2.0 Land Suitability Analysis

2.1 — INTRODUCTION

2.1.1— Foreword

This land suitability analysis has been prepared for the Halifax Regional Municipality in order to delineate, assess, and inventory any sensitive environmental and cultural features that may exist within the boundaries of the Lake Loon Growth Area. Within each section, recommendations will be made for mitigation measures that will support the health and function of the lands and its natural features. The information in this report is derived from a series of both desktop and physical sources. The majority of the GIS data used to create this report was obtained from either the Halifax Regional Municipality, the Province of Nova Scotia, or the Government of Canada. The accuracy of the information in this report is dependent on the quality of this data and any inconsistencies or deficiencies in these original datasets may affect the information presented. Throughout this document, “the province” refers to the Province of Nova Scotia and “the municipality” refers to the Halifax Regional Municipality unless otherwise specified.

It is important to note that all of 6 of the Wilkins properties have been fully developed as either commercial, residential or driving range lands. There is very little undeveloped ecological reserve remaining except a small portion at the rear of the existing ddriving range and a thin strip along the watercourse to the north-east of the property.

Figure 2 — Site Context Map

Figure 3 — View of the Northern corner of the site from the driving range

Figure 4 — Aerial photo of the Lake Loon Golf Centre parking lot, mini putt, and Golf View Drive

Figure 5 — View looking east from the driving range

Figure 6 — Aerial View of PIDs 00261933, 00261925, and 40173395

2.2 — METHODOLOGY

Organizing Indicators

A number of different indicators were assessed during the production of the LSA. Indicators were largely chosen by reviewing the baseline LSA requirements set out by HRM, but several additional indicators were included to provide more context or information to the analyses.

The indicators are grouped into the following sections:

Topography

- Elevation and Slope
- Solar Aspect

Geology and Soils

- Soils
- Surficial Geology
- Bedrock Geology
- Acid Rock Drainage (ARD)
- Karst Topography
- Indoor Radon Risk

Hydrology

- Watercourses
- Wetlands
- Depth to Water Table
- Water Accumulation and Flooding
- Water Source Protection
- Ecological Considerations

Forest Ecology

- Forestry
- Ecosites

Species at Risk

- Potential Species at Risk
- Landscape Connectivity

Cultural Significance

- Archaeological Study

Contaminated Sites

- Contaminated Sites

Indicators are grouped based on overlapping attributes and the shared ways in which they affect the surrounding ecosystem. For example, wetlands and watercourses frequently work in tandem regarding the provision of habitat and stormwater management, making it logical to analyze them together.

Data Collection and Analysis

This assessment was largely completed as a desktop study. Some field research was undertaken during the wetland/watercourse delineation, forest inventory, Drone survey (3D scan) and archaeological assessment which both informed parts of the LSA, but all of the remaining information was sourced using desktop sources.

Desktop sources of information included GIS datasets published by the Government of Nova Scotia (especially the Department of Natural Resources and Renewables), GIS datasets published by the Government of Canada, satellite imagery, provincial reports, academic papers, as well as a number of municipal priority plans and planning documents.

Indicators with available GIS data were represented visually with maps in ArcGIS Pro. However, only some of the indicators feature dedicated maps in the LSA; others, such as karst topography, do not feature a dedicated map because the entire site is underlaid with the same unit, making a map showing the single unit unnecessary.

Once visualized, many of the indicators could be analyzed to identify important ecological features or environmentally sensitive areas. Further information about the specific methods employed can be found within each section of the LSA

Constraint Evaluation

Once natural features had been identified, a scoring system was applied to each. Features assigned a higher score are considered to be more constrained while features with a low score or a score of zero are considered to be less constrained or not constrained at all.

2.3 — TOPOGRAPHY

Figure 7 — Elevation Map

METHODS

LiDAR data was sourced from the Provincial Elevation Explorer database and analyzed using ArcGIS Pro. The most recent LiDAR scans are from 2019. This elevation data was then reviewed for accuracy by conducting a drone scan of the site to create a surface model. Conclusions about drainage and contours were made by reviewing the maps produced following the GIS analysis. The wetland and watercourse delineation process outlined in the hydrology section reinforced assumptions about the drainage channels.

2.3.1— Elevation and Slope

Figure 7 represents the elevation and elevation changes of the site. The shading indicates the changes in elevation in equal increments of 1m. The areas where the colour breaks sit closer together indicate steeper changes in elevation.

The highest point of the subject area is on the southern edge of the site, near Main Street, where the highest elevation is 80m. The site's lowest point is approximately 68m in elevation and is in the middle of the northeast edge of the site that follows Forest Hills Parkway. The total elevation change in the site is around 12m, roughly equivalent to a 4-storey building.

Most of the steeper elevation changes on the site are located in the southern part. This steeper change in the site's elevation along the main street may make this area less suitable for development.

The site's slope considerably impacts its future development potential and feasibility. A property with extreme slopes increases the amount of site preparation required to make the land usable, the infrastructure required to meet accessibility standards, and the potential need to build retaining walls and similar infrastructure.

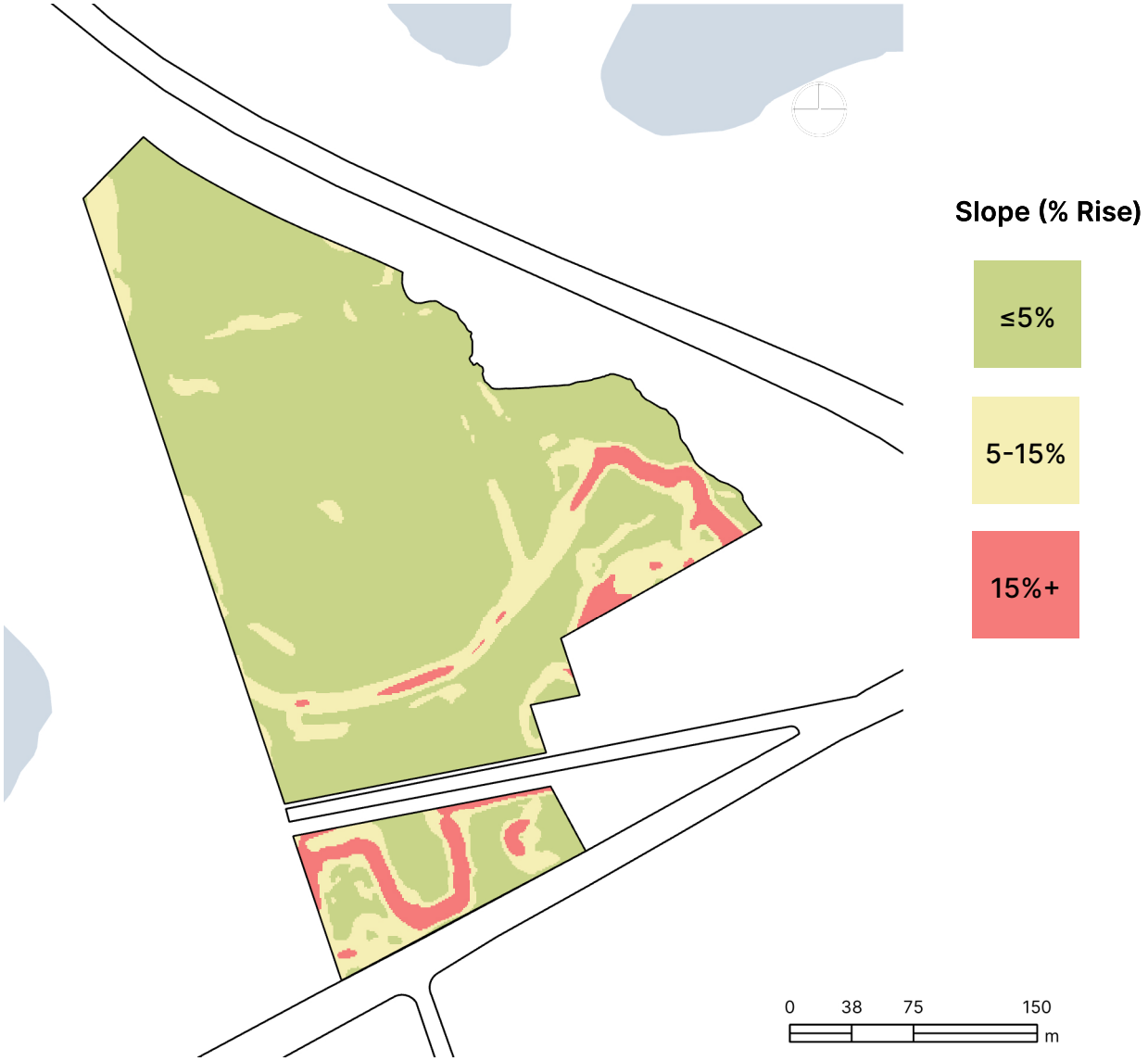


Figure 8 — Slope Map

Figure 8 shows that much of this site has a very low slope ranging from 0-5%, with some steeper slopes around the southern and southeast corners. 0-5% slopes are usually the easiest to develop, requiring the least site disturbance. Land with a 5-15% slope can be developed, but at a slightly higher cost and requires more design consideration, and >15% slopes are the most expensive, and disruptive to the natural features and surrounding habitats as they require the most site preparation.

The flat nature of much of the terrain, particularly in the northern region, is ideal for development as there is less need for grading or terrain alteration. However, some areas in the southern and eastern points with a slope above 15% are less suitable for development. Additionally, they may not be ideal places for roads, as they generally are located in areas with less than 8-10% slopes unless parallel to the contours.

2.3.2— Solar Aspect

Solar aspect refers to how a site's natural topography informs the amount of solar exposure it will receive. It plays a role in shaping the ecological conditions of a site, influencing vegetation patterns, soil stability, and habitats for species at risk, among other things. Slope orientation affects the amount of sunlight and warmth an area receives, which in turn drives vegetation growth and ecological succession. The different colours in Figure 9 correlate to specific cardinal directions of sun exposure, as demonstrated by the colour wheel legend.

Much of the middle of the site slopes in the northern direction, with north, northeast, and northwest-facing slopes, as indicated by the red, orange, and purple on the map. This area of the site can be expected to receive less direct sunlight. These conditions typically retain more moisture, supporting vegetation that thrives in shaded, wetter environments. Similarly, northeast-facing slopes, covering much of this cleared central

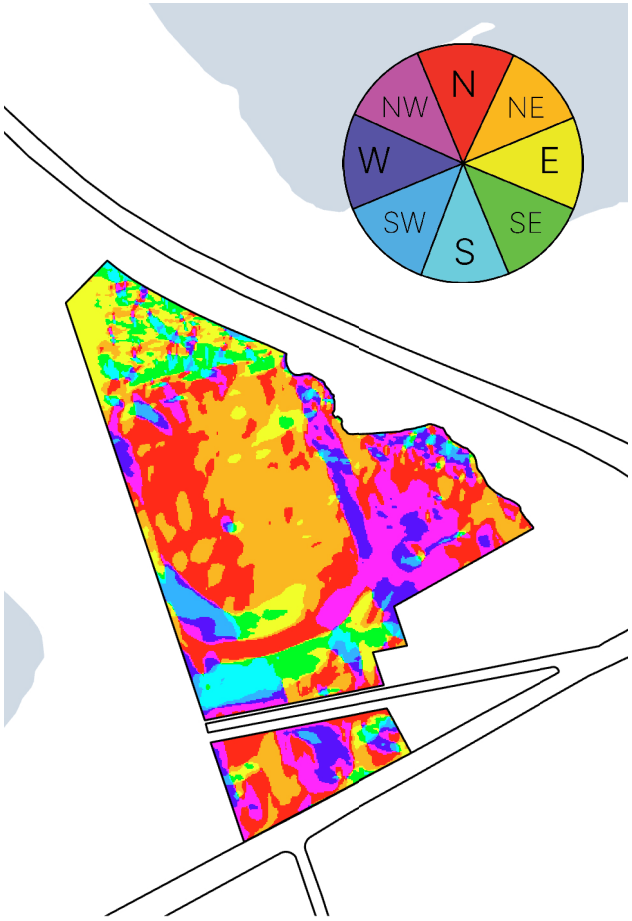


Figure 9 — Solar Aspect Map

area, may act as transitional zones with moderate sunlight and moisture availability. Around the edges of the site, there is more variation in slope direction. However, the forested section of the site generally has more southeast-facing slopes. This means increased solar exposure, which creates warmer, drier conditions. These areas may support plant species adapted to high light and lower moisture availability but could also be more prone to soil erosion if vegetation cover is sparse. Maintaining stable vegetation on these slopes is essential to prevent sedimentation in nearby water systems and to preserve soil integrity. Overall, the difference in soil temperature and moisture between north-facing and south-facing slopes is not immense; instead, it tends to manifest over long periods of time as small changes in the soil makeup. The effects of solar aspect also tend to be more pronounced in arid climates, unlike that of Nova Scotia

2.3.3— Discussion

The site has likely already had some land disturbance when the Lake Loon Golf Centre was built and the development that has taken place on the southern portion of the site to the south of Golf Drive. In the past, a significant portion of the site was cleared to make way for the driving range, resulting in the generally flat terrain that persists today There are some low points around the watercourse where water is likely to flow and accumulate, as well as steeper slopes around the southern and eastern portions of the property. Areas with steeper slopes pose more challenges to development as they often require more land disturbance. If the steeper slopes are developed, more careful planning would be required to prevent environmental degradation and increase feasibility. Key concerns include erosion control, maintaining soil stability, preserving vegetation, and managing stormwater runoff. To ensure sustainable development, a balance must be struck between maximizing the site's utility and preserving its natural features. This requires implementing mitigation strategies that minimize disturbances, address slope-related risks, and consider long-term impacts on the local ecosystem and surrounding community.

Recommended Mitigation Strategies

- Prioritize flat northern areas (0-5% slope) for development to reduce grading and preserve natural contours.
- Consider designating areas with slopes >15% as conservation or recreational zones to limit structural intervention.
- Use erosion-resistant native vegetation to stabilize slopes during and after construction.
- Implement terracing or retaining walls in areas with moderate slopes to reduce soil movement.
- Deploy sediment control measures like silt fences and sediment traps during site preparation.
- Utilize permeable surfaces for parking areas and pathways to enhance water infiltration.
- Use low-impact development (LID) techniques

2.3.4— Constraint Scoring

Steep slopes were identified as the primary constraint pertaining to the topography of the site. The slopes have been categorized into three classes based on their percent rise: 0-5%, 5.01-15%, and >15%. Flatter areas (0%-5%) are ranked as the least constrained due to lower environmental risks, while steeper slopes (>15%) are ranked as the most constrained. The scoring matrix

Slope (% Rise)	Assigned Score
0%-5%	1 - Less Constrained
5.01%-15%	2 - Moderately Constrained
15.01%+	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 1 — Topography Constraint Scoring

Figure 10 — Topography Constraints

2.4 — GEOLOGY AND SOIL

Figure 11 — Soil Map

METHODS

Soil data was sourced from the Soil Survey of Halifax County (Mac Dougall, et al., 1963), which uses the Canadian System for Soil Classification, as well as the Ecological Land Classification (ELC) for Nova Scotia, which uses the Forest Ecosystem Classification (FEC) System for soil classification (Neily, et al., 2017; Neily, et al., 2023). No fieldwork was completed to confirm the results of the existing soil surveys other than a single shovel test performed during the archaeological assessment. Surficial geology and bedrock geology data were sourced from the Province through the Nova Scotia Geographic Data Directory. All of the data was analyzed using ArcGIS Pro.

2.4.1— Soils

The Soil Survey of Halifax County identifies three soil types on the subject site: Ha/B-2, Wv/C-2, and Bw/C-2 (see Figure 11). The first two letters in the soil type code indicate the soil series, then the next letter the slope and the number on the end for the relative stoniness. Ha stands for Hantsport series soil found in a Northeast section of the site, which is a dark reddish sandy loam over reddish-brown sandy clay loam. The parent material of this soil is a reddish-brown loam to sandy clay loam till derived from shales and sandstones. This soil type around Dartmouth is typically found on lower or flatter drumlins with slow run-off. This soil has imperfect drainage and is typically preferred by spruce, balsam fir, red maple, hemlock, alder, and birch tree species.

Then, the Wv represents Wolfville soil series, which is also typical around Dartmouth and covers the majority of the site. This soil is characterized by a dark reddish-brown loam to sandy clay loam with a strong-brown loam to sandy clay loam base layer. The parent material of this soil is reddish-brown loam to sandy clay loam till derived from shale and sandstone. This soil series typically has good drainage.

The final soil series found on a small section of the

Southwest part of the site is classified as Bw. This soil is a part of the Bridgewater soil series, a brown shaly loam over a yellowish-brown shaly loam. The parent material of Bridgewater soil is olive shaly loam till derived from Precambrian slates. This soil typically has good drainage and is vegetated by tree species similar to those in the Hansport series.

The B or C portion of the code defines the site's topography. The B code corresponds to undulating topography with a slope limit of 8%. Then, C corresponds to topography with a rolling slope limit of 16%. The number portion at the end of the soil identifier represents the site's stoniness. This site is classified as 2, meaning the soil is moderately stony, enough to interfere with cultivation unless removed.

The Ecological Land Classification (ELC) provides further insight into the soil on-site. The code for the Ecosection the site is on relates to the site's soil and topography. In the ELC data, the site's ecosection classification is WFDM. The WFDM designation can be broken into three sections to provide more context on the land. The W applies to well-drained soil, and the F stands for fine-textured soil, often sandy clay loams and clay. Then the DM means that the site's topography is comprised of drumlins and flutes, which are caused by glacial ice movement and are recognized in patterns of elongated smooth, streamlined hills (drumlins) and shallow, straight parallel troughs (flutes).

