**Environmental Impact Assessment**
Registration Document #4561-2-1545
Canneberges St-Charles Cranberries Inc.
Peat and Cranberry Operation Expansion
Saint-Charles Station, New Brunswick
Project: 19.03.239

Prepared for:

Canneberges St-Charles Cranberries Inc.
402 St-Charles Station Road
Saint-Charles Station, New Brunswick
E4W 5R8

# Environmental Impact Assessment

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Canneberges St-Charles Cranberries Inc.
Peat and Cranberry Operation Expansion
Saint-Charles Station, New Brunswick
Hive Project No.: 19.03.239

Jul 7, 2020

**Hive Engineering Limited**
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July 7, 2020
Project: 19.03.239

**Canneberges St-Charles Cranberries Inc.**
402 St-Charles Station Road
Saint-Charles Station, New Brunswick
E4W 5R8

Attention: Mr. Gerald Richard

**Re: Environmental Impact Assessment, Registration Document**
**St-Charles Cranberries Inc., Peat and Cranberry Operation Expansion**
**Saint-Charles Station, New Brunswick**

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At your request, Hive Engineering Limited has prepared the following Environmental Impact Assessment for Canneberges St-Charles Cranberries Inc. Our conclusions and recommendations are presented in the following report.

Do not hesitate to contact the undersigned with any questions regarding the information presented herein.

Sincerely,

Andrea Kalafut, M.Sc.E., P.Eng.
Associate and Senior Environmental Engineer
Hive Engineering Limited

## Glossary of Terms

| Abbreviation | Definition |
|---|---|
| ACCDC | Atlantic Canada Conservation Data Centre |
| AIA | Archaeological Impact Assessment |
| ASB | Archaeological Services Branch |
| BMP(s) | Best Management Practice(s) |
| DNR | Department of Natural Resources |
| EIA | Environmental Impact Assessment |
| ECCC | Environment and Climate Change Canada |
| ERD | (New Brunswick) Department of Energy and Resource Development |
| NBDELG | New Brunswick Department of Environment and Local Government |
| NB ESA | New Brunswick Endangered Species Act |
| PDA | Project Development Area |
| PID | Parcel Identifier |
| SARA | Species at Risk Act |
| SNB | Service New Brunswick |
| SCC | Canneberges St-Charles Cranberries Inc. (the Proponent) |
| SOCC | Species of Conservation Concern |
| TRC | Technical Review Committee |
| VEC(s) | Valued Environmental Component(s) |

## TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF APPENDICES

## 1.0 INTRODUCTION

Hive Engineering Limited (herein "Hive") and EXP Services Inc. (herein "EXP") were jointly retained by Canneberges St-Charles Cranberries Inc. (herein "SCC" or "Proponent") to prepare an Environmental Impact Assessment (EIA) Registration Document for an expansion to their existing peat harvesting and cranberry farm located in Saint-Charles Station, New Brunswick. This registration document is required under the New Brunswick *Environmental Impact Assessment Regulation 87-83* of the *Clean Environment Act*. This document has been prepared in general conformance with the following documents:

- New Brunswick Department of Environment and Local Government's *"A Guide to Environmental Impact Assessment in New Brunswick"* dated January 2018;
- New Brunswick Department of Environment and Local Government's *"Additional Information Requirements for Cranberry Operations",* Version 13-10-10; and
- New Brunswick Department of Environment and Local Government's *"Additional Information Requirements for Peat Development Projects",* Version 05-04-07

## 2.0 THE PROPONENT

The Proponent details for this registration document are as follows:

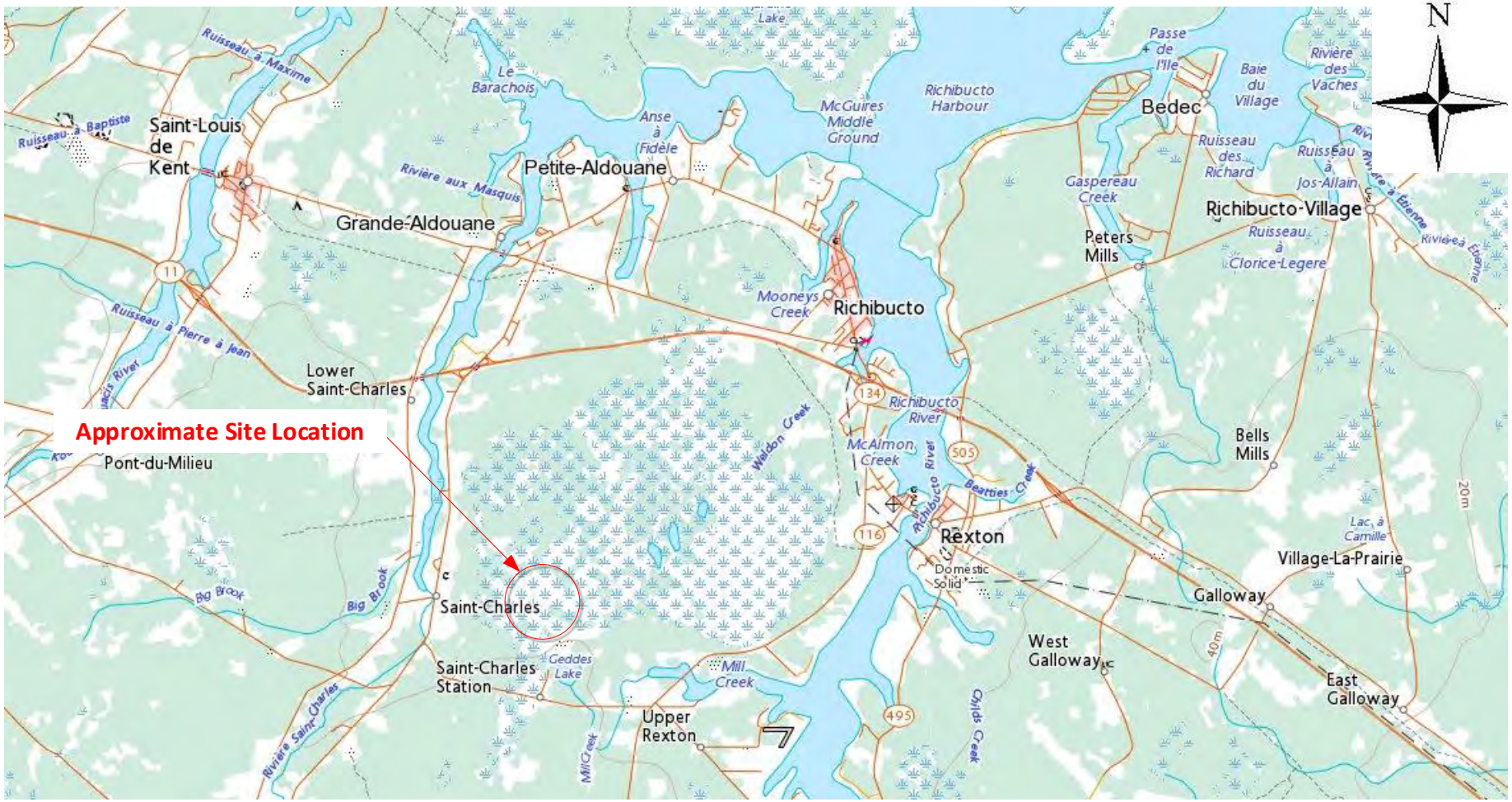
**Table 1 Proponent Information**

| | |
|---|---|
| **Name of Undertaking:** | St-Charles Cranberries Inc. Peat and Cranberry Operation Expansion |
| **Name of Proponent:** | Canneberges St-Charles Cranberries Inc. |
| **Address of Proponent:** | 402 St-Charles Station Road, Saint Charles Station, New Brunswick |
| **Principal Proponent Contact:** | Contact: Mr. Gerald Richard, Operations Manager<br>Cell Phone: 506.524.8447<br>Email: gerald.richard1967@gmail.com |
| **Principal Contact for EIA:** | Company: Hive Engineering Limited<br>Contact: Ms. Andrea Kalafut, M.Sc.E., P.Eng., President and CEO<br>Address: 155 Cornhill Street, Moncton, New Brunswick, E1C 6L3<br>Cell Phone: 506.232.1306<br>Email: andrea.kalafut@hiveeng.ca |
| **Property Ownership:** | NB Natural Resources and Energy |

The area proposed for the Project is a 20.2-hectare portion of land located on PIDs 25147844 and 25356114 (herein referred to as the "Development Area"). Both parcels are currently registered to NB Natural Resources and Energy (i.e. Crown Land).

In 2018, the Proponent submitted a land exchange request to the Department of Energy and Resource Development (ERD). The request included an exchange of 26.1-hectares of privately held land for 20.2-hectares of Crown Land, which would result in a net gain of 5.9 hectares in Crown Land for the province of New Brunswick.

On August 2, 2018, the Proponent received a Conditional Offer for the land exchange from ERD. A copy of the Conditional Offer is included in Appendix A, confirming that the current landowner consented to the land exchange, provided that all the conditions of the offer are confirmed. The approximate project location is present in Figure 1.




This drawing is not to be scaled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| | |
|---|---|
| Project Title | EIA – PROPOSED SCC EXPANSION |
| Dwg. Title: | SITE LOCATION PLAN |
| Drawn By: RSG | Project No. MON-00257148-A0 |
| Dwg. Standards Ckd. By: | Dwg. No. FIGURE 1 |
| Designed By: | Dwg. Design Ckd. By: / Rev. No. |



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## 3.0 PROJECT DESCRIPTION

This section provides the required information under Section 2.0, under sub-heading *"Preparing the EIA Registration Document"* of the NBDELG's *"A Guide to Environmental Impact Assessment in New Brunswick".*

### 3.1 Project Name

St-Charles Cranberries Inc. (SCC) Peat and Cranberry Operation Expansion (herein referred to as the "Project").

### 3.2 Project Overview

The Project consists of an expansion of an existing peat harvesting and cranberry farm operation located in Saint-Charles Station, New Brunswick (Canneberges St-Charles Cranberries Inc.). Canneberges St-Charles Cranberries Inc. originally started harvesting peat at this location circa 1998. The areas originally harvested for peat (referred to herein as "Phase 1" of the SCC operation) have since been converted to cranberry beds. It is understood that the existing operation occupies 860 acres of land; with 110 acres currently allocated to peat harvesting and 92 acres developed for cranberry farming. The existing facility was approved by NBDELG under registration documents EIA Registration Document #4561-3-642 (1998) and EIA Registration Document #4561-3-998 (2004).

