Point and an undisclosed location. The nearest record is 4.4 km from the center of the MLSA. Suitable habitat for Red-necked Phalarope is not present at the MLSA so this species would not be present.

Short-eared Owl

The short-eared owl is listed as Special Concern under the federal SARA but is not listed under the NS ESA. This species is a year-round resident of Nova Scotia. Its preferred nesting habitat is in large open habitats at least 50 ha in size such as grasslands, dyked wet meadows, tundra, and marshes (COSEWIC 2021a). Most breeding occurs near the coast.

There are three records of short-eared owl from within 5 km of the MLSA. Two of the records are from Maritime Breeding Bird Atlas (MBBA) squares in 2010. The MBBA records are derived from a 100 km² area. The center of the MBBA square is used as the location coordinates for all birds recorded in this area. No precise location data are available for bird records from this program. The third record is from South East Passage, Eastern Passage which is located 4.8 km from the MLSA. Short-eared owls have also been observed at 12 Wing Shearwater which is located approximately 200 m south of the southern boundary of the MLSA. There is little open habitat on the MLSA that would provide suitable habitat for short-eared owls. There are several graminoid dominated wetlands, however, these are not large enough to provide suitable habitat. There is a relatively large (approximately 75 ha) area of barrens in the center of the MLSA. This open habitat is of sufficient size; however, the heavy and relatively tall cover of ericaceous shrubs would provide poor foraging and nesting cover. It is unlikely that short-eared owls would be present on the MLSA Site although they may be present near it at 12 Wing Shearwater.



Common Nighthawk

Common nighthawk is listed as Special Concern under the federal SARA and as Threatened under the NS ESA. Common nighthawk was first federally listed as Threatened in 2007 (COSEWIC 2007a); however, due to a stabilization in the rate of decline, and the abundance of common nighthawk in suitable environments, COSEWIC (2018a) revised the status to Special Concern in 2018. The federal SARA status was downgraded from Threatened to Special Concern in 2023. Common nighthawk is a medium-sized aerial insectivore that nests in a variety of open habitats with minimal ground vegetation including open forest (especially areas with cuts, burns or rock outcrops), short grass prairie, dry bogs, rocky areas (such as quarries, gravel pits, and bedrock outcrops), sandy coastal habitats and settled areas that resemble open natural areas such as railways, gravel roads, airports, cultivated fields, orchards, parks, buildings with gravel roofs, oil-well pads, and pipelines. Common nighthawks are opportunistic generalist foragers and aggregate in areas where flying insects are abundant including waterways, lighted areas, and wetlands.

No common nighthawks were observed during the field surveys. There are four records of common nighthawk within a 5 km radius of the center of the MLSA. All the records are from either the Cole Harbour or Halifax MBBA square. Each of these MBBA squares is 100 km² so it is not possible to determine with any accuracy where these common nighthawks were observed. Suitable nesting habitat is present at the MLSA at several locations where grubbing and roads have exposed bare ground and where rocky bedrock outcrops are present. Grubbed areas are present near the northern end of De Said Lake and near the Shearwater Flyers trail head. Small bedrock exposures are scattered throughout the MLSA but are most frequently encountered in the barrens habitat in the center of the MLSA.

Eastern Whip-poor-will

The eastern whip-poor-will is a nocturnal insectivorous bird which is listed as Threatened by both the federal SARA and the NS ESA. This species nests in sparse forests or at the edge of forests adjacent to open habitats required for foraging (ECCC 2018b). Foraging habitats are varied but typically have relatively sparse tree cover. Foraging habitat can include wetlands with shrubs, shrub thickets, regenerating clear-cuts, and agricultural lands. Suitable foraging habitat must have scattered trees or other elevated structures that can be used as perches. A variety of forest types are used as nesting habitat as well as rock or sand barrens with scattered trees, savannahs, old burns, and sparse conifer plantations. Structurally, suitable nesting sites have well drained soils (eastern whip-poor-wills nest on the ground), moderate tree cover, and moderate to sparse shrub and herbaceous cover. Eastern whip-poor-will may also nest in dense forest adjacent to suitable foraging habitat, with nests typically established within 30 m of the edge of the dense forest.

There are two records of eastern whip-poor-wills from within 5 km of the MLSA. Both were recorded in the Cole Harbour MBBA square in 2008. No precise location data are available for the first record other than that it was recorded somewhere within the 100 km² square whose center is located 3.3 km from the Study Area. However, a relatively accurate location is available for the second record which is located at the northern end of De Said Lake. Suitable habitat for eastern whip-poor-will may be present at the western end of the MLSA. This area contains forested habitat located adjacent to large areas of open grassland



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and patches of shrub cover associated with the runways at 12 Wing Shearwater. Eastern whip-poor-wills could potentially nest in a 30 m wide strip of forest extending along the eastern shore of De Said Lake. There is a large area (approximately 75 ha) of barrens habitat in the center of the MLSA that may also provide suitable nesting and foraging habitat. Shrub cover in most of this barrens area is thick and relatively tall which may reduce its value as nesting and foraging habitat for eastern whip-poor-wills.

Chimney Swift

Chimney swift is listed as Threatened under the federal SARA and Endangered under the NS ESA. This species has been assessed by COSEWIC twice, first in 2007, followed by a confirmatory report in 2018 (COSEWIC 2007b; 2018b). Chimney swift is a small aerial insectivore which is found in Eastern North America during the breeding season. Before European settlement, chimney swifts nested and roosted in large hollow trees. These nesting and roosting sites became less common because of forest harvesting. Chimney swifts adapted to the loss of natural nesting and roosting sites by using large masonry chimneys for nesting and roosting. Eventually, large masonry chimneys fell out of favor and the supply of suitable nesting and roosting sites dwindled.

There are three records of chimney swift recorded within 5 km of the MLSA. One record is from Colby Village and the second is from Rainbow Haven. The third record is from the Cole Harbour MBBA which amalgamates bird records from a 100 km² MBBA square. It is, therefore, impossible to determine with precision where this bird was observed. No chimney swifts were observed during the field surveys. No large masonry chimneys are present in the Study Area and there are few large trees at the Study Area that could provide nesting sites. It is unlikely that chimney swifts would breed at the MLSA.

Olive-sided Flycatcher

Olive-sided flycatcher is listed as Special Concern under the federal SARA and as Threatened under the provincial NS ESA. It was first federally listed as Threatened in 2007; however, due to a stabilization in the rate of decline, COSEWIC (2018c) revised the status to Special Concern in 2018. The federal SARA status was downgraded in Schedule 1 from Threatened to Special Concern in 2023. In Nova Scotia, olive-sided flycatchers are found in forested areas where scattered trees or snags remain after clear-cutting or fire, as well as mature stands of black spruce adjacent to bogs, fens, beaver ponds, or clearcuts. Nests are established in black spruce trees.

No olive-sided flycatchers were recorded during the field surveys. The AC CDC data report (2023) indicates that one olive-sided flycatcher has been recorded within approximately 5 km of the MLSA. This bird was observed in the Cole Harbour MBBA square in 2006. Habitat mapping for the Study Area indicates that suitable nesting habitat for olive-sided flycatcher may be present at two locations in the MLSA. There is an area of wooded swamp near the point where the Shearwater Flyer Trail crosses the Cow Bay River that has recently suffered heavy tree mortality because of hydrological fluctuations. The presence of open wetland habitat with scattered snags would provide good olive-sided flycatcher habitat provided patches of thick conifer cover are also present. The large area of barrens habitat in the center of the MLSA may also provide suitable breeding habitat for olive-sided flycatchers. The barrens consists of a matrix of open low shrub dominated areas, small patches of forest including patches of coniferous forest and scattered snags or living trees.



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Eastern Wood-Pewee

Eastern wood-pewee is listed as Special Concern under the federal SARA and Vulnerable under the NS ESA. Eastern wood-pewee is a medium sized flycatcher that typically nests in mature deciduous and mixedwood forest stands. They typically occupy the mid to upper layers of the canopy and favor areas where canopy openings are present where they can catch flying insects (NSDNRR 2022a). Threats to eastern wood-pewee are poorly understood, but like most aerial insectivores, a decline in insect populations is thought to be a key contributor (COSEWIC 2012b).

The AC CDC data request (2023) indicates that there are three records of eastern wood-pewee within approximately 5 km of the MLSA. One record is from 1986 from within the 100 km² Cole Harbour MBBA square so it is not possible to determine with any precision where these birds were observed. The second record is from near the Shearwater Flyer Trail near the bridge over the Cow Bay River at the western boundary of the MLSA. The third record is from South East Passage, 4.6 km southeast of the MLSA. No eastern wood-pewees were recorded during the field surveys; however, the field surveys were executed late in the summer at this site after the end of the breeding season when eastern wood-pewees sing and are most easily detected. FEC forest stand mapping for the Study Area suggests that suitable nesting habitat may be present in the MLSA. This would include mature deciduous and mixedwood forest stands in the northern portions of the MLSA that border open habitats such as man-made forest clearings and those that flank open wetland habitats along the Cow Bay River and recently flooded forest stands.

Bank Swallow

Bank swallow is listed as Threatened under the federal SARA and as Endangered under the provincial NS ESA. Bank swallows nest in burrows that they excavate in a variety of habitat types. These include lake and ocean bluffs; stream and riverbanks; sand and gravel pits; roadcuts; piles of sand, topsoil, sawdust, coal ash, and other materials (COSEWIC 2013c). The nest burrows are excavated in vertical or near vertical slopes (76 - 105° slope). Critical habitat has been defined and mapped for bank swallow in Nova Scotia (NSDNRR 2021). Critical habitat is the habitat that is necessary for the survival or recovery of a species. Critical habitat for this species consists of suitable nesting habitat as well as suitable foraging habitat that is found within 500 m of the nesting habitat. Foraging habitat consists of open habitats that produce insects such as wetlands, salt marshes, grasslands, and hay fields. Seasonal wetlands or ponds that are flooded are important sources of insect prey for bank swallows.