The ELC additionally links the soil series to the Soil types outlined in the Forest Ecosystem Classification (FEC) system. According to the ELC the Wolfville/ Hansport soil series in the Eastern Interior ecodistrict is derived from glacial till, typically has a fine medium texture, and moderate to well-imperfect drainage. The associated FEC Soil Types (STs) are 2-L, 3-L, 5, 6, 8, and 9. In this ecodistrict, the Bridgewater soil series is similarly derived from a glacial till; this soil has a medium texture and primarily well-imperfect drainage.

The common FEC STs are 2-L, 2, 3-L, 3, 8, 9. The code breakdown and names for these STs are:

2 = Fresh – MT
3 = Moist – MT
5 = Fresh – FT
6 = Moist – FT
8 = Rich Fresh – MT
9 = Rich Moist – MT

The letter attached to some ST codes indicates the soil type phase. The letter L indicates that the soil type is a part of the Loamy phase. Then MT indicates medium-textured soils, and FT stands for fine-textured soils.

Both soil classifications provide insight into the soils on-site. From them, it can be deduced that the soil is generally a well to imperfectly drained soil derived from a till parent material. The texture is typically a fine-medium textured soil with some clay loam qualities.

In conducting their Archaeological assessment of the site Cultural Resource Management Group Limited (CRM Group) did a single exploratory shovel test to provide insight into the subsurface material on-site. They excavated within the level southeast corner of the golf centre driving range field excavating 21 centimetres depth below surface (dbs). They recorded three layers of strata. They observed that the upper stratum or top layer consisted of a sod/A-Horizon between 0 and 6 centimetres dbs and was made up of a loosely compacted brown silty loam, with roots, rootlets, and a low percentage of pebbles. The second layer, between 6 and 11 centimetres dbs, consisted of a moderately compacted medium brown silty sand deposit with few rootlets and pebbles. Then the final layer consisted of glacial till between 11 and 21 centimetres dbs, and was made up of a highly compacted, medium to coarse, medium orangish-brown silty sand, with a high percentage of pebbles.

The CRM Group concluded from this test that the driving range area, which comprises a large portion of the subject site, has been previously disturbed and

Figure 12 — Exploratory Shovel Test (CRM Group)

Figure 13 — Exploratory Shovel Test close up (CRM Group)

stripped. They also noted that they did not identify cultural material during the exploratory shovel test. This shovel test confirms that during the development of the golf centre, some soil infill and levelling was done on the site. However, the soil identified is not very different from the soil data from the desktop analysis as the soil is brownish and with glacial till origins. However, the soil identified is siltier and described to have a lower clay content than the soils listed on the site. This could result from other soil being brought in to level the driving range area.

2.4.2— Surficial Geology

The surficial geology is the material layer that sits below the soil that was distributed through previous glacial periods. This layer is significant as it impacts the quality of the soil above it. Figure 14 shows that the site is split into two different surficial geology classifications based on provincial surficial geology data. Most of the site is classified as a silty drumlin, represented in purple; then there is a small portion on the southwest corner and along the eastern part of the property that is classified as silty till plain, represented in teal on the map.

The silty drumlin is characterized by a siltier till, with a "higher percentage of distant source material, including red clay." This layer is normally situated on drumlin lands, so there are often multiple tills. The Silty Till Plain is described as "silty, compact material from local and distant sources." This land is normally flat and rolling as the till cover is thick enough to mask bedrock undulations.

Both surficial geology classifications were created in the last glaciation and are around a similar thickness, 3-4m to 30m. Additionally, they make for good agricultural land, with moderate drainage and stoniness and moderate to good buffering capacity for acid rain because of transported calcareous bedrock components.

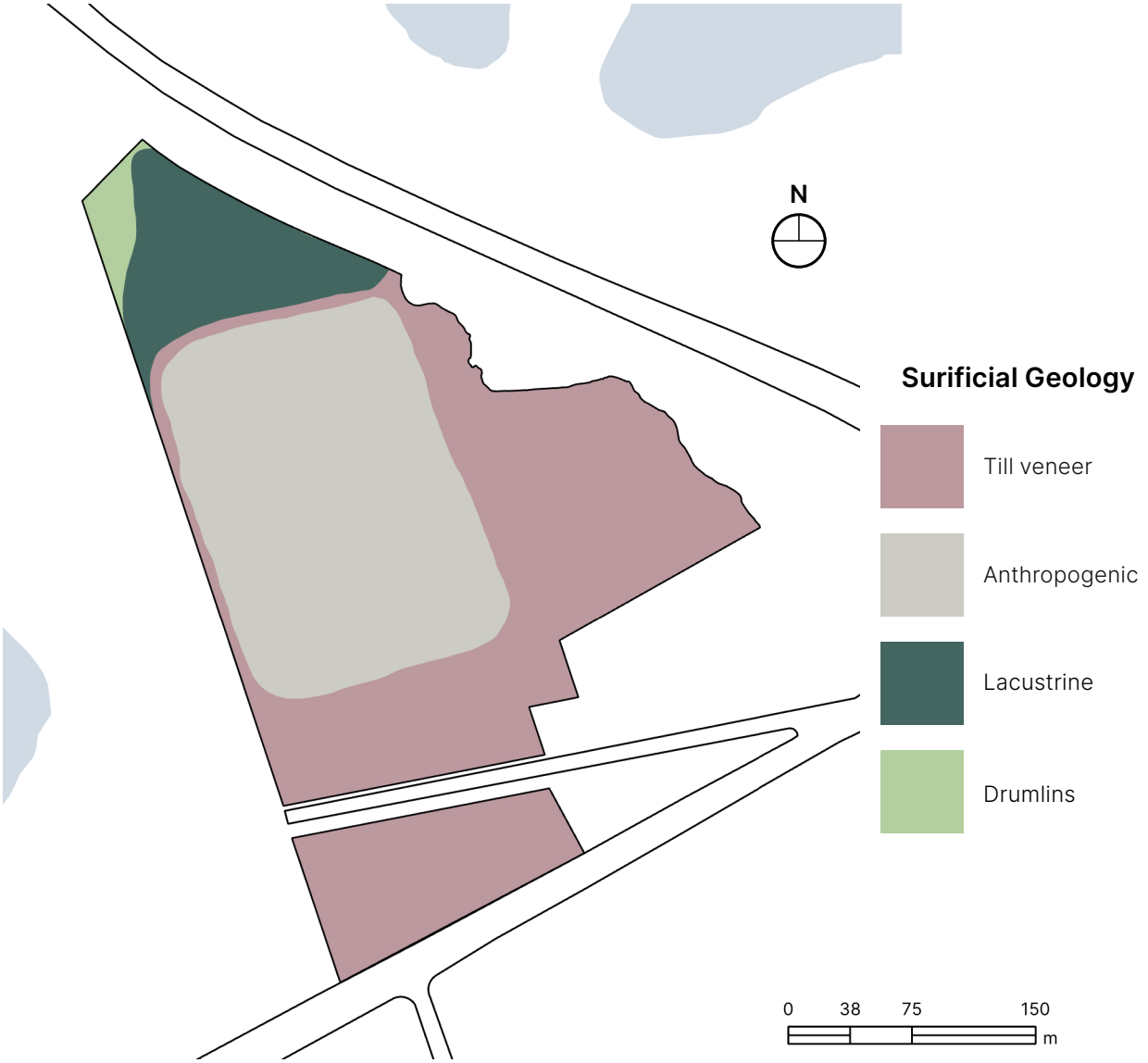


Figure 14 — Surficial Geology Map

2.4.3— Bedrock Geology

Shown in Figure 15, the site is located within the Halifax Formation. This formation spans much of the southeastern portion of Nova Scotia in long bands normally situated beside the Goldenville Formation. It is part of the Ordovician Meguma Group from the Cambrian period, which is generally a continuous sequence of deep-water turbidites. The Halifax Formation is generally slate-dominant, with some siltstone, minor sandstone, Fe-Mn nodules, and calcareous units. Within the Halifax Group, the site is within the Cunard Formation, which is characterized by black rusty slate and metasiltstone interbedded with cross-laminated fine-grained metasandstone (White, 2008).

According to the Government of Nova Scotia's Well Log Database (NSECC, 2022), two wells are within the site. The first well (#841493) is situated in the centre of the site; this well has a depth of 30.45m and hits bedrock at 3.65m. The primary geology of the upper layer is clay, and the primary geology of the bedrock layer is granite. The second well (#060038) is located on the site's southwest corner, with a depth of 36.54m and a distance of 4.26m to bedrock. The primary geology of the upper layer is sand and gravel, and the bedrock layer is shale. These wells indicate that while the subject site is within the Halifax Formation, which is characterized by slate. However, there might also be other types of bedrock on-site, as these well logs indicate the presence of granite, which is less common in this bedrock formation.

2.4.4— Acid Rock Drainage

Acid rock drainage (ARD) is a prevalent issue in Nova Scotia. This issue tends to only arise in regions with sulphide-bearing rock, particularly slate, which is commonly found as Bedrock in the Halifax Formation (Prime, 2001). The subject site is located on the Halifax bedrock formation, so there may be some risk of acid rock drainage. This risk must be considered when planning to develop this site, as any rock removed must be disposed following provincial guidelines.

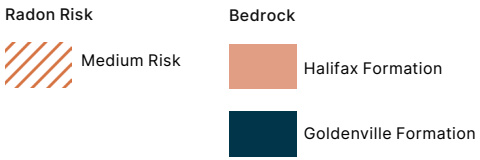
Generally speaking, the bottom of the 2-storey underground parking garages will likely be set between 4-8' below existing grade and the roads will be levated likely 10' above the existing grade to balance the cut and fill on the site. At this shallow depth, it is unexpected that bedrock will be met during excavation however the next phase of construction would require more detailed geotechnical reports to fine tune the grading, establish wether Pyritic slates are present, and develop an overall construction mitigation plan.

2.4.5— Karst Topography

Another site and development consideration is Karst Risk, which is the likelihood of sinkholes. Karst is when the landscape is shaped by the action of water dissolving on carbonate bedrock (primarily limestone or dolomite), which in Nova Scotia is typically found around Windsor, Turo, Antigonsh and much of Cape Breton. According to the Province of Nova Scotia's Karst Risk Map, the Karst risk for this subject site is very low.

2.4.6— Radon

The province also provides mapping for the risk of encountering Radon in indoor air. Radon is a colourless and odourless gas that can be naturally found in the ground in Nova Scotia. When it mixes with fresh air, it



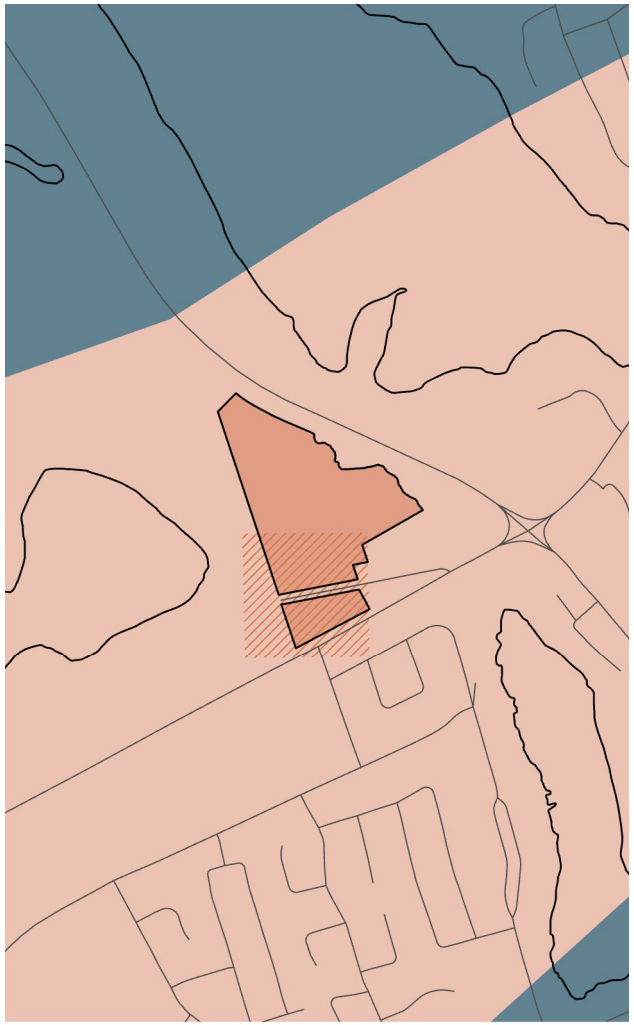


Figure 15 — Bedrock Geology Map

is harmless, but if it is able to seep from the ground and pool in indoor spaces, it can pose a serious health hazard. According to provincial radon risk mapping, the northern half of the site has a low radon risk, and the southern half has a there is a medium radon risk on the southern portion of the subject site (See Figure 15).

2.4.7— Discussion

There are no identified constraints to the site's suitability for development pertaining to soil, bedrock geology, karst topography, acid rock drainage, or indoor radon. However, some potential constraints are created by the site's surficial geology composition, bedrock formation, and radon risk.

The main concerns regarding the surficial geology pertain to the anthropogenic units. Since the anthropogenic fill was brought into the site from a separate location, it carries a potential of contamination, especially if disturbed. The site's anthropogenic fill should ideally be drilled and inspected before any disturbance to identify contaminants, if any.

Since the subject site is within the Halifax Formation, therefore, the risk of ARD due to the possibility of sulphide-bearing rock should be considered in the event of development. In addition to ARD, given that a portion of the site is also categorized as having a medium Radon Risk, this should be additionally considered should the site be altered.

Recommended Mitigation Strategies

- Limit clearing and grading to areas necessary for development, preserving natural vegetation where possible to minimize disturbance to the soil and surficial units.
- Perform tests on the anthropogenic fill to check for contaminants prior to any potential disturbance.
- Conduct detailed geochemical assessments of exposed bedrock, particularly slate, to identify potential Radon and ARD risks.
- Develop a grading plan that reduces the amount of needed fill to be imported on the site or fill that needs to be moved offsite.

2.4.8— Constraint Scoring

The soil and geography constraint map classifies land primarily based on its geological features. The main features of concern are the risk of ARD, indoor radon, and karst topography. The land with these features is considered to be more constrained with these risks due to their implications for development. In this map the presence of ARD-producing bedrock geology, such as the Halifax Formation found throughout HRM and medium risk of Radon contribute to the site being scored a 2 for being moderately constrained by its geology.

Features	Assigned Score
Non-ARD Producing Bedrock Geology Low Risk of Radon Low Risk of Karst Topography	1 - Less Constrained
Potential for ARD Producing Bedrock Geology Medium Risk of Radon Medium Risk of Karst Topography	2 - Moderately Constrained
ARD Producing Bedrock Geology High Risk of Radon High Risk of Karst Topography	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 2 — Geology and Soils Constraint Scoring

