



# Wetlands Study – Phase 2A

SEM Project #162-006

**Prepared for:**

Tracy-Lynn Goosney  
Manager of Development – Engineering  
Planning, Engineering, and Regulatory  
Services  
City of St. John's





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**Prepared by:**

Steve Gullage  
Steve.gullage@sem ltd.ca  
709 754-0499 ext. 234

A black and white image of a handwritten signature, which appears to be "Steve Gullage", written in cursive.

**Address:**

SEM Ltd.  
79 Mews Place  
St. John's, NL  
A1B 4N2

[www.sem ltd.ca](http://www.sem ltd.ca)



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## Executive Summary

This Phase 2A Wetlands Study provides a comprehensive, field-based evaluation of a subset of wetlands located within the City of St. John's. Study Areas as identified by the City of St. John's included the following areas anticipated to be under development pressure over the next two decades: Barrows Road Area; Airport Heights West Area; Bay Bulls Road South Area; Outer Ring Road - East White Hills Road Area; Torbay Road North – Clovelly Area; Southlands Area; Synod Wetlands Area; Viscount Street Area; Kenmount Road Area; Yellow Marsh Area; and Raymond Brook Area.

The original scope of the Phase 2A Wetlands Study identified 88 discrete wetland sites for field evaluation, but based on field assessments it was determined that, in some cases, one or more sites previously mapped as individual wetlands were part of larger contiguous wetland complexes. Thus, while all 88 sites identified in the scope of work were investigated, this report provides results for 67 wetland sites.

Information generated from the Phase 2A Wetland Study includes:

- 1:1,000 scale maps of delineated wetland boundaries for each wetland site;
- Classification of each wetland site to Wetland Class based on the Canadian Wetland Classification System;
- Wetland functional assessment scores for each wetland site determined using the Wetland Ecosystem Services Protocol for Atlantic Canada (with calculator sheets in an appendix);
- The completed Wetland Scoring and Ranking Spreadsheet and an overall wetland score and rank for each wetland site;
- Photos of each wetland site (both in an appendix and in JPEG format);
- Wetland buffer recommendations based on functional assessment and field survey results; and
- A shapefile of the delineated boundaries for each field surveyed wetland including wetland classification and score and rank information in the attribute table.

Globally and across Canada, the importance of managing wetlands as natural assets is gaining attention as a strategy to support sustainable communities. Wetlands provide functions within an ecosystem that can further provide benefits to local communities and support water management and climate change related policies. In addition to supporting biodiversity and providing wildlife habitat, wetlands can improve water quality, attenuate flooding, recharge groundwater, store carbon, and provide valuable green space within an urban setting. Wetland management is increasingly being incorporated into community and land use planning and this Phase 2A Wetlands Study will inform the City of St. John's with respect to best management of wetlands within a subset of areas anticipated to face development pressure in the near to medium term.

# 1.0 Introduction

## 1.1 Objectives and Scope

This document serves as the final report for the Wetlands Study – Phase 2A (2021133-2021) in accordance with the proposal made by Sikumiut Environmental Management Ltd. (SEM) in response to a Request for Proposals issued by the City of St. John's (hereafter "the City") in 2021 to conduct wetland delineation, classification, functional assessment, and wetland scoring and ranking (based on the rubric provided by the City) for specified wetlands across identified study areas within the City's Municipal Planning Area.

The Wetlands Study – Phase 2A builds on a Phase 1 Wetland Delineation Study commissioned by the City in 2019 which involved the application of remote sensing methodologies to identify and classify wetlands. Prior to this, the last comprehensive review of wetlands within the City had been the 1993 Significant Waterways and Wetlands of St. John's report.

Upon completion of the Phase 1 Study, the City identified 17 Study Areas encompassing wetlands anticipated to face development pressure over the next 10-20 years. A requirement for additional Phase 2 field studies of wetlands within these Study Areas was adopted by City Council at that time.

The current Wetlands Study – Phase 2A provides field study information for a subset of these wetlands, within 11 of the Study Areas. Detailed field delineation and functional assessment of identified wetlands based on the Wetland Ecological Services Protocol for Atlantic Canada calibrated for Newfoundland and Labrador were completed and findings are included in this report. In addition, this report includes an overall score and rank for each wetland based on the Wetland Scoring and Ranking spreadsheet developed by the City as well as recommended buffer widths.

## 1.2 Regulatory Framework for Wetlands

### 1.2.1 City of St. John's

Enabled under authority of the NL *Urban and Rural Planning Act* [SNL 2000 cU-8], the City of St. John's Strategic Plan (2019-2029), Envision St. John's Municipal Plan and accompanying Development Regulations provide direction on protecting wetlands and their associated buffers.

The Municipal Plan sets a goal "To conserve, protect and enhance the City's natural environment – it's waterways, wetlands, coastline and forested areas – for their ecological, aesthetic and economic value"

(City of St. John's 2022b), includes protection of the hydrologic functions of wetlands within the associated Strategic Objectives and addresses wetlands within the context of Environmentally Valuable Areas (City of St. John's 2022b).

Standards for protecting wetlands are set out in the St. John's Development Regulations, 2022. Within the Development Regulations, wetland is defined as "land that is seasonally or permanently covered by shallow water, as well as land where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils and has favored the dominance of either hydrophytic or water tolerant plants" (City of St. John's 2022a).

The Development Regulations set out minimum buffer widths around wetlands and other features in section 4.10 Waterways, Wetlands, Ponds and Lakes. Within the context of the Development Regulations, a Buffer "means an area left in its natural state or landscaped with various plants, trees, shrubs, or grasses, in order to assist in conserving a natural resource or to mitigate the impacts of one Use upon another" (City of St. John's 2022a). A buffer of 15 m from the edge of wetland is required and an extended buffer of 50 m is required around several specifically identified wetlands. The Development Regulations allow City Council flexibility to increase the size of buffers adjacent to water bodies. Under the Regulations, developments are not permitted within wetlands or within 1.2 m of their designated buffer. The stipulation that any development must be at least 1.2 m away from a designated buffer also applies to buffers adjacent to waterways, ponds, lakes and in floodplains. Exceptions may be permitted for specific types of developments as indicated within the Development Regulations (City of St. John's 2022a).

The City's Wetland Management Policy is intended to be supplemental to the Regulations, and protection of wetlands also aligns with the City's Stormwater Management Policy.

## 1.2.2 Province of Newfoundland and Labrador

The Water Resources Management Division of the Department of Environment and Climate Change maintains a Policy for Development in Wetlands (hereafter the "Policy") that establishes criteria for issuing a permit for development activities in and affecting wetlands, under Section 48 of the *Water Resources Act* [SNL 2002 cW-4.01] (hereafter "the Act"). The statutory definition of Wetland under the Act refers to "land that has the water table at, near or above the land surface and includes bogs, fens, marshes, swamps and other shallow open water areas" (*Water Resources Act* 2002).

The Policy's stated objective is to permit developments in wetlands which do not adversely affect water quantity, water quality, hydrological characteristics, functions, or habitats of wetlands. Outlined within the Policy are the types of developments having indirect or direct impacts to wetlands that are not permitted and development activities that may be approved with written permission by the Minister of Environment

and Climate Change. When developments affecting wetland are permitted under the Act, any required mitigative or restoration measures are specified in the terms and conditions of the environmental approval. As over 90% of the province is managed as Crown Land, the Policy has wide applicability across the land base.

Activities affecting wetlands in Newfoundland and Labrador may also be regulated by the *Environmental Protection Act* [SNL 2002 cE-14.2, EPA] when a proposed project affecting wetlands triggers an Environmental Assessment based on criteria outlined in the Environmental Assessment Regulations, 2003.

### 1.2.3 Government of Canada

At the federal level, wetland conservation in Canada is promoted by the Federal Policy on Wetland Conservation (hereafter “the Federal Policy”) which centers on the objective to, “promote the conservation of Canada’s wetlands to sustain their ecological and socio-economic functions, now and in the future” (Government of Canada, 1991). The Federal Policy outlines the Goals, Guiding Principles and Strategies for achieving this objective.

Under the Federal Policy, a wetland is defined as “land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment. Wetlands include bogs, fens, marshes, swamps and shallow waters (usually 2 m deep or less) as defined in The Canadian Wetland Classification System published by the National Wetlands Working Group of the Canada Committee on Ecological Land Classification (1987)” (Government of Canada 1991).

Goals of the Federal Policy include: maintaining wetland functions and values throughout Canada; enhancement and rehabilitation of wetlands in areas where degradation has reached “critical levels”; recognition of the value of wetland functions within federal resource planning and management processes; securement of significant wetlands; endorsement of sustainable management practices in relevant sectors (e.g., forestry and agriculture); sustainable use of wetlands that allows continued use by future generations; and no net loss of wetlands on Federal lands and waters (Government of Canada 1991). The no net loss of wetlands goal of the Federal Policy is associated with a three-step mitigation hierarchy whereby wetland loss is primarily avoided, unavoidable wetland loss is minimized, and any remaining loss is offset through compensation to maintain baseline wetland functioning (Government of Canada 1991).

The Federal Policy is applicable to all federal lands and waters and provides a directive to all federal departments to protect wetland functions in their operations and programs. The Federal Policy may have broader applicability extending to private or provincially managed land in cases where wetland impacts are caused by an activity that is federally permitted or funded (Government of Canada 1991).

## 2.0 Wetland Assessment Methodology

### 2.1 Wetland Boundary Delineation

Wetland delineation refers to the in-field determination of the boundary between wetlands and adjacent uplands. Wetlands in the study areas were delineated by SEM and Boreal Environmental field teams based on techniques outlined in the Corps of Engineers Wetlands Delineation Manual (1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (2012) using GPS units with sub meter accuracy to survey the boundaries of each wetland. Field surveys of the 88 locations identified for further study within the 11 study areas were conducted to determine the boundaries of each wetland using the industry accepted methodology between September 2022 – February 2023. Field crew included: Derrick Mitchell, Ryan Power, Steve Gullage, Chris Hearn, and Colin Bursey.

Delineation of wetland boundaries included paired point analysis and walking the perimeter of the wetland consistent with the Corps of Engineers approach as used in other Atlantic Canadian jurisdictions. Paired point analysis involves consideration of hydrophytic vegetation, hydric soils, and wetland hydrology indicators at points on either side of the delineated boundary representing wetland and upland, respectively. Wetland data were recorded on New Brunswick Department of Environment Wetland Delineation Data Sheets.

In accordance with the Corps of Engineers Delineation Manual, an area was determined to be wetland when field evaluation indicated positive evidence of the following criteria:

- The vegetation cover was at least 50%;
- Wetland associated vegetation species are present and dominant;
- Hydrologic conditions exist that result in periods of flooding, ponding, or saturation during the growing season; and
- Hydric soils are present.

Data point locations were sampled to evaluate vegetation, hydrology, and soil data to support a determination of wetland or non-wetland status. The location of boundary and data points were recorded using SXBlue high accuracy GPS receivers.

#### 2.1.1 Determination of Hydrophytic Vegetation

Hydrophytic vegetation, or plants typically adapted to living in saturated soil conditions is technically defined as, “the sum total of macrophytic plant life that occurs in areas where the frequency and duration



of inundation or soil saturation produce permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present.” (p.12 Environmental Laboratory 1987). Identification of plant species was supplemented using The Flora of New Brunswick (Hinds 2000), Native Trees and Shrubs of Newfoundland and Labrador (Ryan, 1995), and Forest Classification Manual, Meades and Moores 1994).

As identified above, one of the criteria for classifying an area as wetland is that hydrophytic vegetation must comprise the dominant plant species. In this study two standard methods, the 50:20 Rule and the Prevalence Index were used to assess dominance of hydrophytic vegetation.