The proposed expansion, subject to approval of the current EIA, is referred to herein as "Phase 3" and will extend the operations into an existing peat bog on Crown Lands. There is currently a conditional offer between ERD and the Proponent to exchange 26.1 hectares of privately held land with 20.2 hectares of Crown Land. This offer is contingent upon approval of the EIA. Pending approval, the Proponent anticipates harvesting peat would begin circa 2021 and ultimately would be turned into cranberry beds. Development of the cranberry bed operations would also essentially form the "Reclamation Plan" for the extracted peat areas.

### 3.3 Purpose/Rationale/Need for Undertaking

According to a study published in 2019, Europe was the largest supplier and consumer of peat with a revenue market share of 90.92%; following Europe is Canada with a 4.28% share in the market. The worldwide market for peat is expected to grow at a Compound Annual Growth Rate (CAGR) of 2.1% over the next five years from 760 million US$ dollars in 2019 to 860 million US$ dollars in 2024.

According to the ERD website, the Province of New Brunswick is the leading producer of peat in Canada and an important player on the international scene. The peat mining industry is a major contributor to the economy of eastern and northeastern New Brunswick. In 2013 the sector employed at peak 1,400 persons: 400 full time and 1,000 part time employees. The production of peat, including the cost of packaging, was valued at $150 million *(https://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Minerals-Minerales/Peat_Mining_Policy-e.pdf)*.

The current proposed project (Phase 3) is dependent on an exchange of the privately-owned peat resource for a portion of Crown-owned peat resource adjacent to the SCC Phase 1 and Phase 2 property. The property exchange is currently understood to be acceptable at the Province of New Brunswick cabinet level, pending the approval of all necessary permits for a peat harvesting expansion. The proposed Phase 3 expansion will only occur in a gradual manner as the Phase 1 and Phase 2 original sections of peat are extracted to the extent permitted and the extracted peat areas are subsequently developed as cranberry beds.

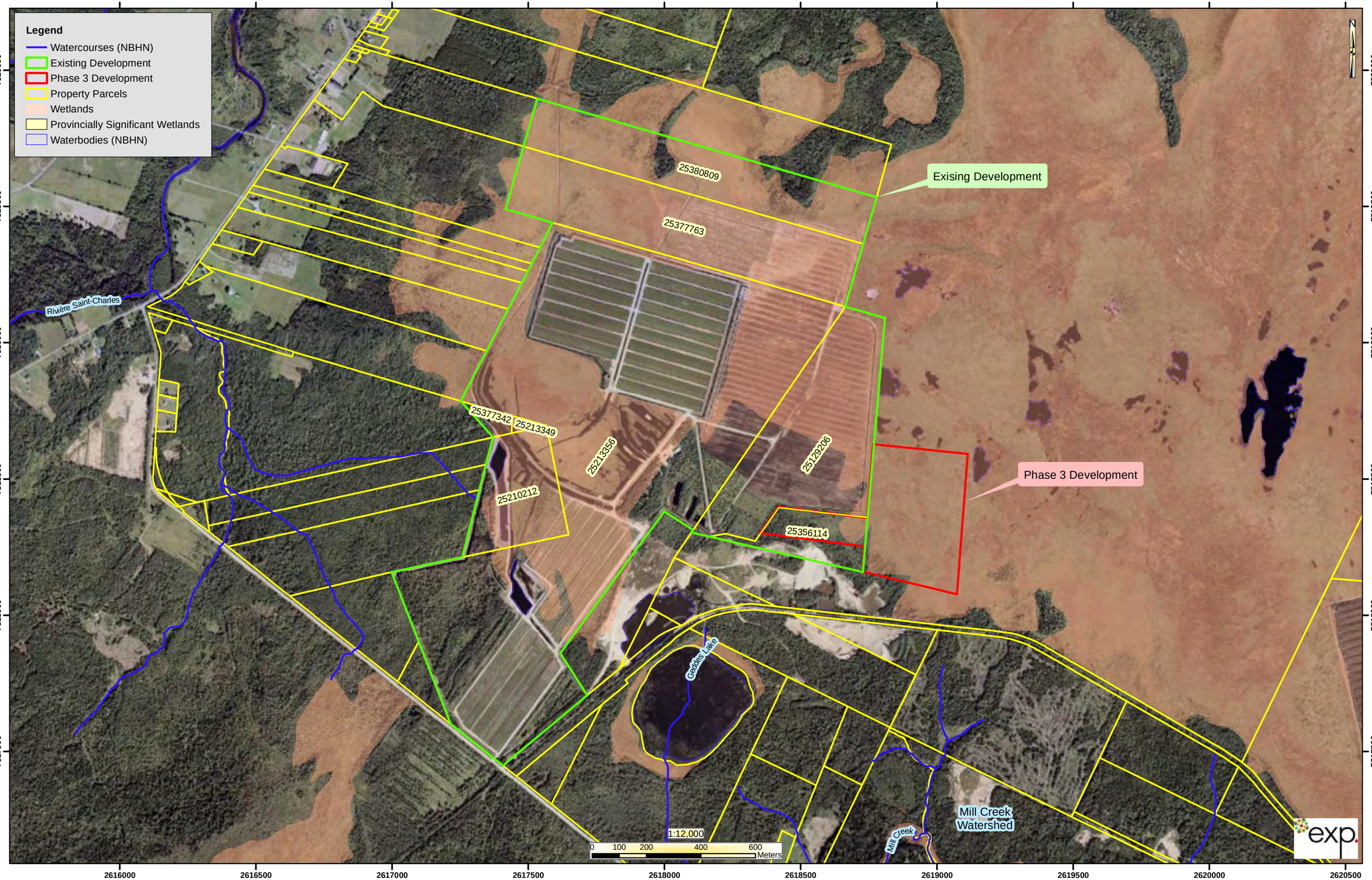
The current SCC operation employees 6-8 full-time employees through the harvesting season. The expansion of the facility is necessary so that SCC can maintain a peat extraction operation that supports their existing equipment and personnel (6 to 8 full-time seasonal employees; operations from approximately May through October in any given year). The operation requires a “critical threshold” level of activity in order to maintain an economically viable operation. Therefore, a “do-nothing” alternative is not economically viable, would result in job loss and would result in a reduction of New Brunswick’s peat and cranberry production.

A second option of developing land currently privately held by SCC was also explored as an option for expanding the operation. However, the alternative of developing the privately-owned land parcel was deemed not viable since the land is too small, the depth of peat is shallower and its distance from the existing SCC operation would generally not allow economic and regulatory viable access (e.g. travelling down provincial highways with specialized and wide equipment).

### 3.4 Project Location

The Development Area is 20.2-hectares in area and straddles PIDs 25147844 and 25356114. The approximate coordinate for the centre of the Development Area is Lat: 46°39’14.1993” and Long: 64°56’49.7051”. The property does not have a civic address and is located in the area of Saint-Charles Station in the Saint-Charles parish of Kent County. The area is situated approximately 1.2 kilometres northeast of the intersection of Route 116 and St-Charles Station

Road, at its nearest point. The project location including recent aerial photography is presented in Figure 3-1.


Legend
Watercourses (NBHN)
Existing Development
Phase 3 Development
Property Parcels
Wetlands
Provincially Significant Wetlands
Waterbodies (NBHN)
Exising Development
Phase 3 Development
25380809
25377763
25377342
25213349
25213356
25129206
25210212
25356114
Rivière Saint-Charles
Geddes Lake
Mill Creek
Mill Creek Watershed
1:12,000
0 100 200 400 600
Meters
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2616500
2617000
2617500
2618000
2618500
2619000
2619500
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2620500
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7519500
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7517500

## 3.5 Siting Considerations

The success of a peat harvesting operation is dependant on the quantity of the resource that is available; the success of a cranberry farm is directly related to the location in which the cranberry beds are constructed. The main reason for selecting the project location is based on its immediate proximity to the existing Canneberges St-Charles Cranberries Inc. facility. The area is known to have ample peat resources and in turn is ideal for conversion to a cranberry farm once the peat resource has been developed to a practical extent.

The expansion of the operation onto an immediate adjoining property will allow the Proponent to utilize existing roads and infrastructure; thereby eliminating the need to invest in additional infrastructure or disturb additional natural features. Furthermore, based on a review of the depth of peat mapping within the proposed Phase 3 footprint of development, the Proponent has determined it is the most economically viable location for the extraction of peat in the area.

The land privately held by Canneberges St-Charles Cranberries Inc. (PID 25126368) proposed in the land exchange was considered as an option for the expansion. However, this land is currently not serviced, which would require the construction of additional infrastructure (e.g. access road, water storage reservoir, other) separated from the existing SCC “closed loop” Phase 1 and Phase 2 operations. Furthermore, the site grades on the privately held land would make it difficult to operate the facility under a gravity system and would likely require the installation of pumps to transfer water between basins. Last, depth of peat mapping indicates that the volume of peat on both the Crown Lands and the privately held lands is similar. However, the depth of peat is greater in the area proposed for expansion (i.e. Crown Lands). This makes peat harvesting on the Crown Lands more economically viable compared to extracting the peat on the privately held lands. The land exchange would provide ERD with 26.1 hectares, while Canneberges St-Charles Cranberries Inc. would acquire 20.2 hectares, resulting in a net gain in provincially owned lands of 5.9 hectares and no net loss of peat resources.

Overall, the proposed Project Site is deemed the best option for the development based on the following:

- Proximity to existing peat/cranberry operation owned by Canneberges St-Charles Cranberries Inc. will allow for seamless integration and minimal to no adverse environmental impact of surrounding lands and communities;
- Ability to use existing infrastructure (e.g. access roads, water storage facilities)

- Depth of peat mapping suggests that it is economically feasible to harvest the peat at the selected location;
- Existing site grades allow water to gravity flow through the system, eliminating the need to install pumps for water movement; and,
- ERD gaining a net increase of 5.9 hectares of Crown Land.

## 3.6 Physical Components and Dimensions of Project

The Development Area location and dimensions are presented in Figure 3-2. The total Development Area is 20.2-hectares (50 acres); the production area (peat extraction followed by cranberry bed construction) will occupy approximately 11.3 hectares (28 acres) of the total footprint. The remainder of the Phase 3 land parcel will be mainly buffer, with a related laydown area developed on the southern portion of the Site. The laydown area will allow peat to be temporarily stockpiled until removal at the end of the season and will be subsequently developed as a reservoir once cranberry beds are brought into operation.