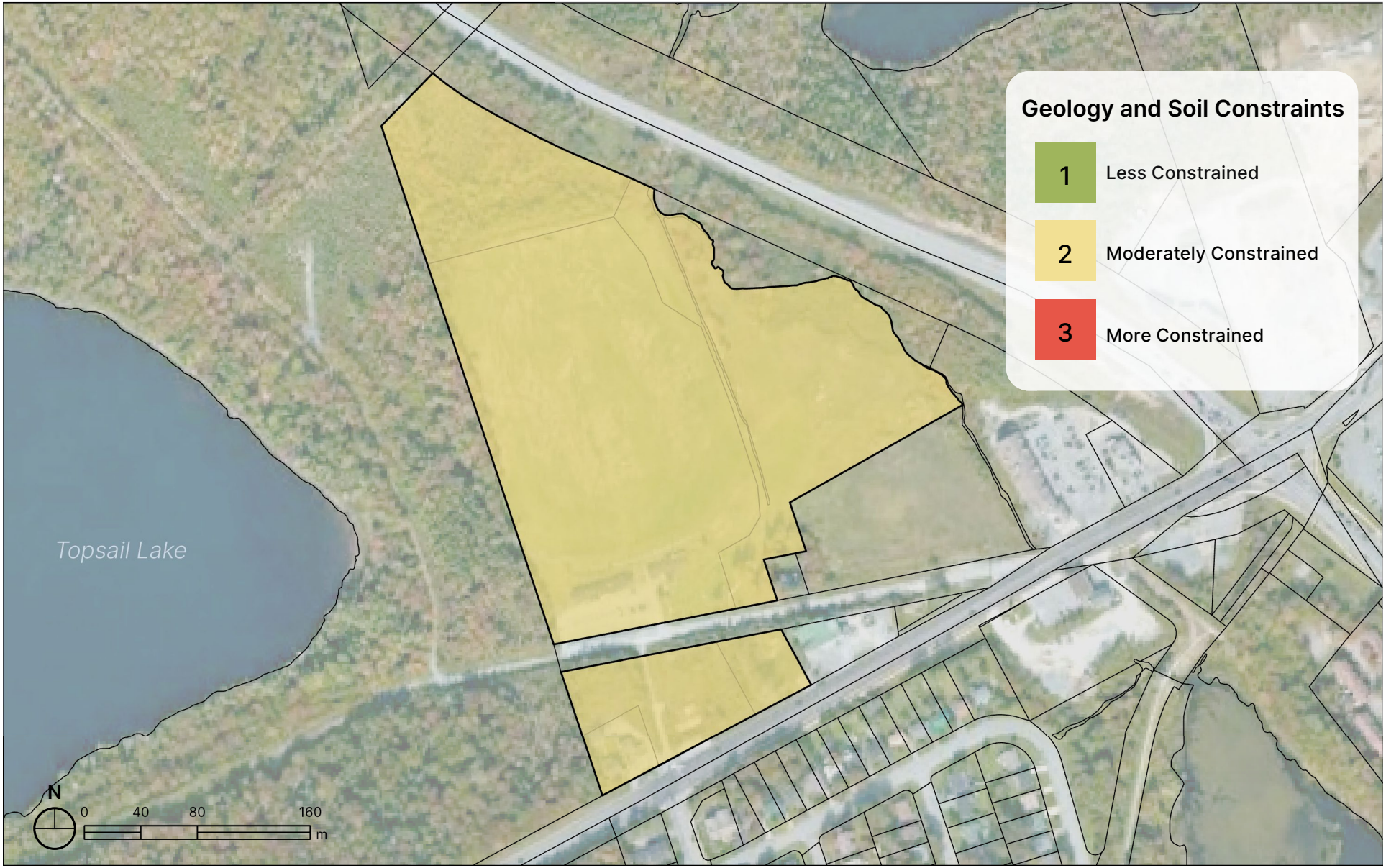


Figure 16 — Geology and Soil Constraints

2.5 — HYDROLOGY

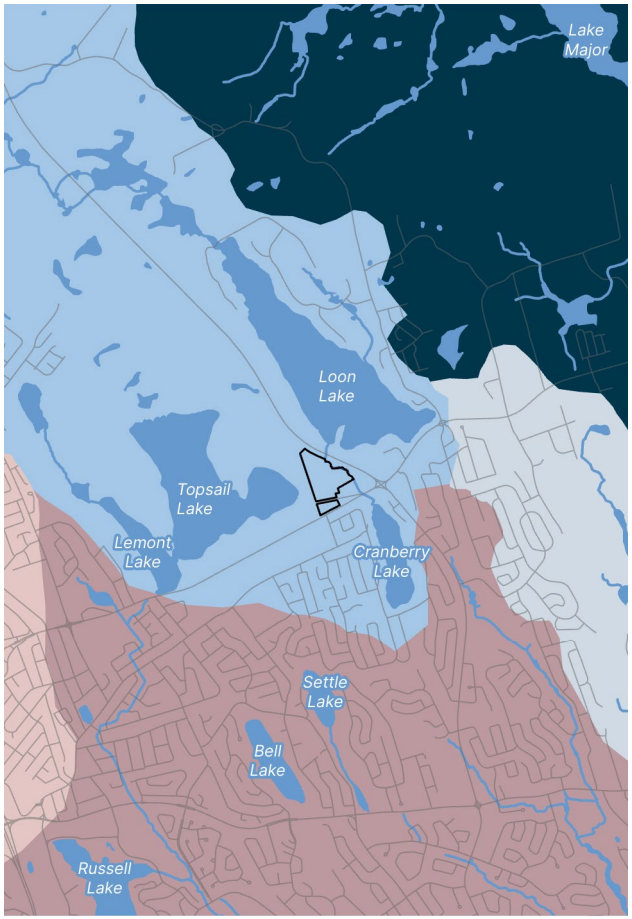


Figure 17 — Secondary Watersheds Map

METHODS

Wetlands and watercourses were identified by an in-person delineation and assessment by Strum Consulting as well as through a desktop analysis of available wetland and watercourse data. Watercourse, water body, watershed, wetland, and Wet Areas Mapping (WAM) datasets were sourced from the Nova Scotia Geographic Data Directory. Then, the water source protection areas and inland flooding datasets were sourced from HRM open data and the Creation of Flood Hazard Maps Halifax Regional Municipality Final Report (CBCL, 2024). The well data was retrieved from the NSECC Well Logs Database (NSECC, 2022). All of the Hydrology data was analyzed to provide insight into the site's water flows and accumulation patterns.

2.4.9— Overview

For the purpose of this analysis, watercourse means lakes, ponds, streams, etc. There are three lakes around the subject site: Lake Loon, Topsail Lake, and Cranberry Lake, and one watercourse that runs north-south through the site connecting Cranberry Lake and Loon Lake.

The site is within the Shubenacadie/ Stewiacke primary watershed and, specifically, the Shubenacadie River secondary watershed (See Figure 17). The Shubenacadie Watershed flows from Charles Lake northward towards the Minas Basin through the Shubenacadie River and a chain of lakes and rivers. Given the flow patterns of this watershed, the flows from the site and surrounding lakes should primarily flow to Charles Lake, which is 3.63km Northwest of the site. Additionally, the site is situated 790m from the Cow Bay River secondary watershed and 747m East of the Cole Harbour Shore Direct Secondary watershed, which both flow southwards, draining into the Atlantic Ocean. Drainage southwards into these surrounding watersheds is also plausible, given flow direction and proximity. Especially to the Cow Bay River watershed, as Topsail Lake to the west of the site is connected to Lemont Lake, which is on the border of the watershed and connects down into the rivers that feed Morris Lake.

Secondary Watersheds

Shubenacadie R.

Little Salmon River

Cow Bay R.

Dartmouth Lakes

Shore Direct

2.4.10— Wetlands

Wetlands are areas where water is present at or near the surface of the soil for long enough periods of time where the vegetation is adapted to the conditions. The purpose of this review of wetlands on-site is to determine where wetland habitat exists within the study area and if there are any Wetlands of Special Significance (WSS). In Nova Scotia, wetland conservation is guided by the Nova Scotia Wetland Conservation Policy, which gets its power from the provincial Environmental Act and Activities Designation Regulations. The goals of this policy are to have no net loss in the area and to function for other wetlands (Government of NS, 2011).

The NS provincially mapped wetland dataset was used to determine the location of wetlands. This data showed a wetland located in the northern part of the subject site (see Figure 18). This wetland is classified as a treed bog and is 0.6 hectares or 6170m², covering around 6% of the site area. Based on the Canadian Wetland Classification System, a treed bog is often covered with Sphagnum spp. and ericaceous shrubs such as leatherleaf, huckleberry, lambkill and Labrador tea. Additionally, there is a lake wetland near the site situated on Cranberry Lake.

To verify the provincial wetland mapping findings,

Figure 18 — Hydrology Map

Watercourses

Water Bodies

Field Delineated Wetlands

Wetland Continues

Delineated Wetland

Provincially Mapped Wetlands

Lake Wetland

Treed Bog

the wetlands on-site were assessed by specialists at Strum Consulting (See Appendix A). They delineated the wetlands on-site and performed a functional assessment of the wetlands. Through this process, they concluded that one wetland is on-site, in roughly the same position as the one provincially mapped. However, the boundaries were larger, and the wetland followed the watercourse on the Northeast side of the site down to the southern part of the property. According to their analysis, the wetland spans 18,511m².

Generally, if a site has a wetland with a contiguous watercourse, HRM requires a buffer between the wetland and any proposed development. If wetland alteration were required for the development, any wetland alteration between 100m² and 2 hectares would require authorization from NSECC; wetland alterations greater than 2 hectares would require a provincial environmental assessment in addition to this provincial authorization. We anticipate WL1 will need to be altered as part of this development plan, but we have maintained a 30m buffer from the watercourse along the east side of the property.

Within the functional assessment, Strum Consulting followed the Wetland Ecosystem Services Protocol - Atlantic Canada (WESP AC) framework to determine if the wetland in the subject site is a WSS (NBDELG, 2018). This process assesses and weighs many specific wetland functions and benefits to natural systems and society to evaluate the importance of the wetland. Their assessment concluded that WL1, the wetland on-site, is not of special significance after it scored low in every function-benefits products category.

2.4.11— Depth to Water Table

Water table depth is the depth to which the unsaturated zone/zone of aeration ends. In development, this is relevant as the closer the water table is to the ground surface, the greater the risk of wetlands developing or

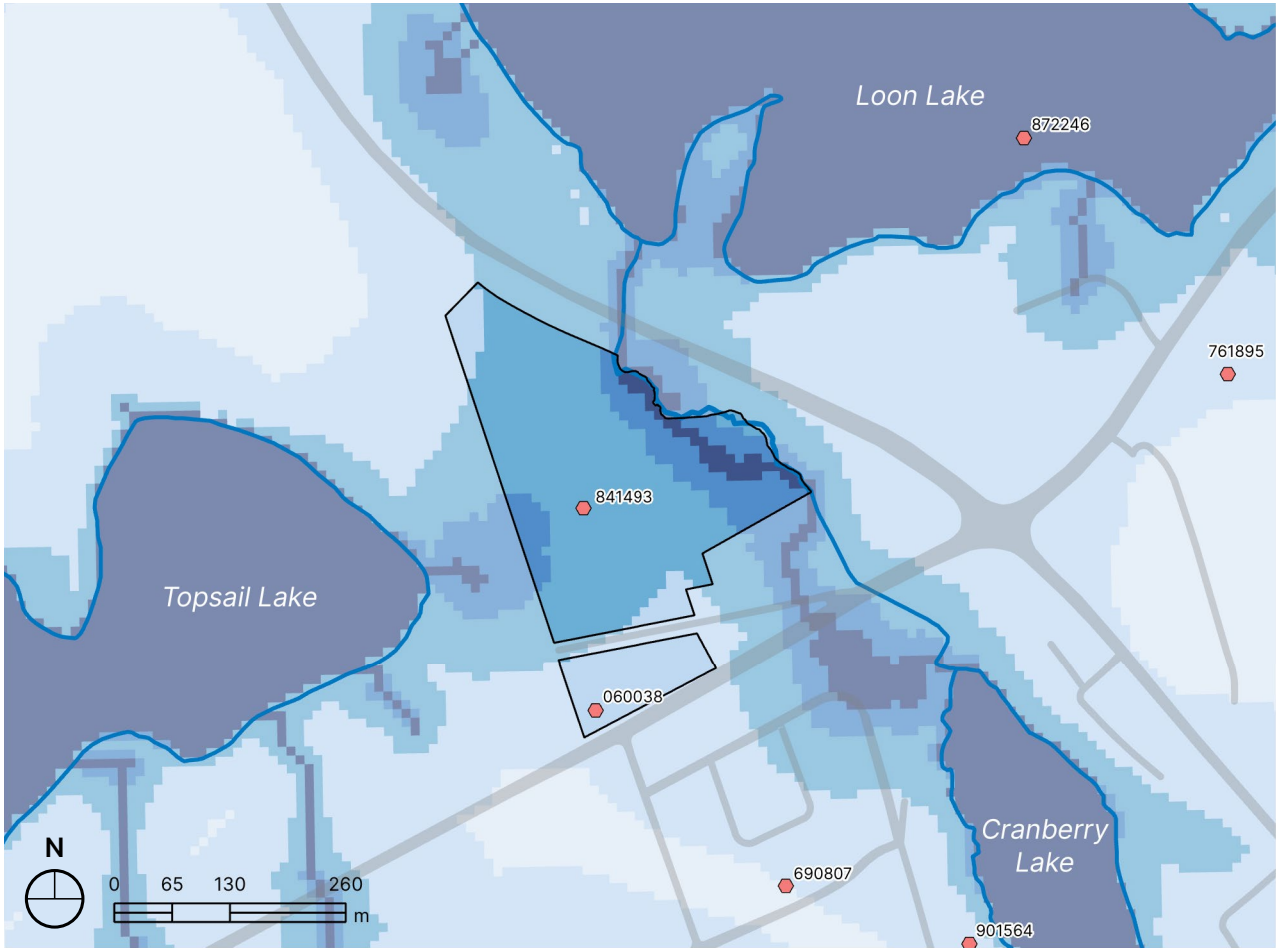


Figure 19 — Watershed and Wells Map

poor drainage. With this in mind, the depth of the water table was estimated using static water levels in existing drilled wells from the NSECC Well Logs Database (NSECC, 2022). It is important to note that drilled wells cannot give a precise depth to water data and can only help estimate it. Static water levels in wells can be affected by factors such as well use and seasons. The locations of the wells in the area are mapped out in Figure 19, and their associated data is shown in Table 1. Well logs are not always accurate or are often tested to give accurate information. Given this, only one of the recorded wells, #761895, located 697m east of the middle of the subject site, had a Static water level recorded, which was 6.7m. This well water table depth number gives an understanding of what the water table depth on-site could be. However, it is difficult to determine without ground-truthing the data.

Water table depth is affected by many factors, and the subject site is at a lower elevation than well #761895, so it is possible that the depth of the water table on the subject site is higher than that of well # 761895. This land will be fully serviced by Halifax Water once developed to reduce the impact from any existing wells due to additional drawdown.

Table 3 — Wells

Well	Depth to Static Water Level (m) [1]	Distance from site (m) [2]
841493	n/a	Onsite
060038	n/a	Onsite
690807	n/a	462
901564	n/a	626
872246	n/a	614
761895	6.7	697

[1] Measured by metres below top of the casing

[2] Measured from the middle of the subject site

2.4.12— Water Accumulation and Flooding

The provincial Wet Areas Mapping (WAM) index dataset, shown in Figure 19, predicts where water will naturally flow and/or accumulate in the landscape. The WAM model uses digital elevation (DEM) in conjunction with the known locations of water features such as streams, water bodies and wetlands. Given this, it generally aligns the elevation maps for the area. The index ranks areas from 1 to 5, with the lowest rankings corresponding to areas with excellent drainage. In contrast, the highest rankings correspond to areas that are either highly prone to accumulate water or water bodies (like streams).

The index ranks have a corresponding depth class which has ranges which correspond with depth values; in this, 1 = 0 - 0.10m, 2 = 0.11 - 0.50m, 3 = 0.51 - 2.00m, 4 = 2.01 - 10.0m and 5 = >10.0m. It is important to note that the WAM metadata states that the depth ranges are not representative of depth to water table or groundwater but are rather a cartographically derived depth-to-water index related to where water is likely to flow and concentrate. This dataset does not take into account other factors that impact water drainage, such as soil texture or changes resulting from human activity.

The data depicted in Figure 19 reveals that water is likely to pool in and around the stream that connects Loon Lake and Cranberry Lake, as well as in the centre point along the western property line of the subject area. Provincially mapped wetlands are areas where water is likely to pool so they typically correspond with the WAM dataset.

In 2024, HRM released a report written by CBCL on flood hazards within the municipality; this included a series of maps depicting the pluvial, fluvial and coastal flood risks around the various water bodies in HRM (CBCL Limited, 2024). Pluvial/fluvial flood risks were depicted with 1-in-2 year floodlines and 1-100 year floodlines, both under current climate conditions. Figure 20 shows the flood map prepared for the area showing the subject site. In this map, the predicted flood zone extends south from the watercourse into the site, overlapping the location of the wetland. Given that this area is already wet, it is important to account for future flooding and storms.

Currently, the majority of the site is covered by permeable surfaces, as much of it is covered by grass for the golf centre's driving range. This permeable surface helps to reduce the risk of runoff on the site. However, there is water accumulation, as seen in the location of the wetland. Comprehensive stormwater management tactics should be employed to minimize future flooding or water accumulation on-site if the amount of non-permeable surfaces increases. The land will be raised during the final grading reducing the site storage slightly however 2 ponds have been located onsite in the low areas to ensure additional runoff is not displaced to downstream areas.

2.4.13— Water Source Protection

The site lies within three Halifax Water Source Protection Areas: BoMont-Shubenacadie River, Lemont Lake, and Collins Park, all of which are critical to Halifax's water supply (See Figure 21). These areas are managed in collaboration with Halifax Water, HRM, and

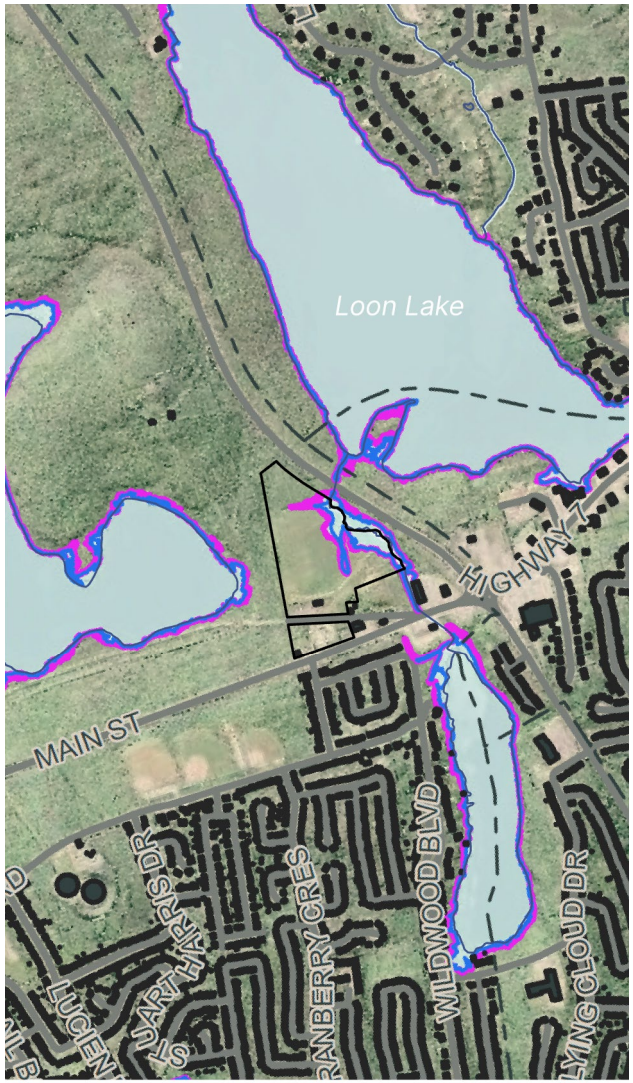


Figure 20 — Projected Inland Flooding Map (CBCL Limited, 2024)

provincial authorities, and they protect watersheds and watercourses that feed key reservoirs, such as Pockwock Lake, Lake Major, and Bennery Lake. These protected zones are essential to maintaining clean, reliable water sources and involve various regulations and practices to prevent contamination and overuse. These water source protection areas are not specifically designated under provincial legislation but are protected through provincial land use designations such as the Nova Scotia Environment Act, which identifies and provides guidelines for Watershed Protected Water Supply Areas, and municipal regulations, such as the Halifax Regional Water Commission Act, that restricts activities in specific water supply areas, and in the HRM land use-bylaws and municipal planning strategies that provide land use regulations.