The 50:20 Rule is a method used to determine the dominance of hydrophytic vegetation in a habitat across all strata (or layers) of the vascular plant community (i.e., plants which have lignified tissues for transporting water and minerals). It involves firstly identifying the most abundant plant species for each stratum and ranking them in order of abundance. Plots were used to sample vegetation in the following strata: woody vine stratum, herb stratum, sapling/shrub stratum, and tree stratum. Based on the 50:20 Rule, dominant species are those plant species that account for more than 50 percent of the total coverage across all strata either individually (single species) or together (multispecies), plus other species that comprise at least 20 percent individually (single species).

Species observed in each plot were classified based on their wetland indicator status (probability of occurrence in wetlands), a description of which can be found in Table 1. Description of Wetland Vegetation Indicator Status, below.

**Table 1 Description of Wetland Vegetation Indicator Status.**

Wetland Indicator Status	Abbreviation	Description
Obligate	OBL	Under natural conditions, almost always occurs in wetlands.
Facultative Wetland	FACW	Occur usually in wetlands but can occur in uplands.
Facultative	FAC	Have equal likelihood of occurring in wetlands or uplands.
Facultative Upland	FACU	Occur usually in uplands but can occur in wetlands.
Upland	UPL	Under natural conditions, almost always occurs in uplands.

Identification of indicator status was in accordance with the National List of Plant Species that Occur in Wetlands Northeast (Region1). When greater than 50 percent of the dominant vegetation within the sample plots were classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC), the site was determined to be dominated by hydrophytic vegetation.

Application of the Prevalence Index involves calculating a weighted average of the wetland indicator status of all species in the sample. Wetland indicators are assigned the following weights OBL=1, FACW=2, FAC=3, FACU=4, UPL=5. A weighted average determined to be less than or equal to three indicates hydrophytic vegetation, and values greater than three indicate upland vegetation.

### 2.1.2 Determination of Wetland Hydrology Indicators

Wetland hydrology refers to the extent and timing of soil saturation or flooding to the degree that it drives wetland formation by influencing the soils and vegetation types that occur in the area. At each sample site, the presence of primary and/or secondary hydrology indicators was recorded. Primary indicators of wetland hydrology include but are not limited to the presence of surface water, a high-water table, water marks, drift lines, sediment deposition, observation of saturated soils, inundation visible on aerial images, and a hydrogen sulfide odor. Secondary indicators include but are not limited to surface soil cracks, drainage patterns, stunted or stressed plants, saturation visible on aerial imagery wetland hydrology was concluded to be present when at least one primary indicator was observed. When no primary indicators of wetland hydrology were observed, wetland hydrology was confirmed by the presence of two or more secondary indicators.

### 2.1.3 Determination of Hydric Soil

Hydric soil refers to soil that has formed under flooded or saturated conditions. This can occur when ponding has occurred for long enough during the growing season whereby anaerobic (low to no oxygen) conditions develop in the upper soil layer. Characteristic morphologies result from these processes that provide recognizable cues for identifying hydric soil. Field Indicators of hydric soils can include soil color (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic moisture regime, reducing soil conditions, sulfidic material (odor), soils listed on hydric soils list, iron and manganese concretions, organic soils (Histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils (USDA NRCS 2018). Identification of hydric soils was conducted with reference to Munsell Soil Color Charts developed by Kollmorgen Instruments Company (1990).

### 2.1.4 Alternative Delineation Methods

Due to the larger than anticipated scope of the wetland delineation component of the project compared as compared to those areas to be delineated as outlined in the RFP, modified boundary delineation methods were employed in some cases as discussed with City staff during the project term.

For some wetlands, desktop assessment methods based on high resolution LiDAR data were employed to delineate a portion of the wetlands due to time and access constraints. The application of this

methodology was used to delineate apparent hard edges of wetlands (e.g., banks of fill, transition to asphalt/rock/cement, manicured grass, etc.). In addition, due to the large extent of some wetlands as compared to the area originally mapped (as provided by the City), in some cases delineation of the boundary was truncated along the boundary of the study area. This was done to maintain a scope of work fitting with the original proposal within the identified budget.

## 2.2 Wetland Classification

Wetland classification was conducted in accordance with the Canadian Wetland Classification System Second Edition (CWCS). The CWCS is a hierarchical system used widely across the country. Under the CWCS, wetlands can be categorized by wetland class, form and type.

There are five wetland classes that are differentiated by the environment where they exist and “their developmental characteristics”. Wetland Classes include bog, fen, swamp, marsh, and shallow open water wetlands (National Wetlands Working Group 1997) and are described in Table 2. Wetland Classes as per the CWCS, below.

Wetland Form further differentiates Wetland Classes based on surface morphology and pattern as well as water type and the morphology of any underlying mineral soil (National Wetlands Working Group 1997). Wetland Type involves further classification based on vegetation physiognomy which refers to the morphological and functional characteristics of the dominant species of plants (National Wetlands Working Group 1997). In this study wetlands were characterised to Class at a minimum and this was recorded on wetland delineation data sheets.

**Table 2 Wetland Classes as per the Canadian Wetland Classification System (National Wetlands Working Group, 1997).**

Wetland Class	Description
Bog	Peatlands that have deep deposits (>40 cm) of poorly decomposed organic material (referred to as peat). They receive water from precipitation and are not influenced by groundwater. <i>Sphagnum</i> dominated vegetation is typical.
Fen	Peatlands with deep organic (peat) deposits (>40 cm) and are influenced by slow, lateral water movement. Water sources have been in contact with nutrient-rich surface and/or groundwater. Fens can be treed, shrubby or open.
Swamp	Peat or mineral wetland dominated by woody plants often >1m tall. Swamps are a diverse group of wetlands occurring in a variety of landscapes. Soils are predominantly mineral based although the presence of peat can occur in some settings. They are often transition areas between upland forest and other wetland areas and typically have hummocky ground that may contain pools of water. Most commonly recognized as shoreline areas of streams, lakes and floodplains, swamps are either treed or shrubby.

Marsh	Often found between open water and shorelines. Water levels fluctuate seasonally, and water sources come from precipitation and associated run-off, groundwater and stream inflow. Vegetation dominated by emergent plants, forbs, graminoids or shrubs. Salt marshes are tidally influenced.
Shallow Open Water	Wetlands with free surface water depths less than two metres deep with less than 25 percent of the surface containing emergent or woody plants. Floating-leaved and submerged aquatic vegetation are usually dominant.

## 2.3 Wetland Functional Assessment

Wetland functions were assessed using the Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC) for non-tidal wetlands with reference to the Manual for Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC): Non-tidal Wetlands (Adamus 2018).

WESP-AC is a rapid assessment method that has been standardized for Atlantic Canada, and a specifically calibrated calculator for use in Newfoundland and Labrador. Application of the protocol involves an in-field evaluation and desktop assessment conducted by trained environmental professionals based on data forms contained within the calculator spreadsheet developed by Dr. Paul Adamus, “NL WESP-AC Non-tidal Calculator Single Site\_2018.xlsx”. The WESP-AC “Field Form” and “Stressor Form” are completed in field and correspond to tabs “F” and “S” of the WESP-AC calculator spreadsheet, while the “Office Form” is completed as a desktop exercise using tab “OF”. The Forms are completed based on visual assessment of indicators of wetland ecological characteristics and the spreadsheet calculator generates scores for a wetland’s functions and ratings for their benefits based on logic-based models (Adamus 2018).

For this study, the field component of WESP-AC was evaluated by the field crew acknowledged in the wetland delineation section above during September 2022 – December 2022. The office component was completed throughout September 2022 – February 2023.

Once the Forms are completed, the calculator spreadsheet generates function scores and benefits ratings for each wetland assessed using the protocol, relative to those wetlands previously assessed when the tool was calibrated for NL. Scores are generated on a 0-10 scale while ratings are assigned as Lower, Moderate or Higher. WESP-AC scores a suite of natural wetland functions, however, does not cover all functions that can be provided by wetlands. For example, WESP-AC does not provide a score corresponding to the groundwater recharge capacity of a wetland as no suitable in-field indicators that can be rapidly assessed have been determined for this function. For a description of the wetland functions evaluated by WESP-AC, see Table 3.

**Table 3 Benefits of Wetland Functions Scored by WESP-AC in Atlantic Canada (Adamus 2018).**

Function	Definition	Potential Benefits
<b>HYDROLOGIC FUNCTIONS</b>		
Water Storage & Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	Flood control, maintain ecological systems.
Stream Flow Support	The effectiveness for contributing water to streams especially during the driest part of a growing season.	Support fish and other aquatic life.
<b>WATER QUALITY MAINTENANCE FUNCTIONS</b>		
Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	Support cold-water fish and other aquatic life.
Sediment Retention and Stabilization	The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilising underlying sediments or soil.	Maintain quality of receiving waters. Protect shoreline structures from erosion.
Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season).	Maintain quality of receiving waters.
Nitrate Removal & Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	Maintain quality of receiving waters.
Organic Nutrient Export	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	Support food chains in receiving waters.
<b>ECOLOGICAL (HABITAT) FUNCTIONS</b>		
Fish Habitat	The capacity to support an abundance and diversity of native fish (both anadromous and resident species).	Support recreational and ecological values.
Aquatic Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	Support salmon and other aquatic life. Maintain regional biodiversity.
Amphibian & Reptile Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	Maintain regional biodiversity.
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	Support hunting and ecological values. Maintain regional biodiversity.
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	Maintain regional biodiversity.
Songbird, Raptor & Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	Maintain regional biodiversity.
Native Plant Habitat, Pollinator Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities,	Maintain regional biodiversity and food chains.



	and/or functional groups, as well as the pollinating insects linked to them.	
Public Use and Recognition*	Prior designation of the wetland, by a natural resource or environmental agency, as some type of special protected area. Also, the potential and actual use of a wetland for low intensity outdoor recreation, education, or research.	Commercial and social benefits of recreation. Protection of prior public investments.

\*a benefit of wetlands rather than a function

The WESP-AC results also provide scores for Grouped Wetland Functions. Wetland functions that are associated with scores for each Grouped Function are indicated in Table 4. Wetland Functions Contributing to WESP-AC Grouped Wetland Function Scores, below.

**Table 4 Wetland Functions Contributing to WESP-AC Grouped Wetland Function Scores (Adamus 2018).**

Grouped Function	Wetland Functions Contributing to Grouped Function Scoring
Hydrologic Group	<ul style="list-style-type: none"> <li>• Water Storage &amp; Delay</li> </ul>
Water Quality Support Group	<ul style="list-style-type: none"> <li>• Sediment Retention and Stabilization</li> <li>• Phosphorus Retention</li> <li>• Nitrate Removal &amp; Retention</li> <li>• Carbon Sequestration</li> </ul>
Aquatic Support Group	<ul style="list-style-type: none"> <li>• Stream Flow Support</li> <li>• Aquatic Invertebrate Habitat</li> <li>• Organic Nutrient Export</li> <li>• Water Cooling</li> </ul>
Aquatic Habitat Group	<ul style="list-style-type: none"> <li>• Anadromous Fish Habitat</li> <li>• Resident Fish Habitat</li> <li>• Amphibian &amp; Reptile Habitat</li> <li>• Waterbird Feeding Habitat</li> <li>• Waterbird Nesting Habitat</li> </ul>
Transition Habitat Group	<ul style="list-style-type: none"> <li>• Songbird, Raptor &amp; Mammal Habitat</li> <li>• Plant Habitat</li> <li>• Pollinator Habitat</li> </ul>

## 2.4 Wetland Scoring and Ranking

Scoring and ranking of wetlands within the Study Areas was conducted using methodology developed by the City using the “City of St. John’s Wetland Scoring and Ranking Spreadsheet August 2021.xlsx”. The spreadsheet was designed to assign weighted scores for Grouped Wetland Function as follows: Hydrologic Grouped functions are assigned a weight of 0.4; Water Quality Support Grouped functions are assigned a weight of 0.3; Aquatic Support Grouped functions are assigned a weight of 0.15; Aquatic Habitat Grouped

functions are assigned a weight of 0.10; and Transition Habitat Grouped functions are assigned a weight of 0.05.