If the EIA registration document is approved, the conditional offer for the land exchange with ERD will be approved and the project will be allowed to proceed. No other easements, land leases, land rentals or purchases of land are required to move the project forward.

**Legend**

- Proposed Ditch
- Reservoir 1A (62.8 ac)
- Reservoir 1B (27.8 ac)
- Reservoir 2 (47.9 ac)

**30m Offset from Subject Crown Land Boundary (total 40 ac)**

**Parcel, Area (acres)**

- 30m Offset from Existing Land Boundary, (6.38 ac)
- 30m Offset from Subject Crown Land Boundary, (33.63 ac)

**Subject Crown Land (total 21 ac)**

**Parcel, Area (acres)**

- Existing Partial Property Parcel, (3.71 ac)
- Subject Crown Land Parcel, (17.28 ac)
- Approximate Area for Materials Stockpile (8.25 ac)
- Phase 3 Development - Area of Water Diversion (50.44 ac)

**Rivière Saint-Charles / Mill Creek Watersheds**

**Watershed, Area (acres)**

- Mill Creek Watershed, 7,762 ac
- Rivière Saint-Charles Watershed, 36,699 ac
- Phase 1 Development Area (345.3 ac)
- Phase 2 Development Area (17.6 ac)
- Phase 3 Development Area (51.9 ac)

Rivière Saint-Charles Watershed

Mill Creek Watershed

1:10,000

0 50 100 200 300 Meters

2616000 2616200 2616400 2616600 2616800 2617000 2617200 2617400 2617600 2617800 2618000 2618200 2618400 2618600 2618800 2619000 2619200 2619400 2619600 2619800 2620000

7519800 7519600 7519400 7519200 7519000 7518800 7518600 7518400 7518200 7518000 7517800 7517600 7517400

# 4.0 PEAT EXTRACTION AND CRANBERRY FARM CONSTRUCTION, OPERATION AND MAINTENANCE

## 4.1 Project Background, Previous Approvals and Siting Considerations

### 4.1.1 Project Background

Canneberges St-Charles Cranberries Inc. (SCC) currently owns and operates a peat extraction and cranberry development in the St. Charles Peat Bog located in Kent County, New Brunswick (Figure 3-1). The SCC current operation owns free and clear 860 acres of land comprised of some forested and shallow peat as well as 110 acres of merchantable peat, which has been extracted in part and partially developed as cranberry beds under previous EIAs and related permitting approvals. Currently, the farm has in production 92 acres of cranberries and related infrastructure including water reservoirs, holding ponds and drainage canals developed on the property.

The current operations were developed in two phases as follows:

- Phase 1 was originally applied for under EIA #4561-3-642 in August 1998 (Richard, 1998). The scope was to develop approximately 85 acres of cranberry beds, two water storage reservoirs (Reservoir 1 to the south and Reservoir 2 to the north) to accommodate bed flooding for harvest and overwinter protection purposes, and a sedimentation pond in the area for the new Phase 3 (proposed in this current EIA registration). The combined reservoir water storage capacity identified in the Phase 1 registration was 1,075,000 $m^3$ over an area of approximately 133 acres with an average depth of 2 m. The development approved under the EIA for the Phase 1 operation grew slowly over time; only Reservoir 1 with an approximate area of 51 acres was constructed, with the additional 65 acres (+/-) for Reservoir 2 to be constructed when needed. Reservoir 2 to date has not been constructed.
- Phase 2 of the development was registered for approval under EIA #4561-3-998 (SCC, 2004) to develop peat followed by an additional 72 acres of cranberry beds in two areas. To date, an estimated 50 % of the peat volume within Phase 2 has been harvested, and no development of cranberry beds has been completed under the approval. However, the Proponent intends to repurpose Phase 2 for cranberry beds once the peat resource has been extracted.

The original vision of SCC in Phase 1 was to operate a cranberry farm. However, after realizing the high cost of removing excess peat to build a level cranberry bed, SCC determined that the

overburden peat material had monetary value and subsequently diversified their operations to include peat extraction on their property prior to developing the cranberry beds. This was reflected in the Phase 2 EIA registration document.

The development model is currently to remove excess peat by way of peat harvesters (versus excavators) and then develop additional cranberry beds in the spent peat fields. There is currently approximately 92-acres of cranberry production related to Phase 1 of the operation and 110 acres of peat extraction beds; it is estimated that approximately 50% of the Phase 2 peat beds have been extracted.

As of 2020, SCC has been harvesting peat for approximately 11 years and believes that their peat deposit will last for several more years, with cranberry farming on-going and continuing to develop. One of the advantages of the operation is that watering needs for cranberry harvesting is provided by the peat farming drainage water versus the need to develop alternate water source supply such as groundwater wells. Socio-economic benefits of the peat farming / cranberry development economic model include maintaining full-time employment of its workforce seasonally for about six months of the year. In this respect the two operations (cranberries and peat) complement each other.

Phase 3 of the development will involve SCC receiving approximately 50 acres of Crown Land (consisting of a portion of PID 25356114 and a portion of PID 25147844; herein referred to as Phase 3) from DNR as part of a land exchange. SCC will exchange peat on their private land parcel (PID 25126368) with DNR for the peat on the subject Crown land based on the DNR requirement for “no net loss of peat reserves”. Note that the land exchange is based on the volume of peat. As such, SCC will be transferring a greater area of land (26.1 hectares = 60 acres) to the province in exchange for 20 hectares (50 acres) of Crown land as part of the proposed “land swap”. The 50 acres of Crown land, identified herein as Phase 3, will adjoin and supplement the existing Phase 1 and Phase 2 developments, with the three phases combined into a “closed circuit” operation regarding water use from their combined reservoir capacity. Of the Phase 3, 50-acre land parcel, SCC estimates it will only be able to harvest about 28 acres of peat due to physical constraints.

An overview of the SCC development phases, site setting, and watershed area boundaries is provided in Figure 4-1.

**Legend**

- Exchange Parcel (PID 25126368)
- Phase 3 Development - Area of Water Diversion (50 ac)

**Rivière Saint-Charles / Mill Creek Watersheds**

**Watershed, Area (acres)**

- Mill Creek Watershed, 7,762 ac
- Rivière Saint-Charles Watershed, 36,699 ac
- Phase 1 Development Area (345 ac)
- Phase 2 Development Area (180 ac)
- Phase 3 Development Area (52 ac)

Rivière Saint-Charles Watershed

Mill Creek Watershed

1:70,000

0 500 1,000 2,000 3,000 Meters

2601000 2602000 2603000 2604000 2605000 2606000 2607000 2608000 2609000 2610000 2611000 2612000 2613000 2614000 2615000 2616000 2617000 2618000 2619000 2620000 2621000 2622000 2623000 2624000 2625000 2626000 2627000 2628000 2629000

7529000 7528000 7527000 7526000 7525000 7524000 7523000 7522000 7521000 7520000 7519000 7518000 7517000 7516000 7515000 7514000 7513000 7512000

### 4.1.2 Previous EIA Approvals

SCC's existing Phase 1 and Phase 2 operations, respectively, were registered and received approval under the Province of New Brunswick Environmental Impact Assessment Regulation. The previous registration documents are as follows:

- NBDELG EIA File No. 4561-3-642; EIA registration prepared by Benoit Richard Cranberry Consultation Services (Richard, 1998); and,
- NBDELG EIA File No. 4561-3-998; EIA registration prepared by SCC (SCC, 2004).

Phase 1 included cranberry operations only; Phase 2 included both peat extraction and cranberry farming operations.

Following EIA approvals of the respective phases, the peat extraction and cranberry developments have proceeded in accordance to applicable regulatory permitting requirements and regulations. To date, it is understood that two Certificate of Approval to Operate have been issued, and it is planned to renew the permit in 2021.

### 4.1.3 Site Considerations

In the early 2000's SCC purchased a 26.1-hectare (65 acre) parcel of land (PID 25126368) on the east side of the St-Charles Bog, which was privately secured for the purpose of expanding their cranberry operation. This property is located approximately 10 km east of the existing SCC operation and is comprised of some reclaimed pastureland and includes approximately 60 acres of harvestable peat. The private land parcel is located some distance from the current SCC operation, which was not optimal for the expansion of the facility. Therefore, SCC proposed the land exchange in an effort to acquire land immediately adjacent to Phase 1 and Phase 2 of the existing operations. The portion of Crown land that will be acquired by SCC has a smaller surface area but has an equal amount of peat as the privately held land proposed in the exchange. The goal of the exchange is to have a "no net loss of peat resource" to the province.

## 4.2 Site Construction, Operations and Maintenance

The Phase 3 development is similar to the Phase 1 and Phase 2 developments initiated circa 1998; details of site construction, operations and maintenance for development can be found in the earlier EIA submissions (Richard, 1998; SCC, 2004). Being located on land directly adjoining the existing Phase 1 and Phase 2 operations, Phase 3 will be integrated directly into the existing operations to form an integrated development footprint. This will allow for site design and

operation to minimize potential for impacts on the environment through continued operation as a “closed loop” system. Advantages of this system include presence of existing and proven infrastructure to minimize potential impacts from erosion and suspended sediment during construction and operation, optimizes use of drainage water from the peat extraction operations to supplement the existing and planned cranberry harvesting water needs, and minimizes potential for impacts on the environment outside the development footprint by containing and recycling water during active operations.

### 4.2.1 Site Construction

Phase 3 will be constructed in accordance to the drawings and plans included in this EIA registration (Appendix B) and in general accordance to construction and development sequencing completed for Phase 1 and Phase 2. It is noted that the bed layout as indicated on the attached drawings at this time is representative of planned development; for example, depending on the operators’ judgement and progress of bed development, the beds may be oriented in an alternate direction should field and operational conditions warrant.

Construction activities related to the combined peat extraction and cranberry bed development include land clearing, grubbing, levelling, draining, ditching, dike forming, sanding and construction of water retention structures. Equipment necessary for these operations will include excavators, bulldozers and/or trucks. Further details are provided in the Phase 1 EIA registration document (Richard, 1998). With regards to grubbing management, the main source of grubbing material is brush and remnants from trees and this material will be used on site generally as road base material.