These areas each have protection plans: the Collins Park Small System Source Water Protection Plan (Halifax Regional Water Commission, 2007), the Bomont Watershed Area Source Water Protection Plan (Halifax Regional Water Commission, 2017), and the Lake Lemont Source Water Protection Plan which is currently under review. The watershed and protection areas have committees and monitoring programs for the streams, rivers and lakes that regulate water quality and activity (Halifax Water, 2010). For development, this means adhering to stringent land-use regulations, implementing stormwater management systems, and ensuring compliance with environmental policies to minimize impacts on these vital water resources. The subject site being within three water source protection areas means that activities such as industrial operations, waste disposal, and extensive deforestation are prohibited or tightly controlled, and the water quality of Lake Loon and Topsail Lake are being regularly monitored so any development on-site should take measures to mitigate the risk of contamination to those nearby lakes. In addition, any development must follow the required vegetative buffers around water bodies to filter pollutants and reduce erosion, supporting ecosystem health.

2.4.14— Ecological Considerations

The site is connected to a larger watershed; thus, any actions on this site may have downstream effects on other parts of the hydrological network. The watercourse and wetland on-site support biodiversity, provide ecological services and contribute to water regulation and quality in the broader region. The wetland connects to a watercourse flowing through the site, linking Cranberry Lake to Lake Loon and the greater Shubenacadie River Watershed furthering its relevance to the hydrological network. The treed bog wetland on-site is vital for water filtration, carbon storage, and wildlife habitat. While the wetland was not classified as WSS, it still provides ecological services and functions. Wetlands and adjacent watercourses serve as habitats for aquatic and semi-aquatic species supporting a variety of amphibians, reptiles, birds, insects, fish and more, which can be sensitive to hydrological changes caused by development, so it is important that wetland habitat on-site is preserved as much as possible.

2.4.15— Discussion

The hydrology assessment of the subject site highlights several important considerations for its development potential. The run-off water from the site flow northward towards Minas Basin, with some pathways southwards to the Atlantic. The on-site watercourse connecting Cranberry Lake and Loon Lake plays a role in maintaining hydrological connectivity and regional water flows. Disrupting these natural drainage pathways could impact the site and downstream areas. Accounting for stormwater and runoff is esspecially important as the WAM data already shows that the site is wetter and the CBCL mapping predicts flooding on-site in both the 1-in-2 year and 1-100 year floodlines.

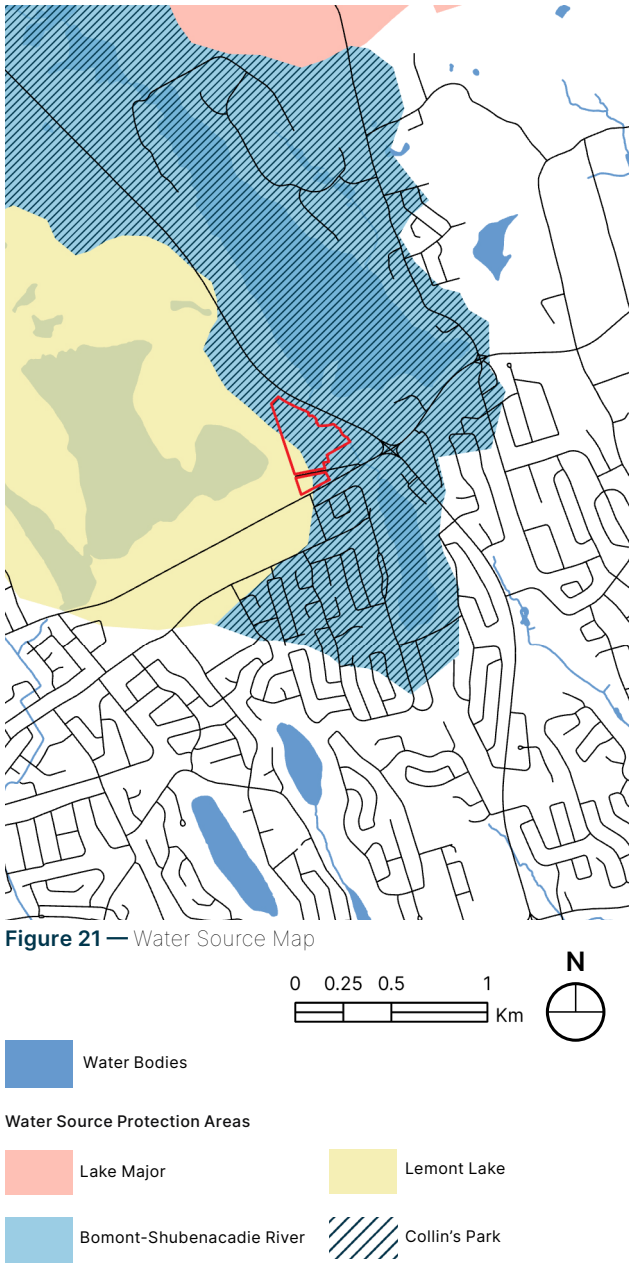


Figure 21 — Water Source Map

Currently, much of the site is covered by permeable surfaces, such as grass, which allows for more water retention. However, if any future development involves more impervious surfaces, potential issues with stormwater and flood risks will need to be mitigated. This would need to could include using green infrastructure such as bioswales, rain gardens, permeable pavements, detention basins, and other stormwater management tactics outlined in Administrative Order 2010-010-OP published by HRM.

As the site falls within three water source protection areas there is an additional layer of regulatory oversight. A 30m riparian buffer should be implemented around the watercourse on-site to maintain its ecological value and respect the direction of council and the municipality, as outlined in the Draft Regional Plan. This riparian zone would act as a natural buffer, shielding watercourses from the impacts of nearby development while also playing a crucial role in mitigating the severity of flooding on surrounding lands.

While the wetland was not deemed to have special significance under the Wetland Ecosystem Services Protocol, its preservation remains essential due to its contributions to biodiversity and hydrological stability. If the wetlands cannot be retained within a future development, they should be rebuilt within the watershed at a 2:1 ratio, as per provincial regulations and subject to authorization from the Department of Environment and Climate Change (NSECC). By doing so, the site can balance ecological sustainability with the needs of potential development.

Recommended Mitigation Strategies

- Implement Green Infrastructure and Stormwater Management methods, especially those outlined in AO-2010-010-OP.
- Conduct a detailed hydrological assessment to determine areas of high runoff and prioritize intervention in these areas.
- Establish a minimum 30m buffer zone around the delineated watercourse and wetland, in alignment with recommendations from the Draft Regional Plan and Green Network Plan.
- Enhance riparian zones with native vegetation to stabilize soil, reduce erosion, and filter pollutants before they reach downstream waterbodies.
- Incorporate wetland preservation into site design as part of stormwater management to retain and filter excess water.
- Align drainage infrastructure with natural contours to maintain existing hydrological patterns.
- Collaborate with Halifax Water and other regulatory bodies to ensure compliance with the Water Protection Areas guidelines to safeguard drinking water sources.
- Adequate landscaping to protect the Lake Lemont Watershed Area
- Controlling erosion and sedimentation during the construction of the development.

2.4.16— Constraint Scoring

Areas without any identified hydrological features in any of the mapping are the least constrained. This includes areas on the WAM with depth value of 4 or 5 (corresponding to a predicted depth of 2.01m or greater). The CBCL flood mapping shows an accumulation of water on the site. This shows that the design must have plans in place to hold that water.

Areas without any identified hydrological features in any of the mapping are the least constrained. This includes areas on the WAM with a depth value of 4 or 5 (corresponding to a predicted depth of 2.01m or greater).

While the wetland on-site was not considered of high ecological value compared to other wetlands and its connection to a known watercourse contributed to it being assigned a constraint score of three. This score is also applied to lands with a WAM depth value of 3.

The other most constrained areas also scoring a three are areas within the 30m riparian buffer, lands with a WAM depth value ranging from 1 to 2.

Features	Assigned Score
No identified hydrological features WAM value of 1 or 2	1 - Less Constrained
Wetlands without watercourse connection or WSS status WAM value of 3	2 - Moderately Constrained
Wetlands with watercourse connection or WSS status 30m Riparian Buffer WAM value of 4 or 5	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 4 — Hydrology Constraint Scoring

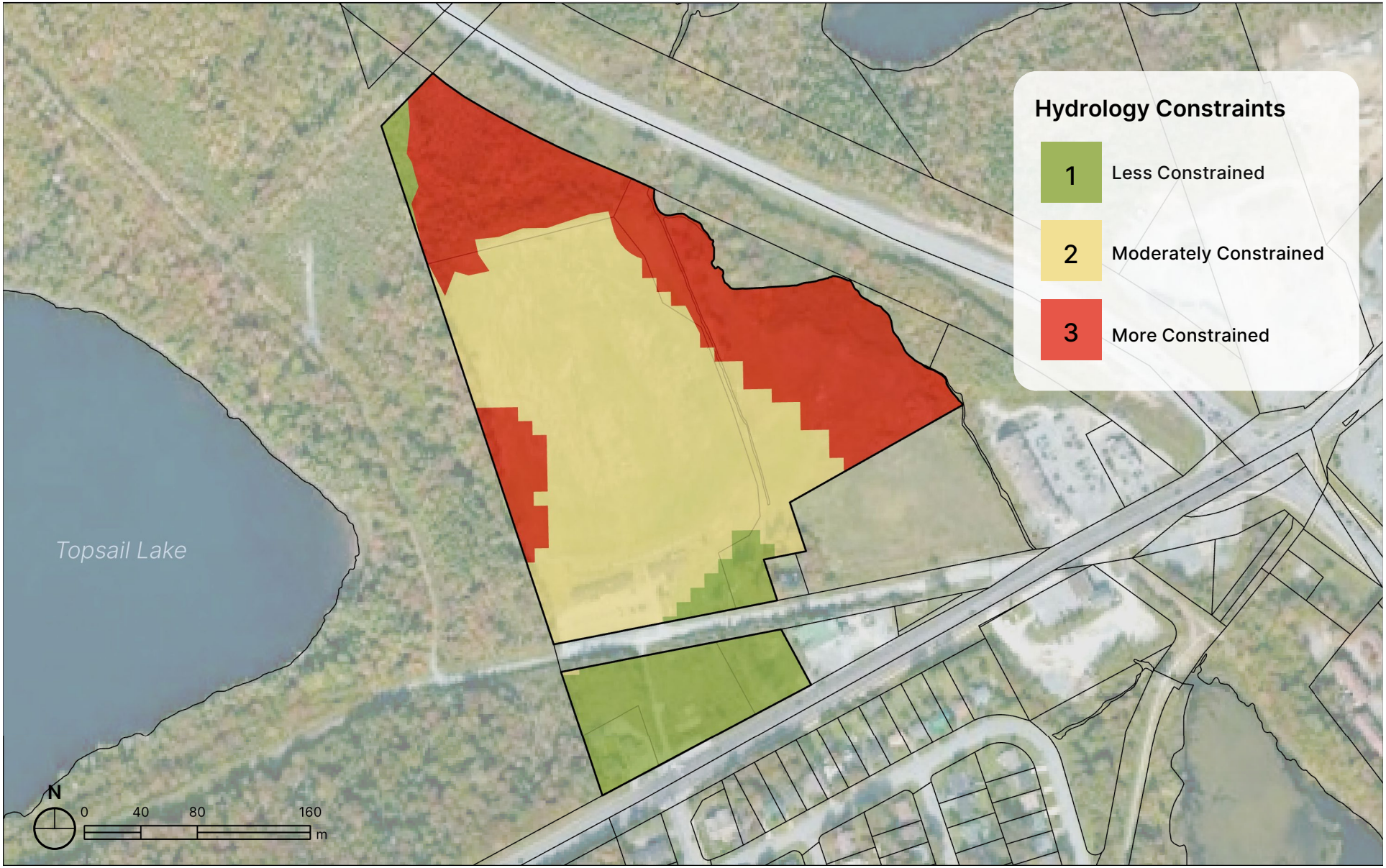


Figure 22 — Hydrology Constraints

2.6 — FOREST ECOLOGY

Figure 23 — Land Cover Map

Non-Forested

- Urban
- Wetland In Lake
- Road Corridor
- Inland Water
- Miscellaneous non-forested

Forested

- Natural Stand
  - Any forested stand which has not been treated silviculturally and does not qualify under clear cut, partial cut, burn, old field, wind throw, alders, brush or dead categories.
- Tree Plantation
  – A group of trees artificially established by direct seeding or setting out seedlings, transplants or cuttings

METHODS

Natural features were identified through a desktop analysis of available forestry and ecological data and planning documents. Ecological data was sourced from the 2015 Ecological Land Classification (ELC) for Nova Scotia (Neily, et al., 2017). The Ecological land classification data helps to understand the environmental context of the site, such as the ecology and topography typically found in the area. It is important to note that given the scale of the ELC dataset, it is less site-specific, providing the more general ecosystem classifications and not always the current land use of the site. This analysis also used the Nova Scotia Department of Natural Resources and Renewables (NSDNRR) Forest Inventory Database, obtained from the Nova Scotia Geographic Data Directory. The NSDNRR Forest Inventory Dataset is derived from air photo interpretation and provides more location-specific details on tree species and forest growth. The reference air photos used for the subject area were taken in 2017. However, it is essential to note that this dataset is not ground-truthed. To ensure the accuracy of the data, the site was surveyed by drone, and a site visit was conducted. The data collected from the visit and provincial datasets was then evaluated using the Nova Scotia Forest Ecosystem Classification (FEC) system outlined in the 2022 FEC for Nova Scotia Field Guide (Neily, et al., 2023) to provide more details on the site's vegetation and forestry. The landscape connectivity map used in assessing the site's landscape connectivity was sourced from the Halifax Green Network Plan and georeferenced in ArcGIS for location accuracy. All of the data was analyzed using ArcGIS Pro.

2.6.1— Forestry

Figure 23 shows the site's land cover per the NSDNRR Forest Inventory Database classification. Their dataset shows that much of the site is classified as urban, with the northern portion of the site and along the northern boundary line being classified as a natural stand and a small portion of the northwest corner being classified as tree plantation. According to the NSDNRR data, the urban and road corridor land cover classifications cover 67% of the site. The ecological emphasis classification additionally lists the majority of the site as converted, implying that much of the site's vegetation has been anthropogenically altered.

In this data, the forested areas were classified as having extensive ecological emphasis. The following will talk about the forested areas partially cover and surround the subject site.

The Lake Loon site lies within the Eastern Interior (440) Ecodistrict, as outlined by the 2017 Nova Scotia ELC Report (Neily, et al., 2017). Eastern Interior is the largest Ecodistrict in Nova Scotia, stretching from Halifax to Guysborough. This district generally comprises a rolling till plain, typically with gravelly and stony soils, and is underlain with rocks from the Halifax and Goldenville formations. This eco-district features drumlins scattered throughout but has three distinct drumlin groupings that align with different watersheds: the Sackville River, Tangier River, and Moser River watersheds.

In the Eastern Interior Ecodistrict, the soil depth is strongly linked to the type of forest that will grow in the area (Neily, et al., 2017). Spruce Pine Forest Groups are typically found in areas with less nutrient-dense soils. Spruce hemlock forest groups in nutrient-medium soils and Tolerant hardwood forests in soils with fewer nutrients. Within the Ecodistrict, the subject site is situated within the Tolerant Hardwood Drumlins and Hummocks element (see figure 25). This element typically refers to hardwood forests of sugar maple, yellow birch and red maple) on fresh, nutrient medium to rich soils.

Using data from NSDNRR from the Forest Inventory Database, FEC, ELC, and observations collected from visiting the site, the forests were analyzed using the FEC System (Neily, et al., 2023). This system highlights the various common forest landscapes and vegetation mixes throughout Nova Scotia. The Vegetation Types (VTs) were identified based on the percent cover of dominant tree and shrub species in the different tree stands. The site is within the Tolerant Hardwood Drumlins and Hummocks element, so the forests are classified under the Tolerant Hardwood Forest Group. The Tolerant Hardwood Forest Group is typically associated with shade-tolerant hardwood forests on zonal Acadian Forest Ecosites. These forests are typically mid to late successional and dominated by sugar maple, yellow birch, and beech, typically paired with white ash, ironwood, and red maple. Spruce species are also commonly scattered through the forest stand, and balsam fir is in the forest understory. The VT that the forest stands on the site most align with is TH8, Red maple – Yellow birch / Striped maple (Acer rubrum – Betula alleghaniensis /Acer pensylvanicum), as it is a known forest type in the Dartmouth Area and features all of the species known in the forest stands except for Eastern Larch.