The Study Area does not fall within Bank Swallow critical habitat that is currently mapped. The AC CDC data search (2023) indicated that there are 50 records of Bank Swallow within approximately 5 km of the MLSA with most of the records from Hartlen Point. The nearest record is from the northern shore of Cow Bay which is 2.7 km from the center of the MLSA. No Bank Swallows were observed during the field surveys. No natural potential nesting sites (lake bluffs and stream banks) or anthropogenic nesting sites (steep embankments or soil stockpiles) were observed within the Study Area. It is unlikely that Bank Swallows nest at the MLSA.



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Barn Swallow

Barn swallow is listed as Threatened under the federal SARA and Endangered under the provincial NS ESA; however, the species was re-assessed as Special Concern in 2021 (COSEWIC 2021b) making it eligible for a status change under the federal SARA. Barn swallow is a mid-sized aerial insectivore that forages in open habitats (e.g., agricultural fields, shorelines) and nests on anthropogenic structures, particularly in rural areas, and other structures (e.g., culverts; COSEWIC 2011b). Before European settlement, barn swallow nesting habitat was mainly characterized by natural features such as caves, holes, crevices, and ledges associated with rocky cliff faces. Although barn swallows continue to nest in traditional natural situations, they are now most closely associated with human-made structures in rural areas. Such nesting sites include a variety of artificial structures that provide either a horizontal nesting surface (e.g., a ledge) or a vertical face, usually with some sort of overhang that provides shelter. Nests are most commonly located in and around open barns, garages, sheds, boat houses, bridges, road culverts, verandahs, and wharfs, and are situated on such things as beams and posts, light fixtures, and ledges over windows and doors (COSEWIC, 2011b). This species was listed on Schedule 1 of SARA in 2017, but critical habitat has not been identified to date.

No barn swallows were observed during the field surveys in August when this species would be present in Nova Scotia. There were 19 records of barn swallows reported by the AC CDC (2023) within a 5 km radius from the MLSA. The nearest record is from Colby Village, 3.3 km north of the MLSA. There is no suitable nesting habitat inside the MLSA; however, the MLSA is bordered in some areas by residences, some of which may provide suitable nesting habitat. Potential foraging habitat for barn swallows that might nest adjacent to the MLSA would include Morris Lake and De Said Lake at the northern end of the Study Area and Cow Bay River along the western boundary of the MLSA.

Canada Warbler

Canada warbler is listed as Threatened under the federal SARA and Endangered under the provincial NS ESA; however, the species was re-assessed as Special Concern in 2020 (COSEWIC 2020c) making it eligible for a status change under the federal SARA. Close to 80% of the Canada warbler population breeds in Canada (COSEWIC 2020c). Many key threats identified by COSEWIC (2020c) are present on the wintering grounds outside of Canada, though habitat loss in Canada is recognized as a contributing factor.

Canada warblers are found in a variety of forest types, but are most common in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. It is also found in shrub swamps, red maple (*Acer rubrum*) stands, eastern white cedar (*Thuja occidentalis*) stands, conifer swamps dominated by black spruce and larch (*Larix laricina*), and riparian woodlands along rivers and lakes.



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No Canada warblers were encountered during the field surveys. This species is typically found in dense vegetation and the field surveys were not conducted during peak Canada warbler breeding activity in June when this species can be detected by its song so it is likely that Canada warbler may have gone undetected during the field surveys. There are 74 AC CDC records of Canada warbler within approximately 5 km of the MLSA. There are two records that appear to be inside the MLSA. Both records are from near the point where the Shearwater Flyer Trail crosses Cow Bay River. There are six records from just outside of the MLSA approximately 100 m northwest of the same bridge crossing. The remaining records are from outside of the MLSA on the Shearwater Flyer Trail, the Salt Marsh Trail as well as from the Cole Harbour MBBA.

There is suitable habitat for Canada warblers at various locations within the MLSA. Twenty forested or tall shrub dominated wetlands having relatively open tree overstories and dense shrub understories were encountered during the field surveys which could provide suitable breeding habitat for this species.

Yellow-breasted Chat

The yellow-breasted chat is listed as Endangered under the SARA but is not listed under the NS ESA because this species occurs in Nova Scotia as a vagrant. It does not nest in Nova Scotia and does not normally migrate through the province. There are four records of yellow-breasted chat from within 5 km of the MLSA. Three of the records are from Colby Village and the fourth is from Sunset Acres. All records are from early winter and most are likely birds blown north by storms or are reverse migrants. Yellow-breasted chats typically nest in dense shrub cover often near habitat edges and forage in the same habitat type outside of the breeding season (COSEWIC 2011c). Suitable nesting and foraging habitat is present in the MLSA; however, since this bird occurs as a vagrant, this habitat is not ecologically important to this species.

Ipswich Sparrow

The Ipswich Sparrow is listed as Special Concern under the federal SARA but is not listed under the NS ESA. The Ipswich Sparrow is a large sub-species of Savannah Sparrow. Almost the entire population of Ipswich Sparrows breeds on Sable Island (COSEWIC 2008a). A few Ipswich Sparrows do not return to Sable Island in the spring and breed with Savannah Sparrows on mainland Nova Scotia. Ipswich Sparrows nest on Sable Island in areas dominated by heath and areas dominated by Marram grass (*Ammophilla breviligulata*) which comprise most of the vegetation on Sable Island.

There are 21 records of Ipswich Sparrow from within 5 km of the MLSA. Most of the records are from South East Passage, with a few records from Eastern Passage and one from Devils Island. All the records are of spring migrants which pass through Nova Scotia during the period from late March to early May. The MLSA does not provide suitable habitat for either breeding or migrating Ipswich Sparrows.



Harris's Sparrow

Harris's Sparrow is listed as Special Concern under COSEWIC but is not listed under either the SARA or the NS ESA. Harris's Sparrows nest in northwestern Canada and winter in south central United States of America (COSEWIC 2017a). This species breeds in the transitional zone between boreal forest and tundra. During migration and in the wintering grounds, Harris's Sparrows use a variety of habitats including riparian thickets, woodland edges, hedgerows, willow thickets, and agricultural fields. This species does not breed in Nova Scotia and does not normally migrate through Nova Scotia. It occurs as an occasional vagrant. There is one record of Harris's Sparrow from 7.1 km from the MLSA. This record is from early winter and is likely a migrant blown off course or a reverse migrant. Suitable winter foraging habitat is present on the MLSA; however, since this bird occurs as a rare vagrant, this habitat is not ecologically important to this species.

Bobolink

The Bobolink is a medium sized grassland passerine that is listed as Threatened under the federal SARA and Vulnerable under the NSESA; however, the species was re-assessed as Special Concern in 2022 (COSEWIC 2022a) making it eligible for a status change under the federal SARA. Bobolinks nest in natural grasslands and in agricultural lands used as hay fields and pasture. They prefer to nest in areas composed mainly of dense grass of moderate height (ECCC 2022b). Grass swards with moderate thatch are preferred. Forb cover in suitable nesting habitat is low to moderate and the cover of trees and shrubs is low. Scattered trees, tall shrubs, power poles, or fence posts are required as singing posts for males. Minimum habitat size varies geographically and by habitat quality, but 10 ha is believed to be the minimum habitat size required for successful nesting.

No bobolinks were encountered in the MLSA. The AC CDC data report indicates that there are two records of bobolink within a 5 km radius of the Study Area. One was from the Cole Harbour MBBA square from 1986 and the second was from Rainbow Haven. The MLSA contains no suitable habitat for bobolinks and this species is not expected to be present in the MLSA.

Rusty Blackbird

Rusty blackbird is listed as Special Concern under the federal SARA and Endangered under the provincial NS ESA. Rusty blackbird is a medium-sized blackbird found in coniferous-dominated forests adjacent to wetlands (COSEWIC 2017b). Approximately 85% of the rusty blackbird breeding range is in Canada. Rusty blackbird breeding habitat includes sedge meadows, beaver ponds, muskegs, swamps, scrub riparian habitats of islands, lakes, rivers and streams, as well as alder and willow thickets. In Cape Breton rusty blackbirds will occasionally occur in pastures. This species typically selects breeding areas that contain shallow water areas for foraging and low open coniferous cover for nesting. Rusty blackbirds are typically found in remote areas.



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No rusty blackbirds were recorded during the field surveys. There is one record of rusty blackbird located within approximately 5 km of the MLSA. This record is from the Cole Harbour MBBA square in 1986. No precise location data are available for this record other than that it was recorded somewhere within the 100 km² square whose center is located 3.3 km from the center of the MLSA. The habitat mapping for the Study Area reveals that potential rusty blackbird nesting habitat may be present in coniferous forest and conifer dominated forested wetlands located adjacent to streams that flow through the MLSA including Smelt Brook in the southeastern corner of the MLSA and Cow Bay River and several of its tributaries that are located along the western edge of the MLSA. These areas contain both shallow water areas and patches of low open coniferous cover. However, given the proximity of the MLSA to residential development, the likelihood of rusty blackbirds nesting in these areas may be low.

Evening Grosbeak

Evening grosbeak is listed as Special Concern under the federal SARA and Vulnerable under the provincial NS ESA. Evening grosbeaks nest in large mature conifer stands and old mixed forest stands with a high proportion of balsam fir, white spruce (*Picea glauca*) or trembling aspen (*Populus tremuloides*) (COSEWIC 2016a). Forest Stands having varied structure and open canopy are preferred as breeding habitat. Evening grosbeaks are resident birds that can remain in their breeding range year-round. During the winter months evening grosbeaks are often attracted to areas where seeds and berries are abundant. This species is attracted to plant species that produce large-winged seeds, particularly Manitoba maple (*Acer negundo*) and will also visit bird feeders where common sunflower (*Helianthus annuus*) seeds are available.