Each wetland is assigned an overall score based on the weightings described above and automatically assigned an overall wetland rank of Low, Low-Moderate, Moderate, or High, based on the spreadsheet formulas.

Wetland Scoring and Ranking was completed for a total of 67 wetland sites rather than 88 as originally described in RFP. This was due to discrepancies between the field delineated wetland boundaries as compared to the wetland boundaries originally provided by the City. In some cases, wetlands that had been identified as discrete from each other were observed to be part of the same larger wetland complex. This was particularly relevant for the Southlands Study Area and is noted throughout the results section for Study Areas where there were substantial deviations from the original mapped wetlands.

## 2.5 Buffer Recommendations

Determination of recommended buffer widths around surveyed wetlands involved consideration of wetland functional scores in the context of available research, viewing delineated wetland boundaries overlaid on aerial imagery, and viewing the existing extent of various buffer widths around the delineated wetlands. Spatial information provided through the City of St. John's Map Viewer was also reviewed in this process. Buffer widths of 15 m, 20 m, 30 m, and 50 m were considered for each wetland because they reflect commonly ascribed wetland buffer widths through various policy mechanisms within Atlantic Canada as described below.

The City of St. John's Development Regulations 2022 indicate that at a minimum, a 15 m buffer shall be applied around wetlands and outlines specific wetlands for which a 50 m buffer is required. At a provincial level for Newfoundland and Labrador, recommended buffer widths around wetlands have not been indicated in publicly available documents. However, Environmental Protection Guidelines for Forestry Operations in Newfoundland and Labrador dictate a minimum 20 m buffer be maintained around waterbodies identified on 1:50,000 topographic maps. An increased buffer is applied where there is a slope greater than 30% equivalent to a no harvest buffer of 20 m plus 1.5 times percent slope (Government of Newfoundland and Labrador 2018). Expanding buffer widths to account for steep areas sloping towards wetlands can mitigate the effects of upslope land uses that disrupt the natural flow of water. Such land uses can increase flows of water entering the wetland that potentially carry increased amounts of sediments or other contaminants (Environmental Law Institute 2008).

Drawing from other Atlantic Canadian jurisdictions, the Province of New Brunswick's Wetland Guidelines indicate all impacts to wetlands, including a 30 m buffer, should be avoided when possible (Government of New Brunswick 2021). Additionally, within Halifax Regional Municipality, the 2014 Regional Municipal Planning Strategy Plan outlines the requirement for a 20 m watercourse buffer implemented through secondary planning processes and the relevant Land Use Bylaws apply to wetlands when those wetlands are associated with a watercourse (Halifax Regional Municipality 2014).

## 3.0 Results

### 3.1 Barrows Road Area

Four wetlands were assessed within the Barrows Road Study Area. Delineated boundaries covered a similar footprint than the originally mapped wetlands provided by the City. For a map of the delineated wetlands see Appendix A, Figure A1, Barrows Road Area Delineated Wetlands.

#### BAR1 – Basin Marsh

Dominant wetland indicator plant species at this wetland included *Ranunculus repens* (FAC), *Calamagrostis canadensis* (FACW), and *Phalaris arundinacea* (FACW) in the herb stratum. Hydric soil was confirmed by the presence of histosol and primary indicators of wetland hydrology included surface water, saturation, a high-water table and water marks.

The functional assessment of BAR1 resulted in “Higher” scores for the following wetland functions:

- Streamflow Support
- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Amphibian Habitat

#### Buffer Recommendation:

Maintenance of a 20 m buffer is recommended for this wetland due to its association with a watercourse. Residential development along Quidi Vidi Village Road already extends into the area corresponding to the buffer zone to the north, however, space exists to manage a 20 m vegetated buffer around the remainder of the wetland’s perimeter.

#### BAR 2 – Marsh

At this wetland, dominant wetland indicator species recorded included *Spiraea alba* (FAC) in the sapling/shrub layer and *Typha latifolia* (OBL), *Calamagrostis canadensis* (FACW) as well as *Potamogeton* spp. (OBL) in the herb stratum. Hydric soil conditions were evidenced by presence of histosol and histic epipedon. Wetland hydrology indicators included surface water, saturation, high-water table and water marks and the visual presence of inundation on aerial imagery.

The functional assessment of BAR2 resulted in “Higher” scores for the following wetland functions:

- Streamflow Support
- Water Cooling
- Organic Nutrient Export
- Resident Fish Habitat
- Aquatic Invertebrate Habitat

**Buffer Recommendation:**

As much of the wetland’s perimeter is already sandwiched between Cuckholds Cove Road East to the south, MacDonnell Road to the northeast and residential development along Regiment Road, there is minimal space remaining to maintain a vegetated buffer zone. Management of a 15 m buffer is recommended where possible.

**BAR 3 – Fen**

The dominant wetland indicator species at this site was *Myrica gale* (OBL) in the sapling/shrub stratum. Wetland hydrology indicators included presence of surface water, high-water table and saturation while the presence of histosol confirmed hydric soil conditions.

The functional assessment of BAR3 resulted in “Higher” scores for the following wetland function:

- Streamflow Support

**Buffer Recommendation:**

Maintenance of the 20 m buffer is recommended, due to the association of this wetland with a watercourse. There appears to be some encroachment from surrounding land use into the area corresponding to the buffer zone.

**BAR 4 - Fen**

Dominant wetland indicator species recorded in the sapling/ shrub stratum at this wetland were *Spiraea alba* (FACW), *Myrica gale* (OBL), *Chamaedaphne calyculata* (OBL) and *Salix* spp. (FAC) as well as *Phalaris arundinacea* (FACW) in the herb stratum. Hydric soil was confirmed by the presence of histosol and primary indicators of wetland hydrology included surface water, saturation, high-water table and water marks.

The functional assessment of BAR4 resulted in “Higher” scores for the following wetland functions:

- Streamflow Support
- Water Cooling



- Organic Nutrient Export
- Resident Fish Habitat

**Buffer Recommendation:**

A 20 m buffer is recommended for this wetland, due to the association with a watercourse. As BAR3 and BAR4 are associated with the same watercourse, there may be an opportunity to maintain an overlapping buffer zone between the two to maintain habitat connectivity. If a 15 m buffer is maintained along the watercourse as per the City of St. John's Development Regulations, there will be an area of contiguous buffer zone that spans the two wetlands and adjoins the watercourse buffer.

## 3.2 Airport Heights West Area

Two wetlands were surveyed in this Study Area. Wetland boundaries were determined to be slightly larger than the original mapped wetlands provided by the City. Both wetlands (AWH1 and AWH2) were assigned an overall rank of "High" based on the Scoring and Ranking Spreadsheet. For a map of these wetlands see Appendix A, Figure A2 Airport Heights West Area Delineated Wetlands.

The following dominant indicator species of vegetation in the herb stratum were recorded at both of these sites: *Empetrum nigrum* (FAC); *Rhododendron groenlandicum* (FACW+); *Eriophorum vaginatum* (OBL); *Andromeda polifolia* (OBL); and *Kalmia angustifolia* (FAC). The presence of histosol indicated hydric soil conditions and the presence of a high-water table and saturation served as indicators of wetland hydrology.

**AHW1 – Basin Bog**

The functional assessment of AHW1 resulted in "Higher" scores for the following wetland functions:

- Water Storage and Delay
- Sediment Retention and Stabilization
- Nitrate Removal and Retention
- Carbon Sequestration

**Buffer Recommendation:**

The 15 m minimum buffer is recommended to be maintained around the basin bog surveyed at site AHW1. However, a portion of the wetland boundary lies adjacent to residential properties located on Galaxy Crescent to the southeast and a portion of the 15 m buffer spans into residential land that has already been developed. Therefore, a modified approach to management may be needed for the already developed portion of the wetland buffer.

## AHW2- Basin Bog

The functional assessment of AHW2 resulted in “Higher” scores for the following wetland functions:

- Water Storage and Delay
- Sediment Retention and Stabilization
- Carbon Sequestration

### Buffer Recommendation:

It is recommended to maintain the 15 m minimum buffer around the basin bog surveyed at site AHW2. A portion of the wetland boundary lies in proximity to Airport Heights Drive to the southeast and Autumn Drive to the west and a portion of the 15 m buffer spans existing residential and road development. As a result, the full extent of the buffer zone will not be possible to maintain due to existing developments.

## 3.3 Bay Bulls Road South Area

Three wetland complexes were identified at the Bay Bulls Road South Study Area in the Goulds. One of the wetlands surveyed (BBR2) encompassed three of the originally mapped wetland polygons provided by the City in one large wetland complex. For a map of these wetlands see Appendix A, Figure A3 Bay Bulls Road South Area Delineated Wetlands.

### BBR1 – Conifer Swamp

This wetland complex is predominantly conifer swamp which transitions to marsh in the west. It appears to have been connected historically to BBR2 described below but now separated by the presence of a road.

Dominant wetland indicator species in coniferous swamp/ marsh complexes in this region include *Picea mariana* (FACW) and *Calamagrostis canadensis* (FACW). Histosol is a common hydric soil indicator and presence of wetland hydrology was confirmed by high-water table and saturation.

The functional assessment of BBR1 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Amphibian Habitat
- Waterbird Feeding Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

A portion of the buffer zone adjacent to existing agricultural and residential areas appears to have already been altered. For the north and northwest portion of the wetland it is recommended to maintain a 15 m buffer where possible and the presence of a scrap yard adjacent and potentially extending into the buffer zone may require monitoring.

**BBR2 – Conifer Swamp/Fen/Bog Complex**

This large wetland complex encompasses three of the original polygons identified in the mapping provided by the City. Another nearby polygon was excluded from this complex as it was assessed and determined not to be wetland. The wetland complex includes both Basin Fen, Hilltop Basin Bog and Swamp.

Dominant wetland indicator species of vegetation at this site included *Larix laricina* (FAC) in the tree stratum as well as in the sapling/shrub stratum, *Picea mariana* (FACW) in the sapling/shrub stratum and *Vaccinium oxycoccos* (OBL) and unidentified *Carex* species in the herb stratum. The presence of histosol indicated hydric soil conditions and wetland hydrology was confirmed by the following primary indicators, high-water table, saturation and surface water.

The functional assessment of BBR2 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Amphibian Habitat
- Waterbird Feeding Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

One of the largest wetlands surveyed as part of this study, proactive measures may be warranted to maintain the ecological integrity of this primarily intact wetland complex. The wetland scored Higher for multiple habitat functions, which is influenced in part by the large tract of contiguous undeveloped land to the southwest of the wetland. Ideally to maintain the habitat quality of this wetland, this connectivity would be maintained. Therefore, for the western upslope part of the wetland a larger buffer area of 30 m is recommended while a buffer of 15 m is recommended for the eastern part of the wetland where it abuts agricultural land.

### BBR6 – Graminoid Marsh

This wetland was classified as a graminoid marsh within an agricultural area. The dominant wetland indicator species recorded at this wetland included *Ranunculus repens* (FAC), and *Calamagrostis canadensis* (FACW). Saturation at this site indicated wetland hydrology and a histosol was present (Sandy Mucky Mineral (S1).

The functional assessment of BBR6 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Amphibian Habitat
- Waterbird Feeding Habitat
- Songbird, Raptor and Mammal Habitat

#### Buffer Recommendation:

As this wetland adjoins Ruby Line to the south and Main Road to the east and is immediately adjacent to already established agricultural fields, most of the buffer zone has already been impacted by surrounding land use. A 15 m buffer is recommended, where possible to maintain.

## 3.4 Old Bay Bulls Road Area

One riparian water wetland area was identified at the Old Bay Bulls Road Study Area in Kilbride. This wetland area was comprised of a riparian floodplain/marsh complex. For a map see Appendix A, Figure A4 Old Bay Bulls Road Area Delineated Wetlands.