Specific to Phase 3, site construction will involve establishing a harvested peat product laydown area in the southern portion of the Development Area. A drainage ditch will be constructed downgradient of the Development Area so that as the peat is developed to the north, the peat beds can be sloped to drain so that water flows south. The water will then be captured in the ditch and flow west to a sedimentation pond in the southern portion of Phase 2 and then to the existing reservoir in the southern portion of Phase 1.

Along the western portion of this drainage course and before reaching the existing Reservoir 1, the sedimentation ponds (developed for the Phase 2 portion; 2004 EIA registration) will be enhanced to allow for suspended solids to be removed and provide some buffer for stormwater overflows. The sedimentation ponds will be excavated in an area where there is clay under about 1.5 m to 2 m of sand. It is planned that this sand will be stockpiled and subsequently used either

in the existing cranberry operation as bedding material or used once the new cranberry bed construction and operations commence in Phase 2 or 3. Sedimentation pond volume is expected to increase as development of Phase 3 occurs, with the full operation volume of 17,000 $m^3$ as identified on the drawings in Appendix B.

Regarding potential for stormwater to impact operations (and related potential for environmental impacts off-site), personal communication with SCC indicates that in general, there is only discharge from the combined development area during spring runoff (there is no active farming operations generally occurring at this time). SCC also commented that based on their experience, stormwater can be managed exclusively on-site (for example during September 2019 when Hurricane Dorian made landfall in Atlantic Canada, all stormwater was able to be collected and stored on-site in the existing reservoir, ditching and canal system).

Once the Phase 3 general site area is constructed to accommodate overall drainage objectives, the peat harvesting will proceed in an incremental manner, following which construction of cranberry beds will be completed within the footprint of the extracted peat areas. Pending water requirements, it is anticipated that the laydown area in the southern portion of Phase 3 will ultimately be developed as additional reservoir area, with this new reservoir incorporated into the combined "closed circuit" operation.

### 4.2.2 Operations

Site operations will initially consist of peat harvesting followed by incremental development of the Phase 3 cranberry beds as the peat harvesting progresses over time. As noted above, the existing system (Phase 1 and Phase 2) of settling ponds and canals will be part of the peat harvesting and cranberry operations, with drainage and reservoir development in the new Phase 3 integrated into the overall development as operational requirements warrant. An overview of peat extraction and cranberry operations is presented in the following sections.

#### 4.2.2.1 Peat Extraction

The initial operation will be peat extraction. Based on the current understanding of peat quality and distribution, it is anticipated that approximately 28 acres of peat extraction will be developed within the approximate 50-acre footprint of Phase 3. Most of this peat will be extracted from the eastern portion of the property with the possibility of some additional peat extraction in the western "finger" portion of the land exchange area and encroaching into previously undeveloped areas of Phase 2.

The peat extraction operation consists of approximately 5 to 6 cm of peat being harvested each year via vacuum extraction (SCC's best year was approximately 10 cm) from a peat bed of approximately 24 m in width and variable length. The bed is crowned and sloped to allow drainage to perimeter drainage ditching that drains water from the peat areas to the system of collection canals and reservoirs. The crowning of the peat beds facilitates the extraction of the peat by allowing it to naturally dry.

Peat thickness in the portion of Crown Land that is the subject of the current EIA is understood to have 1.5 to 2.5 m of peat with an average thickness of about 2 m. At a removal rate of 6 cm to 10 cm of peat per year, it would take about approximately 15 to upwards of 30 years to extract the viable peat resource based on current market conditions.

The existing geodetic top of peat elevation contour is understood to be 25 m with the highest point located towards the middle of the property. The anticipated bottom elevation of peat extraction is expected to be approximately 22 m due to anticipated peat quality and site infrastructure and grading.

It is understood that the peat generally has not been cored beyond 1.5 to 3 m depth; therefore, the quality of peat below this depth is uncertain and may degrade with depth. In general, longer fibres are preferred in the peat. The highest quality peat is "Professional Peat" grade and the lowest quality peat is "Retail Peat" grade. The final depth of peat extraction will be a function of peat quality and the need to maintain sufficient elevation within the peat development area so that the peat can drain via gravity with drainage flowing westward. The lower elevation is expected to be at the southwest corner of Phase 3 so that water drained from the Phase 3 beds can flow along ditching to sedimentation pond(s) and then into Reservoir 1 (see Appendix B).

The exact timing and progress of development will be dictated in large part by market conditions and economics of the operation. Currently, the anticipated time frame for property development under this current EIA application is 15 to 20 plus years after development commences. It is expected that there may be appreciable time (e.g. 15 to 20 years) before the peat is extracted sufficiently to warrant cranberry bed development and harvesting on the new land parcel (Phase 3). Under previous approvals, peat extraction operations will continue on portions of Phase 2 as Phase 3 development proceeds.

The Canadian Food Inspection Agency (CFIA) inspects and tests the peat bog every year since it is an exported product (e.g. look for nematodes, etc.). There is complete traceability in peat exports as sellers can be held liable for selling poor quality peat.

SCC's Approval to Operate will not allow them to stockpile peat on-site beyond the harvesting season as there can be environmental issues with stockpiling peat (e.g. wind erosion, etc.) and the peat quality can degrade with time when exposed to the elements. Historically, SCC has complied with all requirements of CFIA and their existing Approval to Operate.

#### 4.2.2.2 Cranberry Operations

As noted above, peat harvesting will proceed in an incremental and progressive manner. Once the peat is harvested to its maximum economic recoverable depth and sufficient area and economic conditions permit, cranberry beds will be established within the footprint of the peat extraction area.

The following outlines the general operation (and some maintenance activities) related to the cranberry bed development:

- The cranberry beds are shaped and maintained to allow the beds to drain so that the water elevation is kept at least 60 cm below the base of cranberry beds.
- 75 mm of sand is typically added to the bottom of the beds for plant stability and to serve as ballast to keep underlying peat from rising when plants are flooded for frost protection. Sand will be sourced from on-site (e.g. stockpiled from sedimentation pond development area).
- The beds will be flooded in October for harvesting and in December to form a protective ice layer for frost protection.
- A Gates Harrow (Gates manufacturing company) will be used to coral the cranberries to one end of the field where they are pumped into a truck. During pumping, screens take out excess/unusable vegetation. The water is recirculated back to the beds during harvesting operations. Approximately 500 kg of fruit per minute can be loaded during harvest.
- The proposed cranberry beds will be approximately 36 m wide (SCC uses this width based on their harvesting equipment).
- Berms situated between beds will be approximately 12 m wide on top; this will allow for equipment to access the fields.
- As a general rule, the side slopes of the berms will be constructed "as steep as possible" (1:1); this allows the bed footprint to be optimized and better use of the cranberry vines.

The cranberry production / growing period is generally within the window May 1 to October 31, following which the beds are flooded to harvest the cranberries and provide frost protection over the winter period.

### 4.2.3 Maintenance

During the peat extraction phase of work, maintenance activities are predominantly limited to maintenance of access, service roads, and berms, cleaning of erosion control structures, ponds, canals and reservoirs (i.e. to remove accumulated suspended solids).

During the cranberry operation phase, maintenance includes the activities above plus the need to irrigate / flood the beds for winter protection, application of fertilizers, and application of pesticides and herbicides in accordance to the Environmental Protection Plan and regulatory approved measures. A key consideration relevant to minimizing potential environmental impacts include that cranberries grown in peat have lesser fertilizer requirements compared to those grown in mineral soil (SCC, personal communication).

Regarding the use of herbicides and pesticides in cranberry operations, only regulatory approved (e.g. Government of Canada) substances are used, and during application, unlike traditional agriculture, the substances are applied only to the growing area with no off-site discharge of water. This allows the surface waters to be retained on-site during active operations and facilitate the breakdown of chemical residues to be enhanced through the sun's ultraviolet rays while the substances are contained on-site in the beds or water reservoirs.

## 4.3 Water Source/ Water Balance

### 4.3.1 Existing Drainage and Modifications

An overview of the development footprint and related watersheds is provided in Figure 4-2. Most of the property encompassed within the footprint of the Phase 3 expansion is understood to drain to Mill Creek, which is a small tributary to the Richibucto River watershed. Under the proposed design, a drainage ditch/canal will be constructed to redirect surface flow within the footprint of Phase 3 to drain west into sedimentation ponds and then to the existing Reservoir 1. Reservoir 1 drains (generally only during the spring runoff period) into the St. Charles River watershed, which is also a sub-watershed of the larger Richibucto River watershed. Under these conditions there will technically be a physical transfer of water from one sub-watershed (Mill Creek) to another sub-watershed (Saint Charles River). However, minimal if any net environmental impact is expected for the following reasons:

- There will be no net water loss from the Richibucto River watershed since both sub-watersheds are part of the larger Richibucto system;
- The Phase 3 property is only 50 acres in size. In comparison, the drainage area of the Mill Creek watershed is estimated to be on the order of 7,700 acres (26.1 $km^2$), and the Saint Charles watershed is estimated to be on the order of 36,700 acres (190 $km^2$). Therefore, the entire Phase 3 property at 50 acres (0.2 $km^2$) would represent only 0.8 % of the Mill Creek watershed area, and only 0.1 % of the Saint Charles River watershed area.

Regarding timing and rate of water discharge, it has been SCC's experience based on Phase 1 and Phase 2 that the only time water will leave the site is during spring runoff. At all other times there is sufficient capacity to capture and hold water on-site until it is needed for cranberry harvest operations. As noted above, it is SCC's experience that even large stormwater events (e.g. Hurricane Dorian, September 2019) can be managed by capturing and storing water on-site until it is used for cranberry harvest and recycled within the closed loop system.

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**Legend**

**Drainage Modifications - Phase 3**

- Existing Ditch
- Proposed Ditch
- 30m Offset from Existing Land Boundary, (6.38 ac)
- 30m Offset from Subject Crown Land Boundary, (33.63 ac)
- Existing Partial Property Parcel, (3.71 ac)
- Subject Crown Land Parcel, (17.28 ac)
- Laydown Area / Future Reservoir (6.5 ac)
- Phase 3 Development - Area of Water Diversion (52.5 ac)

**Rivière Saint-Charles / Mill Creek Watersheds**

**Watershed, Area (acres)**

- Mill Creek Watershed, 7,762 ac
- Rivière Saint-Charles Watershed, 36,699 ac

Rivière Saint-Charles Watershed

Mill Creek Watershed

N

1:2,500

0 50 100 200 300 Meters

exp.