No evening grosbeaks were observed during the field surveys. The AC CDC data search (2023) indicated that there are three records of evening grosbeak within 5 km of the MLSA. An evening grosbeak was confirmed as nesting within the Cole Harbour MBBA square in 2010. It is not possible to determine the precise location where it was observed. The two remaining records are from late fall or early winter and were recorded from the Forest Hills area 4.6 and 5.7 km from the MLSA. The MLSA contains few old conifer or mixedwood stands and none of these stands had the tree species composition preferred by nesting evening grosbeaks. It is therefore unlikely that evening grosbeak would nest at the MLSA. There are some residences located around the periphery of the MLSA and it is likely that some of these residences feed birds which may attract evening grosbeaks to the MLSA outside of the breeding season.

Myotis and Perimyotis Bats

The AC CDC (2023) data request results indicate that bats may be present near the MLSA. Three species of hibernating bat have been listed as Endangered by both the federal government and the province of Nova Scotia. These include little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*) and tri-colored bat (*Perimyotis subflavus*) (COSEWIC 2013d). The populations of these three bat species have been severely reduced by white-nose syndrome, an introduced disease caused by the fungus (*Pseudogymnoascus destructans*) that affects hibernating bats. Little brown myotis, northern myotis and tri-colored bat are considered location sensitive species in Nova Scotia, and thus location data for sightings of these species are considered confidential and are not provided in AC CDC data reports.



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Habitat for these three species consists of hibernacula for overwinter survival and summering areas with suitable foraging areas within commuting range of structures used for roosting or maternity colonies. Hibernacula have been identified as critical habitat for little brown myotis, northern myotis and tri-colored bat (ECCC 2018b). All three species hibernate in caves or abandoned mines. Hibernation habitat is used for approximately six months each year. No critical habitat has been identified near the MLSA. The nearest areas known to provide bat hibernacula are near Ship Harbour approximately 50 km to the east and Milford Station approximately 45 km to the north.

These bat species forage in a variety of habitat types which vary by species. Foraging habitat includes lakes, ponds and rivers, forest gaps, the edges of forests and along trails. These bat species tend to avoid large open areas such as agricultural land, large clear-cuts and burned forests. Maternity colony habitat varies by species. Little brown myotis females will establish maternity colonies in buildings, under bridges, in rock crevices, or in cavities of canopy trees in forests. Northern myotis establish maternity colonies in large trees. Tri-colored bats often establish maternity roosts in clumps of arboreal lichens and may also establish maternity colonies in buildings. Maternity colonies often consist of hundreds of females and their young, so the locations of these roost sites are important. Males typically do not roost in large numbers and may use a variety of sites such as snags, crevices under bark and human made structures.

Hibernaculum sites and maternity colonies are the most important and sensitive habitats for non-migratory bats since large numbers of individuals gather at these sites. The geology of the MLSA is not conducive to the formation of solution caves and there was no evidence to indicate that underground mine workings are present in the Study Area. As such, it is unlikely that the Study Area provides potential hibernacula for bats. The Study Area is mostly forested. The mature mixed forest stands found in the Study Area could potentially be suitable for maternity colonies. Attics in residences situated around the periphery of the MLSA could provide maternity colony sites for little brown myotis and possibly tri-colored bat. Suitable foraging habitat would be present throughout most of the MLSA.

Silver-haired Bat

The silver-haired bat is listed as Endangered by COSEWIC but has not been listed under either the federal SARA or the NS ESA. The silver-haired bat is a migratory species that breeds in much of North America and winters in the United States of America and Mexico (COSEWIC 2023). Silver-haired bats are uncommon in Nova Scotia during late spring and summer and are absent during the rest of the year although an overwintering silver-haired bat has been recorded in the province. While in Canada silver-haired bats require roosting, drinking and foraging habitat. Foraging habitat is the most important of these habitats. Roosting sites provide shelter for resting bats during the day as well as sheltered sites for bat pups. Silver-haired bats prefer to roost in tree cavities (hollow trees or woodpecker holes) or under sheets of loose bark. These preferred roost sites are typically associated with large trees.

The AC CDC data report indicates that there is one record of silver-haired bat near the MLSA. The location of the record is listed as Bon Portage which is located in southwestern Nova Scotia; however, the coordinates place it 6.5 km west of the center of the MLSA. The MLSA contains a number of mature forest or forested wetland stands that would have trees large enough to be used as roosting sites by silver-haired bats; consequently, there is potential for this species to be present in the MLSA.



Snapping Turtle

Snapping turtle is listed as Special Concern under the federal SARA and Vulnerable under the provincial NS ESA. Snapping turtles are found in Canada through Nova Scotia, New Brunswick, Quebec, Ontario, and in parts of Saskatchewan (COSEWIC 2008b). They are typically found in slow moving or standing water with a soft mud bottom and dense aquatic vegetation. Snapping turtles are found in lakes, ponds, sloughs, shallow bays or river edges and slow streams. Snapping turtles will bask on offshore logs or rocks when water temperatures are low. This species spends most of its time in the water; however, between mid-May and mid-June female snapping turtles leave the water to find suitable sites to lay their eggs. These nesting sites include sand and gravel banks along waterways, muskrat houses, abandoned beaver lodges, railroad and road embankments, gardens, pastures, sawdust piles, manure piles, and forest clearings. Nesting sites are usually located near water. Snapping turtles may follow streams (including rocky streams) to reach suitable nesting sites. Mating may occur in these streams during the movements to nesting sites. The eggs hatch during the early fall and the hatchlings disperse to water where they bury themselves under leaf litter and debris and hibernate until spring.

There are nine records of snapping turtles within approximately 5 km of the MLSA. The nearest records are from Morris Lake which forms the northern boundary of the MLSA. All the remaining records are from north and northeast of the Study Area. Suitable aquatic habitat for snapping turtles is present in or adjacent to the MLSA at Morris Lake, De Said Lake and the Stillwater portion of Cow Bay River which forms the northeastern boundary of the MLSA. Signage regarding snapping turtles is present on the Shearwater Flyers Trail Bridge that crosses Cow Bay River. Presumably, this would indicate that snapping turtles have been observed in this watercourse. The railroad bed and shoreline beaches at this location would provide good nesting habitat for snapping turtles. The borrow pit located near the north end of De Said Lake and the gravel pad located in the forest to the northeast of De Said Lake would also provide good nesting sites for snapping turtles.

Eastern Painted Turtle

The eastern subspecies of the painted turtle is listed as Special Concern under the federal SARA but is not listed under the NS ESA. Eastern painted turtle was first assessed by COSEWIC in 2018 (COSEWIC 2018d) and was designated as Special Concern in 2021. This suggests that a status change under the NS ESA is possible, as the federal designation was recent. The painted turtle is a small turtle with one of the most northerly distributions of North American freshwater turtles. In Canada, the eastern painted turtle subspecies is found in mainland Nova Scotia and near the coast in New Brunswick.

Eastern painted turtles occupy slow moving, relatively shallow and well vegetated wetlands (swamps, marshes, ponds, and oxbows) and water bodies (lakes, rivers, creeks, and streams) with abundant basking sites and organic substrate. They are found in association with aquatic plants including water shield (*Brasenia schreberi*), American water lily (*Nymphaea odorata*), cow lily (*Nuphar variegata*), pickerel weed (*Pontederia cordata*), and pondweed (*Potamogeton* spp.), which are used for cover and feeding.



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No eastern painted turtles were observed during the field surveys. There are 17 AC CDC records of this species from within approximately 5 km of the MLSA. Most of the records are from Colby Village and the nearest record is from 2.7 km north of the MLSA in Colby Village. Suitable habitat for eastern painted turtles is present in or adjacent to the MLSA at Morris Lake, De Said Lake and the Stillwater portion of Cow Bay River which forms the northeastern boundary of the MLSA.

Wood Turtle

Wood turtle is listed as Threatened under both the federal SARA and the provincial NS ESA. Wood turtle was first added to Schedule 1 of SARA in 2010 and had the status of Threatened reaffirmed in 2018 (COSEWIC 2018e). Wood turtle is a medium-sized turtle with a grey/brown or yellow carapace. They can be found throughout Eastern North America, and prefer semi-aquatic, riparian environments. Wood turtle is considered a location sensitive species in Nova Scotia, and thus location data for individual sightings of wood turtle are considered confidential.

Wood turtles are associated with meandering shallow rivers with sand, gravel and/or cobble bottoms. These rivers are typically clear, with moderate current and frequent oxbows. Secondary tributaries (brooks) that feed these rivers may also support wood turtles by providing travel routes to resource patches. Still water or slow water habitats such as vernal pools, oxbows, marshes, and beaver ponds are also used, though less frequently than riverine habitats. Wood turtles are highly terrestrial and will forage in riparian and wetland habitats adjacent to river systems.

The AC CDC records indicate that wood turtle has been recorded within 5 km of the MLSA; however, since this species is considered location sensitive there is no precise location data available. The Cow Bay River runs along the northeastern boundary of the Study Area; however, it provides little exposed sand and gravel substrates during early summer when nesting occurs. The wetland habitats that surround it are acidic and oligotrophic and are not expected to provide good foraging habitat. Wood turtles are not expected to be present at the MLSA.

Atlantic Wolffish

The Atlantic wolffish is listed as Special Concern under the federal SARA but is not listed under the NS ESA. The Atlantic wolffish is an ocean fish that typically occupies benthic habitats that are rocky or sandy (COSEWIC 2012c). This fish is found from nearshore to depths of 918 m. There is one record of Atlantic wolffish from Devils Island, 5.9 km east of the Study Area. The MLSA contains no marine habitat so there is no potential for this species to be found there.



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American Eel

The American eel is listed as Threatened by COSEWIC but is not listed under either the federal SARA or the NS ESA. American eels reproduce in the Sargasso Sea. Some eels remain at sea while others migrate to the rivers and streams where they mature before heading back to sea to reproduce (COSEWIC 2012d). American eels use a wide range of aquatic habitats and are capable of overcoming barriers to movement by leaving the water and moving over wet surfaces on the land. As such, they can be found far up small streams. American eels are generally nocturnal and spend the day in burrows or under cover objects. They feed on fish and aquatic invertebrates.