The TH8 Red maple – Yellow birch / Striped maple VT is a mid to late successional forest common in the Easter Interior with a canopy comprised of predominantly hardwood species such as red maple and yellow birch and a lesser softwood component of Balsam fir, red spruce, and white spruce. However, unlike the overstory, the shrub layer is typically dominated by softwood species, along with some other shrubs like striped maple, mountain maple, and fly honeysuckle. This VT features many fern species along with other common plants, such as bunchberry, wood-sorrel and gold thread. There are also often species such as broom moss, stair-step moss, and log moss; however, they are less of a characteristic of this VT. The bryophyte layer in the TH8 is often not developed. This VT mainly occurs on fresh to fresh moist nutrient medium soils with good to imperfect drainage; it is often associated with the soil types 2L, 2, 6, 5, 9, 8, 3L, 12, and 8C. The common disturbance agents for TH8 are wind, ice damage, insects, disease and forest harvesting. Yellow birch in these forests is a seed source for many species of birds and small mammals during the winter, and red maple is an important early spring pollen source.

Figure 25 — Eco element Map

Figure 26 shows the forest stands in the subject site that the NSDNRR has identified. These forest stands do not perfectly align with the VT classification as the VT classification is based on the ecoelement classification for the area which is not always representative of the individual forest stands on-site. Therefore it is vital to analyse the forest stands individually as well. Forest stand data is represented in Table 3. According to the forest inventory dataset, the most common tree species of the listed stands are black spruce (Picea mariana), large tooth and trembling aspen (Populus grandidentata, Populus tremuloides), red spruce (Picea rubens), red maple (Acer rubrum), and white spruce (Picea glauca). The surrounding forests vary in age from young to multi-aged/old forest. The surrounding forests are tallest to the site's western edge, with the lowest forest height to the Northern end of the site.

As shown in Figure 26, a small portion of stand 02024 is a planted area that falls within the site. This portion of the forest was planted in 2007 with a species mix of 90% white spruce and 10% black spruce. Given that this area is planted, it could fall under the Forest Group Planted Forest, either PF1 In Situ Conifer Planted Forest or PF2 Ex Situ Conifer Planted Forest, depending on the planted tree canopy cover, as they both feature similar species: red spruce, white spruce, black spruce, white pine, red pine, jack pine, eastern larch, balsam fir and hemlock. The planted stand was treated for early competition control in 2012 for red, black and white spruce species and balsam fir and treated with pre-commercial thinning in 2019 for the same tree species. Given that the site falls within a water supply protection area, more care is taken not to disturb the habitat in the silvicultural practices in the surrounding forests. There aren't any more planted areas nearby, but there are other instances of forest treatment in the surrounding forests, with some to the north of the site pruned in 2019.

Old Growth

Within the past few decades, the provincial government has made an increasing effort to identify and preserve the remaining old growth forestry resources. In Nova Scotia, old-growth forest is defined as late-successional forest ecosystems that have developed over long periods without significant human disturbances. These forests are characterized by features such as uneven-aged trees, multi-layered canopies, large deadwood, and minimal recent human impact. For policy purposes, an old-growth forest must have at least 20% of its basal area composed of trees that meet or exceed specific reference ages for each forest type, reflecting the onset of old-growth conditions. The ages vary depending on the dominant species and forest type, with thresholds near 140 years for tolerant hardwood forests and 125 years for mixedwood stands.

Preserving old-growth forests is vital for several reasons. Ecologically, they provide unique habitats for a wide array of species, supporting biodiversity that younger forests cannot replicate. Old-growth forests also play a significant role in ecosystem services such as carbon storage, water flow regulation, and soil conservation. Socially and culturally, these forests are significant for Indigenous communities, including the Mi'kmaq, for their cultural practices and teachings. Additionally, old-growth forests offer opportunities for recreation, education, and scientific research, making their conservation a priority for maintaining environmental and societal well-being.

In 2022, the provincial government legally protected approximately 30,000 hectares of land under the Old-growth Forest Policy. The closest land to the subject site that is protected under this policy are three areas located roughly 4km to the Southeast of the site. One is located off Cole Harbour Road, and the other in between Bissett Lake and Coal Harbour. It is important to note that not all areas protected under Nova Scotia's Old Growth Forest Policy necessarily contain confirmed old-growth forests. Instead, these areas are designated based on their potential to meet the old-growth forest criteria or to contribute to the ecological, cultural, and scientific goals of the policy.

Figure 26 — Dominant Tree Species Map

Table 5 — Forest Stands that extend into the site's boundaries

Stand[1]	Height (m)	Species 1	Species 2	Species 3	Species 4	Seral Stage[2]	Development Class[2] [3]
02029	14	White Spruce - 50%	White Pine - 20%	Red Maple - 20%	Eastern Hemlock - 10%	Mid	Multi-Aged / Old Forest
02026	14	Red Spruce - 40%	Red Maple - 30%	Yellow Birch - 20%	Balsam Fir - 10%	Mid	Multi-Aged / Old Forest
02023	14	Red Maple - 40%	White Birch - 30%	Red Spruce - 20%	Eastern Hemlock - 10%	Mid	Early Mature Forest
02024	4	Red Spruce - 10%				Late	Young Forest
02025	5	Black Spruce - 60%	Eastern Larch - 30%	White Birch - 10%		Late	Early Mature Forest
02038	7	Aspen (Large Tooth and Trembling) - 40%	White Birch - 30%	Black Spruce 20%	Red Maple 10%	Early	Early Mature Forest

Softwood Species Hardwood Species

[1] The forest stand data is from the Forest Inventory Database from Map 090.

[2] Occasionally the forestry layers in the Provincial landscape viewer do not perfectly align as they may come from different source years or datasets. Table 5 references the most resent forest stand GIS data available from the NSDNRR. It is important to note that occasionally there are more than one feature classification within a forest stand. In those cases the classification of that stand within the subject site was used.

[3] Development Class Definitions sourced from the Provincial Landscape Viewer Metadata (Service Nova Scotia, n.d.):

Forest establishment development class (0–25 yrs)

New growth after disturbance, dominated by diverse, short-lived, shade-intolerant pioneer species.

Young forest development class (26–40 yrs)

Developing canopy with vigorous self-thinning and crown differentiation. Lacks significant understory development as trees compete for dominance.

Mature forest development class (41–120 yrs)

Developing canopy with self-thinning, crown differentiation, and no understory development.

- **Early Mature** (41–80 yrs): Initial stages of canopy differentiation and regeneration.
- **Late Mature** (81–120 yrs): Advanced development with more pronounced understory initiation.

Multi-aged/Old Forest development class (> 120 years old):

Old forests with varied canopy sizes, multi-layered understory, and continuous overstory recruitment.

2.6.2— Ecosites

Ecosites represent the conjunction between the VT and ST, connecting them with the nutrient and moisture systems in the province identified in the ELC (Neily, et al., 2017). The nutrient and moisture regimes associated with a particular ecosite are vital in determining what VTs can naturally grow within the bounds of that unit. This unit helps check if the FEC process was accurate and provides insight into tree and plant species suitability, successional pathway prediction, wildlife habitat analysis, and biodiversity considerations. The ecosites are split into two forest macrogroups, Acadian and Maritime Boreal. The forest habitat in and around the subject area is a part of the Acadian Forest Macrogroup, which covers the majority of the province. Within this macogroup, the forest FEC ecosites identified using the FEC classification, which cross-references VT and STs. This process found that all of the soil types associated with the site are known to occur in the TH8 VT confirming that the ecosite classification for the forests are the azonal ecosites: AC13 Fresh-Rich / Sugar maple-beech and AC14 Moist-Rich / Sugar maple-yellow birch. These ecosites are

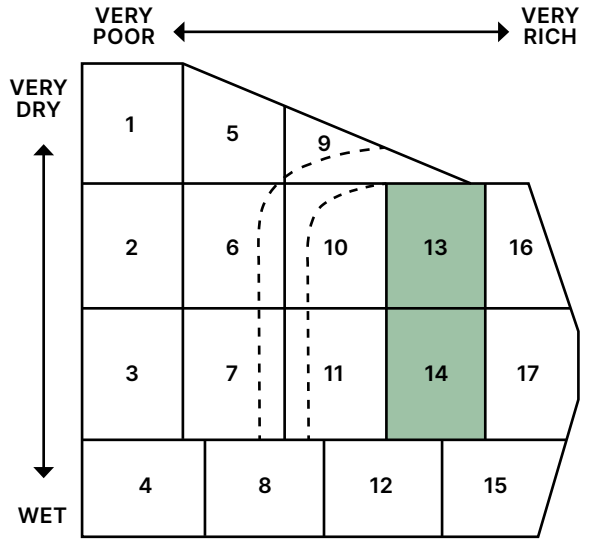


Figure 27 — Edatopic grid showing relative moisture and nutrient regimes for the Acadian Forest Macrogroup

shown in the Edatopic grid in Figure 27, which shows the moisture and nutrient regimes for the Acadian Forest Macrogroup.

2.6.3— Site Visit

Pages 34 to 38 show photos taken during a site visit during the afternoon on November 13th, 2024. Figure 28 shows the recorded GPS track from the visit overlaid over an drone aerial photo of the subject site taken on November 12th, 2024. The images are numbered to correspond with the locations in Figure 28, and there are some species observed listed under the photos. This site visit focused on the ecological context of the site mainly exploring the golf centre and forested areas on-site. For more images and context on the buildings and developed areas on-site can be found in the aerial images taken of the site and the Archaeological Fieldwork done by CRM Group for the Archaeological Resource Impact Assessment attached in Appendix D.

Figure 28 — Site Visit Route and Labeled Tree Stands

Broom Moss

Red Spruce and Trembling Aspen

Image Caption

White Birch (Betula papyrifera), Black Spruce (Picea mariana)

Image Caption

Red Spruce (Picea rubens)

Sweet-fern (Comptonia peregrina)

Balsam Fir (Abies balsamea), White Birch (Betula papyrifera)

Sphagnum moss (Sphagnum fallax)

Red Spruce (Picea rubens)

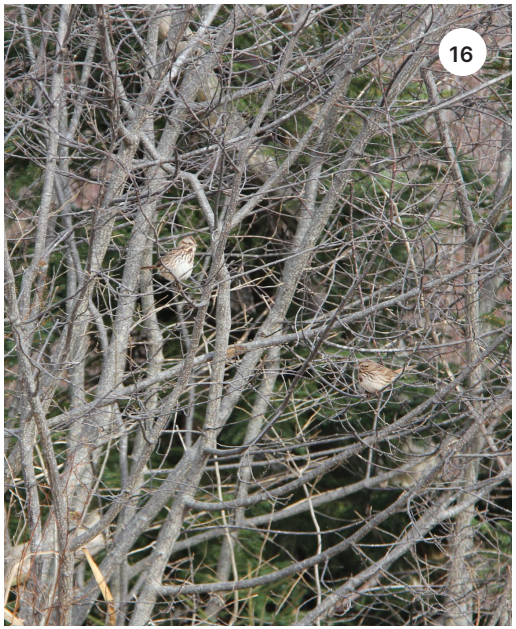
Bracken Fern (Pteridium aquilinum)

Pincushion Moss (Leucobryum glaucum)

Raspberry (Rubus Idaeus)

Aster Family (Aster spp.)

Broadleaf Cattail (Typha latifolia)



Song Sparrow (Melospiza melodia)

Broadleaf Cattail (Typha latifolia)

Goldenrod (Solidago canadensis)

2.6.4— Discussion

The analysis of the forest ecology site highlights the interplay between ecological classification, vegetation diversity, and the potential impacts of development on forested areas.

Although much of the site is classified as urban or anthropogenically altered, the forested areas provide valuable ecological services, including carbon sequestration, habitat for native species, and water regulation. The ecological emphasis classification underscores the importance of responsibly preserving and managing these forested areas, especially given the site's location within a Halifax Water Source Protection Area.

Potential development impacts on forest ecosystems should be minimized through maintaining connectivity with surrounding natural areas, and incorporating buffers to reduce edge effects. Additionally, preserving older forest stands and natural regeneration processes can support biodiversity and align with regional conservation goals.

Recommended Mitigation Strategies

- Retain existing forest stands where possible.
- Incorporate green infrastructure, such as wildlife corridors and naturalized stormwater systems, to harmonize development with ecological priorities.
- Avoid clear-cutting or other intensive clearing methods that could disrupt the site's ecological balance.
- Monitor the forest health, soil conditions, and hydrological systems to identify and address potential impacts from development.
- Use adaptive management approaches to ensure long-term sustainability of the site's natural features.

2.6.5— Constraint Scoring

The constraint scoring for the subject site was based on the forest ecology features used in the stands development class and land use data. As the forests are scored individually in the 2.7 - Species at Risk section for their habitat potential this constraint scoring focused on their development class. The development class was used because it provides an indication of the age of the forest stands and their possible ecological significance. Within the NSNDRR Forest Inventory Database development class dataset was used over the maturity dataset as the maturity dataset has not been made publicly available and is restricted for internal use by the NSNDRR.

Non-forested areas or new forests with an establishment development class were considered less constrained and scored a 1. More established forests, such as early mature forests, were given a score of 2 and considered moderately constrained. Late mature and Multi-Age/Old Growth Forests were given a score of 3, indicating that they were the most constrained as they have the potential to be the most ecologically diverse and old forest stands.

Features	Assigned Score
Cleared/non-forested Establishment	1 - Less Constrained
Early Mature	2 - Moderately Constrained
Late Mature Multi-Aged/Old Forest	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 6 — Forest Ecology Constraint Scoring

Figure 29 — Forest Ecology Constraints

2.7 — SPECIES AT RISK

Figure 30 — Land Cover Map

ESA Ranking

- Not Listed
- Vulnerable
- Endangered
- Wetland
- Delineated Wetland
- Mainland Moose Concentration Area

Data Source

- iNaturalist user
- Monarch (Danaus plexippus) and Milkweed MTRI records from the 2022 Field Season 2 (Feltham, 2022)

METHODS

This section uses information retrieved from the Atlantic Canada Conservation Data Centre (AC CDC) on species to assess the potential of species at risk within and around the Lake Loon site (See Appendix C). The AC CDC data was refined to species found within the site and 2km from the site property boundary to assess the potential species that could be found within the subject site. In addition to the species that the AC CDC recorded near the site, other species listed in the NS ESA whose preferred habitat is similar to the habitats on-site have also been listed. Species habitat data from the Provincial Landscape Viewer, and the Critical Habitat for Species at Risk National Dataset, and other available habitat predicting datasets were also used during this process. There is a full table of all the current NS ESA species and likelihoods in Appendix B.

2.7.1— Species Identification

This section focuses on any species with a status of Special Concern, Vulnerable, Threatened, or Endangered by the Nova Scotia Endangered Species Act (NS ESA), the Federal Species at Risk Act (SARA), or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and select SOCC species. SOCC is defined as any species with an AC CDC S-rank of S1 (Critically Imperilled), S2 (Imperilled), or S3 (Vulnerable) and not otherwise defined as SAR. The tables 7 and 8 on page 42 shows the species at risk that have recorded sightings within the subject site and the surrounding area within 2km of the site's boundary. This table shows the species' COSWIC, SARA, and NS ESA ranking, as well as the AC CDC classification. Figure 30 shows this data visually and the placement of the species sightings within close proximity to the subject site.

While no species at risk were identified on-site during the site visits or in the AC CDC data, this section will look at species identified near the site that have a similar habitat to that on-site. It will also briefly list other NS ESA species not identified by AC CDC but could have potential habitat on-site. The habitat preferences

Table 7 — Rare Species within 2 km of the Subject Site.

Scientific Name	Common Name	COSEWIC	SARA	NS ESA	AC CDC
Carex swanii	Swan's Sedge				S3
Mimus polyglottos	Northern Mockingbird				S1B
Fagus grandifolia	American Beech				S3-S4
Hirundo rustica	Barn Swallow	SC	TH	EN	S3B
Coccothraustes vespertinus	Evening Grosbeak	SC	SC	VU	S3B, S3N, S3M
Danaus plexippus	Monarch	EN	SC	EN	S2B?, S3M
Cardellina canadensis	Canada Warbler	SC	TH	EN	S3B
Chelydra serpentina	Snapping Turtle	SC	SC	VU	S3
Gomphaeschna furcillata	Harlequin Darner				S3-S4
Chrysemys picta picta	Eastern Painted Turtle	SC	SC		S4
Cathartes aura	Turkey Vulture				S2S3B, S4S5M

Table 8 — Location Sensitive Species

Scientific Name	Common Name	SARA	NS ESA	Know within the Study Area?
Alces alces americana	Moose – Mainland population		EN	No
Fraxinus nigra	Black Ash		TH	No
Emydoidea blandingii	Blanding's Turtle - NS pop.	EN	EN	No
Glyptemys insculpta	Wood Turtle	TH	TH	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.		VU	**Yes**
Bat Hibernaculum or bat species occurrence	Habitat/shelter for bat species	EN	EN	**Yes**
Snake hibernaculum	Habitat/shelter for snake species	TH	TH	No

RANKING

EN - Endangered

TH - Threatened

VU - Vulnerable

SC - Special Concern

AC CDC SUBNATIONAL RARITY RANK OF TAXON

S1 - Extremely rare in province

S2 - Rare in province,

S3 - Uncommon in province

S4 - Widespread, common and apparently secure in province.

B - Breeding Conservation status refers to the breeding population of the species in the nation or state/province.

N - Non-breeding Conservation status refers to the non-breeding population of the species in the nation or state/province.

M - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention.

of the listed species were compared to the results of the rest of this LSA, giving special consideration to the site's wetlands, water sources, site visits, and forest habitats.

Boreal Felt Lichen (Erioderma pedicellatum) in NS is known as a landmark species for lichen conservation as an indicator species and key nitrogen source. Given its importance, a predictive habitat model was developed for the species (Cameron and Neily 2008). This model helps with identifying the specific habitat features critical to Boreal felt lichen in NS. The predicted distribution of the species from the habitat model was assessed against the site's habitat features to assess the likelihood of the species being present on-site.