2619000

### 4.3.2 Groundwater Resources and Use

There will be no groundwater source development related to this project. Currently there is one well located on SCC property (approximate location indicated on accompanying figures). The well is reported to have been drilled in 1999 to a depth of approximately 40 m. The well is used in the small office on-site for toilets and washing hands. As discussed below, there will be no groundwater used in site operations other than to service this small domestic demand. Further, as noted below in discussion of water balance, it is understood that the St. Charles peat bog is ombrotrophic and in this respect it is likely that there is minimal connection to the larger scale groundwater recharge and flow system.

The nearest residential wells outside of the SCC property are anticipated to be those along Saint Charles Station Road to the south of the site. These wells are in the range 1 to 1.5 kms from the Phase 3 development. It is not anticipated that the Phase 3 development will have any impact to the quantity or quality of water in these wells.

### 4.3.3 Water Source

For the peat extraction operation, there is no off-site water source or groundwater supply well network required. Essentially the beds are developed and sloped to drain so that the upper portion of peat dries and allows for an incremental layer (generally in the range of 5 cm, 10 cm maximum) to be harvested (vacuumed off) each year. Prior to draining, the peat is approximately 80% water by volume.

The proposed cranberry operation will also not require any on or off-site groundwater supply source. The beds operate as a "closed loop" water system during the collection season with water drained from the peat bog area used to supply operational water for cranberry operations as follows:

- The gravity drainage of peat water from the peat bog area will drain and be collected in a ditch in the south portion of Phase 3;
- The collection ditch will flow from east to west and include sedimentation ponds which in turn will drain to the existing Reservoir 1 toward the west.
- Water from this closed loop system will be used as follows:
  - If required in the near term it will supplement the existing Phase 1 and future Phase 2 cranberry bed flood operations to permit harvesting in the fall, and over winter protection of the bed areas;

- Longer-term once cranberry bed development proceeds in the Phase 3 area, in the proposed laydown area which will service peat extraction operations in the nearer term, construct a reservoir in the south portion and use this water in the combined operations area (mainly expected to be used for the future Phase 3 cranberry bed flooding).

The existing Reservoir 1 is equipped with a flume/dam; Reservoir 1 overflows when full (only in the spring) via overland flow for dispersal over peat (natural runoff). It is understood that no water quality monitoring of water leaving the site is generally required since monitoring is only required during the operational season and water only leaves the site outside of the operational period.

### 4.3.4 Water Balance

An evaluation of water balance for the Phase 1 development was completed by McMahon (1998) and provided as Appendix 5 of the 1998 EIA registration (EIA File No. 4561-3-642) prepared by Benoit Richard Cranberry Consultation Services. The rationale and assumptions provided in that document are considered appropriate for a general assessment of the water balance for the current development and are summarized as follows:

- The Saint Charles Bog is classified as ombrotrophic meaning the bog receives all water and nutrients from precipitation, rather than from streams or springs. Such environments are generally hydrologically isolated from the surrounding landscape;
- The hydraulic conductivity of the peat is low;
- Precipitation either evapotranspires, replenishes the shallow groundwater system in the bog, or runs off as surface water or near surface runoff;
- For a mean annual precipitation of 1,100 mm an estimated 43% is evapotranspiration. With minimal infiltration due to the bog's low hydraulic conductivity, the remaining 67% would be essentially surface or near surface runoff. Under these assumptions, surface runoff was estimated to be 700 mm.

Under the above assumptions, the 50-acre footprint (202,000 $m^2$ area @ 4047 $m^2$/acre) of the Phase 3 property would have on the order of 141,400 $m^3$ runoff per year. According to the operator, a general rule of thumb for cranberry farm water demand is 2.5 acre-ft of water per year (1 acre-ft = 1,233 $m^3$), although it is SCC's experience that use of 4.0 acre-ft is a more realistic assumption for their operation given the uneven nature of some of their beds. SCC estimates that approximately 28 acres of the 50-acre parcel will ultimately be developed as cranberry beds. At

2.5 acre-ft water per year, 28 acres would require 70 acre-ft of water. At 1 acre-ft = 1,233 $m^3$, the required amount of water to service the cranberry beds at full build out at 2.5 acre-ft requirement would be 86,310 $m^3$ and at 4.0 acre-ft this would increase to 138,100 $m^3$. However, the system is a closed loop. The existing facility has never required an external water source to operate and it is anticipated that that future water demand will be supplied completely by the on-site operations.

According to the above assumptions and estimates, the Phase 3 cranberry beds at full build out would therefore use approximately 61% of the runoff from the Phase 3 development footprint assuming 2.5 acre-ft per acre, and 98% assuming 4.0 acre-ft per acre. Any surplus water will ultimately flow to Reservoir 1 and if not needed to service Phase 1 and Phase 2 would leave Reservoir 1 and flow to the Saint-Charles River. Because there will be incremental development of Phase 3 cranberry bed area over the years it could be expected that the difference in water balance demand (61 – 98 %) would develop over time. Therefore, it is reasonable to expect there will be adequate time to monitor bed development and adjust operations as required to manage the available water balance.

As noted above, the Phase 3 development water runoff and operational requirement will be integrated with the Phase 1 and Phase 2 water reservoir system and form a closed loop system to service all three phases of development. This closed system (currently in place for Phase 1 and Phase 2) operates by recycling water. Although the planned reservoir volume for the Phase 1 Reservoir 1 plus Reservoir 2 is understood to have an estimated storage volume of 1,075,000 $m^3$, it is understood to date that only Reservoir 1 has been constructed and is operational. Therefore, going forward as cranberry beds are established within the footprints of the extracted peat areas in Phase 2 and the new Phase 3 it is expected that additional reservoir capacity will be developed as operational conditions and requirements warrant.

## 4.4 Documents Related to the Undertaking

### 4.4.1 Initial Registration (Phase 1) Document Submitted by the Proponent

Canneberges St.-Charles Cranberries Inc. originally submitted an Environmental Impact Assessment registration document for a cranberry development on peat substrate. The initial registration was titled as follows:

- *"Canneberges St.-Charles Cranberries, an environmental assessment and undertaking presented by: Britton Consultants",* dated August 1998.

The title page indicates that the report was prepared by Benoit Richard Cranberry Consultation Services, RR#1, Site 6, Box 1, Richibucto Village, New Brunswick, E0A 2N0. The report was subsequently reviewed by the TRC. Upon successfully responding to the questions posed by the TRC, the Certificate of Determination allowing the project to proceed was issued by the Minister of the Environment on October 29, 1998 (EIA File No. 4561-3-642). There were eight conditions of approval issued with the determination.

#### 4.4.2 Expansion of the Existing Facility – 2004 (Phase 2)

Canneberges St.-Charles Cranberries Inc. proposed to construct its first expansion to the cranberry farm in 2004. The expansion also triggered an EIA registration. The registration document for the expansion is as follows:

- *"Enregistrement pour étude d'impact sure l'environnement Expansion de la cannebergeraie, Canneberges St Charles, St-Charles, N.-B."*

There is no date on the report; however, based on a review of records, it is anticipated that it was submitted to NBDELG in early 2004 (likely March). The Certificate of Determination allowing the project to proceed was issued by the Minister of the Environment on May 18, 2004 (EIA File No. 4561-3-998). There were 16 conditions of approval issued with the determination.

## 5.0 DESCRIPTION OF EXISTING ENVIRONMENT

### 5.1 Physical and Natural Features

#### 5.1.1 Watercourses and Wetlands

According to GeoNB mapping, the Project Area is wholly situated within a provincially regulated wetland (Saint Charles Bog, ombrotrophic bog type; SCC, 1998). The nearest natural surface water feature is a tributary to Geddes Lake, which is located approximately 400 metres southwest of the Site. Geddes Lake is situated approximately 500 metres southwest of the Site, at its nearest point. Geddes Lake appears to be a man-made feature for retaining water. The outlet of the Lake flows predominantly north to south towards a tributary to Mills Creek. The project footprint and surface water features, drainage and proposed modifications to drainage have been discussed above and are shown on related figures accompanying this EIA registration document located in Appendix B.

### 5.1.2 Coastal Features

The Development Area is not located in proximity to the coastline or a tidal watercourse. There are no beaches, dunes, rock platforms, coastal marshes or diked lands on the Site or within 30 metres of the Development Area.

### 5.1.3 Geology and Hydrogeology

The geology and hydrogeology were provided in the original EIA registration (SCC, 1998) completed by McMahon. A summary of the information provided in the original EIA registration document is presented in Sections 5.1.3.1 and 5.1.3.2.

#### 5.1.3.1 General Geology

The underlying bedrock consists of Pennsylvanian aged sedimentary rocks, primarily sandstones, conglomerates, and mudstones. The unconsolidated surficial sediments overlying the bedrock are composed of glaciofluvial sands and the dominating sphagnum peat.

#### 5.1.3.2 Hydrogeology

The Saint Charles Bog is classified as ombrotrophic; therefore, there is little to no recharge of the groundwater in the area of the bog other than the shallow groundwater in the bog itself. The deeper and regional groundwater flow system would discharge to the various surface water features in the area: locally Mill Creek, and more regionally the Richibucto River.

### 5.1.4 Groundwater

Groundwater use in the immediate area of the Development Area consists of one well within the footprint of the SCC operations. This well provides domestic water for office use; there is no groundwater used as part of cranberry/peat operations (e.g. bed flooding, etc.). There are sparsely distributed private wells that serve residences in the area with the closest wells understood to be on the order of 1 to 1.5 kms from the Site along Saint Charles Station Road. It is also understood that the peat operation by others to the east of the Site would also have a well to service domestic needs.

Larger scale groundwater use in the area would include the communal wells used by Elsipogtog (over the years since circa 1990s approximately four production wells have been established). These wells are located on the order of 7m to the southwest of the Site. The Town of Richibucto also operates municipal production wells in the area; these wells are understood to be on the order of 7m east/northeast of the SCC operations. Given the significant distance from communal and municipal groundwater wells and the fact that SCC relies exclusively on surface water to meet

its requirements it is reasonable to conclude that the Phase 3 expansion will have no impact on the potable groundwater resources in the area.

### 5.1.5 Protected Wellfields/Watersheds

According to NBDELG records, the Site is not located within a watershed or wellfield protected area.