Aquatic species surveys were outside the scope of this work and there were no incidental observations of American eels while conducting other field-based work. There are four AC CDC records of American eel within approximately 5 km of the MLSA with the nearest observations in Eastern Passage, 3.7 km southwest of the center of the MLSA. There are several locations at the MLSA where American eels could be expected to be present. These include Morris Lake, De Said Lake, Smelt Brook which drains De Said Lake, as well as the Cow Bay River and its tributaries which are found along the northeastern boundary of the MLSA.

Striped Bass

The striped bass is listed as Threatened by COSEWIC but is not listed under either the federal SARA or the NS ESA. The striped bass is an anadromous fish which spawns in freshwater and grows in salt water. In Nova Scotia, spawning occurs only on the Shubenacadie River (COSEWIC 2012e). There is one record of striped bass from Devils Island, 5.9 km east of the MLSA. The MLSA contains no marine or estuarine habitat so non-breeding striped bass would not be present. None of the freshwater watercourses on the site are connected to the watershed of the Shubenacadie River so spawning striped bass would not be present.

Atlantic Cod

The Atlantic cod is listed as Threatened by COSEWIC but is not listed under either the federal SARA or the NS ESA. The Atlantic cod is a marine fish that occupies a wide range of habitats. The most essential habitat for this species is thought to be the benthic habitat used by juvenile cod. Benthic habitat having abundant vertical structure such as eel grass (*Zostera marina*) beds provide necessary cover and prey sources for juvenile cod (COSEWIC 2010). There is one record of Atlantic cod from Devils Island, 5.9 km east of the MLSA. The MLSA contains no marine habitat so there is no potential for this species to be found there.

Monarch

Monarch is listed as Special Concern under the federal SARA and as Endangered under the NS ESA. The monarch is a milkweed butterfly in the family *Nymphalidae*. The eastern North American population is migratory and monarchs that breed in Northeastern North America migrate to overwintering sites in Mexico, Florida, and the Gulf Coast of the United States (COSEWIC 2016b). Adult monarchs feed on a variety of plant species and can be found in a variety of habitats. In Nova Scotia, monarch larvae feed on



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the introduced common milkweed (*Asclepias syriaca*) and the native swamp milkweed (*Asclepias incarnata*). This limited selection of suitable larval food plants restricts the distribution of larval monarchs to the distribution of the two milkweed species. Common milkweed is typically found along roadsides and in agricultural fields particularly in sandy soils. It is uncommon in most of Nova Scotia but may be locally common in the Annapolis Valley. Swamp milkweed is an uncommon native species in Nova Scotia that is typically found in wet thickets usually near a stream or lake shore.

Monarchs have been recorded 93 times within approximately 5 km of the MLSA. The nearest record is 390 m south of the MLSA on Jeep Crescent. Six of the records were larval monarchs indicating that suitable host plants were present. The nearest larval record is from approximately 2.3 km north of the northern tip of the MLSA. Neither common milkweed nor swamp milkweed was noted at the MLSA during the habitat surveys; however, small populations of these species could potentially be present. Gardeners may also cultivate milkweed to provide breeding habitat for monarchs. Areas of the MLSA with the greatest potential to provide breeding habitat for monarchs would be relatively rich swamps and shorelines where swamp milkweed may be present such as along the shores of Cow Bay River. Patches of common milkweed could potentially be present on roadsides. Residential areas, which are found on the periphery of the MLSA, could also provide breeding habitat. Adult monarchs feed on nectar of a wide variety of flowers. In open habitats suitable feeding areas for adult monarchs in the MLSA would include the margins of trails and disturbed areas where preferred food plants such as asters and goldenrod produce abundant flowers. The MLSA could provide habitat for both larval and adult monarchs.

Yellow-banded Bumble Bee

Yellow-banded bumble bee is designated as Special Concern under the federal SARA and as Vulnerable under the NS ESA. The species was first assessed in 2015 (COSEWIC 2015) and was designated for federal status in 2018. Yellow-banded bumble bee is found in much of Canada and parts of the United States and occurs in a diverse range of habitats, including mixed woodlands, farmlands, urban areas, montane meadows, prairie grasslands and boreal habitats. It has been recorded foraging on flowers for pollen and nectar from a variety of plant genera. Like many bumble bees, it usually nests underground in pre-existing cavities such as abandoned rodent burrows and rotten logs. Yellow-banded bumble bee queens overwinter underground and in decomposing organic material such as rotting logs” (COSEWIC 2015; ECCC 2022c).

There are five records of yellow-banded bumblebee within approximately 5 km of the MLSA. The nearest record is from Shearwater approximately 540 m west of the western boundary of the MLSA. Given the generalist nature of this species and the wide range of forested and open habitats that it uses, yellow-banded bumble bees could potentially be present throughout the MLSA.

Gypsy Cuckoo Bumble Bee

The gypsy cuckoo bumble bee is listed as Endangered under both the federal SARA and the NS ESA. This species is an obligate nest parasite of other bumble bee species. Gypsy cuckoo bumble bee queens usurp the nests of other bumble bee species and use the host worker bees to care for the offspring of the gypsy cuckoo bumble bee queen (ECCC 2022d). In Nova Scotia, the host species is the yellow-banded



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bumble bee which is also a SAR. Because the gypsy cuckoo bumble bee is entirely dependent on yellow-banded bumble bees, required habitat for this species is the same as for the yellow-banded bumble bee. Gypsy cuckoo bumble bee has been recorded once within 5 km of the MLSA. This species was found on Mc Nabs Island in 1968. Given the generalist nature of the yellow-banded bumble bee and the wide range of forested and open habitats that it uses, the parasitic gypsy cuckoo bumble bee could potentially be present throughout the MLSA.

Boreal Felt Lichen

Boreal felt lichen is listed as Endangered under both the federal SARA and the NS ESA. The distribution of boreal felt lichen formerly included Nova Scotia, New Brunswick and Newfoundland; however, it is now extirpated in New Brunswick. As of 2020, there are 54 sites where boreal felt lichen still exists, down from 317 sites in 2014.

This species inhabits cool, humid forests containing balsam fir. Boreal felt lichens are found in or adjacent to forested wetlands having a ground vegetation layer dominated by *Sphagnum* moss, located within 25 km of the Atlantic coast and at elevations < 200 m above sea level (COSEWIC 2014a). In the past, this species was found growing on balsam fir, black spruce, white spruce (*Picea glauca*), red maple (*Acer rubrum*), and white birch; however, it is currently found only on mature balsam fir.

There are no historical records of boreal felt lichen or any indicator species within 5 km of the MLSA (AC CDC 2023). However, predicted boreal felt lichen habitat polygons are found at 14 locations scattered throughout the MLSA. These boreal felt lichens are found both within forested wetlands and in coniferous and mixedwood forests stands around the periphery of wetlands. These results indicate that boreal felt lichen are potentially present in this area (Figure 3.8). There is also a small (<1 ha area) section of predicted habitat in the southern corner of the MLSA near Southbrook Crescent that is unlikely to support boreal felt lichen as it is disturbed by the immediately adjacent residential area.

Targeted surveys of the predicted habitat polygons in the MLSA including a buffer of 100 m around them are required to determine if the predicted habitat is suitable for or supports boreal felt lichen (NSDNR 2018) prior to physical work at the site. If boreal felt lichen is present, a 500 m Special Management Zone applies (NSDNR 2018).

Coast Pepperbush

The coast pepperbush is listed as Threatened under the federal SARA and Vulnerable under the NS ESA. It is an Atlantic Coastal Plain species that reaches the northern end of its distribution in Nova Scotia (COSEWIC 2014b). Natural populations of coast pepperbush are restricted to six lakes in southwestern Nova Scotia. This species grows on upper lake shores and in deciduous treed swamps within 20 m of streams. Coast pepperbush is grown as an ornamental shrub, and several populations believed to be derived from plantings have been identified in Nova Scotia. One of these populations was reported on McNabs Island in 1968 (AC CDC 2023). No coast pepperbush was encountered at the MLSA. Although potentially suitable habitat is present at the MLSA, the limited distribution of this species in Nova Scotia makes it highly unlikely that it is present.