2.7.2— Species Identified by AC CDC

SAR identified in the AC CDC data for the site are described below. Species are presented in the same order as in Table 8 and information on the species' habitat and regulatory status.

Swan's Sedge

Swan's Sedge (Carex swanii) is not featured on COSEWIC, SARA, or NS ESA lists. However, the AC CDC ranks the species S3, meaning vulnerable under their species ranking system. This rank is given to species that are "Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation." Swan's Sedge is a sedge native to Nova Scotia. It grows in loose rhizomatous clumps to 1-3' tall. It is known to grow in bottomland forests and swamps (Missouri Botanical Garden, n.d.; Brouillet et al., 2010+). It has grass-like leaves, and lives in various habitats but mostly moist to wet areas (Missouri Botanical Garden, n.d.). The National Wetland Indicator Statuses in the United States vary by state ranging from rarely occurring in wetlands to usually occurring in non-wetlands (Flora of North America, 2019). According to the AC CDC, this species was reported by LaPaix, Richard in Bell Lake Park, off Portland Street, 2,189m from the middle of the subject site (Munro, 2013). Since they like wet forested areas, while not identified, there is reason to believe they could exist on-site.

Northern Mockingbird

The Northern Mocking bird (Mimus polyglottos), is a bird known for its song that is common in towns and cities (National Audubon Society, 2024). While not listed under COSEWIC, SARA, or NS ESA, the AC CDC has listed the species as S1B, meaning that it is extremely rare in the province and that this classification refers to the species' breeding population. The species is known to sometimes migrate further south during the winter. However, they do not always follow this pattern. The map by Farnsworth et al. (2020) lists the species as living in Nova Scotia year round, whereas the National Audubon Society (2024) maps show that it is uncommon that they live in NS all year round. Their population trendlines are below the national goal; however, given that they only live in the most southern parts of Canada, they are listed as a species of low national responsibility (ECCCBC, 2024). The National Audubon Society's Birds and Climate Visualizer shows that their habitat is increasing in Canada as we experience warmer temperatures. They list the threats to the species as fires, spring heat waves when the birds typically nest, and urbanization.

The Northern Mockingbird is uncommon in the forest interior, preferring an open or partially open habitat. They prefer scattered brush or trees, and forest edges and are typically found in scrubs, thickets, gardens, towns, and open ground. They often nest in dense shrubbery or trees, usually 1-3 m above ground (Nature Serve, 2024; National Audubon Society, 2024). There was one record by the AC CDC of a Northing Mockingbird spotted by an iNatrualist user at Bel Ayr Park 2,011m from the centre of the site (iNaturalist.ca, 2024). Given that the Northing mockingbird likes forest edges and open land, there is reason to believe that it could inhabit or frequent the site.

American Beech

The American Beech (Fagus grandifolia), is a beech species native to Nova Scotia (Lady Bird Johnson Wildflower Center, 2018). This species is not featured on COSEWIC, SARA, or NS ESA lists. However, AC CDC ranks the species S3 S4, meaning vulnerable to secure under their species ranking system. The rank secure is defined as "Common, widespread, and abundant in the province" (ACCDC, n.d.). This species likes moist, rich, well-drained soils drought (LBJWC, 2018; Natural Resources Canada, 2015). Sandy loam, clay loam, medium loam, and acid-based soils. Shade tolerant and long-lived tree that is susceptible to root zone disturbance. It also provides food and shelter for many species, such as chipmunks and squirrels. In addition, it is a typical breeding habitat for a variety of birds, such as the endangered Canadian Warbler and a habitat for butterfly and moth larvae (Adirondacks Forever Wild, n.d.).

While not a primary species of concern based on its rankings under different organizations, it is a species that affects another endangered species, the Canadian Warbler. The AC CDC recorded three within 2km of the site identified by iNaturalist users (iNaturalist.ca, 2023). The closest one is 960m away from the middle of the site off Mt. Edward Rd, the second at Cranberry Lake and the furthest, 1849m away at Settle Lake. Listed as usually occurring in non-wetlands but may occur in wetlands under the USA National Wetland Indicator statuses. No American beech trees were listed in the forest stand details under the NSDNRR forest stand data, although beech trees have a 22% frequency of being in TH8 VTs. Given this and that there are sandy loam and clay loam soil types, it is

possible that there is an American beech tree on-site. However, the probability is lower given how little of the site is forested.

Barn Swallow

The barn swallow (Hirundo rustica), is one of the most globally widespread swallow species. This species is listed as Threatened under the federal SARA and Endangered under the provincial NS ESA, then as a Special concern in 2021 under COSEWIC, so its federal status may change (COSEWIC, 2021). The barn swallow's primary nesting areas are human-made structures such as barns, stables, houses, sheds, and bridges. However, pre-colonization, they used to nest on cliffs, ledges, rock overhangs, and caves. They construct a small cup-shaped nest affixed to a vertical or occasionally horizontal surface. Barn swallows are insectivores, catching flying insects, so they prefer to forage in open spaces such as grasslands, agricultural fields, shorelines, woodland clearings, wetlands, sand dunes, tundra, and roads. Because of this, they are greatly affected by modifications to natural environments caused by increased urbanization and changes in agricultural practices, which have led to declining populations across Canada (COSEWIC, 2021).

One record of a barn swallow was reported by the AC CDC at Wildwood Lake within 1674m from the centre of the subject site by an iNaturalist user (iNaturalist.ca, 2023). While their critical habitat is less known, their nesting habitat is easier to predict. Given that the subject site is a golf course, there are many structures around the site that could be suitable habitats for a barn swallow. The Lake Loon Golf Centre is on the Northern side of Golf View Drive and, to the Southwest corner of the subject site, has many areas where a barn swallow could nest. In addition, many poles and large light fixtures around the main building offer a horizontal surface for the swallow to nest (see Figures 31 and 32). Additionally, on the northeast side of the property, there is a sign that could also potentially host a nest; however, at the time of the site visit, no nest was spotted on the structure. This site also provides a habitat that this species is known to use for foraging, as they frequent open lands, rivers, and wetland habitats (COSEWIC 2021).

Evening Grosbeak

Evening grosbeak (Coccothraustes vespertinus) is a bright-coloured songbird with a massive greenish-yellow bill and a familiar visitor to bird feeders in the winter. The evening grosbeak is listed as a Special Concern under the federal SARA and COSEWIC, then Vulnerable under the provincial NS ESA. Their breeding habitat generally includes open, (large) mature mixed-wood forests, especially foresters with balsam fir species and/or white spruce (COSEWIC, 2016). They mainly feed off spruce budworm. However, they also like trees that produce big seeds, such as the Manitoba maple (Acer negundo) or fruit and bird feeders stocked with sunflower seeds.

Nova Scotia has 5.4% of the National Evening Grosbeak population. Their populations are known to fluctuate with spruce bugworn populations, which naturally go through 25-40-year cycles in Eastern Canada. Other noted threats to their populations are the reduction of mature and old-growth forests due to commercial forest management, changing climate conditions, and accidents when feeding off bird feeders and road salt. Data from the AC CDC shows that the species was spotted by an iNaturalist user in Forest Hills 2,041m Southeast of the site midpoint (iNaturalist.ca, 2023). Given that there are a mix of tree species in the study area, including spruce and balsam fir, it is possible that the evening grosbeak nests in or around the subject site.

Monarch

The monarch (Danaus plexippus) is listed as Special

Figure 31 — Light posts and structures, potential barn swallow habitat

Figure 32 — Sign structure, potential barn swallow habitat

Concern under SARA, Endangered under COSEWIC, and endangered under the NS ESA (COSEWIC, 2016). This butterfly is one of the most well-known and studied butterflies worldwide. This species is known for its yearly migration from southern Canada to Mexico and is found all across Canada. Monarchs are found in areas where wildflowers grow, often in open areas such as open fields, meadows, gardens, open forests, wetlands, and roadsides (MTRI, 2015). They like the nectar from Native plants such as goldenrods, asters, boneset, and joe-pye-weed. However, monarch caterpillars rely solely on milkweeds for food; thus, the presence of this plant is necessary for them to lay their eggs. In North America, their habitat is threatened primarily by increased herbicide use, affecting their nectar supplies and habitat loss.

The AC CDC has recorded monarchs in the residential neighbourhoods surrounding the site, with 12 records in the Forest Hills, Sunset Acres, and Highland Acres areas (Feltham, 2022; iNaturalist.ca, 2020; iNaturalist.ca, 2023; iNaturalist.ca, 2024). Four of these reports are from MacLeod, Shauna, who counted monarch caterpillars and butterflies at 264 Taranaki Dr, which is 960m southeast of the middle of the site. The rest are from iNaturalist users all around 1,600 – 1,700m away from the middle of the subject site. No milkweed was reported on the site which would indicate the use of the site for breeding; however, there is open land and wetlands to the eastern side of the site that could provide flowers, and that monarch butterfly may use for nectar.

Canada Warbler

The Canada warbler (Cardellina canadensis), is a small colourful songbird listed as Threatened under the federal SARA and Endangered under the provincial NS ESA. It was re-assessed as a special concern in 2020. (COSEWIC, 2020). Nearly 80% breed in Canada, making Canada primarily responsible for the conservation of the species. Warblers prefer wet, mixed deciduous-coniferous forests with a well-developed shrub layer tend to be for breeding, but the Canada warbler also uses riparian shrub forests on slopes and in ravines and stands regenerating after natural and anthropogenic disturbances. The Canada Warbler favours mature forests at altitudes of 1000 to 2000 m in its wintering range but also occurs in second-growth forests, forest edges, shade coffee plantations, and other semi-open areas. During migration, the species most frequently occurs in woodlands with dense understory, including floodplain forests. They prefer red maple (Acer rubrum) stands, eastern white cedar (Thuja occidentalis) stands, and wet areas with black spruce (Picea mariana) and eastern larch (Larix laricina) species.

There are many threats to this species, but their declining population has largely been attributed to loss of wintering forest habitat. They are also threatened by a loss of breeding habitat along migration corridors, especially where forested wetlands have been lost due to urban development or conversion to agricultural land. Additionally, they are vulnerable to collisions with tall buildings and other structures.

There is an AC CDC record of Canadian warblers within 2km of the study area (Neily et al., 2018). While doing fieldwork, Pepper, C recorded two Canada warblers 2,047m east of the middle of the site, noting that the area was a suitable nesting habitat. The Canada Warbler likes dense shrub areas and wet grounds for nesting, so it is possible that they live in the mapped wetland area to the northeastern side of the property along the watercourse.

Snapping Turtle

The snapping turtle (Chelydra serpentina), is listed as a Special Concern under the federal SARA and Vulnerable under the provincial NS ESA. Snapping turtles are generally found in eastern Canada. They

Figure 33 — Northeastern corner of the site, potential edge habitat

are of special significance as they are Canada's largest terrestrial or freshwater reptile and have a similar to or greater lifespan than humans, making mature snapping turtle (COSEWIC, 2008). They prefer slow-moving water, often found in lakes, ponds, shallow bays, sloughs, and slow streams. They can also be found in developed areas such as golf course ponds and irrigation canals. They like water habitats with dense aquatic vegetation and muddy bottoms. Their habitat is diminishing in quantity due to the conversion of wetlands for agricultural or urban development use and quality with contamination limiting their reproductive success (MTRI, 2015).

While water habitat is important to their success, they also rely on habitat and features around waterways for nesting, such as sand and gravel banks, artificial dams and railway embankments, muskrat houses, abandoned beaver lodges, road shoulders, fissures in rocky shorelines, sawdust heaps, freshly dug soil, gardens, lawns and forest clearings (COSEWIC, 2008). AC CDC records include a snapping turtle identification at Cranberry Lake, 441m from the middle of the subject site, by an iNaturalist user (iNaturalist.ca, 2023). While this waterbody is separated from the site's stream by the main street, it is possible that there are snapping turtle species in the watercourse that runs through the site as it is shallow and slow-moving.

Harlequin Darner

The harlequin darner (Gomphaeschna furcillata) is a very small darner, a part of the dragonfly family. The International Union for Conservation of Nature (IUCN) assessed the species for the IUCN Red List of Threatened Species in 2014, concluding that listing the species as the Least concern and the current population trend is stable (Paulson, 2017). This species is similarly not listed by COSEWIC or SARA. However, AC CDC, which has a more local assessment of species, listed the species as S-3, S-4 meaning uncommon to widespread, common and secure in the province.

The harlequin darner's habitat is often forested areas with shrub-dominated wetland habitats, such as bogs, marshes, swamps, fens, and peatlands (Dunkle, 2000). This species is known to like swamps with cypress, alder and cedar tree species, and females lay their eggs in wet wood about 15 cm above water level. The AC CDC records show that an iNatrualist user spotted this species at the northern end of Cranberry Lake 485m southeast of the middle of the subject site (iNaturalist.ca, 2023). Since forested wetlands are delineated on-site, there is a suitable habitat for this species.

Eastern Painted Turtle

The eastern subspecies of the painted turtle (Chrysemys picta) is a small to medium-sized freshwater turtle known for adaptability and cold-water tolerance. This turtle species is listed as Special Concern under the federal SARA but not listed under the NS ESA. It is new to COSWIC as of 2018 and listed as a special concern in 2021, so the NS ESA status could change in the future. Much like the snapping turtle, the eastern painted turtle likes slow-moving, shallow, well-vegetated wetlands (swamps, marshes, ponds, fens, and oxbows) and water bodies (lakes, rivers, and streams) with many basking sites. This species is more adaptable than other wetland species as it is known to be sometimes found in areas disturbed by humans, such as urban ponds, farm ponds, impoundments, and water treatment facilities. For nesting, they generally like open, often south facing, and sloped areas with sandy loam or gravel substrate, usually within 1200m of aquatic habitat. They overwinter in shallow water with deep sediment. Juvenile survival is often low due to predation, but adult survival is high eastern painted turtles are subject to many threats including, but not limited to, road mortality, habitat loss, subsidized predators, introduced plant and animal species, climate change, fisheries by-catch, pollution, disease, and collection.

The AC CDC data shows that two iNaturalist users spotted eastern painted turtles around the same area on the northern part of Cranberry Lake (iNaturalist.ca, 2023). They were found near the site in Cranberry Lake, 435m from the centre of the subject site. However, given that the watercourse running through the site is mostly covered by trees, there are less suitable basking sites on-site, which are important to this species. This would make the wetland and watercourse habitat on-site less likely to be home to the eastern painted turtle.

Turkey Vulture

The turkey vulture (Cathartes aura), is a large bird known for its purplish-red featherless head and short hooked beak. This species is common throughout South and North America, although it only goes as far north as southern Canada and migrates south in the winter. Due to the low Canadian responsibility, the turkey vulture is not on the COSEWIC or SARA lists, and nationally, the species population is now above the goal target (Birds Canada, 2024; BirdLife International, 2018). The IUCN has classified this species as of least concern; however, AC CDC has classified it as S2S3B, S4S5M. Their classification means that their rarity ranks are lower, S4-5 for migrant species, meaning that migrating turkey vulture species are more common or secure in the province. However, their breeding population is rarer on the rarity ranks from rare to uncommon in the province.

The turkey vulture breeds in open landscapes or road edges close to undisturbed natural forested areas with areas for perching and nesting (Kirk, 2024). They like to nest in protected crevices such as recesses beneath boulders, on cliff ledges, in caves, hollow trees, logs, stumps, brush piles, and abandoned buildings. As foragers, turkey vultures provide important ecosystem services, feeding off carrion and acting as clean-up

crew for natural areas. Because of their flexible diet and nesting places, they can do well in natural and human-dominated landscapes. AC CDC has recorded a turkey vulture sighting 1,682m Northeast of the site on Maclaughlin Road by an iNaturalist user (iNaturalist.ca, 2023). This species may nest in the forest in or around the site; they are known to like foraging along forest edges, which the site has all around the golf course. However, given that the Lake Loon Golf Centre maintains the grass, it is less likely that they would find carrion on the field. There is a possibility that they use the site.

2.7.3— Additional Species Considered

NS ESA Species with similar habitat not previously listed:

**Citations for this section are in Appendix B with the NS ESA List Table.*

Higher Relevance:

Chimney Swift

NS ESA Status: Endangered

Habitat: Found across NS. Nests mainly in urban and rural areas where chimneys and similar structures are available. They prefer open fields, meadows, or wetlands for catching flying insects.

Common Nighthawk

NS ESA Status: Threatened

Habitat: Typically inhabits open, disturbed habitats. While it can occasionally be found in meadows or grasslands, it prefers environments that offer unobstructed aerial foraging opportunities. Golf courses can mimic some of the disturbed or post-fire landscapes nighthawks favour, providing flat, unobstructed areas ideal for nesting or roosting.

Little Brown Myotis

NS ESA Status: Endangered

Habitat: During the summer, they forage over water, and along forested edges and in fields for flying insects. It roosts during the day in buildings, eves of houses, woodpiles, under bark and in tree cavities. They overwinter in Nova Scotia by hibernating with other bat species in cold and humid caves or abandoned mines .

Northern Myotis

NS ESA Status: Endangered

Habitat: During the summer this species typically lives in mature coniferous and deciduous forest stands with large trees containing cavities and cracks that can support female maternity colonies. Males roost alone in both deciduous and coniferous trees. They forage in forest gaps and edges.

Olive-sided Flycatcher

NS ESA Status: Threatened

Habitat: They like coniferous forest edges and open areas such as, meadows, rivers, bogs, swamps and ponds. It can also be found in disturbed areas such as early post-fire landscapes. It likes to perch on the tops of tall trees or snags, from which it takes off to catch flying insects.