### OBBR1 – Riparian Water

This riparian water complex is predominantly floodplain with marsh on the distal western portion. This wetland area has been historically impacted by local development, invasive species, and alteration to drainage patterns. Lawns of homeowners have encroached upon the riparian zone, and have abutted the stream directly with no buffer zone.

Dominant wetland indicator species included Reed Canary Grass (*Phalaris arundinacea*) and Tall Meadow Rue (*Thalictrum pubescens*). The soil was a mucky organic histosol and the presence of wetland hydrology was confirmed by high-water table and saturation.

The functional assessment of OBBR1 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Aquatic Invertebrate Habitat

- Amphibian Habitat
- Waterbird Feeding Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor, and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

A portion of the buffer zone adjacent to existing residential areas has already been altered. For the remainder of the wetland (and riparian zone of the stream itself) it is recommended to maintain a 15 m buffer.

### 3.5 Outer Ring Road – East White Hills Road Area

Eight wetland sites were surveyed at this study area. For a map of these wetlands see Appendix A, Figure A5 East White Hills Road Area Delineated Wetlands.

**EWH1 - Shrub Swamp/ Marsh**

Dominant wetland indicator species at this wetland included *Picea mariana* (FACW) in the sapling/ shrub stratum and *Calamagrostis canadensis* (FACW) in the herb stratum. Wetland conditions were evidenced by a soil sample pit too waterlogged to retrieve a soil profile as well as the following primary indicators of wetland hydrology high-water table, saturation, and a hydrogen sulfide odor. The wetland was classified primarily as Shrub Swamp in transition to Marsh.

Functional assessment of EWH1 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Amphibian Habitat
- Waterbird Feeding Habitat

**Buffer Recommendation:**

Much of the perimeter of EWH1 has already been altered by the presence of what appears to be an ATV path to the west, northwest and northeast and the Trans-Canada Highway to the south. However, the southeastern portion of the buffer appears to be relatively intact and a buffer of 15 m is recommended.

**EWH2 and EWH3 - Shrub Swamp**



The two wetlands sampled at EWH2 and EWH3 appear to have once been an area of contiguous wetland, now separated by a road. The dominant wetland indicator species at these sites was *Picea mariana* (FACW) in the tree and sapling/ shrub strata and *Calamagrostis canadensis* (FACW) in the herb strata. Wetland conditions were evidenced by a soil sample pit too waterlogged to retrieve a soil profile as well as the following primary indicators of wetland hydrology surface water, high-water table, and saturation. The wetland was determined to be Shrub Swamp in transition to Marsh.

Functional assessment of EWH2 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Songbird, Raptor and Mammal Habitat

Functional assessment of EWH3 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Resident Fish Habitat
- Songbird, Raptor and Mammal Habitat

#### **Buffer Recommendation:**

For both EWH2 and EWH3, a 15 m buffer is recommended where possible to maintain. It would not be possible to maintain a larger buffer as EWH2 is confined by the Trans-Canada Highway to the northeast and by Cheyne Drive to the southwest as well as by developed land to southeast and northwest. EWH3 is constrained by Cheyne Drive to the northeast, Stonebridge Place to the southeast and residential development to the northwest.

#### **EWH4 (Lundrigan’s Marsh) – Shrub Swamp/ Marsh**

This wetland, known locally as Lundrigan’s Marsh, is an identified Conservation Area under the Municipal Habitat Stewardship Program through an agreement between the City of St. John’s and the NL Department of Fisheries, Forestry and Agriculture.

Lundrigan’s Marsh consists of Shrub Swamp and Marsh and dominant indicator species of vegetation recorded on site included *Calamagrostis canadensis* (FACW) and *Chamaedaphne calyculata* (OBL), both in the herb stratum as well as *Picea mariana* (FACW) in the sapling/ shrub stratum. Hydric soil conditions were apparent and evidenced by the presence of standing water within soil sample pits. Primary indicators of wetland hydrology included surface water, a high-water table, saturation, and a hydrogen sulfide odor.

Functional assessment of EWH4 resulted in “Higher” scores for the following wetland functions:



- Water Cooling
- Nitrate Removal and Retention
- Aquatic Invertebrate Habitat
- Amphibian Habitat
- Waterbird Feeding Habitat
- Waterbird Nesting Habitat

#### Buffer Recommendation:

As is currently identified with the City of St. John's Development Regulations, the existing 15 m buffer is recommended for Lundrigan's Marsh. As encroachment into the buffer zone by adjacent land use has already occurred in some areas, regular monitoring of the Lundrigan's Marsh Conservation Area is encouraged.

#### EWH5 and EWH6 – Basin Bog

Both sites lie in proximity and showed similar composition. The following dominant indicator species of vegetation in the herb stratum were recorded at these sites: *Vaccinium oxycoccos* (OBL); *Myrica gale* (OBL); and both sites were classified as Basin Bog. Indicators of hydric soil for these sites were determined by the presence of histosol and presence of wetland hydrology was confirmed by the following primary indicators a high-water table, saturation, inundation visible on aerial imagery, as well as several secondary indicators. EWH5 was assigned an overall rank of "High" based on the Scoring and Ranking Spreadsheet.

Functional assessment of EWH5 resulted in "Higher" scores for the following wetland functions:

- Sediment Retention and Stabilization
- Phosphorous Retention
- Nitrate Removal and Retention
- Amphibian Habitat
- Waterbird Feeding Habitat
- Waterbird Nesting Habitat
- Pollinator Habitat
- Native Plant Habitat

Functional assessment of EWH6 resulted in "Higher" scores for the following wetland functions:

- Organic Nutrient Export
- Waterbird Feeding Habitat
- Songbird Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

Except along Sugarloaf Road to the north, the buffer for EWH5 is primarily natural vegetation and the entire buffer appears to be intact around EWH6. A 15 m buffer is recommended to be maintained for both sites which because of overlap, will provide a continuous buffer around both bogs.

**EW7 – Basin Bog**

This site encompasses two of the polygons previously identified as discrete wetland sites in the RFP but were determined by field evaluation to comprise one larger wetland classified as a Basin Bog. The dominant indicator vegetation species at this site were *Myrica gale* (OBL) in the herb stratum and *Picea mariana* (FACW) in the sapling/ shrub stratum. Indicators of hydric soil for these sites were determined by the presence of histosol and the presence of saturation confirmed wetland hydrology.

Functional assessment of EWH7 resulted in “Higher” scores for the following wetland functions:

- Organic Nutrient Export
- Waterbird Feeding Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

The perimeter of EWH7 is predominantly natural vegetation and a 15 m buffer is recommended to be maintained.

**EW9 – Basin Fen**

This site was classified as Basin Fen and the following dominant indicator species of vegetation were recorded *Picea mariana* (FACW) (in tree and sapling/shrub strata) and *Chamaedaphne calyculata* (OBL) and *Vaccinium oxycoccos* (OBL) were recorded in the herb stratum. Similar to other peatlands surveyed within this study area, the presence of histosols served as an indicator of hydric soil conditions. Wetland hydrology was confirmed by the following primary indicators saturation, water stained leaves, and inundation on aerial imagery as well as several secondary indicators.

Functional assessment of EWH9 resulted in “Higher” scores for the following wetland functions:

- Organic Nutrient Export
- Amphibian Habitat
- Songbird Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

The perimeter of EWH9 consists of natural vegetation and a 15 m buffer is recommended to be maintained.

## 3.6 Torbay Road North – Clovelly Area

Twelve wetlands were surveyed at this study area. For a map of these wetlands see Appendix A, Figure A6 Torbay Road North – Clovelly Area Delineated Wetlands. TRN1 was omitted from surveys and the study as it was primarily an open water vegetated area located within a pond (and adjacent to a golf course).

**TRN2 – Coniferous Basin Swamp**

This wetland encompasses three of the original polygons identified for further study in the RFP.

Dominant species of wetland indicator vegetation included *Picea mariana* (FACW) in both the tree and sapling/shrub stratum. In the herb stratum, dominant wetland indicator vegetation recorded was *Carex trisperma* (OBL) and *Kalmia angustifolia* (FAC). The presence of histosol confirmed wetland soil conditions and primary indicators of wetland hydrology included a high-water table and saturation.

The functional assessment of TRN2 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Anadromous Fish Habitat
- Resident Fish Habitat
- Aquatic Invertebrate Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

As TRN2 encompasses a watercourse and lies adjacent to a waterbody, additional consideration of surrounding land use is warranted. This wetland scored Higher for multiple functions including those contributing the Aquatic Support, Aquatic Habitat, and Transition Habitat Groups of functions and a 30 m buffer is recommended to reduce the potential for sediments and pollutants from adjacent commercial

development into the wetland. While almost all the buffer within 15 m of the wetland remains intact natural vegetation, a portion of the area within 30 m of the wetland has already been altered.

#### TRN4 - Lacustrine Sedge Swamp/ Marsh Complex

This small, ponded wetland lies adjacent to TRN2 described above and appears to be hydrologically connected to it. Dominant species of wetland indicator vegetation recorded at this site included *Larix laricina* (FAC) and *Picea mariana* (FACW) in the sapling/shrub stratum while dominant species in the herb stratum indicative of wetlands included *Carex utriculata* (OBL), *Carex exillis* (OBL), *Chamaedaphne calyculata* (OBL) and *Carex echinata* (OBL). The presence of histosol confirmed wetland soil conditions and primary indicators of wetland hydrology included presence of surface water, a high-water table and saturation.

The functional assessment of TRN4 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Anadromous Fish Habitat
- Resident Fish Habitat
- Aquatic Invertebrate Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

#### Buffer Recommendation:

To the north and northwest of TRN4, the perimeter has already been extensively altered by clearing and the presence of a road. A 15 m buffer is recommended for this wetland which will overlap with the buffer area for TRN2, providing connectivity between the two.

#### TRN5 - Marsh

At this site dominant wetland indicator plant species included *Abies balsamea* (FAC) in the tree stratum, *Myrica gale* (OBL) in the sapling/shrub stratum and *Scirpus cyperinus* (FACW) and *Kalmia angustifolia* (FAC) in the herb stratum. The presence of histosol confirmed wetland soil conditions and primary indicators of wetland hydrology included presence of surface water, a high-water table, saturation, water marks and water-stained leaves.

The functional assessment of TRN5 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Anadromous Fish Habitat
- Resident Fish Habitat
- Aquatic Invertebrate Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

TRN5 encompasses a watercourse and scored Higher for multiple functions including those contributing the Aquatic Support, Aquatic Habitat, and Transition Habitat Groups of functions. The area surrounding TRN5 is predominantly comprised of intact natural vegetation and a buffer of 30 m is recommended to maintain the natural functions of the wetland.

**TRN6 - Graminoid Basin Swamp**

The dominant species of wetland indicator plants identified at sample plots on this site include *Abies balsamea* (FAC) in the tree stratum, *Betula cordifolia* in the sapling/shrub stratum (FACU) and, in the herb stratum, *Symphyotrichum puniceum* (FACW) and *Calamagrostis canadensis* (FACW). The presence of saturated mucky peat was the indicator identified for hydric soil and primary indicators of wetland hydrology included presence of surface water, a high-water table, saturation, and water-stained leaves.

The functional assessment of TRN6 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Organic Nutrient Export
- Aquatic Invertebrate Habitat

**Buffer Recommendation:**

TRN6 lies directly to the southeast of roads associated with the St. John’s International Airport. Due to the association of this wetland with a watercourse, a buffer of 20 m is recommended for this wetland. The area corresponding to a 20 m buffer zone around the wetland primarily consists of intact vegetation.

**TRN7 – Treed Fen**

The wetland identified at TRN7 encompasses three of the original wetland polygons that had been identified for further study by the City. Several of the study sites appear to have historically been contiguous wetland but are now segmented by roads, including TRN7, TRN9, TRN11, TRN12 and TRN 13, which are described below.