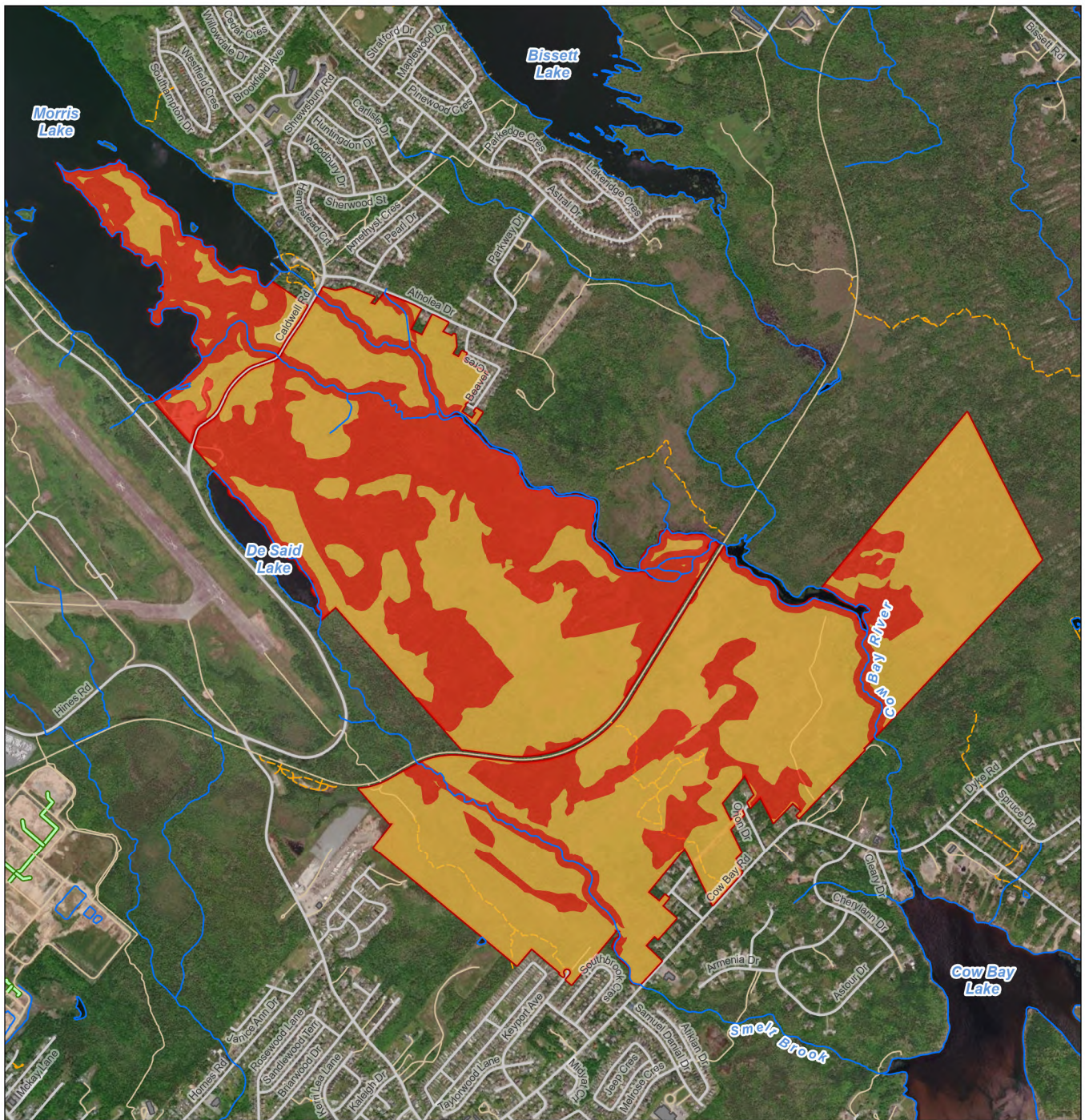


3.4.3.2 Species at Risk Distribution

The presence of individual SAR was not used exclusively to evaluate the presence and distribution of SAR within the MLSA since it was not feasible to conduct comprehensive investigations to detect all individuals of all SAR species that may be present in the MLSA. Instead, SAR that are or could potentially be present in the MLSA were identified from both the results of the field surveys and from AC CDC records of SAR reported within 5 km of the MLSA. The habitat preferences of these species were compared to the results of the upland, wetland and aquatic surveys conducted in the MLSA along with available habitat mapping and aerial imagery. Where matches were found between SAR habitat preferences and the habitats that had been mapped in the MLSA, those species were considered potentially present. The habitat mapping was then used to map the potential distribution of various SAR in the Study Area.

The distributions of each SAR that could potentially be present in the MLSA were plotted onto a single map to identify areas where SAR were potentially present, absent, or where multiple SAR could be present. The habitat areas were ranked based on the number of SAR species the area could potentially support. Habitat areas that could potentially support more than three SAR were given the lowest priority for development, while habitat areas that are unlikely to support any SAR were given the highest priority for development. In some instances, SAR habitat areas are subdivisions of habitat polygons. Subdivision of habitat polygons was done when the habitat polygon contained areas that were both suitable and unsuitable for a particular SAR and where these suitable and unsuitable areas could be viewed and mapped from the available imagery. In other instances, buffers were created around habitat features such as watercourses or shorelines to identify habitat areas such as riparian areas that may be regularly used by semi-aquatic SAR. The final map product incorporates the potential suitable habitat for all SAR that may be present in the MLSA (Figure 3.9).





Notes
 1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
 2. Data Sources: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services
 3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

- Study Area
- Species at Risk**
 - Habitat Potentially used by 4+ SAR
 - Habitat Potentially used by 1-3 SAR
 - Habitat Unlikely to be used by SAR
- Utilities**
 - Pipeline
- Transportation**
 - Road
 - Resource / Seasonal Road
 - Trail
 - Waterway
 - Building

0 250 500 Metres
 (At original document size of 8.5x11)
 1:25,000



Project Location
 Halifax Regional Municipality,
 Nova Scotia

Prepared by SCHubbs on 2024-05-23

Client/Project
 Halifax Regional Municipality
 Future Serviced Communities
 Background Studies

Fig ID: 160410459_024

Figure No.
 3.9

Title
 Potential Distribution of Species at Risk - Morris Lake Expansion

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Several patterns are visible in the SAR distribution mapping (Figure 3.9). There are no areas in the MLSA where no SAR could potentially be present. This was attributable to the potential presence of yellow-banded bumble bee which has a broad niche and the gypsy cuckoo bumble bee which is a nest parasite of the yellow-banded bumble bee. These species can potentially be found in all terrestrial habitat types in the MLSA.

Areas in the MLSA potentially capable of supporting more than three SAR are typically associated with five habitat features including watercourses, wetlands, mature forests, barrens, and anthropogenic habitats. Watercourses provide habitat and travel routes for a variety of SAR that have been recorded in the vicinity of the MLSA including American eel, snapping turtle, and eastern painted turtle. SAR associated with wetlands include lesser yellowlegs, eastern whip-poor-will, Canada warbler, olive-sided flycatcher, rusty blackbird, monarch, yellow-banded bumble bee, gypsy cuckoo bumble bee, and boreal felt lichen. SAR that are associated with mature forests include eastern wood pewee, evening grosbeak, little brown myotis, northern myotis, tri-colored bat, silver-haired bat, gypsy cuckoo bumble bee, yellow-banded bumble bee, and boreal felt lichen. Barrens in the MLSA could potentially support common nighthawk, eastern whip-poor-will, olive-sided flycatcher, gypsy cuckoo bumble bee, and yellow-banded bumble bee.

The areas where SAR are potentially concentrated in the MLSA are often linked by watercourses. Cow Bay River on the northern side of the MLSA is particularly important in this regard. This is probably attributable to several factors. The watercourses provide habitat for their own suite of SAR. Wetlands often develop along these watercourses or are the headwaters for watercourses and support a different group of SAR. The riparian habitats along the watercourses are protected by buffer zones within which no forest harvesting may occur. Therefore, the remnants of mature forest can become concentrated along the shores of these watercourses. These mature forest remnants provide habitat for other SAR. These linear concentrations of SAR are of particular benefit since they can provide both habitat for SAR and corridors to connect plant and animal populations in urban areas.

Eight of the 19 SAR that have been identified as potentially present in the MLSA are known to make use of anthropogenic habitat for at least part of their life history. These include barn swallow, common nighthawk, evening grosbeak, little brown myotis, common snapping turtle, yellow-banded bumble bee, gypsy cuckoo bumble bee, and monarch. It is important to note that although these species can exploit anthropogenic habitats, they often also require nearby undisturbed habitats to satisfy other aspects of their natural history. For instance, barn swallows and common nighthawks often nest on human structures or in areas heavily disturbed by humans; however, both species require nearby foraging habitats such as wetlands or water courses that produce abundant flying insects to provide food for themselves and their nestlings. In heavily developed areas these food sources may not be present or may be degraded to the point where they do not produce enough food.



3.4.4 LAND SUITABILITY ANALYSIS – FOREST HABITAT AND SPECIES AT RISK

Stantec conducted a land suitability assessment for forest habitat and species at risk by collating existing desktop data, referring to previously published reports, and conducting field surveys. The data underwent analysis using geographic information systems (GIS) and other tools to identify factors influencing land suitability. Following digitization, Stantec established a list of key terrestrial layers and devised a scoring system based on their significance to the assessment objectives. The evaluated layers include:

- Forest Maturity and Forest Succession
- Species at Risk Habitat

This process culminated in the creation of a map (Figure 3.10) that illustrates these criteria and weights used to evaluate the suitability of different areas for development. The results allow for the identification of potentially suitable and unsuitable areas, as well as the recognition of potential constraints. The sections below apply a suitability score for field confirmed forest habitat and its potential to facilitate SAR.

Figure 3.10 displays the land suitability output collated from the previous sections based on scoring criteria presented in Table 3.15. The reader is reminded that a lower score for land suitability for development generally corresponds with higher ecological value associated with the three categories, and a higher suitability score corresponds with a lower ecological value for the three categories.

Table 3.15 Forest Habitat and Species at Risk – Land Suitability Ranking Framework

Layers	Land Suitability Ranking		
	1 - Low suitability for development	2 - Moderate suitability for development	3 - Higher suitability for development
Forest Maturity / Forest Succession*	Potential old growth (>80 years old) / late and mid-to-late successional	Mature (30-80 years old) / mid-successional and edaphic	Immature (<30 years old) / early and early-to-mid successional
SAR Habitat	Habitat potentially used by more than 3 SAR	Habitat potentially used by 3 or fewer SAR	Habitat unlikely to be used by SAR
Notes: *When no forest maturity class could be determined based on field determined stand age, forest succession was used			



3.4.4.1 Forest Maturity and Forest Succession

Forest maturity classes were assigned based on the estimated stand ages from field data collection. Forested stands under 30 years of age are considered immature stands, while stands between 30-80 years of age are considered mature. Immature stands are composed of younger overstory vegetation compared to the mature stands which have progressed towards the climax community seen in old growth forests. Many VTs identified within the study area are immature; successional dynamics suggest that many could support the development of old growth characteristics given enough time. For this analysis forested stands above 80 years of age are considered to have the potential to be old growth forest. The province of Nova Scotia defines old growth forest as an area where 20% or more of the basal area is in trees greater than or equal to the reference age for that forest type (NSDNRR 2022b; Appendix E). This age criteria ranges between 100-140 years of age depending on the FEC VT. At this time, the exact stand age and forest maturity status cannot be determined without specific old growth forest sampling and thus stands estimated to be over 80 years old are considered to have the potential to be old growth forest for this land suitability analysis.