Rusty Blackbird

NS ESA Status: Endangered

Habitat: Known to from April to August in wetlands including coniferous-dominated wooded streams, swamps, and bogs. It is also found in wet forested areas near beaver ponds.

Wrinkled Shingle Lichen*

NS ESA Status: Threatened

Habitat: Found on mature deciduous tree species, often red maple trees, in imperfectly drained habitats. This lichen is found on trees close to the edge of treed swamps or floodplains.

Moderate Relevance:

Bank Swallow

NS ESA Status: Endangered

Habitat: This species prefers nesting in vertical banks, so this site is less suitable for nesting. However, they like open fields, meadows, or wetlands for catching flying insects.

Black Foam Lichen*

NS ESA Status: Threatened

Habitat: Found throughout Nova Scotia, preferring forests with more light in the winter and high moisture. It typically grows on mature trees and species like red maple, red oak, white ash, and sugar maple. Its specific habitat conditions are not met on-site as the swampy area is early-mature stage and spruce dominated, but fits the VT for the area.

Blue Felt Lichen

NS ESA Status: Vulnerable

Habitat: Found across Nova Scotia, on mature broad-leaved trees (maple, ash, and birch) in moist habitats near streams and lakes. Less likely on-site but could be in the forests near the site.

Eastern Wood-Pewee

NS ESA Status: Vulnerable

Habitat: Found in the mid-canopy layer of deciduous and mixed wood forest edges and clearings. It likes sugar maple, oak and poplar tree species, and is often near lakes, rivers or wetlands.

Macropis Cuckoo Bee

NS ESA Status: Endangered

Habitat: Prefers open wetlands with specific plants like swamp candle and fringed loosestrife. This species is reliant on the host bee species Macropis nudarequire sandy, well-drained soils nearby to create tunnelled nests.

Moose (Mainland Population)

NS ESA Status: Endangered

Habitat: Found in boreal and mixed wood forests often near wetlands, especially areas with abundant food sources like twigs, stems, and foliage of young deciduous trees. The site is close but not in the mainland moose population concentration area.

Peregrine Falcon

NS ESA Status: Vulnerable

Habitat: Known to live in downtown Dartmouth. This species nests on cliffs or tall structures near open areas such as wetlands, meadows, and coastlines.

Transverse Lady Beetle*

NS ESA Status: Endangered

Habitat: A generalist species they can be found in a range of habitats, such as agricultural areas, suburban gardens, parks, forests, prairie grasslands, meadows, riparian areas and other natural areas. This species is reliant on seasonal aphid populations and appropriate vegetation.

Tri-colored Bat

NS ESA Status: Endangered

Habitat: During the summer, they roosts in large clumps of the lichen, specifically, old man's beard. Typically foraging for insects in forests or edge habitats with water bodies.

Wood Turtle

NS ESA Status: Threatened

Habitat: Found in rivers and tributaries with clear, slow-moving water and riparian vegetation in forests or floodplains. They nest in sandy bars or gravel areas to lay their eggs.

Yellow-banded Bumble Bee*

NS ESA Status: Vulnerable

Habitat: Typically found in a range of habitats mixed woodlands, meadows, prairie grasslands, farmlands, urban areas and boreal habitats. It relies on a variety of plants for pollen and nectar and typically nests underground in pre-existing cavities of decomposing organic material such as rotting logs in the winter.

Unless otherwise cited all other information on the NS ESA species was sourced from: SAR information Guide

There is more information on the NS ESA Species in Appendix B.

Low

Boreal Felt Lichen*

The boreal felt lichen (Erioderma pedicellatum) is typically found on only on balsam fir (Abies balsamea) tree species, but has historically been found on black spruce (Picea mariana), white spruce (Picea glauca), red maple (Acer rubrum), white birch (Betula papyrifera) tree species (Environment and Climate Change Canada, 2018). They grow on mature and over mature trees that typically have other fungi or moss species growing on them. Given their special significance the predictive habitat model developed for this species was used to assess the likelihood of their presence on-site (Cameron and Neily 2008). The site is within 30km from the Atlantic Coast and contains wetland habitat which is generally an indicator that there is a possibility of the species in an area. However, using the model and noting the age and species of the forest stands on-site it was deemed unlikely to occur on the subject site.

2.7.4— Landscape Connectivity

Landscape connectivity refers to the ability of natural habitats to facilitate the movement of wildlife and ecological flows, both locally and regionally. Maintaining connectivity is essential for sustaining biodiversity, promoting ecosystem resilience, and adapting to environmental changes. After reviewing of the site's hydrology, forest ecology, and potential SAR, an examination of the site's role in regional and local connectivity was undertaken. The Halifax Green Network Plan (HGNP) served as the basis for most of the analyses regarding landscape connectivity.

The site does not register as particularly valuable on most of the maps within the HGNP. This includes the maps regarding ecological open spaces, working landscapes, socio-cultural landscapes, green network ecology, and cultural landscapes, all of which report a minimal-to-low value for the site (See Figure 34). However, the on-site wetland and watercourse constitute a significant ecological feature relative to the rest of the site. Although most of the site is characterized by cleared grassland, limiting natural

habitat in its central areas, the wetland and its riparian zones, along with the adjacent forested areas, support local connectivity for small to medium-sized wildlife species. These features stabilize soil, provide key habitat for some species, and enable species movement between larger habitat patches.

Regionally, the site's contribution to the Green Network is limited but noteworthy in the context of its wetland and forested boundaries. According to Maps 5 and 6 of the HGNP (Green Network Ecology Map), parts of the wetland areas are classified as "Regulated Areas" which are critical for maintaining connectivity. The site itself does not serve as a primary wildlife corridor but acts as a stepping-stone between adjacent riparian zones and forested landscapes. Specifically, the site serves as a link between the two conservation areas in the north (surrounding Topsail Lake and Loon Lake) with the network of lakes, parks, and protected areas to the south that extend throughout Dartmouth and Cole Harbour.

However, the connectivity of the site is not limited to its riparian zones. While the central cleared areas of the golf course may restrict wildlife movement and discourage the establishment of wildlife habitat, the fact that the golf course directly abuts the forest also creates an edge environment that is favourable for many species for grazing and feeding. In determining the location or size of potential wildlife corridors, the interface between the forest and the grassy clearings of the site should also be considered.

The HGNP outlines a number of objectives to maintain wildlife habitats and protect riparian areas. Section 4.1.3.1 of the HGNP emphasizes maintaining wildlife habitats and ensuring connectivity by preserving essential and important corridors. Essential corridors should ideally exceed 1 km in width, while important corridors must maintain a minimum width of 100 m to facilitate movement. The forested area between

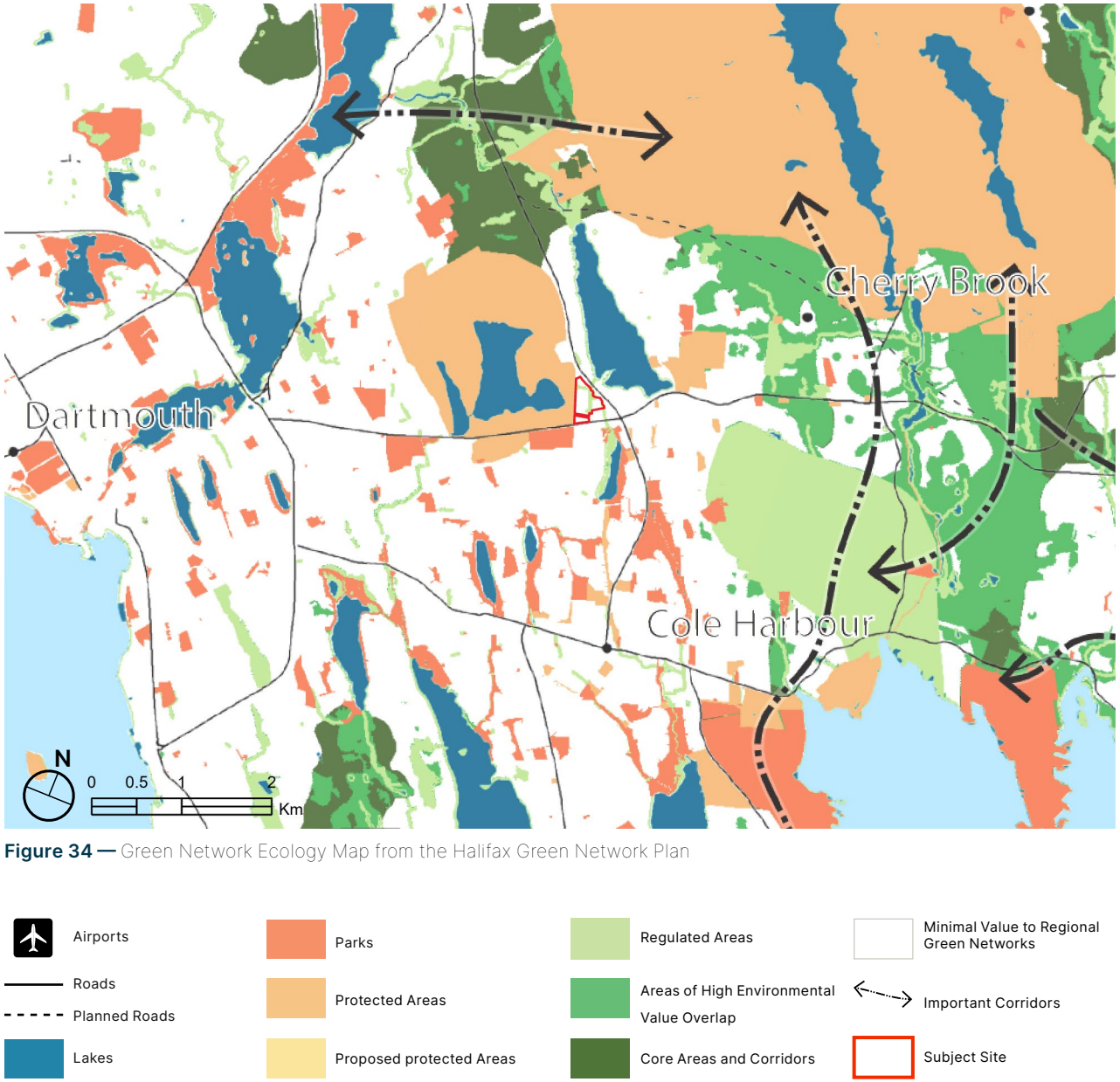


Figure 34 — Green Network Ecology Map from the Halifax Green Network Plan

the golf course and Highway 107 does not exceed 100m in width at any point along the boundary of the site, resting closer to 60m in width as it moves from southeast to northwest. However, since the site's essential connectivity is concentrated around the wetland's regulated areas, the preservation of this zone is a priority regardless of whether or not it meets the definition of an important corridor. Section 4.1.3.3 highlights the need to protect riparian corridors and wetlands from degradation, pollution, and other threats. It recommends consolidating watercourse buffer zones and applying wider buffers in sensitive areas. For the site, the wetland and watercourse's ecological should be preserved with buffers ranging from 20 to 30 meters, aligning with Regional Plan and HGNP guidelines. Additionally, riparian vegetation along the wetland edge should be maintained and expanded to improve habitat quality and resilience.

Corridor enhancement efforts should focus on connecting the wetland with adjacent forested areas. This can be achieved by creating stepping-stone habitats in open areas and minimizing artificial barriers. Encouraging natural regrowth in disturbed zones will also contribute to corridor functionality.

2.7.5— Discussion

This species-at-risk analysis indicates that, while no species at risk (SAR) were identified directly within the Lake Loon site during field visits, there is no definitive way of knowing whether or not species at risk are on the subject site. Therefore, to provide further insight into the species that could be on-site records, the AC CDC records, combined with additional habitat models and provincial datasets, were used to suggest what species the site may support.

The site's terrain, including a wetland, stream, forested areas, and open space, provides a variety of habitats for species. The species identified all had a preferred habitat on-site. The watercourse along the site's eastern side could support species such as the snapping turtle and wood turtle. Then, wetland habitats may be used by birds such as the barn swallow, Canada warbler, chimney swift, peregrine falcon, and rusty blackbird. The edge habitat provided by the divide between the open driving range and surrounding forested area creates an edge habitat that could support species that like to forage for insects and small rodents, such as birds, bats and insect species, including the eastern wood-pewee, little brown myotis, olive-sided flycatcher, and tri-colored bat. The human-made structures present on the site, such as the light posts, signs, and buildings on the south of the site, provide high vertical spots that could be used by the barn swallow for nesting. Some species also like a variety of habitats, such as the monarch butterfly, which needs nectar-producing plants, and may find suitable habitats in the open spaces and wetlands of the site. It is crucial that in the case of development, on-site species are accounted for through measures to mitigate the negative externalities on the species.

Another part of maintaining biodiversity on-site is the importance of landscape connectivity, as it is vital for biodiversity and ecosystem resilience, enabling wildlife movement and ecological flows. While the site doesn't rank highly in the HGNP, its wetland and riparian zones are significant for local connectivity, supporting small to medium-sized wildlife species. The wetland, along with adjacent forested areas, provides key habitat and facilitates movement between larger habitat patches. Though the golf course's cleared areas limit wildlife movement, the interface between the forest and grasslands offers some ecological value. As noted, with the species at risk, many of them like edge habitats, so ensuring future connectivity will help reduce strain on species that may use the subject site.

Recommended Mitigation Strategies

- The site plays a minimal but still important role in landscape connectivity due to its adjacency to forests and wetlands. By aligning site management practices with the objectives of the HGNP, it is possible to enhance the site's contribution to broader ecological goals while maintaining its current functionality.
- To achieve these goals, the following actions are recommended:
- Establish a 30m buffer around the wetland and watercourse to preserve their ecological value and prioritize connectivity with adjacent forested areas.
- Designate a wildlife corridor running along the eastern edge of the property.
- Maintain forest edge areas in the event of development to serve as key grazing and feeding grounds for certain species.
- Implement reforestation projects on cleared sections of the site to improve habitat quality.
- Monitor wildlife usage to assess the success of corridor enhancement efforts and adapt strategies as needed.

2.7.6— Constraint Scoring

As it was not possible to conduct a comprehensive survey for all potential SAR species, the presence of individual Species at Risk (SAR) was not the only factor in evaluating land suitability within the subject site. Instead, this analysis focused on SAR that could be present on-site. These species were identified through data collected from AC CDC records, site visits, aerial imagery, and information about the natural features and habitats on-site informed by the rest of the Land Suitability Analysis. For the purposes of scoring, only species included in the NS ESA and considered high to moderately relevant to the lake loon site or spotted within 2km of the subject site were included in the constraints mapping.

The site was categorized into distinct habitats, as shown in *Figure* 35, including clearing, grasses, edge,

Figure 35 — Habitat Map

* The numbers in the Map are associated with the forest stands introduced in Section 2.6 - Forest Ecology.

forested areas, wetlands, watercourses, and urban zones. Forested areas were further divided into specific stands to reflect the close link between species' habitat preferences and vegetation types. Habitat preferences of the identified SAR were cross-referenced with the mapped site habitats, and species were considered potentially present where these preferences matched.

This mapping approach was then used to estimate the potential distribution of SAR across the site. The habitat areas were then ranked based on the number of SAR species they could potentially support. Areas that could support six or more SAR species were considered the most constrained, while areas with less than two potential species were ranked the least constrained. Areas with the lowest SAR constraints are considered the most suitable for development, given that they have the lowest potential to be used by SAR species. Figure 35 illustrates the distribution of suitable SAR habitat on-site.

All areas within the study zone have the potential to be used by SAR, as many species utilize broad habitat ranges. Interestingly, the grasslands in the eastern portion of the site were ranked as highly constrained due to their suitability for several SARs, as they could be used by many of the at-risk birds and insects. The other areas ranked moderately constrained were often areas where habitats overlapped, such as forested wetlands and edge habitats and forests or wetlands. This is understandable as many SAR concentrations are linked to watercourses, which provide distinct habitat types such as wetlands, riparian zones, and mature forest remnants protected by no-harvest buffer zones. These wetland and forested areas serve as critical habitats and corridors, connecting plant and animal populations across urbanized landscapes.

The urban habitat was also scored as moderately constrained as many NS ESA SAR are known to use anthropogenic habitat for certain purposes such as nesting. These include barn swallow, chimney swift, and little brown myotis, who commonly nest on structures and buildings. While these species may use urban areas to fulfill one part of their habitat needs, they often require nearby undisturbed habitats to fulfill other ecological requirements, such as foraging. Given the site's size, location, and adjacent forests, these needs should still be met. However, it is important to consider retaining or accommodating existing habitat on-site and ensuring the integrity of the surrounding habitat is not degraded.