Dominant wetland indicator species at this site included *Picea mariana* (FACW) and *Abies balsamea* (FAC) in the tree and sapling/shrub stratum as well as *Betula cordifolia* (FACU) and *Myrica gale* (OBL), also in the sapling/shrub stratum. In the herb stratum dominant wetland indicator species included *Osmunda cinnamomea* (FAC), *Calamagrostis canadensis* (FACW), *Kalmia angustifolia* (FAC), *Carex exilis* (OBL), *Juncus canadensis* (OBL), *Myrica gale* (OBL), *Chamaedaphne calyculata* (OBL), *Oclemena nemoralis* (OBL), and *Vaccinium oxycoccos* (OBL). Histosol confirmed the hydric soil requirement and primary indicators of wetland hydrology include a high-water table and saturation.

The functional assessment of TRN7 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Resident Fish Habitat
- Aquatic Invertebrate Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

#### Buffer Recommendation:

Much of the buffer around TRN7 has already been developed. The wetland abuts Torbay Road to the east and development off Hebron Way to the south. A 15 m buffer is recommended where possible to maintain and consideration of a larger buffer zone of 20 m around the yet undeveloped northern part of the wetland could be considered to support maintenance of the natural functions of the wetland indicated above.

#### TRN9 - Fen

Dominant wetland indicator species at this site included *Myrica gale* (OBL) in the sapling/shrub stratum and herb stratum as well as *Calamagrostis canadensis* in the herb stratum (FACW). Histosol was present and is indicative of hydric soil conditions and the presence of saturation served as a primary indicator of wetland hydrology.

The functional assessment of TRN9 resulted in “Higher” scores for the following wetland functions:





- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

This wetland abuts existing development around most of the perimeter and while a 15 m buffer is recommended, the only remaining vegetated part of the buffer lies to the north and south of the western end of the wetland. The remainder of the wetland buffer has already been developed along Verafin Way to the north, east and south and an airport access road to the west.

**TRN11 - Fen**

Dominant wetland indicator species at this site included *Myrica gale* (OBL) in the sapling/shrub stratum and herb stratum as well as *Calamagrostis canadensis* in the herb stratum (FACW). Histosol was present and is indicative of hydric soil conditions and the presence of saturation served as a primary indicator of wetland hydrology.

The functional assessment of TRN11 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

The wetland abuts Torbay Road to the west and development off White Rose Drive and Aberdeen Avenue to the south. A 15 m buffer is recommended with consideration of implementing a larger buffer zone of 20 m around the yet undeveloped northern part of the wetland. Some impacts from adjacent land development do appear to have impacted the buffer zone.

**TRN12-TRN15**

Within this study area several of the wetlands surveyed (TRN12, TRN13, TRN14 and TRN15 described below) were located on Clovelly Golf Course and it was not permissible to dig soil pits at this facility to assess soil conditions.

**TRN12 - Fen**

This wetland is part of the same complex described as TRN11 above but separated by a golf cart road and culverts. The dominant wetland indicator species at this site similarly included *Myrica gale* (OBL) in the sapling/shrub stratum and herb stratum as well as *Calamagrostis canadensis* (FACW) in the herb stratum. The presence of saturation served as a primary indicator of wetland hydrology.

The functional assessment of TRN12 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat

### TRN13 - Fen

This wetland appears to have been historically contiguous with TRN12 described above but is now separated by the access road into the golf course but remains hydrologically connected through culverts.

Dominant wetland indicator species at this site included *Myrica gale* (OBL) in the sapling/shrub stratum and herb stratum as well as *Calamagrostis canadensis* in the herb stratum (FACW). Histosol was present and is indicative of hydric soil conditions and the presence of saturation served as a primary indicator of wetland hydrology.

The functional assessment of TRN13 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export

### TRN14 - Fen

Dominant wetland indicator species at this site included *Myrica gale* (OBL) in the sapling/shrub stratum and herb stratum as well as *Calamagrostis canadensis* in the herb stratum (FACW). Histosol was present and is indicative of hydric soil conditions and the presence of saturation served as a primary indicator of wetland hydrology.

The functional assessment of TRN14 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export

### TRN15 – Fen/Swamp Complex

Dominant species of wetland indicator vegetation in swamps in the region include *Picea mariana* (FACW) and *Larix laricina* (FAC) in tree and sapling/shrub strata. In the herb stratum, dominant wetland indicator vegetation typically includes *Myrica gale* (OBL). The presence of histosol confirmed wetland soil conditions and primary indicators of wetland hydrology included a high-water table and saturation. This fen/Swamp complex contains a stream and small lacustrine habitat (small pond adjacent to the fen/swamp complex) bisecting the fen with forested areas along the riparian zone of the stream.

The functional assessment of TRN15 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export

#### **Buffer Recommendations (TRN12-15):**

For wetlands located on Clovelly Golf Course (TRN12, TRN13, TRN14, and TRN15), a 15 m buffer width is recommended. For TRN 12, TRN13, and TRN14 much of this buffer area spans into the cultivated golf course. As well the southern edge of TRN15 lies adjacent to residential properties located on Soldier Crescent and much of the 15 m buffer there has already been developed.

#### **TRN16 – Basin Fen**

Dominant wetland indicator plant species identified at this site included *Larix laricina* (FAC) in the tree stratum as well as the sapling/shrub stratum. In the herb stratum, *Chamaedaphne calyculata* (OBL) was dominant. The presence of histosol confirmed wetland soil conditions and primary indicators of wetland hydrology included a high-water table and saturation.

The functional assessment of TRN16 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Songbird, Raptor and Mammal Habitat

#### **Buffer Recommendation:**

This wetland was found to be larger than the area of wetland originally mapped and directly abuts residential properties to the south. While there is no undisturbed area to encompass a buffer to the south, undeveloped land to the north and northwest of the wetland can provide a buffer and a 15 m buffer is recommended where possible around the wetland.

## TRN17 - Fen

This Fen spans a watercourse and was substantially larger than the extent of wetland originally mapped. *Calamagrostis canadensis* (FACW) was the dominant wetland indicator species in the herb stratum. Mucky soil with a hydrogen sulfide smell was present and is indicative of hydric soil conditions and the presence of saturation plus the hydrogen sulfide smell served as a primary indicator of wetland hydrology.

The functional assessment of TRN17 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat

### Buffer Recommendation:

Given the area of wetland was documented to be larger than originally thought, extending to building lots on Gallipoli Street and Dyer Place to the north and abutting Ashkay Drive to the east, a portion of the buffer zone has already been developed. A 15 m buffer is recommended for this wetland as there is minimal undeveloped land adjacent to the wetland to accommodate a larger buffer.

## 3.7 Southlands Area

Fifteen wetlands were surveyed at this study area. For a map of these wetlands see Appendix A, Figure A7 Southlands Area Delineated Wetlands.

### SL1 - Treed Basin Bog

The extent of the delineated boundary for this wetland was truncated to the northeast by the limit of the study area as the remaining portion of the wetland spanned outside the identified geographic scope of this project. This wetland was assigned an overall rank of “High” based on the Scoring and Ranking Spreadsheet.

Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Vaccinium oxycoccos* (OBL), *Juncus effuses* (FACW), and *Myrica gale* (OBL). Hydric soils were indicated by the presence of histosol and the following primary indicators of wetland hydrology were observed: high-water table, saturation, sparsely vegetated concave surface.

The functional assessment of SL1 resulted in “Higher” scores for the following wetland functions:

- Water Storage and Delay

- Sediment Retention and Stabilization
- Nitrate Removal and Retention
- Carbon Sequestration
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

A portion of the wetland appears to have been impacted by road construction to the south and the wetland directly abuts the linear development in this area. A buffer of 30 m is recommended around the entire wetland where possible including the portion of the wetland that lies outside of the study area due to its “High” overall rank based on the Scoring and Ranking Spreadsheet.

**SL2 – Fen**

This Fen contained a stream and pool within the peatland. Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Myrica gale* (OBL), *Calamagrostis canadensis* (FACW), and *Chamaedaphne calyculata* (OBL). Hydric soils and wetland hydrology were indicated by the presence of histosol and saturation, respectively.

The functional assessment of SL2 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Carbon Sequestration
- Organic Nutrient Export
- Resident Fish Habitat
- Waterbird Feeding Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

While the vegetated perimeter of SL2 has been somewhat impacted by residential development from Pepperwood Drive and Cherrybark Crescent to the south and southwest and road construction to the north the vegetation remains largely intact surrounding a 20 m buffer zone around the wetland. The northeast boundary of the wetland remains undeveloped, and maintenance of the associated upland habitat is a contributor to this wetland scoring Higher on several habitat functions. A 20 m buffer is recommended to be maintained for this wetland due to its association with a watercourse.

### SL3 –Fen

This Fen contained a stream and pool within the peatland which extended down from SL2 described above maintaining similar characteristics. Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Myrica gale* (OBL), *Calamagrostis canadensis* (FACW), and *Chamaedaphne calyculata* (OBL). Hydric soils and wetland hydrology were indicated by the presence of histosol and saturation, respectively. The functional assessment of SL3 resulted in “Higher” scores for the following wetland functions:

- Organic Nutrient Export
- Anadromous Fish Habitat
- Resident Fish Habitat
- Amphibian Habitat
- Waterbird Feeding Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

#### Buffer Recommendation:

This wetland scored Higher on several functions contributing to Aquatic Habitat and Transitional Habitat Grouped functions and is located next to a popular walking trail and residential neighborhoods. A larger buffer zone of 30 m is recommended where possible around the wetland to better conserve the habitat functions of this wetland and support recreational use of open space. The 15 m minimum buffer zone may be required along the portion of the wetland perimeter adjacent to residential development on Peppertree Place, as a larger buffer could not be accommodated there.

### SL4 –Fen

The wetlands located at SL4 and SL5 appear to have once been adjoined but are now separated by Sprucedale Drive with hydrologic connectivity through a watercourse that runs through both, via a culvert under that road.

Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Myrica gale* (OBL), *Calamagrostis canadensis* (FACW), and *Chamaedaphne calyculata* (OBL). Hydric soils and wetland hydrology were indicated by the presence of histosol and saturation, respectively.

The functional assessment of SL4 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Waterbird Feeding Habitat
- Songbird, Raptor and Mammal Habitat

**Buffer Recommendation:**

This wetland, when delineated, was much larger than the original wetland polygon provided by the City for this site. It spans most of the area between surrounding residential development and the minimum 15 m buffer is recommended where possible to maintain. Some of the adjacent land use has already impacted the area of the buffer.

**SL5 - Fen**

Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Myrica gale* (OBL), *Calamogrostis canadensis* (FACW), and *Chamaedaphne calyculata* (OBL). Hydric soils and wetland hydrology were indicated by the presence of histosol and saturation, respectively.

The functional assessment of SL5 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Amphibian Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat

**Buffer Recommendation:**

A 20 m buffer is recommended for this site due to its association with a watercourse, however, a portion of the buffer zone has already been impacted by Green Acre Drive to the east.

**SL6 - Fen**

Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Myrica gale* (OBL), *Calamogrostis canadensis* (FACW), and *Chamaedaphne calyculata*

(OBL). Hydric soils and wetland hydrology were indicated by the presence of histosol and saturation, respectively.

The functional assessment of SL6 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Carbon Sequestration
- Organic Nutrient Export
- Resident Fish Habitat
- Aquatic Invertebrate Habitat
- Amphibian Habitat
- Waterbird Feeding Habitat
- Waterbird Nesting Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

The wetland SL6 spans most of the undeveloped natural area that is surrounded by residential development. While residential development off of Gisborne Place does span into the buffer zone, a relatively intact 15 m vegetated buffer exists around the wetland, to the west and north and it recommended to be maintained.