Where age was not estimated in the field, forest succession types from the FEC manual are used based on the above ranking criteria. Forest succession is typically divided into three classes; early successional, mid successional, and late successional which correspond to stand age and successional dynamics. Using the FEC VTs for each stand, each VT (e.g., MW2, IH6, SH5) is assigned successional classifications of early, early-to-mid, mid, mid-late, late and edaphic. For sites classified as barrens types, they are assigned a score of 2 based on the lack of available knowledge on successional dynamics of barrens in Nova Scotia and the potential for diversity within the VT.

Additional consideration for forested wetland VTs should be factored into further planning given the services these VTs provide as carbon sinks and wildfire breaks and attenuating stormwater flow.

Stands with the potential for old growth forest provide the highest ecological significance and are ranked as lower for potential future development, while immature stands are ranked higher for development. VTs with early and early to mid-successional stages are assigned a higher priority for development as they generally do not support key habitat and are not close to progression to later more structurally complex successional stages. A list of VT types that can reach old growth classification can be found in Appendix E. Stands with site limiting factors such as sites with low nutrients or wetlands are denoted as edaphic and are rated as moderate for development as due to the limiting factors; they will not reach a climax stage but can provide distinct habitat types. Late successional forests are assigned the lowest priority for development due to their limited occurrence on the landscape and the high potential to provide key habitat.

There is an old growth policy applicable to crown lands in Nova Scotia and it provides accepted survey methods for confirming old growth forests within the province. Stantec recommends HRM consider these surveys in the event the municipality wishes to develop a provincially acceptable inventory of old growth forests within the municipality. Although applicable to crown land only, the policy also encourages projects on private lands to survey for old growth forests (Natural Resources and Renewables, 2022).



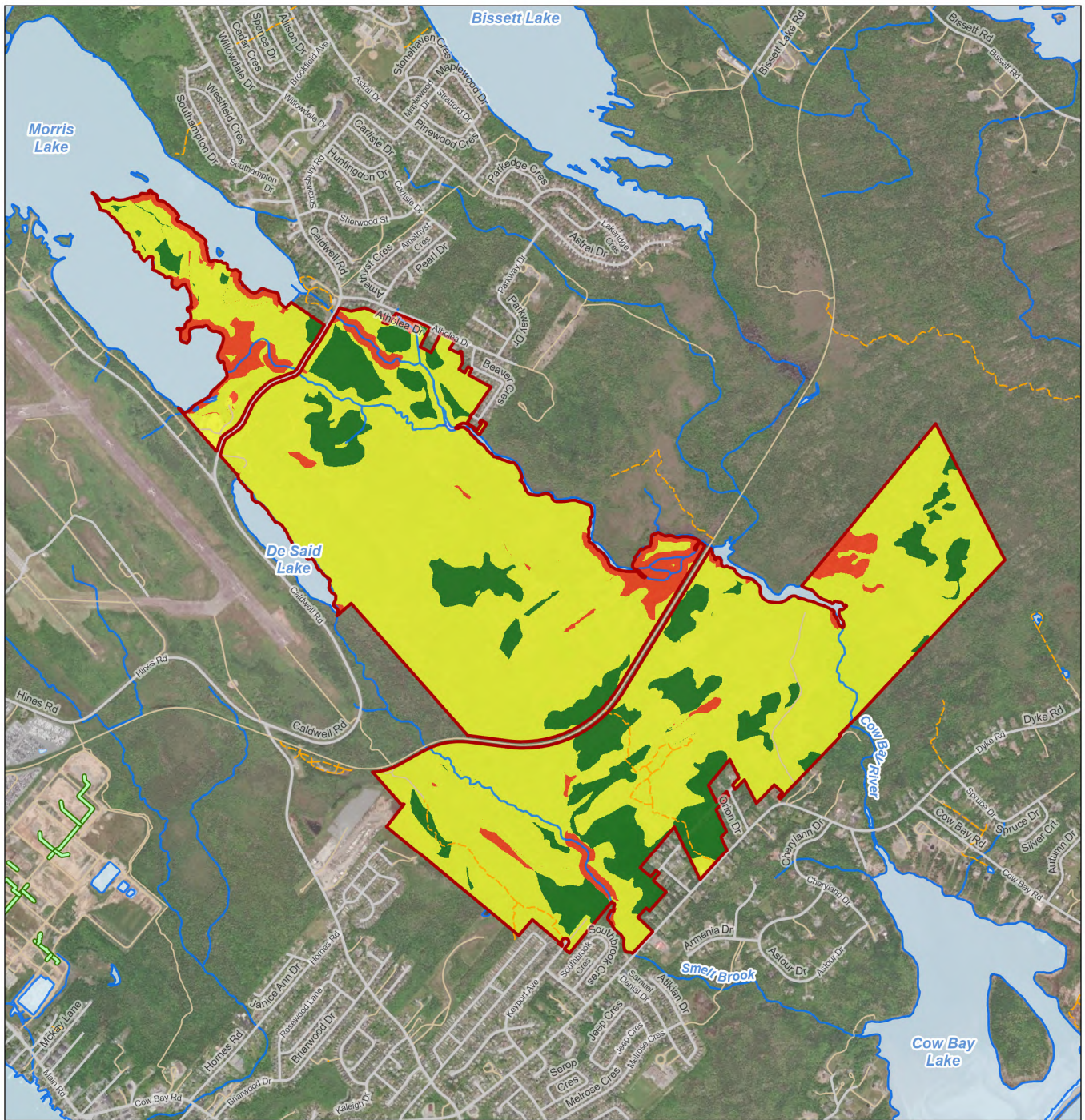
3.4.4.2 Species at Risk

The presence of individual SAR was not used exclusively to evaluate the role of SAR on land suitability within the MLSA since it was not feasible to conduct comprehensive investigations to detect all individuals of all SAR species that may be present at the MLSA. Instead, SAR that are or could potentially be present in the MLSA were identified from both the results of the field surveys and from AC CDC records of SAR reported within 5 km of the MLSA. The habitat preferences of these species were compared to the results of the upland, wetland, and aquatic surveys conducted on the MLSA along with available habitat mapping. Where matches were found between SAR habitat preferences and the habitats that had been mapped in the MLSA, those species were considered potentially present. The habitat mapping was then used to map the potential distribution of various SAR on the site. This information was also considered and evaluated as part of the landscape connectivity exercise.

SAR identified in the AC CDC (2023) report that have suitable habitat within the MLSA and/or were identified during the field programs are compiled and the habitat areas are ranked based on the number of SAR species this habitat could potentially support. Habitat areas that potentially support multiple species (i.e., three or more) of SAR are given the lowest priority for development, while habitat areas that are unlikely to be used by SAR are given the highest priority for development. Some habitat areas are subdivisions of habitat polygons or buffers are created around habitat features such as watercourses as habitat preferences vary by species. Figure 3.10 incorporates the potential suitable habitat for all SAR that may be present in the MLSA.

The forgoing analysis of potential land suitability based on forest habitat and species at risk should only be viewed as a preliminary tool to assist in planning for future development in the MLSA. Responsible land development depends on many factors including those described above, and no one factor or group of factors should be considered determinative. Rankings are meant to be indicative, and to lay the groundwork for future, site specific investigations to be conducted as planning proceeds. In particular, further field confirmation will be required (e.g., for wetlands) in areas not covered in this study.





Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec; Government of Nova Scotia, Department of Service Nova Scotia and Internal Services
3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

Study Area

Land Suitability Score

- 3 (High)
- 2
- 1 (Low)

Utilities

- Pipeline

Transportation

- Road
- Resource / Seasonal Road
- Trail

Other Features

- Waterway
- Waterbody

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(At original document size of 8.5x11)
1:27,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by NWhite on 2024-03-15
Revised by NWhite on 2024-05-24

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Fig ID: 160410459_033

Figure No.
3.10

Title
**Forest Habitat and SAR Land
Suitability Analysis - MLSA**

3.5 Landscape Connectivity

The land suitability mapping derived from the integration of the forest maturity / succession, wetland, watercourse, and SAR mapping exercises were used in conjunction with existing studies of landscape connectivity in HRM to identify potential wildlife corridors within the MLSA. The goal of this exercise is to identify connectivity between patches of undisturbed habitat that may be potentially isolated by development. The provision of wildlife corridors allows wildlife that require larger home ranges to inhabit areas that would otherwise consist of isolated patches too small to support those species. Wildlife corridors allow wildlife to emigrate from areas that are overpopulated and immigrate to areas where suitable habitat is available. They also provide conduits for genetic material, reducing the potential for inbreeding.

The Halifax Green Network Plan (HGNP) identifies an Important Corridor that runs from Cole Harbour to Hartlen Point. This Corridor intercepts the Cow Bay River and passes through the eastern end of the MLSA (Figure 3.11). It consists of a large area of relatively undisturbed forested habitat that also supports large areas of wetland. The HGNP recommends that Essential Corridors be at least 1 km wide and Important Corridors should be at least 100 m wide to facilitate movement of wildlife (Halifax Regional Municipality and O2 Planning + Design 2018).

An analysis of the distribution of sensitive ecological features in the MLSA such as species at risk, potential old growth forests, wetlands and watercourses has been undertaken to identify which areas of the MLSA are of the greatest ecological importance and where a wildlife corridor would be most beneficial. Most of the field records of SOCC from the Study Area are from the southern end of the MLSA (Figure 3.8). The species at risk habitat modelling indicates that areas that could potentially support more than three SAR are scattered throughout the MLSA with large areas of such habitat associated with wetlands and aquatic habitat along the Cow Bay River and Smelt Brook as well as in areas of mature forest in the northcentral portion of the MLSA (Figure 3.9). The highest potential concentrations of SAR are found along the Cow Bay River with up to 11 SAR species potentially present there.

There is little potential old growth forest in the MLSA, with patches of potential old growth forest restricted to the remote eastern corner of the MLSA, the peninsula that extends out into Morris Lake and along the Cow Bay River. Some of the potential old growth forest along the Cow Bay River has been killed by recent hydrological alterations to the riparian zone of the river, likely caused by old beaver flooding near point ML37 on Figure 3.7a. Mature forest is present throughout much of the MLSA.