### 5.1.6 Ambient Air Quality

A summary of air quality for the Richibucto River Watershed provided by Turcotte-Lanteigne and Ferguson (2008) was reviewed as part of this assessment. In general, there is limited air quality monitoring within the watershed; the summary noted that acid sulphate deposition in 2003 was elevated for one monitoring station in the watershed. More recent data suggested improvements in acid sulphate deposition. It was also noted there were no large-scale emitters in the region.

Locally, the most significant air quality impact from the SCC operation would expected to be dust generation related to fugitive dust emissions from roadways and soil or peat stockpiles. These can be managed by maintaining adequate buffers and establishing best management practices for the management and handling of peat and other overburden soils. Regarding peat stockpiles, the Proponent is required to remove this at the cessation of seasonal harvesting, so the potential adverse effects associated with stockpiling are minimized.

The implementation of best management practices will eliminate/reduce any impacts to ambient air quality. Furthermore, SCC and a second peat facility located east of the Site both currently operate peat harvesting facilities and there have been no complaints with respect to ambient air quality.

### 5.1.7 Existing Vegetation

Derrick Mitchell, R.F.P. a senior biologist with Boreal Environmental was retained by Hive to conduct a vegetation and rare flora survey within the project footprint. Prior to conducting the field reconnaissance, desktop data provided by the Atlantic Canada Conservation Data Centre (ACCDC) was reviewed to preliminarily determine rare plants that are known or suspected to be present within a 5-kilometre radius of the project footprint. Particular to the rare plant survey, the database search provided the following information:

- Reported observations of rare and endangered flora; and
- Expert opinion maps identifying species that have not been reported but are expected to be present based upon estimates of habitat and wildlife distribution.

Upon completion of a review of the ACCDC data, a pedestrian survey was completed by Boreal Environmental on September 6, 2019. The ACCDC data are presented in Appendix C.

The Site reconnaissance focused on unique habitats (i.e., rock outcrops, watercourses and wetlands) in a random meandering fashion. In general, these habitats have an elevated potential for the occurrence of rare plant species. The locations of all encountered rare flora (if present) were recorded using a hand-held GPS unit. A complete inventory of all plant species encountered while conducting the field reconnaissance program was completed and documented in the field.

#### 5.1.7.1 Summary of Findings of the Vegetation and Rare Flora Survey

The field survey identified the presence of 28 plant species within the project footprint. All the species were common to the region and specifically to ombrotrophic bogs. A list of the species identified during the field reconnaissance is presented in Table 2.

## Table 2 Summary of Plant Species Identified within the Project Footprint

| Scientific Name | Common Name | S-Rank | NB DERD General Status |
|---|---|---|---|
| Andromeda polifolia | Bog Rosemary | S5 | Secure |
| Betula populifolia | Gray Birch | S5 | Secure |
| Chamaedaphne calyculata | Leatherleaf | S5 | Secure |
| Drosera intermedia | Spoon-leaved Sundew | S5 | Secure |
| Drosera rotundifolia | Round-leaved Sundew | S5 | Secure |
| Empetrum nigrum | Black Crowberry | S5 | Secure |
| Eriocaulon aquaticum | White Buttons | S5 | Secure |
| Eriophorum angustifolium | Narrow-leaved cottongrass | S5 | Secure |
| Eriophorum virginicum | Tawny cottongrass | S5 | Secure |
| Gaylussacia baccata | Black Huckleberry | S5 | Secure |
| Kalmia angustifolia | Sheep Laurel | S5 | Secure |
| Kalmia polifolia | Sheep Laurel | S5 | Secure |
| Larix laricina | Tamarack | S5 | Secure |
| Nemopanthus mucronatus | Mountain Holly | S5 | Secure |
| Nuphar lutea ssp. variegata | Variegated Pond-lily | S5 | Secure |
| Oclemena acuminata | Whorled Wood Aster | S5 | Secure |
| Photinia melanocarpa | Black Chokeberry | S5 | Secure |
| Platanthera dilatata | White Bog Orchid | S5 | Secure |
| Pinus banksiana | Jack Pine | S5 | Secure |
| Pinus strobus | Eastern White Pine | S5 | Secure |
| Pteridium aquilinum | Bracken Fern | S5 | Secure |
| Rhynchospora alba | White beakrush | S5 | Secure |
| Rhododendron canadense | Rhodora | S5 | Secure |
| Sarracenia purpurea | Northern Pitch plant | S5 | Secure |
| Trichophorum alpinum | Alpine Clubrush | S5 | Secure |
| Vaccinium myrtilloides | Velvet-leaved Blueberry | S5 | Secure |
| Vaccinium angustifolium | Lowbush Blueberry | S5 | Secure |
| Vaccinium oxycoccos | Small cranberry | S5 | Secure |

Based on the findings of the rare and vascular plant survey completed in September of 2019, 28 species are present in the Development Area. All the identified species have a S5 ranking of "Secure"; no rare, threatened or endangered plants were observed.

NBDELG has indicated that the Southern Twayblade has previously been identified in the area. The Southern Twayblade is a rare bog orchid that only blooms for a few weeks, typically in June. As part of the approval, a second rare plant survey will be conducted in June to determine whether other rare plants that typically flower in June, including the Southern Twayblade, are present within the project footprint. If rare plants are identified in the area, a plan will be prepared discussing the impact the project may have on any rare plants and propose strategies to mitigate impacts to rare flora species.

### 5.1.8 Fish Habitat

There are no open surface water bodies on-site. The system on-site is a closed loop system. There is no fish habitat on-site and the proposed project is not anticipated to impact fish or fish habitat.

### 5.1.9 Migratory Birds

Derrick Mitchell, R.F.P. a senior biologist with Boreal Environmental was retained by Hive to conduct a bird habitat assessment within the project footprint. Consideration of birds in the project area focused on habitat associated with SOCC. The purpose of the habitat assessment was to determine the quantity and quality of the bird habitat that exists within the Development Area.

Prior to conducting the field reconnaissance, desktop data provided by ACCDC was reviewed to preliminarily determine birds that are known or suspected to be present within a 5-kilometre radius of the project footprint. Particular to the bird habitat survey, the database search provided the following information:

- Reported observations of rare and endangered birds; and
- Expert Opinion Maps identifying species that have not been reported but are expected to be present based upon estimates of habitat and wildlife distribution.

In addition to ACCDC data, forestry inventory and aerial photography provided by the New Brunswick Department of Energy and Natural Resources (ERD) was also reviewed prior to the field reconnaissance.

#### 5.1.9.1 Bird Habitat Description

The Development Area is approximately 20.2-ha in area and consists of an ombrotrophic bog dominated by ericaceous shrubs including; Chameadaphne caliculata (Leatherleaf), Rhododendron canadense (Rhodora) and several Vaccinium species (blueberry/cranberry). Trees are sparse and where present, tend to be stunted due to the anoxic conditions associated with the bog. There are several small isolated ponds located on the periphery of the development footprint with depths ranging from 0.5 to 2 m.

#### 5.1.9.2 Bird Species

Several species of concern were identified by ACCDC as having been reported within a 5 km radius of the project location. Potential habitat for some of the cross-referenced species exists within the project area. Bird SOCC reported by ACCDC with potential habitat occurring in the area of study are presented in Table 3. Based on the initial findings of the bird habitat assessment, a second bird habitat assessment will be carried out in June to further identify birds that may be present within the project footprint.

**Table 3 – Bird Species of Conservation Concern reported by the ACCDC identified within 5 km of the Study Area**

| Common Name | Scientific Name | Breeding Habitat | Probability of Occurrence | SARA (Schedule 1) NB ESA | S-Rank | General Status |
|---|---|---|---|---|---|---|
| Bank swallow | *Riparia riparia* | Riverbanks, aggregate pits, road cuts, lake and ocean bluffs | Low | NA | S2S3B, S2S3M | Sensitive |
| Barn swallow | *Hirundo rustica* | Artificial structures, bridges, barns, other outbuildings | Low | Threatened | S2B, S2M | Sensitive |
| Bald Eagle | *Haliaeetus leucocephalus* | Tall trees adjacent to water bodies | Low | Endangered | S4B | At Risk |
| Brown-headed Cowbird | *Molothrus ater* | Grasslands with low and scattered trees, forest edges, shrub thickets, fields, pastures, orchards, and residential areas | Low | NA | S3B, S3M | Secure |
| Greater yellowlegs | *Tringa melanoleuca* | Coniferous swamps and bogs | Moderate | NA | S1B, S5M | Secure |
| Killdeer | *Charadrius vociferus* | Various but prefer open habitat. Pastures, plowed fields, large lawns, mudflats, lake shores and coastal estuaries. | Moderate | NA | S3B, S3M | Sensitive |
| Solitary sandpiper | *Tringa solitaria* | Bogs and ponds surrounded by coniferous forest | Moderate | NA | S2B, S5M | Secure |
| Spotted Sandpiper | *Actitis macularius* | Edge of fresh water in a wide variety of settings, including lakes, ponds, rivers, streams, in either open or wooded country. | Moderate | NA | S3S4B, S5M | Secure |

There were eight bird species identified within a 5 km radius of the study area. The bald eagle (*Haliaeetus leucocephalus*) was the only species identified in the ACCDC report as "At Risk". The bald eagle is regionally endangered under the NB ESA but is not considered under Schedule 1 of Species at Risk Act (*SARA)*. Bald eagles are ranked S4B by ACCDC and "At Risk" by ERD.

Bald eagle nests are often conspicuous and located in large mature trees that are used year after year. No bald eagle nests were observed during the site visit on September 6th of 2019. Based on the type of vegetation observed on-site (i.e. little to no mature trees), it is not anticipated that bald eagles nest within the area of study.

The remaining bird species identified within 5 kilometers of the Site have general statuses of "Sensitive" or "Secure" by ERD. One of these species, the barn swallow, was identified under SARA Schedule 1 as "Threatened". However, based on the barn swallow's preferred habitat (artificial structures, bridges, barns, other outbuildings), it is not anticipated that this species is nesting or breeding within the study area.

The remaining species are not listed under the SARA and are either secure or have low potential of nesting/breeding within the Development Area based on each species' preferred habitat. In order to further confirm the presence/absences of birds within the project footprint, a second bird survey will be completed in June of 2020, which will also include evaluation for the presence of the Common nighthawk.

#### 5.1.10 Environmentally Sensitive Areas

There are no environmentally sensitive areas reported within proximity to the Site.