**SL7 - Bog**

Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Vaccinium oxycoccos* (OBL), *Juncus effuses* (FACW), and *Myrica gale* (OBL). Hydric soils were indicated by the presence of histosol and the following primary indicators of wetland hydrology were observed: high-water table, saturation, sparsely vegetated concave surface. This wetland was assigned an overall rank of “High” based on the Scoring and Ranking Spreadsheet.

The functional assessment of SL7 resulted in “Higher” scores for the following wetland functions:

- Sediment Retention and Stabilization
- Nitrate Removal and Retention
- Carbon Sequestration

**Buffer Recommendation:**



It is recommended to maintain a 15 m buffer around this bog located to the northwest of Southlands Boulevard. A portion of this buffer area has already been impacted by institutional development to the west.

### SL8 - Bog

Dominant wetland indicator species at this site were *Larix laricina* (FAC) in the sapling/shrub stratum, and in the herb stratum *Vaccinium oxycoccos* (OBL), *Juncus effuses* (FACW), and *Myrica gale* (OBL). Hydric soils were indicated by the presence of histosol and the following primary indicators of wetland hydrology were observed: high-water table, saturation, sparsely vegetated concave surface. This wetland was assigned an overall rank of “High” based on the Scoring and Ranking Spreadsheet.

The functional assessment of SL8 resulted in “Higher” scores for the following wetland functions:

- Water Storage and Delay
- Sediment Retention and Stabilization
- Phosphorous Retention
- Nitrate Removal and Retention
- Pollinator Habitat

### Buffer Recommendation:

It is recommended to maintain a 15 m buffer around this wetland. The buffer area remains relatively intact with some vegetation changes due to adjacent residential land use.

### SL9 - Basin Bog/ Coniferous Swamp Complex

This large wetland complex encompasses six of the original polygons provided in the RFP and is the largest wetland surveyed as part of this study. Delineation of this wetland boundary was truncated to the east and south as it was seen to extend as far as 700 m into an adjacent agricultural area, outside of the geographic scope of the project.

In the tree stratum dominant wetland indicator species included *Picea mariana* (FACW) and *Larix laricina* (FAC), in the sapling/shrub stratum was *Picea mariana* (FACW) and *Ilex mucronata* (FAC) and in the herb stratum *Myrica gale* (OBL) and *Viburnum nudum* (FAC). Histosol confirmed hydric soil conditions and primary indicators of wetland hydrology included high-water table, saturation, hydrogen sulfide smell.

The functional assessment of SL9 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Pollinator Habitat

**Buffer Recommendation:**

The wetland surveyed at site SL9 is the largest predominantly intact wetland complex evaluated as part of this study. While it did not score High on as many wetland functions as some other sites based on the WESP-AC protocol, this study highlights that there are few wetlands of this size remaining adjacent to the developed areas of St. John's that have not yet been extensively altered. It is also associated with several watercourses and it is recommended to establish a 20 m buffer around this entire wetland including where it extends past the limits of the study area into adjacent agricultural land to the east and south.

**SL10 - Bog**

Dominant wetland indicator species at this site included *Picea mariana* (FACW) and *Ilex mucronata* (FAC) in the sapling/shrub stratum and *Trichophorum caespitosum* (OBL) and *Empetrum nigrum* (FAC) in the herb stratum. Hydric soil conditions were confirmed by presence of histosol and a hydrogen sulfide smell. In addition to the observed odor, other primary indicators of wetland hydrology included surface water, high-water table, and saturation. This wetland was assigned an overall rank of "High" based on the Scoring and Ranking Spreadsheet.

The functional assessment of SL10 resulted in "Higher" scores for the following wetland functions:

- Sediment Retention and Stabilization
- Phosphorous Retention
- Nitrate Removal and Retention
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

This wetland adjacent to recreational facilities appears predominantly intact. The 15 m buffer is recommended to be maintained. Some impacts to the buffer have already occurred due to the presence of a trail to the west and south, residential development to the east and a field to the north.

**SL16 – Bog/Swamp**

This wetland was larger than indicated in the RFP and encompassed five of the originally provided polygons within one wetland. In field delineation of this wetland was truncated at the limit of the study area to stay within the scope of the project.

In the tree stratum, dominant wetland indicator species included *Picea mariana* (FACW) and *Larix laricina* (FAC), in the sapling/shrub stratum was *Picea mariana* (FACW) and *Ilex mucronata* (FAC) and in the herb stratum *Myrica gale* (OBL) and *Viburnum nudum* (FAC). Histosol confirmed hydric soil conditions and primary indicators of wetland hydrology were apparent and included high-water table, and saturation.

The functional assessment of SL16 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Carbon Sequestration
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Pollinator Habitat
- Native Plant Habitat

#### Buffer Recommendation:

The perimeter of SL16 remains in a natural condition and a 20 m buffer is recommended around the entire perimeter of the wetland including the parts of the wetland that were not delineated in field.

#### SL17 – Bog/Swamp

In the tree stratum, dominant wetland indicator species included *Picea mariana* (FACW) and *Larix laricina* (FAC), in the sapling/shrub stratum was *Picea mariana* (FACW) and *Ilex mucronata* (FAC) and in the herb stratum *Myrica gale* (OBL) and *Viburnum nudum* (FAC). Histosol confirmed hydric soil conditions and primary indicators of wetland hydrology were apparent and included high-water table, and saturation.

The functional assessment of SL17 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Sediment Retention and Stabilization
- Phosphorous Retention
- Nitrate Removal and Retention
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

#### Buffer Recommendation:

A 20 m buffer is recommended around this wetland. The buffer zone is undeveloped natural vegetation at this site.

### SL18 – Bog/Swamp

In field delineation of this wetland was truncated along a small portion of the southeast part to stay within the scope of the project.

In the tree stratum, dominant wetland indicator species included *Picea mariana* (FACW) and *Larix laricina* (FAC), in the sapling/shrub stratum was *Picea mariana* (FACW) and *Ilex mucronata* (FAC) and in the herb stratum *Myrica gale* (OBL) and *Viburnum nudum* (FAC). Histosol confirmed hydric soil conditions and primary indicators of wetland hydrology were apparent and included high-water table, saturation, hydrogen sulfide smell.

The functional assessment of SL18 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Organic Nutrient Export

#### Buffer Recommendation:

A minimum 20 m buffer is recommended around this wetland, including the extent not delineated as part of this study. The buffer zone is undeveloped natural vegetation at this site.

### SL19 – Bog/Swamp

In field delineation of this wetland was truncated at the limit of the study area to stay within the scope of the project along the southern part.

In the tree stratum dominant wetland indicator species included *Picea mariana* (FACW) and *Larix laricina* (FAC), in the sapling/shrub stratum was *Picea mariana* (FACW) and *Ilex mucronata* (FAC) and in the herb stratum *Myrica gale* (OBL) and *Viburnum nudum* (FAC). Histosol confirmed hydric soil conditions and primary indicators of wetland hydrology were apparent and included high-water table, saturation, hydrogen sulfide smell.

The functional assessment of SL19 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat

- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

Most of the perimeter of SL19 remains in a natural condition and a 20 m buffer is recommended around the entire perimeter of the wetland including the parts of the wetland that were not delineated in field.

**SL20 – Fen**

In field delineation of this wetland was truncated in some places at the limit of the study area to stay within the scope of the project.

This wetland encompasses two of the original polygons supplied with the RFP. The dominant wetland indicator species at this site was *Rhynchospora alba* (OBL). Hydric soil was confirmed by the presence of histosol and primary indicators of wetland hydrology were apparent and included Surface water, high-water table, saturation, hydrogen sulfide smell.

The functional assessment of SL20 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Organic Nutrient Export

**Buffer Recommendation:**

Most of the perimeter of SL20 remains in a natural condition with some minor influence by agricultural land use and associated roads to the east and south. A 20 m buffer is recommended around the entire perimeter of the wetland including the parts of the wetland that were not delineated in field.

## 3.8 Synod Wetlands Area

Five wetlands were surveyed at this study area. For a map of these wetlands see Appendix A, Figure A8 Synod Wetlands Area Delineated Wetlands.

All Synod Wetlands surveyed were Treed Swamp with the following characteristics. Dominant wetland indicator species included *Larix laricina* (FAC) and *Picea mariana* (FACW) in the tree and sapling/shrub strata and *Calamagrostis canadensis* (FACW) and *Spiraea alba* (FAC) in the herb stratum. Hydric soil indicators present throughout the Study Area include the presence of histosol and hydrogen sulfide. Primary indicators of wetland hydrology included presence of a high-water table, saturation, and hydrogen sulfide odor.

## SYN 1 and SYN1A

SYN1 and SYN1A were assessed together as they were determined to be part of the same wetland but separated by a walking trail.

The functional assessment of SYN1 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Resident Fish Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

### Buffer Recommendation:

While it is beneficial to extend buffer areas to maintain optimal wildlife habitat, in this case, the location of the wetland adjacent to residential areas and the Trans-Canada Highway, does not allow space for an expanded buffer area around most of the perimeter. The 15 m minimum buffer width is recommended.

## SYN2 and SYN2A

Due to their proximity and connectivity via forested upland areas SYN2 and SYN2A were assessed together.

The functional assessment of SYN2 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Aquatic Invertebrate Habitat
- Pollinator Habitat
- Native Plant Habitat

### Buffer Recommendation:

Maintenance of the 20 m buffer around each will provide an overlapping buffer that links the two wetlands. As the wetlands are part of a natural forested green space, and associated with a watercourse, this will support maintenance of habitat connectivity between them.

## SYN3 (Synod Lands West Wetland)

The functional assessment of SYN3 resulted in “Higher” scores for the following wetland functions:

- Sediment Retention and Stabilization
- Phosphorous Retention
- Nitrate Removal and Retention
- Pollinator Habitat

**Buffer Recommendation:**

As outlined in the St. John's Development Regulations, this wetland has previously been assigned a buffer of 50 m buffer. Due to the high level of public interest in and recreational value of this area it is recommended to maintain the extended buffer for this wetland.

### 3.9 Viscount Street Area

One wetland was surveyed at this study site and the extent of field delineated wetland was larger than the previously mapped area of wetland and encompassed both areas originally identified for further study. For a map of the wetland see Appendix A, Figure A9 Viscount Street Area Delineated Wetlands.

**VIS1 – Tree'd Bog**

The wetland within this study area is Treed Bog with the following characteristics. Dominant wetland indicator species included *Picea mariana* (FACW) in the tree, sapling/shrub, and herb stratum, *Larix laricina* (FAC) in the sapling/shrub strata and *Kalmia angustifolia* in the herb stratum. Hydric soil was indicated by the presence of histosol and primary indicators of wetland hydrology included a high-water table and visible saturation. This wetland was assigned an overall rank of "High" based on the Scoring and Ranking Spreadsheet.

The functional assessment of VIS1 resulted in "Higher" scores for the following wetland functions:

- Water Storage and Delay
- Nitrate Removal and Retention

**Buffer Recommendation:**

Since the Viscount Street Area wetland encompasses most of the undeveloped area but is associated with a watercourse, it was assigned an overall rank of "High" based on the Scoring and Ranking Spreadsheet, it is recommended to maintain a 20 m wetland buffer, recognizing that some degradation of that buffer zone has already occurred due to adjacent development.

### 3.10 Kenmount Road Area

Five wetlands were delineated within this study area. See Appendix A, Figure A10 Kenmount Road Area Delineated Wetlands, for a map showing the delineated areas.

Other areas identified in the RFP for further study located to the northeast and connected to the outlet of KMT5, were field assessed and determined not to be wetland but rather a contiguous highly altered and channelized watercourse.

### KMT1 – Bog

Wetland indicator species of vegetation typical of bogs in this vicinity include *Empetrum nigrum* (FAC), *Rhododendron groenlandicum* (FACW+), *Eriophorum vaginatum* (OBL), *Andromeda polifolia* (OBL), and *Kalmia angustifolia* (FAC) in the herb stratum. The presence of histosol and saturation are commonly seen and serve as indicators of hydric soil and wetland hydrology. This wetland was assigned an overall rank of “High” based on the Scoring and Ranking Spreadsheet.