Wetlands are also scattered throughout the MLSA; however, the greatest concentrations of wetlands are found along the Cow Bay River and Smelt Brook. These areas support relatively large wetland complexes composed of a variety of wetland types. The Cow Bay River is the largest watercourse present in the MLSA and has the greatest potential to support fish and other aquatic or semi-aquatic organisms.



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The wildlife corridor recommended in the HGNP (Figure 3.11) would help to preserve about half of the wetland habitat associated with the portion of the Cow Bay River found in the MLSA as well as approximately one kilometer of the river. This area also potentially supports a high concentration of SAR. Modifications to the HGNP Important Corridor could increase its efficacy as a wildlife corridor. Modifications would consist of extending the corridor to the northwest to encompass the entire wetland complex that flanks the Cow Bay River, establishing another corridor along Smelt Brook and connecting the two corridors with a third corridor that would flank the Shearwater Flyers Trail.

Protection of the Cow Bay River and the riparian wetlands associated with it would provide an aquatic corridor between Cow Bay Lake and Morris Lake as well as a terrestrial corridor between the remnants of upland habitat associated with Morris Lake and 12 Wing Shearwater. It would also protect the area in the MLSA that has potentially the highest concentration SAR and the location where the rarest plant discovered during the field surveys (smooth rose) was found (Figure 3.8).

The establishment of a corridor along Smelt Brook would provide an aquatic corridor to De Said Lake and a second terrestrial corridor to the area around Morris Lake and 12 Wing Shearwater. This corridor would have the added benefit of preserving the habitat of three of the four vascular plant SOCC (cursed buttercup, purple false-foxglove and bright-green spikerush) that were discovered in the MLSA during the field surveys (Figure 3.8). This corridor also potentially supports high concentrations of SAR. The corridor along the Shearwater Flyers Trail would provide a terrestrial connection between the riparian habitats along the Cow Bay River and Smelt Brook and would help to preserve the aesthetic quality of the Shearwater Flyers Trail.

Both the Cow Bay River and Smelt Brook corridors are currently identified as Protected Areas under the Halifax Green Network Plan (Halifax Regional Municipality and O2 Planning + Design 2018) presumably due to the presence of watercourses and associated wetlands. Watercourses and wetlands are important ecological features that are regulated under provincial legislation. Watercourses and the wetlands that are often associated with them are often used as travel routes by wildlife, and for aquatic species they are typically the only means by which they can disperse through terrestrial habitats. Given the importance of watercourses and wetlands, these features have low land suitability rankings (i.e., less favorable for development).

The Cow Bay River is the largest watercourse in the MLSA and extends northwest/southeast almost the entire length of the MLSA. Smelt Brook is the second largest watercourse in the MLSA. Both watercourses provide natural travel routes for both aquatic and terrestrial species. The riparian habitat flanking the Cow Bay River and Smelt Brook would be buffered 30 m to protect the stream. Both streams also support an extensive wetland complex which would be difficult to develop and, according to the SAR modelling, could potentially support up to 11 SAR species. This would indicate that preservation of this area would be beneficial. HRM regulations require that in instances where watercourses are hydraulically connected to wetlands, the watercourse buffer must extend 30 m beyond the upland edge of the wetland. The Province of Nova Scotia recommends that, where feasible, wetlands should be buffered in the same manner as watercourses (Government of NS 2011). The margins of wetlands in the MLSA would therefore be buffered by 30 m in this corridor mapping exercise to reduce the potential for adverse effects to these wetlands from adjacent development such as hydrological or trophic level disturbances. In areas



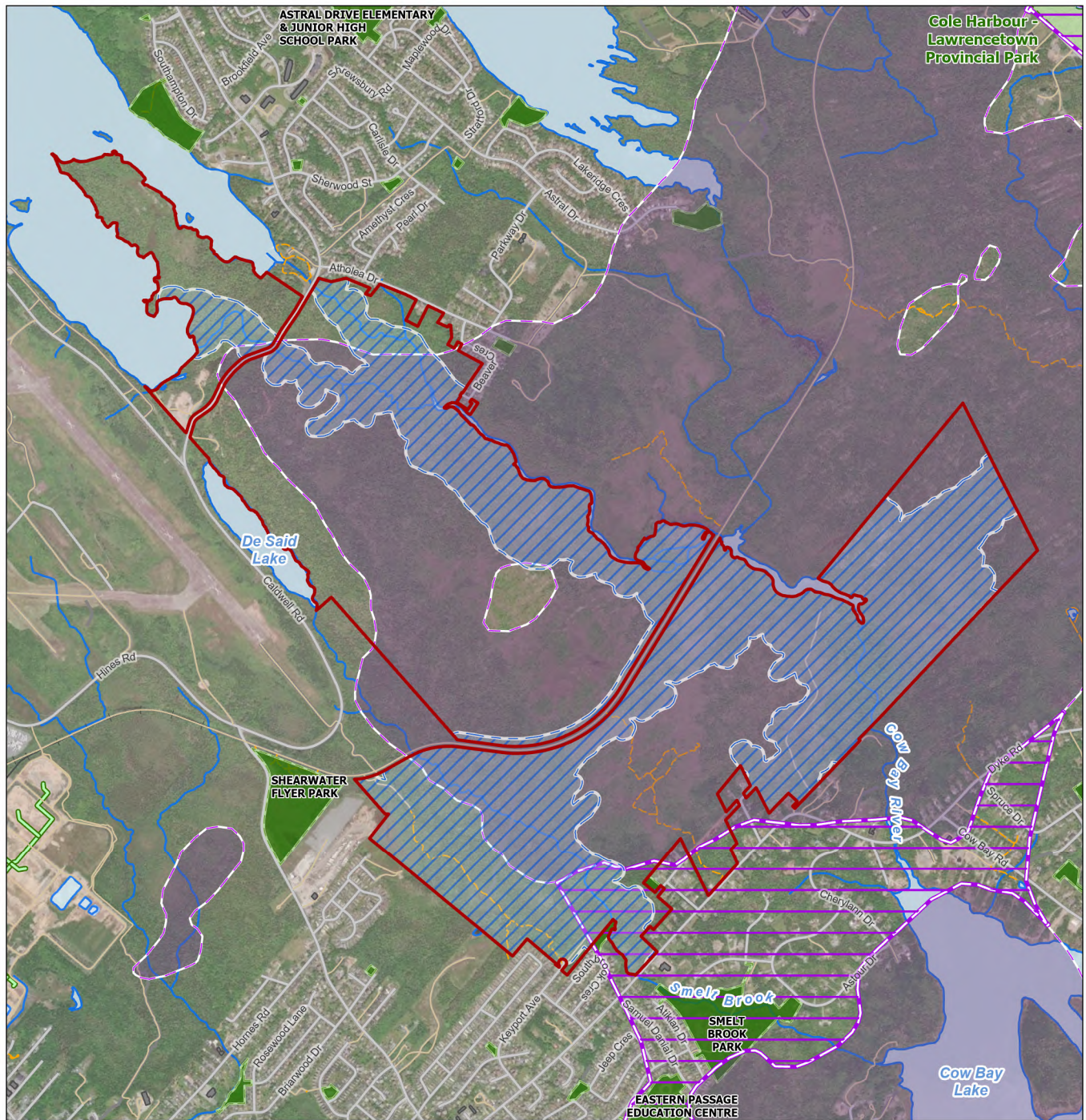
**HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES
FINAL REPORT – VOLUME 5: MORRIS LAKE STUDY AREA REPORT – LAND SUITABILITY
ANALYSIS**

where the combined buffering of watercourses and/or wetlands along this corridor is insufficient to provide a 100 m wide corridor, additional buffering has been applied (Figure 3.11) to make the corridor at least 100 m wide as recommended in the HGNP.

It may be necessary to cross the wildlife corridors with roads and utilities to develop areas otherwise suitable for development. The MLSA is surrounded on three sides by roads and undeveloped areas of the MLSA that are suitable for development butt up against existing roads. It is recommended that roads and utilities enter the areas suitable for development using existing roads and utility corridors to minimize disturbance to the proposed wildlife corridors. To enhance public safety and maintain ecological connectivity, the number of locations where roads or utilities intersect wildlife corridors should be kept as low as possible to reduce traffic and wildlife interactions.



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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services, NSCSLLT
3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services

- | | |
|---|--------------------------|
| Study Area | Pipeline |
| Proposed Corridor (Stantec 2024) | Other Features |
| Halifax Green Network Plan Important Corridor | Road |
| Halifax Green Network Plan Essential Corridor | Resource / Seasonal Road |
| Halifax Regional Municipality Parks | Trail |
| Protected Wilderness Area | Waterway |
| | Waterbody |
| | Buildings |

0 250 500 750 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by SCHubbs on 2024-05-23

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Fig ID: 160410459_025

Figure No.
3.11

Title
**Proposed Landscape Connectivity
Options for MLSA**

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.6 Surficial and Bedrock Geology

A desktop assessment was conducted using provincial bedrock and surficial geology mapping and GIS layers to delineate and inventory the acid generating potential of bedrock and the amount of overburden that may be covering the bedrock (i.e., surficial geology). An inventory of acid rock potential was developed for the MLSA using publicly available GIS data, including surficial and bedrock geologic mapping and acid-rock drainage (ARD) risk mapping developed for Nova Scotia. The reported depth to the water table in the vicinity of the Study Area was estimated through an assessment of existing groundwater wells using data gathered from the NSECC Well Logs Database (NSECC 2022).

The presence of sulphide-bearing rock has land-use planning implications as disturbance during development/construction can expose the bedrock to air and water, which has the potential to leach sulphuric acid. This leaching can result in decreased pH of associated waters, which can then result in mobilization of metals and adversely affect aquatic habitats. Increased costs for development can be incurred as excavated material in areas of known sulphide-bearing rock must be managed and disposed of according to Sulphide Bearing Material Disposal Regulations (NSECC 2021).