## 5.2 Cultural Features

### 5.2.1 Traditional Use

Hive has recently been in negotiations with First Nations to engage them to complete the Traditional Use survey on behalf of the project, if required, as part of the approval process.

### 5.2.2 Archaeology and Heritage Resources

An Archaeological Impact Assessment (AIA) was conducted in order to meet the provincial requirements outlined in the *Heritage Conservation Act* (2010) and *The Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (hereafter referred to as 'the Guidelines') (Government of New Brunswick 2012). The final report for the AIA is included in Appendix D.

Initially mapping provided by the Archaeological Services Branch (ASB) of the New Brunswick Department of Tourism, Heritage and Culture was reviewed. The mapping indicated the possible presence of archaeological features within the project footprint. Therefore, Chelsea Colwell-Pasch, M.M.A., RPA of Colbr Consulting Inc. completed a pedestrian survey on December 2, 2019 (Colwell-Pasch 2020).

Areas of elevated archaeological potential were identified within the Project Development Area (PDA) and within the 80 m buffer surrounding the possible kettle lake. Upon further consultation with the provincial ASB, it was determined that additional sub-surface testing was not required. In lieu, regular inspections of the peat extraction operation were recommended.

The entire bog is considered high archaeological potential with high organic archaeological resource conservation potential (i.e. leather, bone, wood, etc.). The PDA is consistently peat bog with a small lake (possibly a glacial kettle lake) in the southeast corner and forested wetland to the west. Based on consultation with ASB, it is recommended that the entire PDA, especially the lake buffer (80m), be annually inspected by the Proponent for archaeological material and an Emergency Management Plan (EMP) be implemented in case of accidental finds. It is also recommended that ASB intermittently inspect and/or monitor the activities in the PDA over the lifespan of the peat harvesting activities, with special attention to the 80 m buffer surrounding the kettle lake.

Due to the methodical nature of peat extraction; the entire PDA should be surveyed for surface artifacts annually by the proponent and/or an archaeological monitor/archaeologist to ensure any archaeological resources are identified in a timely manner and stratigraphic control is maintained. This annual inspection is more economical than testing the entire lake buffer within the PDA, which is covered in 2.5-3 m of dense peat. The EMP requested by ASB and recommended by Colbr will be included as part of the overall EIA for the project and outlines what the procedure is when an archaeological resource is found during peat extraction and conservation first aid methods for organic material. No significant cultural resources were encountered on the surface during the AIA, mostly due to the significant vegetation ground cover (near 90-95% coverage). A copy of Colbr Consulting Inc.'s report is presented in Appendix D.

## 6.0 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

The SCC Phase 3 development will be integrated into existing Phase 1 and Phase 2 operations to 1) form an integrated development footprint and 2) allow Phase 3 to access existing infrastructure for construction, operation and maintenance of the facility. The existing

infrastructure will allow for site expansion while minimizing the potential for impacts on the environment through the utilization of a contiguous development footprint, closed loop water system and use of existing and proven operation and maintenance practices. In particular, the drainage water from the peat extraction operations will be used to supplement the existing and planned harvesting water needs, as mentioned above.

However, as the proposed undertaking will involve new construction and development (i.e. new peat extraction and new cranberry bed development) potential environmental impact considerations associated with the expansion project could include the following:

- Effect on the water table on and off-site through drainage ditches. Risk should be minimal as drainage will be part of a closed-circuit operation and will be used to supplement the existing and planned cranberry bed operations and harvesting water needs.

- Possible incremental increase in noise levels on fauna from machinery during construction. No risk should be associated with the noise level on fauna as adjacent undeveloped land can provide relocation to fauna should the noise level become detrimental.

- Minor fuel oil spills from equipment used during construction and operation. There is no bulk storage of fuel on-site. The risk associated with minor fuel spills can be mitigated through the implementation of proper operation and maintenance practices.

- Uncontrolled inundation to the adjacent surface water. Risk should be minimal to none; during operations, surface water remains on-site within a closed-circuit operation and will be used to supplement the existing and planned harvesting water needs. The only time surface water discharges from the Site is during spring melt conditions when the facility is not in operation.

- Surface water and sub-surface water quality impacted by fertilizers, pesticides, fungicides and herbicides. Risk should be minimal as the water used at the facility is contained on-site in a closed loop system. During active operations, breakdown of residual compounds will be enhanced by the sun's ultraviolet rays while the substances are contained on-site or in the water reservoir. In addition, the containing layer underlying the sphagnum bogs prevent chemicals and fertilizers from leaching to underlying soils or groundwater and cranberries grown on peat crops typically require less chemicals than other conventional crops. Furthermore, the facility only uses chemicals that are approved by the government for use at cranberry farms.

- Erosion and sedimentation. Risk should be low as proven infrastructure exists which would minimize potential impacts from erosion and suspended sediment during construction and operation.

- Potential for incremental increase in fugitive dust emissions related to Phase 3 operations and maintenance. Fugitive dust emissions should largely be mitigated by maintaining setbacks, minimizing exposed stockpile areas, and removing harvested peat stockpiles by the end of the season. Furthermore, there have never been any complaints of fugitive dust emissions during operations of Phases 1 and 2, suggesting that proper BMPs are implemented on-site.

- Existing vegetation. Rare flora was not observed on-site in September of 2019. However, the biologist was unable to survey for Southern Twayblade (known to reside in proximity to ombrotrophic bogs). A second rare plant survey was conducted in June of 2020 to assess for Southern Twayblade. The report will be provided to the TRC under separate cover once the results are received. In the event that this plant or any other rare/endangered plants are identified on-site, an EMP will be developed to mitigate impacts to rare/endangered flora.

- Birds and Bird Habitat. ACCDC reported the identification of two bird SOCCs within a 5-km radius of the project location (Bald Eagle and Barn Swallow). Based on a site-specific habitat assessment, preferred habitat for either species is not present within the project footprint. However, a second bird survey, including an assessment for the Common nighthawk, was completed in June of 2020. The results will be provided to the TRC under separate cover. In the event that migratory birds are nesting within the project area, an EMP will be prepared to mitigate risk to birds and their habitat.

- Archaeological and Heritage Resources. Areas of elevated archaeological potential were identified in the project area and within the 80 m buffer surrounding the possible kettle lake northeast of the Site. Potential impacts to archaeological and heritage resources can be mitigated with the establishment of an EMP and regular inspections. This information is outlined by the archaeological consultant in the report located in Appendix D.

Concerning potential socio-economic impacts, it is expected that the project will have a positive effect on the local economy as the completion of the work will permit the continued and future economic growth and viability of the SCC facility.

A summary of the rating scale used to interpret the impact of the project on key VECs is presented in Table 4. A qualitative rating system was employed to assist with the assessment; the evaluation was based on the professional judgement and experience of the project team in addition to our current understanding of the project. A list of key VECs, their rating and brief summary of findings are presented in Table 5.

**Table 4 VEC Assessment Rating Scale**

| Rating | Interpretation |
|---|---|
| 0 | No interaction with this VEC is anticipated; |
| 1 | Interaction occurs, but it would not be expected to result in a significant effect even without mitigation; or the interaction would not be expected to result in a significant environmental effect upon the implementation of suitable mitigation measures (e.g. typical environmental “best practices”, project specific mitigation, etc.); and, |
| 2 | Interaction occurs and may result in an environmental effect of concern, even with mitigation (this would typically require compensation for habitat loss, etc.). |

**Table 5 VEC Summary Table**

| VEC | Rating | Summary of Findings |
|---|---|---|
| Watercourses and Wetlands | 0 | The Site is situated in an ombrotrophic bog; however, it is our understanding that peat/cranberry harvesting activities are permitted at this location. |
| Coastal Features | 0 | There are no coastal features in the project area. |
| Groundwater | 0 | The project is a closed loop system and does not require groundwater resources for site operations (aside from office use). There is no anticipated impact to local groundwater resources. |
| Protected Wellfields/Watersheds | 0 | The project area is not within a watershed or wellfield protected area; the project will not impact water-protected areas. |
| Ambient Air Quality | 1 | The extraction of peat could result in localized fugitive dust emissions. The implementation of BMPs will eliminate/reduce any impacts to ambient air quality. Furthermore, SCC is currently extracting peat from the facility (Phases 1 and 2) and there have been no complaints with respect to ambient air quality in the area. |
| Existing Vegetation | 1 | Twenty-eight species of plants were identified within the development area in September of 2019. All 28 species have a S5 ranking (Secure) and no threatened or endangered plants were observed. A Southern Twayblade survey was conducted in late June 2020. The findings will be provided to the TRC under separate cover once the results are received. |
| Fish Habitat | 0 | There are no open surface water bodies on-site. The system on-site is a closed loop system; the proposed project is not anticipated to negatively impact fish or fish habitat. |
| Birds and Bird Habitat | 1 | ACCDC reported the presence of two SOCCs within a 5 km project footprint (Bald Eagle and Barn Swallow, which are Endangered and Threatened, respectively). The Site does not have preferred habitat for either of these species and it is not anticipated that they would nest on-site. However, a second bird study, including an assessment for the Common nighthawk will be completed in June 2020. In the event that bird/bird nests are observed, appropriate BMPs (i.e. avoiding nests, etc.) can be implemented to reduce/eliminate impact to birds in the area. |
| Environmentally Sensitive Areas | 0 | There are no known environmentally sensitive areas within proximity to the project area. |
| Archaeology and Heritage Resources | 1 | Areas of elevated archaeological potential were identified in the project area and within the 80 m buffer surrounding the possible kettle lake. Potential impacts to archaeological and heritage resources can be mitigated with the establishment of an EMP and regular inspections. |

As indicated in Table 5, mitigation measures will be required for some potential impact categories as detailed in Section 7.0.

## 7.0 SUMMARY OF PROPOSED MITIGATION

A summary of the proposed mitigation efforts associated with the Undertaking are outlined herein. A tiered approach was utilized in developing the project mitigation measures as suggested in the technical guide to EIA in New Brunswick. Under this approach, environmental impact avoidance is implemented whenever possible. If it is not possible or practical to avoid some degree of environmental impact, impact reduction measures are stipulated. Finally, in occasional instances where more extensive impacts are unavoidable and justifiable (e.g. public good, etc.), compensation measures are proposed.

For purposes of this Project, there are no environmental impacts that cannot be mitigated through the establishment of BMPs, EMPs and/or proper management and operational practices.