The functional assessment of KMT1 resulted in “Higher” scores for the following wetland functions:

- Water Storage and Delay
- Sediment Retention and Stabilization
- Nitrate Removal and Retention
- Carbon Sequestration

### Buffer Recommendation:

This bog and surrounding vegetated area are relatively undisturbed and a portion of the wetland lies adjacent to the Protected Windsor Lake Watershed. A 30 m buffer is recommended for this bog.

### KMT2 –Fen

As identified in the RFP only the portion of this wetland laying outside of the already protected Windsor Lake Watershed was delineated as part of this study.

In the sapling/ shrub layer the following wetland indicator species were dominant *Larix laricina* (FAC), *Picea mariana* (FACW) and in the herb stratum *Eriophorum virginicum* (OBL) and *Rhododendron groenlandicum* (FACW+) were the dominant species. The presence of histosol provided indication of hydric soil and the presence of surface water, a high-water table, and saturation serve as primary indicators of wetland hydrology.

The functional assessment of KMT2 resulted in “Higher” scores for the following wetland functions:



- Sediment Retention and Stabilization
- Phosphorous Retention
- Nitrate Removal and Retention
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

This wetland is associated with a watercourse that flows into the Protected Windsor Lake Watershed area. As this wetland scored Higher on several wetland functions related to the Water Quality Support group of functions, a buffer of 50 m is recommended around the portion of the wetland that lies outside of the watershed area, to support maintenance of these functions.

**KMT4 – Treed Swamp**

Of wetland indicator plant species identified in sample plots, the following dominant species were found: *Abies balsamea* (FAC) was dominant in both the tree and sapling/shrub stratum; and wetland associated *Carex* spp. were dominant in the Herb stratum. Observed indicators of hydric soil included presence of histosol and a hydrogen sulfide smell while primary wetland hydrology indicators exhibited were presence of surface water, saturation, water marks, and hydrogen sulfide.

The functional assessment of KMT4 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

**Buffer Recommendation:**

This wetland is located north of Kenmount Road and lies adjacent to areas that are under development. A portion of the buffer zone has already been developed along Kenmount Road and by residential development located roughly to the east and west. A 20 m buffer is recommended where possible to maintain natural vegetation, especially to the northwest.

**KMT5 - Basin Fen**

This Basin Fen has a stream running into and out of it. An assessment of wetland indicator species revealed that the following plant species were dominant in both the tree and sapling/ shrub stratum: *Picea mariana* (FACW), *Larix laricina* (FAC) and these species were dominant in the herb layer: *Chamaedaphne calyculata* (OBL), *Myrica gale* (OBL).

The functional assessment of KMT5 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export
- Resident Fish Habitat
- Aquatic Invertebrate Habitat

**Buffer Recommendation:**

This wetland lies within an already developed area roughly north of Kenmount Road and south of the Kenmount Terrace neighbourhood. A portion of the buffer zone has already been developed along Kenmount Road and Great Eastern Avenue and a 15 m buffer is recommended where possible to maintain.

**KMT11 - Basin Swamp/ Marsh (Georges Pond)**

This area, known as Georges Pond, consists of Basin Swamp/ Marsh Complex. Dominant species observed during the assessment of wetland indicator plant species included: *Picea mariana* (FACW) and *Abies balsamea* (FAC) (in both tree and sapling/shrub layer) as well as *Kalmia angustifolia* (FAC), *Myrica gale* (OBL), and *Maianthemum trifolium* (OBL). Histosol was present at the sample site and indicated hydric soil conditions. Primary wetland hydrology indicators included presence of surface water, high-water table and saturation.

The functional assessment of KMT11 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Resident Fish Habitat
- Waterbird Feeding Habitat
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat
- Native Plant Habitat

**Buffer Recommendation:**

The existing 50 m buffer indicated in the St. John’s Development Regulations, is recommended to be kept in place to maintain the habitat and hydrologic and stream flow support functions of this wetland.

## 3.11 Yellow Marsh Area

Five wetland polygons were delineated within this study area. For a map of delineated wetlands, see Appendix A, Figure A11 Yellow Marsh Area Delineated Wetlands.

### YM1 - Basin Fen/ Basin Bog

The dominant wetland indicator species of plants recorded at this site included *Juncus effusus* (FACW) and *Carex* spp in the herb stratum. Histosol was present and served as an indicator of hydric soil conditions, and wetland hydrology was shown by surface water, high-water table and saturation.

The functional assessment of YM1 resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Water Cooling
- Organic Nutrient Export

#### Buffer Recommendation:

A 20 m buffer is recommended for this wetland due to association with a watercourse. The suggested buffer zone is relatively intact around most of the wetland except along the Team Gushue Highway. Maintenance of vegetation in the steep upslope area to the northwest of this wetland lying in a basin position would be beneficial for preventing wetland degradation.

### YM5 – Basin Fen/ Basin Bog

Dominant indicator species of wetland vegetation included, in the sapling/shrub stratum, *Picea mariana* (FACW) and *Larix laricina* (FAC). In the herb stratum wetland vegetation was shown by the following dominant species, *Juncus articulatus* (OBL) and *Carex gynocrates* (OBL). Histosol indicated hydric soil and wetland hydrology was apparent due to surface water, high-water table, saturation, aquatic fauna, and hydrogen sulfide odor.

The functional assessment of YM5 resulted in “Higher” scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

#### Buffer Recommendation:

A 20 m buffer is recommended for this wetland due to association with a watercourse. The suggested buffer zone is relatively intact around the northern boundary of the wetland, however, vegetation within 20 m of much of the southern boundary has already been degraded in relation to development of

Messenger Drive. Maintenance of vegetation in the steep upslope area to the northwest of this wetland lying in a basin position would be beneficial for preventing wetland degradation.

While the 15 m buffer may be suitable for this wetland, as the wetland lies in a basin position, maintenance of vegetation in the upslope area to the northwest would be beneficial.

#### **YM6A,B,C,D and YM7A,B Basin Fen/Basin Bog**

Orthophotos taken prior to development in this area show historical connectivity of the wetlands described below prior to development of the adjacent lands. Wetlands surveyed at these sites were considered to comprise the same ecological system and were evaluated accordingly.

Dominant indicator species of wetland vegetation included, in the sapling/shrub stratum, *Picea mariana* (FACW) and *Larix laricina* (FAC). In the herb stratum wetland vegetation was shown by the following dominant species, *Chamaedaphne calyculata* (OBL) and *Carex* spp. Histosol indicated hydric soil and wetland hydrology was indicated by a high-water table and saturation (primary indicators).

The functional assessment of this segmented wetland resulted in “Higher” scores for the following wetland functions:

- Stream Flow Support
- Organic Nutrient Export
- Songbird, Raptor and Mammal Habitat
- Pollinator Habitat

#### **Buffer Recommendation:**

As the area around these wetlands has been highly developed, and this wetland study has confirmed that the boundaries of wetlands in this Study Area deviate from the originally mapped wetland areas, much of the buffer zones around YM6B, YM6C, YM6D, YM7A, YM7B have already been altered by surrounding land use and there is minimal vegetated area into which to expand a buffer. Therefore, it is recommended that the buffer be kept to 15 m and emphasis placed on preventing further degradation of the buffer zones.

#### **Buffer Recommendation: 6A**

While parts of the buffer for this large wetland have already been altered due to surrounding land use, given the size of this wetland that is still intact despite being impacted by development, a buffer of 30 m is recommended where possible around the wetland. This would provide additional upland habitat to protect

the wetland from degradation and support a contiguous habitat corridor with the adjacent Watershed Zone to the east.

## 3.12 Raymonds Brook Area

Three wetland polygons were delineated within this study area. See Appendix A, Figure A12 Raymonds Brook Area Delineated Wetlands, for a map showing the delineated areas.

Based on field assessment of identified sites within this Study Area, it was determined that much of the riparian area that had been mapped along Raymond's Brook in the Phase 1 Study did not meet criteria for being classified as wetland. Three wetland study sites were identified (RB1A, RB1B, RB1C). Note that the extent of wetland identified as site RB1C spanned outside of the defined Study Area for Raymonds Brook. In keeping with the project scope, the straight boundary running along the east of the representative polygon truncates the wetland boundary. The full extent of the wetland spans towards Third Pond.

### RB1A, RB1B, RB1C – Swamp/ Marsh

The following dominant indicator species of vegetation were recorded in sampling at these sites: *Picea mariana* (FACW) and *Calamagrostis canadensis* (FACW).

The functional assessment of RB1A, RB1B, RB1C resulted in "Higher" scores for the following wetland functions:

- Water Cooling
- Organic Nutrient Export
- Resident Fish Habitat
- Amphibian Habitat

### Buffer Recommendation:

As these wetland areas are associated with a watercourse, maintenance of a 20 m buffer around wetlands at this Study Site is recommended, considering the full extent of the wetland at site RB1C which is contiguous with the graminoid marsh spanning the shoreline of Third Pond.

## 3.13 Summary of Wetland Scoring, Ranking and Classification

A summary of Scoring and Ranking as well as Wetland Classification in accordance with the Canadian Wetland Classification System, is outlined in Table 5. Study Site Characterization to Wetland Class and Scoring and Ranking Results, below.

**Table 5 Wetland Characterization to Wetland Class and Scoring and Ranking Results.**

Study Area	Field Site	Wetland Class	Overall Wetland Score	Overall Wetland Rank
Barrows Road (BR)	BR1	Marsh	3.55	Low
	BR2	Marsh	3.73	Low
	BR3	Fen	4.47	Low-Moderate
	BR4	Fen	3.41	Low
Airport Heights West (AHW)	AHW1	Bog	7.21	High
	AHW2	Bog	7.12	High
Bay Bulls Road South (BBR)	BBR1	Swamp/Marsh	3.83	Low-Moderate
	BBR2	Fen/ Swamp	3.83	Low-Moderate
	BBR6	Marsh	3.82	Low-Moderate
Old Bay Bulls Road	OBBR1	Marsh	3.55	Low
ORR-East White Hills Road (EWH)	EWH1	Swamp/ Marsh	3.68	Low
	EWH2	Swamp/ Marsh	3.86	Low-Moderate
	EWH3	Swamp/ Marsh	3.18	Low
	EWH4	Swamp/ Marsh	4.15	Low-Moderate
	EWH5	Bog	7.29	High
	EWH6	Bog	4.25	Low-Moderate
	EWH7	Bog	3.85	Low-Moderate
	EWH9	Fen	4.07	Low-Moderate
Torbay Road North-Clovelly (TRN)	TRN2	Swamp	4.39	Low-Moderate
	TRN4	Swamp/Marsh	4.39	Low-Moderate
	TRN5	Swamp	4.47	Low-Moderate
	TRN6	Swamp	4.33	Low-Moderate
	TRN7	Fen	4.50	Low-Moderate
	TRN9	Fen	3.52	Low
	TRN11	Fen	3.36	Low
	TRN12	Fen	3.20	Low
	TRN13	Fen	3.21	Low
	TRN14	Fen	3.21	Low
	TRN15	Fen/Swamp	3.21	Low
	TRN16	Fen/Swamp	3.59	Low
	TRN17	Fen	3.43	Low
Southlands (SL)	SL1	Bog	7.20	High
	SL2	Fen	4.99	Moderate
	SL3	Marsh	3.54	Low
	SL4	Fen	3.75	Low

	SL5	Fen	3.40	Low
	SL6	Marsh	4.46	Low-Moderate
	SL7	Bog	6.90	High
	SL8	Swamp	7.27	High
	SL9	Bog/Swamp	4.44	Low-Moderate
	SL10	Bog	6.90	High
	SL16	Fen/Swamp	4.83	Moderate
	SL17	Bog	6.77	Moderate
	SL18	Fen	4.44	Low-Moderate
	SL19	Fen	3.26	Low
	SL20	Fen	4.44	Low-Moderate
Synod Wetlands (SYN)	SYN1	Swamp	3.82	Low-Moderate
	SYN1A	Swamp	3.82	Low-Moderate
	SYN2A	Swamp	3.54	Low
	SYN2B	Swamp	3.54	Low
	SYN3	Swamp	6.05	Moderate
Viscount Street (VIS)	VIS1	Fen	7.22	High
Kenmount Road (KMT)	KMT1	Bog	7.46	High
	KMT2	Fen	6.85	Moderate
	KMT4	Swamp	2.35	Low
	KMT5	Fen	4.24	Low-Moderate
	KMT11	Swamp/Marsh	4.04	Low-Moderate
Yellow Marsh (YM)	YM1	Fen/Bog	3.07	Low
	YM5	Fen/Bog	2.65	Low
	YM6A	Fen/Bog	3.69	Low
	YM6B	Fen/Bog	3.69	Low
	YM6C	Fen/Bog	3.69	Low
	YM6D	Fen/Bog	3.69	Low
	YM7A	Fen/Bog	3.69	Low
	YM7B	Fen/Bog	3.69	Low
Raymonds Brook (RB)	RB1A	Swamp/Marsh	3.59	Low
	RB1B	Swamp/Marsh	3.59	Low
	RB1C	Swamp/Marsh	3.59	Low

## 4.0 Conclusions

This Phase 2A Wetlands Study provides a comprehensive, field-based evaluation of a subset of wetlands located within the City of St. John's. Field delineation and functional assessment of wetlands provides characterization of a wetland at a particular point in time and, in the absence of major land use changes in the vicinity of the wetland, are typically considered valid for a period of 5 years.