3.6.1 BEDROCK GEOLOGY

The MLSA is underlain by the Cambrian to Early Ordovician age metamorphosed sedimentary bedrock of the Goldenville Group and is marginal to the Halifax Group (White et. al. 2014) (Figure 3.12).

The Goldenville Group consists of the Taylors Head and Beaverbank Formations. The Taylors Head formation consists of grey, thickly bedded and weakly cleaved, metasandstone locally interlayered with green, cleaved metasilstone and rare black to rusty slate and is considered non-acid producing. The Beaverbank Formation overlies the Taylors Head Formation and consists of grey to black, cleaved metasilstone interbedded with minor thin, light grey metasandstone and black graphitic slate and is considered potentially acid producing (White and Goodwin 2011).

The Halifax Group consists of the Bluestone and Cunard Formations. The Cunard Formation consists of black and rusty slate with thin beds and lenses of black metasilstone. This formation typically contains abundant sulphide-rich pyrrhotite and pyrite and is considered to have the highest acid-producing potential for bedrock in the HRM (White and Goodwin 2011). The Bluestone Formation is not located in the vicinity of the development areas.

Detailed bedrock geology mapping is not available in the area immediately surrounding the MLSA. Regional mapping indicates that the entirety of the MLSA is underlain by the Goldenville Group with the southeast edge of the development area marginal to the Halifax Group (Figure 3.12). However, the groups can be sub-divided based on detailed bedrock geology from adjacent map sheets (White et. al. 2014). Most of the MLSA is underlain by the Taylors Head Formation except the southeastern extent of the development area, which intersects the potentially acid producing Beaverbank Formation. The sulphide-rich Cunard Formation lies proximal to the southeastern extent of the development within approximately 100 m.

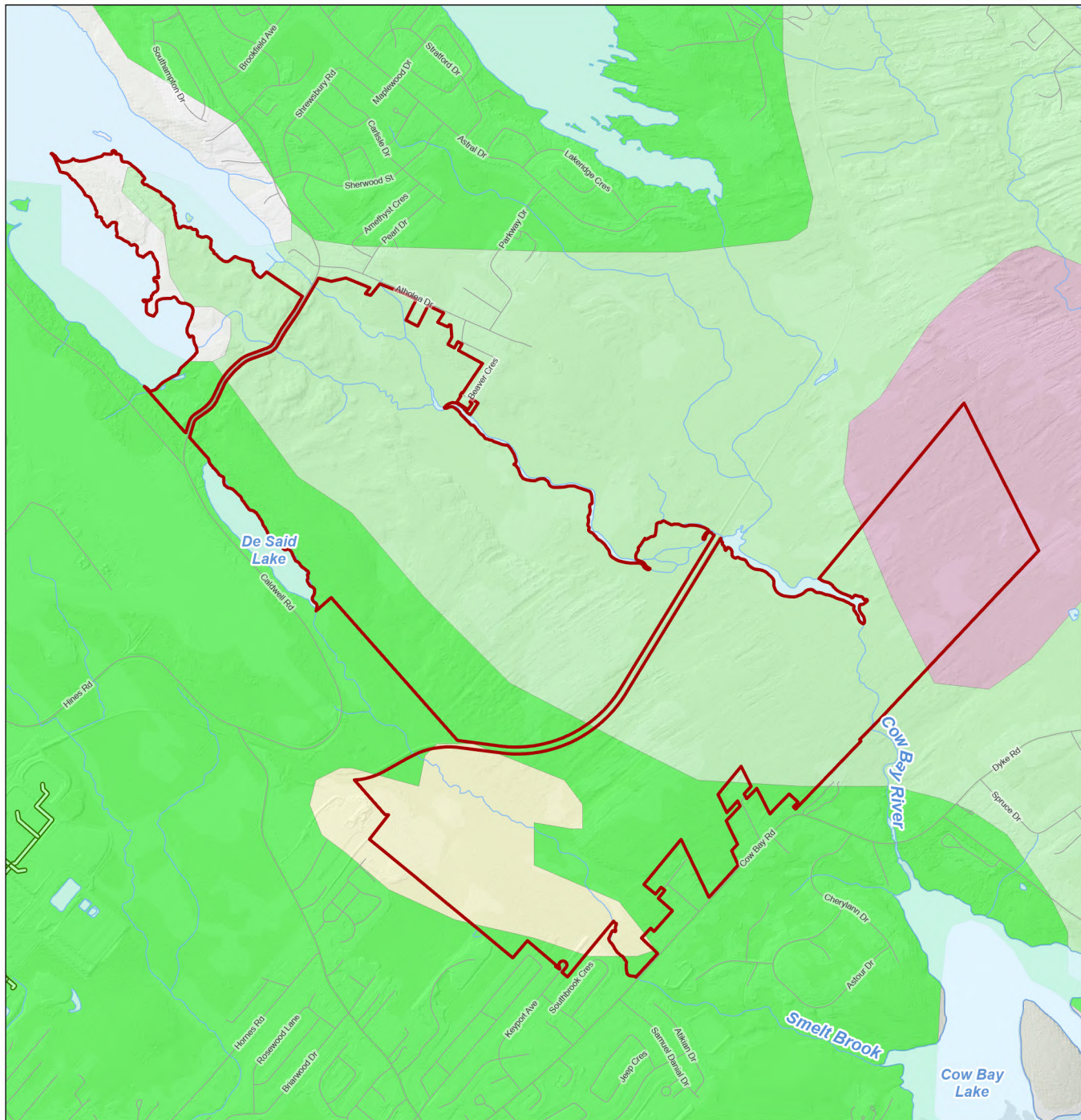


3.6.2 SURFICIAL GEOLOGY

A review of surficial geology mapping for the area (Stea et al. 1992) was carried out to identify areas of exposed bedrock, which may present a greater risk for ARD during development (Figure 3.13).

Overburden at the MLSA consists primarily of stony and silty till plains with overburden depths ranging from 2-30 m thick. Overburden thins in the northeastern limb of the development area, where exposed bedrock, or bedrock concealed by veneers of soil and vegetation, is expected. Areas of exposed bedrock correspond to the non-acid producing Taylors Head Formation.





- Study Area**
- Study Area
- Surficial Geologic Units**
- Organic Deposits
 - Stony Till Plain (Ground Moraine)
 - Silty Till Plain (Ground Moraine)
 - Exposed Bedrock
 - Lakes

- Utilities**
- Pipeline
- Other Features**
- Road
 - Waterway
 - Waterway

0 250 500 Metres
(At original document size of 8.5x11)
1:25,000



Project Location
Halifax Regional Municipality,
Nova Scotia

Prepared by IPodrug on 2024-01-05
Revised by NWhite on 2024-04-03
Revised by Schubbs on 2024-05-10

Client/Project
Halifax Regional Municipality
Future Serviced Communities
Background Studies

Figure ID: 002

Figure No.
3.13

Title
Surficial Geology - MLSA

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Government of Nova Scotia, Department of Natural Resources and Renewables
3. Background: Government of Nova Scotia, Department of Service Nova Scotia and Internal Services; Nova Scotia Department of Natural Resources and Renewables

3.6.3 DEPTH TO WATER TABLE

Depth to water table in the MLSA was estimated using static water levels in existing drilled wells provided in the NSECC Well Logs Database (NSECC 2022). While static water levels in drilled wells can be used to infer the depth to water table, they are not considered a precise representation of the water table, particularly with partially confined or confined aquifer conditions, or if the water level was measured prior to full recovery in the wells and if water levels are measured during different seasons. Statistical summaries of static water levels in existing groundwater wells within 100 m of the MLSA are shown in Table 3.16.

Table 3.16 Static Water Level Summary in Existing Groundwater Wells

Development Area	Number of Wells ¹	Minimum Static Water Level (mbtoc ²)	Maximum Static Water Level (mbtoc)	Average Static Water Level (mbtoc)	Median Static Water Level (mbtoc)
Morris Lake	15	1.52	9.74	4.18	3.04
Notes: 1 – Includes wells with static water level data within the MLSA boundary and any well within a 100 m radius of the MLSA boundary 2 – mbtoc=metres below top of casing					

The NSECC Well Logs Database generally indicates that static water levels in drilled wells are shallow (generally within 4 m of ground surface). Shallow groundwater table is also inferred from nearby surface water bodies and wetlands in the vicinity of the development area. The provincial wet areas mapping, shown on Fig 3.4 of this report, also indicates depth to water table.

3.6.4 LAND SUITABILITY ANALYSIS – GEOLOGY

For the geology component of the land suitability analysis, bedrock was classified based on its acid producing potential (Table 3.17; Figure 3.14). In the context of ARD, surficial geology is primarily relevant in situations where overburden thickness is insufficient to prevent exposure of potentially acid producing bedrock to air and/or water during development. Information available from provincial mapping provide a wide range of thicknesses for each surficial geology unit, so surficial geology was classified primarily on the acid producing potential of the bedrock underlying the overburden.

Surficial and bedrock geology, as it relates to potential acid generation, is only one of many factors that must be considered when evaluating land suitability for development. The current assessment of surficial and bedrock geology is based on a desktop review of available provincial mapping, and does not purport to be definitive regarding development risks and opportunities. If sulphide-bearing rock is encountered during development, it must be managed and disposed of according to Sulphide Bearing Material Disposal Regulations (NSECC 2021).



**HALIFAX REGIONAL MUNICIPALITY – FUTURE SERVICED COMMUNITIES
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ANALYSIS**

Table 3.17 Surficial and Bedrock Geology – Land Suitability Ranking Framework

Layer	Land Suitability Ranking		
	1 - Low suitability for development	2 - Moderate suitability for development	3 - Higher suitability for development
Bedrock Geology	Cunard Formation	Beaverbank Formation	Taylors Head Formation
Surficial Geology	Exposed bedrock in a potentially acid-producing formation	Soil greater than 2 m overlying potentially acid-producing bedrock	Non acid-producing bedrock