Due to the nature of the expansion of the proposed project and the existing infrastructure already in place at the SCC facility (Phases 1 and 2), the project-environment interaction requiring mitigation measures will be limited to a few VECs as previously indicated in Table 5 and outlined in Section 6.0. It is expected that there will be no significant residual adverse environmental impacts if the mitigation measures outlined herein are implemented.

### 7.1 Effect on the Water Table on and Off-site through Drainage Ditches

To prevent any negative effects on the water table on and off-site, regular inspection and maintenance of the drainage system should be conducted. Drainage ditches should be constructed so that water flows south and is captured in the drainage ditch, which discharges to the sedimentation pond and ultimately to the existing reservoir. These recommendations are made as a BMP. The overall risk to the project impacting the water table is minimal; the drainage system is a closed-circuit operation and will be used to supplement the existing and planned harvesting water needs.

### 7.2 Fuel Oil Spills from Equipment used during Construction and Operation

To reduce the potential for minor fuel spills during construction and operation activities, all equipment should be in good working condition and free of any known fluid leaks. Also, inspection of the equipment should be completed regularly in order to prevent any equipment failure which could potentially cause a release. Spill kits should be available in proximity to any

fuel-operated machinery in the event of an unexpected release. Any releases of fuel should be reported to NBDELG in accordance with provincial guidelines.

### 7.3 Erosion and Sedimentation

To reduce or eliminate potential for erosion and/or sedimentation, cleaning and maintenance of the erosion control structures, ponds, canals and reservoir should be completed on a regular basis to remove accumulated suspended soils. The risk for erosion/sedimentation is low given the fact that any suspended sediments are within the closed loop circuit, which is diverted to a sediment pond and ultimately discharged into the existing reservoir.

### 7.4 Surface/Sub-surface Water Quality Impacted by Fertilizers, Pesticides, Fungicides and Herbicides

The proposed project and existing Phases 1 and 2 of the facility only use chemical products that are approved by the government for the specific use of developing a cranberry farming operation. In order to mitigate impacts from fertilizers/pesticides/fungicides and/or herbicides, only government-approved products should be used on-site.

Regardless, the risk associated with the use of these approved chemicals is low. Surface water at the Site is predominantly contained in a closed loop circuit. During active operation, the sun's ultraviolet rays will assist with the natural degradation of these compounds. Furthermore, the containing layer underlying the sphagnum bogs prevent chemicals and fertilizers from leaching to groundwater sources and cranberries grown on peat crops require less chemicals than other conventional crops. The use of approved fertilizers/pesticides/fungicides and/or herbicides on-site is not expected to have a significant adverse effect.

### 7.5 Uncontrolled Inundation to Adjacent Surface Water

To prevent uncontrolled inundation to the adjacent surface water, stormwater should be managed, collected and stored on-site in the existing reservoir, ditching and canal system. As mentioned above, risk should be minimal as surface water will essentially remain on-site within a closed-circuit operation and will be used to supplement the existing and planned cranberry harvesting water needs.

### 7.6 Ambient Air Quality

In order to mitigate fugitive dust emissions, the appropriate setbacks for the facility should be maintained, the Proponent should minimize exposed stockpile areas, and the harvested peat stockpiles should be removed at the end of each harvesting season.

## 7.7 Existing Vegetation

Rare/endangered flora have not been identified on-site. A Southern Twayblade survey was conducted in June of 2020. The results of the survey will be provided to the TRC upon receipt. In the event that Southern Twayblade or other rare/endangered flora are identified within the project footprint, an EMP will be prepared to mitigate any risk to rare/endangered flora.

## 7.8 Birds/Bird Habitat

Bird SOCCs were not identified on-site during the 2019 bird survey. A second bird/bird habitat survey was conducted in June of 2020, including an assessment for the Common nighthawk. The results of the survey will be provided to the TRC upon receipt. In the event that migratory birds/nests are identified within the project footprint, an EMP will be prepared to mitigate any risk to rare/endangered bird species.

## 7.9 Archaeology and Heritage Resources

Areas of elevated archaeological potential were identified in the project area and within the 80m buffer surrounding a possible kettle lake. Potential impacts to archaeological and heritage resources can be mitigated with the establishment of an EMP and regular inspections. The proposed mitigation measures are outlined in the archaeologist's report located in Appendix D.

# 8.0 PUBLIC AND FIRST NATIONS INVOLVEMENT

The project originally was initiated in 2017, when the peat harvesting, and cranberry farm realized that they needed to expand their operations in order to be sustainable. NBDNR was subsequently engaged to discuss the potential for land exchange opportunities.

Canneberges St-Charles Cranberries Inc. was committed from the start of the project to consult with First Nations and Aboriginal Organizations that might be impacted by the project. Consultation with First Nations group began in October of 2017 and has been on-going through April of 2020. A summary of all engagement opportunities and communication between the Proponent and First Nations groups is presented in Table 6.

Canneberges St-Charles Cranberries Inc. is committed to continue to address questions, concerns and suggestions raised by First Nations groups throughout the approval process.

**Table 6 – Summary of First Nations Consultation to Date**

| Date | Activity | Purpose of Activity / Topics of Discussion |
|---|---|---|
| Oct. 17, 2017 | Site visit on location with members of Elsipogtog, MTI, NBDERD and NB Aboriginal Affairs | Opportunity to allow Proponent to show the farm in operation during harvest. There were several questions about water use, which was addressed by explaining that the farm operates on a closed loop system. With regards to the peat harvesting area, the conversation focused around the Land Exchange. The Proponent explained that the properties proposed for the land exchange contain the same volume of peat; however, the piece of land the farm is looking to harvest is more economically viable for a peat harvesting operation. Therefore, the exchange will ensure the viability and longevity of the farm. |
| Oct. 31, 2019 | Email Correspondence to Mi'gmawe'l Tplu'taqnn Inc. (MTI) Chiefs and Representatives | An email was sent to MTI to invite them for an on-site meeting to visit the farm and ask any questions or express any concerns that they might have regarding the operations. There was no response to this email. |
| Oct. 31, 2019 | Email correspondence to Elsipogtog First Nation (Kopit Lodge) Chief and Representatives. | An email was sent to Kopit Lodge to invite them for an on-site meeting to visit the farm and ask any questions or express any concerns that they might have regarding the operations. Kopit Lodge requested a meeting which was held on November 15, 2019. |
| Nov. 15, 2019 | Meeting at Kopit Lodge to discuss the project. | The Proponent provided an overview of the project including commitment to work with First Nations groups. In addition, the water usage (closed loop system), land exchange (no net loss of peat resource), and sustainability of the operation were discussed. Kopit Lodge indicated that they would like to see ongoing cooperation between the Proponent and Kopit Lodge including any training or employment opportunities that might be available. The project is to ensure the sustainability of existing jobs and does not create new jobs; however, the Proponent agreed to training opportunities for First Nations people, if and when available. |
| Jan. 13, 2020 | Email from MTI. | Email was to confirm a tentative meeting with MTI scheduled for January 23, 2020; this meeting was cancelled by MTI on January 22, 2020. |
| Jan. 17, 2020 | Meeting with NBDELG, NBDNR, and NBAA | Discuss the logistics of the project including First Nations consultation and the Land Exchange. |
| Jan. 30, 2020 | Email to MTI to reschedule the meeting intended for Jan. 23, 2020 | An email was sent requesting to reschedule the meeting with MTI. There was no response. |
| Feb 27, 2020 | Third email sent to MTI to reschedule meeting for First Nations consultation. | There was no response to this email. |

## 9.0 APPROVAL OF PROJECT

The following approval is required for the proposed project:

- Authorization/conditional approval of the undertaking under the provincial EIA requirements outlined in NB Regulation 87-83.

It is our understanding that a watercourse/wetland alteration permit is not required. No other permits or approvals are known to be required at this time.

## 10.0 FUNDING

The project is solely funded by the Proponent (SCC) and does not include any municipal, provincial, federal or other funding.

## 11.0 SIGNATURE

This EIA registration document was prepared by a team of professionals from Hive Engineering Limited and EXP Services Inc. on behalf of Canneberges St-Charles Cranberries Inc.

Date: July 7, 2020

Andrea Kalafut, M.Sc.E., P.Eng.
Senior Environmental Engineer
Hive Engineering Limited

## 12.0 CLOSURE

This report has been prepared for the sole benefit of Canneberges St-Charles Cranberries Inc. This report and any of its content cannot be relied upon by any other person or entity without the express written consent of Hive Engineering Limited and Canneberges St-Charles Cranberries Inc. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Hive Engineering Limited accepts no responsibility for damages incurred by any third party resulting from decisions or actions based on the content of this report.

The conclusions presented herein represent the best technical judgement of Hive Engineering personnel based on current engineering and scientific practices and environmental standards at the time the work was performed. The conclusions are based on the site conditions encountered at the time the work was performed at the locations presented in this report.

## 13.0 REFERENCES

*"Canneberges St.-Charles Cranberries, an environmental assessment and undertaking registration"*, Britton Consultants, prepared by: Benoit Richard Cranberry Consultation Services, August 1998. (SCC, 1998)

*"Enregistrement pour etude d'impact sur l'environment Expansion de la cannebergeraie"* Canneberges St Charles, St.-Charles, N.B., June 23, 2004 (SCC, 2004)

New Brunswick Department of Environment and Local Government's *"A Coastal Areas Protection Policy for New Brunswick",* Version 2.0, March 31, 2019.

New Brunswick Department of Environment and Local Government's *"Additional Information Requirements for Cranberry Operations",* Version 13-10-10

New Brunswick Department of Environment and Local Government's *"Additional Information Requirements for Peat Development Projects",* Version 05-04-07New Brunswick Department of Environment and Local Government's *"A Guide to Environmental Impact Assessment in New Brunswick"* dated January 2018.

New Brunswick Department of Environment and Local Government, Watershed Protected Area Designation Order. Clean Water Act. November 2001.

New Brunswick Department of Environment, Wellfield Protection Area Designation Order. Clean Water Act. September 2000.

New Brunswick Department of Natural Resources. Aerial Photographs.

Ecosystem Overview of the Richibucto River Watershed in New Brunswick, Canadian Manuscript Report of Fisheries and Aquatic Sciences 2847A, Turcotte-Lanteigne and E. Ferguson, Department of Fisheries and Oceans Canada, Oceans and Science Branch, Gulf Region, P.O. Box 5030, Moncton NB E1C 9B6, 2008

Service New Brunswick. Registry and Mapping Services. (www.planetsnb.ca).