Beyond that timeframe there is the possibility that natural ecological changes within a wetland may contribute to shifting soil, hydrologic or vegetation characteristics or differences in function scores as determined by WESP-AC. In addition, functional assessment scores are influenced by surrounding land use and connectivity to other natural areas, thus, permitted land alterations, even outside of an area maintained as a buffer may affect wetland functioning and consequently the results of evaluation using WESP-AC even within a 5-year window.

Within some of the City's more developed areas, there is evidence of encroachment from surrounding land use into the minimum 15 m buffer zone outlined by the City of St. John's Development Regulations 2022. Instances where the minimum buffer zone has already been degraded highlight the importance of monitoring these areas and conserving the remaining extent of intact buffer zones in these areas. Remediation of vegetated buffer zones could be considered in highly degraded areas and wetland stewardship opportunities in collaboration with adjacent landowners could be explored. Whether the minimum 15 m buffer or larger buffers are applied to wetlands throughout St. John's, maintenance of the ecological composition of upland buffers around wetlands is important for reducing ecosystem degradation and supporting wetland functioning. It is also important to note that maintaining buffers on a site-specific scale does not replace the need for landscape level considerations. Buffers of any width are insufficient to mitigate significant changes occurring at a landscape level, such as substantial loss of natural vegetation and replacement with impervious surfaces within a watershed (Beacon Environmental 2012).

Furthermore, based on assessment using WESP-AC, large intact wetland complexes further away from the built environment may not score as high on some wetland functions as other smaller, potentially more degraded wetlands in proximity to infrastructure. However, the value of conserving larger intact wetland complexes should not be ignored.

The findings and conclusions presented in this report constitute the professional opinion of the project team based on technical and scientific knowledge and observable site conditions. This report has been prepared for the sole benefit of the City of St. John's and may not be relied on by any third party without the express written consent of SEM and the City of St. John's. Any use of the report by a third party,



including decisions made based upon the contents of the report are the responsibility of such third parties. SEM accepts no responsibility or liability for damages in respect of any use of or reliance upon this report or data by any third party.

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## Appendix A: Wetland Delineation Maps

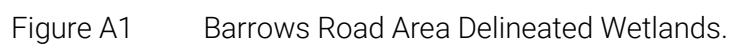


Figure A1 Barrows Road Area Delineated Wetlands.





Figure A2 Airport Heights West Area Delineated Wetlands.



Bay Bulls Road South Area Delineated Wetlands.





Bay Bulls Road South Area Delineated Wetlands.



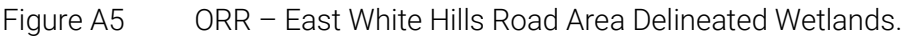


Figure A5 ORR – East White Hills Road Area Delineated Wetlands.

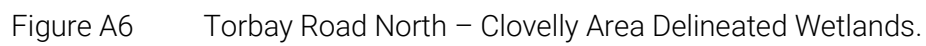








Figure A8 Synod Wetlands Area Delineated Wetlands.



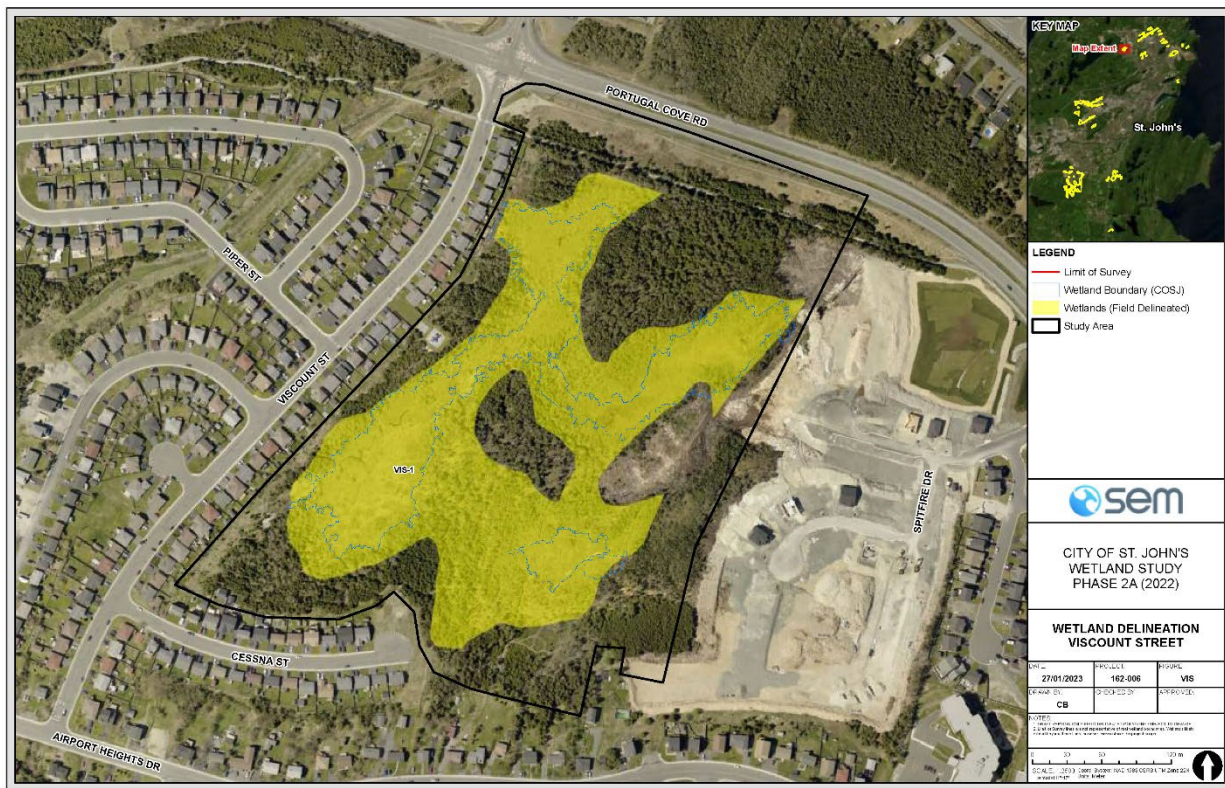


Figure A9 Viscount Street Area Delineated Wetlands.



Figure A10 Kenmount Road Area Delineated Wetlands.





Figure A11 Yellow Marsh Area Delineated Wetlands.







## Appendix B: Wetland Site Photos

## Barrows Road Area



Figure B1 BR1 Wetland Site Photo.



Figure B2 BR2 Wetland Site Photo.



Figure B3 BR3 Wetland Site Photo.





Figure B4 BR4 Wetland Site Photo.

## Airport Heights West Area



Figure B5 AHW1 Wetland Site Photo.



Figure B6 AHW2 Wetland Site Photo.

## Bay Bulls Road South Area



Figure B7      BBR1 Wetland Site Photo.





Figure B8      BBR2 Wetland Site Photo.



Figure B9      BBR6 Wetland Site Photo.



ORR – East White Hills Road Area



Figure B10 EWH1 Wetland Site Photo.



Figure B11 EWH2 Wetland Site Photo.



Figure B12 EWH3 Wetland Site Photo.





Figure B13 EWH4 Wetland Site Photo.



Figure B14 EWH5 Wetland Site Photo.



Figure B15 EWH6 Wetland Site Photo.





Figure B16 EWH7 Wetland Site Photo.



Figure B17 EWH9 Wetland Site Photo.



## Torbay Road North – Clovelly Area



Figure B18 TRN2 Wetland Site Photo.



Figure B19 TRN4 Wetland Site Photo.



Figure B20 TRN5 Wetland Site Photo.



Figure B21 TRN6 Wetland Site Photo.





Figure B22 TRN7 Wetland Site Photo.



Figure B23 TRN9 Wetland Site Photo.



Figure B24 TRN11 Wetland Site Photo.



Figure B25 TRN12 Wetland Site Photo.





Figure B26 TRN13 Wetland Site Photo.



Figure B27 TRN14 Wetland Site Photo.



Figure B28 TRN15 Wetland Site Photo.





Figure B29 TRN16 Wetland Site Photo.



Figure B30 TRN17 Wetland Site Photo.



## Southlands Area



Figure B31 SL1 Wetland Site Photo.



Figure B32 SL2 Wetland Site Photo.





Figure B33 SL3 Wetland Site Photo.



Figure B34      SL4 Wetland Site Photo.



Figure B35 SL5 Wetland Site Photo.





Figure B36 SL6 Wetland Site Photo.



Figure B37 SL7 Wetland Site Photo.



Figure B38 SL8 Wetland Site Photo.





Figure B39 SL9 Wetland Site Photo.



Figure B40 SL10 Wetland Site Photo.



Figure B41 SL16 Wetland Site Photo.





Figure B42 SL17 Wetland Site Photo.



Figure B43 SL18 Wetland Site Photo.



Figure B44 SL19 Wetland Site Photo.



Figure B45 SL20 Wetland Site Photo.



## Synod Wetlands Area



Figure B46 SYN1 Wetland Site Photo.





Figure B47 SYN1A Wetland Site Photo.



Figure B48 SYN2A Wetland Site Photo.





Figure B49 SYN2B Wetland Site Photo.



Figure B50 SYN3 Wetland Site Photo.



## Viscount Street Area



Figure B51 VIS1 Wetland Site Photo.

## Kenmount Road Area



Figure B52 KMT1 Wetland Site Photo.



Figure B53 KMT2 Wetland Site Photo.



Figure B54 KMT4 Wetland Site Photo.





Figure B55 KMT5 Wetland Site Photo.



Figure B56 KMT11 Wetland Site Photo.



## Yellow Marsh Area



Figure B57      YM1 Wetland Site Photo.



Figure B58 YM5 Wetland Site Photo.





Figure B59      YM6A Wetland Site Photo.



Figure B60      YM6C Wetland Site Photo.



Figure B61 YM6D Wetland Site Photo.





Figure B63      YM7A Wetland Site Photo.



Figure B64 YM7B Wetland Site Photo.



## Raymonds Brook Area



Figure B65 RB1A Wetland Site Photo.



Figure B66 RB1B Wetland Site Photo.





Figure B67 RB1C Wetland Site Photo.