Features	Assigned Score
Habitat Potentially used by 0-2 SAR	1 - Less Constrained
Habitat Potentially used by 2+ SAR	2 - Moderately Constrained
Habitat Potentially used by 6+ SAR	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 9 — Species at Risk Constraint Scoring

Figure 36 — Species at Risk Constraint Map

2.8 — CULTURAL SIGNIFICANCE

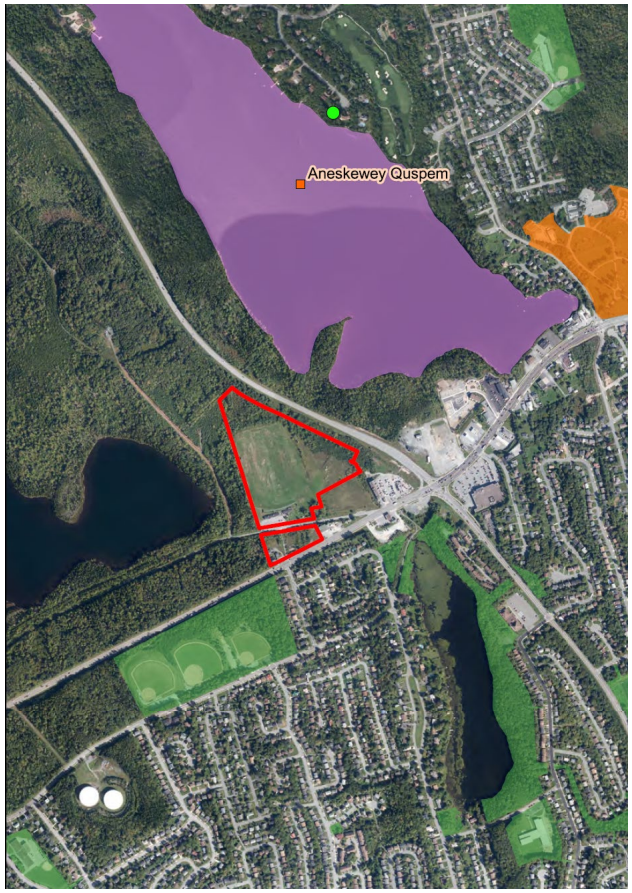


Figure 37 — Cultural Heritage Context (CRM Group)

METHODS

Cultural Resource Management Group Limited (CRM Group) conducted an Archaeological Resource Impact Assessment (ARIA) for the subject site. Involving Mi'kmaw engagement, background research, and archaeological fieldwork, this ARIA was designed to search for, document, interpret, and make management recommendations for cultural heritage resources and areas of archaeological resource potential for the subject site. The full report is located in Appendix D and outlines the results and recommendations of the ARIA. This report was also submitted to the Nova Scotia Department of Communities, Culture, Tourism, and Heritage to fulfill the requirements of the Heritage Research Permit (HRP).

2.8.1— ARIA Summary

The Dartmouth area in which the subject site sits is rich in cultural and historical significance, reflecting diverse narratives tied to Mi'kmaw traditions, African Nova Scotian communities, and early Euro-Canadian settlers (See Figure 37 for features mapped in the ARIA). The region's historical depth is evident in its landscape, settlement patterns, and its continuing cultural legacy.

The site is part of the traditional Mi'kmaw territory known as *Sɨpekne'katik*, which was historically significant for its interconnected waterways. The Shubenacadie River system served as a crucial transportation and resource corridor, linking Mi'kmaq communities from Halifax Harbour to Cobequid Bay. The lakes and wetlands in this area, including Lake Loon and Cranberry Lake, supported fishing, hunting, and foraging activities central to Mi'kmaw lifeways.

To Mi'kmaq peoples, these waterways were not only practical but spiritual, with specific locations holding ceremonial and ecological importance. Given this areas near watercourse and contains a wetland it could contain artifacts or evidence of seasonal Mi'kmaw campsites, therefore archaeological assessment during development is beneficial.

In 1767, the land comprising the Study Area was included in a 2,000-acre land grant to Benjamin Green, an influential Nova Scotia naval officer and judge. Green was the first Naval Officer of Halifax and later served as a judge of the Vice-Admiralty Court and Treasurer of Nova Scotia. His land holdings in the Lake Loon area exemplify the colonial transformation of the landscape from Mi'kmaw territory to agricultural and residential development.

By 1796, the Crown reacquired much of this land to establish settlements for the Trelawney Maroons, a group of approximately 600 African exiles from Jamaica. The Study Area appears to have been subdivided into lots for Maroon settlement, with a road constructed to connect Maroon Town to Preston and Dartmouth. While no precise evidence of Maroon occupation was located within the Study Area, historical documents suggest the area was included in their settlement footprint. After the Maroons departed in 1800, the land was sold at auction

Figure 38 — Faribault, 1908
Map of the Area

1931

1947

1954

1992

2003

2024

and subsequently developed by other settlers.

Later, estates such as those of Charles Morris III, a surveyor and political leader, symbolized the rise of prominent families who further altered the land through farming and resource extraction. Charles Morris III's country residence is shown in Figure 39.

The 19th century brought industrial development to the area, with logging and milling activities supported by the Shubenacadie Canal system. This industrial phase left an imprint on the local landscape and economy, shaping the development patterns visible today. Wetlands and waterways, such as those around Lake Loon, remain ecologically and historically significant, contributing to the region's cultural and natural heritage.

Faribault's 1908 Map in shown in Figure 38 depicts the area depicts two buildings within the Study Area, on the north side of the Old Preston Road now known as Golf Drive (Faribault, 1908), as well as a third building just outside the west edge of the Study Site, east of a road which extends north from the Old Preston Road.

Faribault identifies one of these three structures as a Forge. These maps also indicate the presence of boggy ground along the east edge of the study site, along the outflow from Cranberry Lake to Lake Loon. Which is relevant to understanding the origins of the current wetland on-site.

A later map from 1923 depicts a similar groupings of structures to those identified in the 1908 map, then an examination of aerial photographs indicates that, in 1931, the northwest portion of the study area was predominately a cleared agricultural field (Figure 39). While the remainder of the Study Area is treed or boggy wetland. The building identified in 1908 and 1923 mapping as being located just outside the west edge of the study area is visible. However, the two structures previously depicted within the study area are not identified. By 1945, buildings associated with the

Figure 39 — Aerial Photographs - 1931, 1947, 1951, 1992, 2003, 2024 (CRM Group)

farmstead are visible within the study area, north of the Old Preston Road, while the building to the west of the study area is no longer visible (Figure 39). Just north of the study area, the alignment of the underground pipe connecting Topsail Lake and Lake Loon can be identified. By 1954, the alignment of Main Street was straightened south of Topsail Lake and Lake Loon.

This brought the alignment of Main Street to its present position, south of the Study Area, with the Old Preston Road becoming a dead end at the watershed property (Figure 38). Buildings associated with the farm north of Old Preston Road are still visible. The triangular property formed by the intersection of Main Street and the Old Preston Road has been cleared and a laneway between the two roads has been created.

By 1981, a survey plan of property north of Old Preston Road (Golf View Drive) depicts the existing Lake Loon Golf Centre in place of the former farmstead. The only structure indicated within this portion of the study area is one of the Golf Centre's long, rectangular buildings.

By 1992, a second building was added, the Golf Centre's parking lot was paved, the second building and mini putt constructed (Figure 39). Most of the southern portion of the study area, between Main Street and Golf View Drive, had been developed. The northernmost portion of the study area remained treed. Between 1992 and 2024, with no significant development had occurred within the study area.

2.8.2— Other Considerations

In understanding the cultural significance of the subject site the Green Network Plan was referenced (Halifax Regional Municipality and O2 Planning + Design, 2018). The maps and materials in the Green network Plan showed no areas or features of significance on the subject site. However, it did show that the subject site is surrounded by three priority areas in the Cultural Landscapes map shown in Figure 40. This map also shows that there are some areas of archaeological significance nearby, specifically around Topsail Lake.

2.8.3— Discussion

Fieldwork conducted for the ARIA found no visible archaeological resources in most of the study area due to previous disturbances from road construction and modern development. However, the parking lot and mini-golf area of the Lake Loon Golf Centre were identified as having moderate potential for archaeological resources related to historic structures, as structural remains from Golf View Drive may still exist in that area. Recommendations include archaeological monitoring during ground disturbance in this area and no further archaeological investigation for the remainder of the site unless human remains or significant cultural deposits are encountered during construction.

Recommended Mitigation Strategies

- It is recommended that ground disturbance activities within the parking lot and mini putt area of the Lake Loon Golf Centre be monitored by an archaeologist under the guidelines of a Heritage Research Permit
- It is recommended that an ARIA be undertaken to address any proposed extension of the study area.
- If archaeological deposits or human remains are encountered during construction activities associated with the Project, all work in the associated area(s) should be halted and immediate

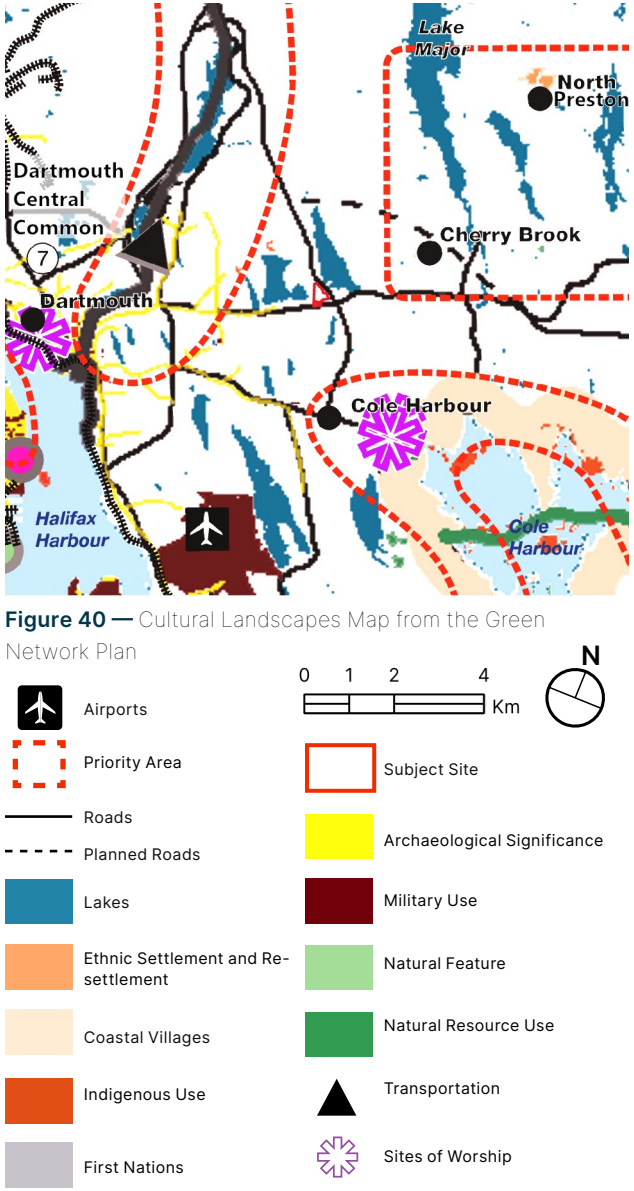


Figure 40 — Cultural Landscapes Map from the Green Network Plan

contact made with the Special Places Program (John Cormier: 902-424-4542).

2.8.4— Constraint Scoring

The Cultural Significance feature was scored based on the results of the recommendations map on page 64 of the ARIA (See Appendix D). This map highlights the majority of the site as "Area of Low Archaeological Potential - No Further Assessment Required" and the scored 2 as "Archaeological Monitoring Recommended". This area was given a score of two because while Archaeological monitoring is recommended there was of significance found during their study that would pose a enough of a significant constraint to development to highly constrain development.

Features	Assigned Score
Area of Low Archaeological Potential - No Further Assessment Required	1 - Less Constrained
Area of Moderate Archaeological Potential - Archaeological Monitoring Recommended	2 - Moderately Constrained
Area of High Archaeological Potential - Archaeological Monitoring Required	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 10 — Cultural Significance Constraint Scoring

Figure 41 — Cultural Significance Constraints Map

2.9 — CONTAMINATED SITES

METHODS

To analyze the potential for contamination on-site the an analysis of the site history was conducted, along with the results of a regulatory search of provincial government datasets for regulatory infractions and environmental investigations for the Study Area. Findings in the ARIA were additionally used to provide additional insights into the site.

The review did not include sampling or testing of air, soil, groundwater, surface water, or building materials, nor did it involve an audit of operational environmental compliance or any environmental management systems that may exist for the Study Area.

Overview

Based on the ARIA and a review of the previous land uses, no immediate concerns of contamination were identified. However, the site's current use as a golf course and driving range introduces potential environmental concerns commonly associated with such facilities. Golf courses often rely heavily on the application of pesticides, herbicides, and fertilizers to maintain turf health and aesthetics. These chemicals can persist in the soil and leach into groundwater, potentially impacting local ecosystems. Additionally, the storage and handling of maintenance-related chemicals such as fuels and oils present risks of localized spills or leaks. While these practices are standard for golf courses, they require careful management to minimize contamination risks.

To clarify the risk of contamination, a request has been submitted to the Nova Scotia Department of Environment and Climate Change (NSECC). The request will reveal any information about former hazardous uses, regulatory infractions, environmental investigations, tank registrations, or applications for approval to use harmful chemicals or explosives. We have still not received a response from the NSECC as of the submission of this draft report but we anticipate a reply within the coming weeks and will update this document accordingly.

Features	Assigned Score
Habitat Potentially used by 0-2 SAR	1 - Less Constrained
Habitat Potentially used by 2+ SAR	2 - Moderately Constrained
Habitat Potentially used by 6+ SAR	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 11 — Cultural Significance Constraint Scoring

Figure 42 — Contaminated Sites Constraints Map

2.10 — FINAL CONSTRAINTS MAPPING

This section combines the LSA constraint maps for topography, geology and soils, hydrology, forest ecology, species at risk, cultural significance, and contaminated sites sections to create one final constraints map.

This map combines the constraints for all the indicators to demonstrate the overall suitability of the subject area's land. Since there were seven constraint maps created that assigned a suitability score from 1-3, the final summed values would fall within the range of 7 to 21 with land assigned a value of 7 being the least constrained and land assigned a value of 21 being the most constrained. The final scoring matrix is as follows:

Features	Assigned Score
7-11	1 - Less Constrained
12-16	2 - Moderately Constrained
17-21	3 - Highly Constrained
TOTAL POTENTIAL SCORE	**1-3**

Table 12 — Combined Constraint Scoring

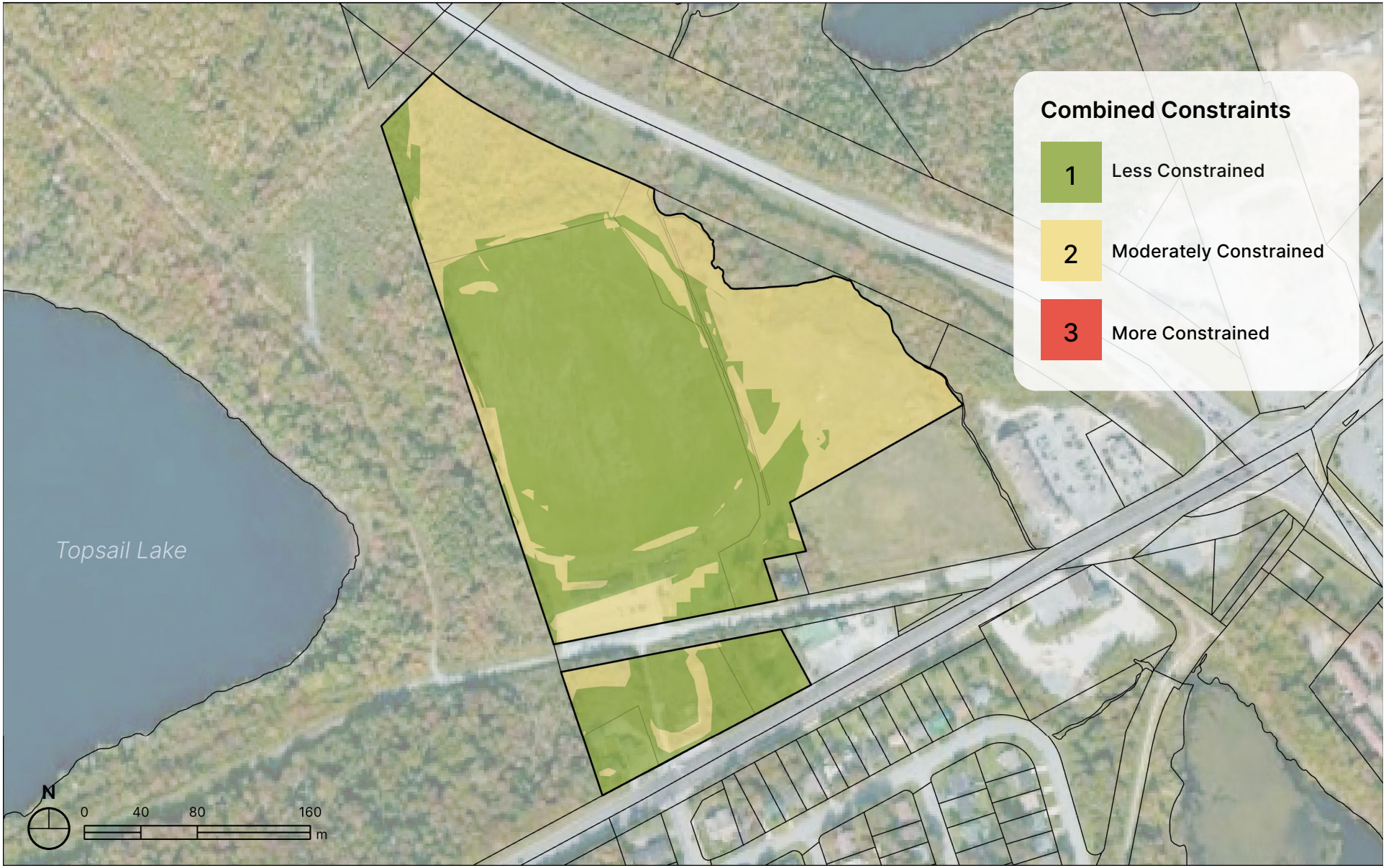


Figure 43 — Combined Constraints Map