



## **FISHER ENGINEERING LTD.**

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April 19, 2021

File: DE144

Mr. David Maguire  
Manager, Sustainable Development,  
Planning & Impact Evaluation Branch  
Department of Environment  
20 McGloin Street  
PO Box 6000  
Fredericton, NB E3B 5H1

Attention: Mr. Maguire:

**EIA Project Registration: Town House Development Expansion, Hampton NB**

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Enclosed is an electronic copy of the registration document for the above noted undertaking. Once an EIA file number is assigned, the fee will be paid on line.

If you have any questions or require further details, please do not hesitate to contact the undersigned.

A handwritten signature in black ink that reads 'Michael Fisher'. The signature is written in a cursive style.

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Michael Fisher, P. Eng.

MJF

Enclosures

cc: Mr. Andrew Dunn

**EIA Registration**  
**Town House Development Expansion Hampton NB**

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# EIA Registration

## Town House Development Expansion Hampton NB

Pursuant to Section 5(2) of  
The Environmental Impact Assessment Regulation 87-83  
Clean Environment Act

### 1 The Proponent

**Name:** 697800 NB Corp. c/o Andrew Dunn

**Address:** 62 Chamberlain Road, Quispamsis, NB E2G 1C1

**Principal Contact Person for Purposes of EIA:**

Andrew Dunn

(506) 870-0797, Andrew.dunn@yahoo.ca

and

Michael Fisher, Fisher Engineering Ltd. (506) 863-1991.

michael@fisherengineeringltd.com

**Property Ownership:** Same as Proponent

### 2 The Undertaking

**Name:** Town House Expansion Project

**Project Overview:** In early 2020, the proponent began work on a town house development at 153 Demille Court in Hampton NB. As part of his development requirements to obtain a building permit for two twelve-unit townhouse buildings, the proponent was required to retain the services of numerous professionals to provide drawings and reports to satisfy the Town of Hampton. The items included but not limited to building and foundation plans, site servicing plan, drainage plan, stormwater management design along with the completion of a hydrogeological study. As a result of all of the work and submissions, the proponent obtained a building permit for two twelve-unit town house buildings on October 2, 2020. Both buildings are identical and are scheduled to be completed in early spring 2021. In total there are 24 two bedroom units for rent with the targeted renters of mature 55+.

The proponent always had the plan that if the first two buildings were a success, he would apply for another permit for two additional buildings as the large property has the area to allow for four buildings. Currently he has over 95 percent of the original twenty four units rented and as such he would like to move forward with the construction of two more buildings for a total of 48 units within four buildings on site.

**Purpose/Rationale/Need:** The proponent has had excellent response to the renting of the current units and based on the demographics, he does not anticipate any issues with being able to fill two additional buildings. The proponent has recently constructed other rental units in neighbouring communities of Quispamsis and Rothsay which have targeted the 55+ age group. The proponent has found that there is a lack of rental units for that targeted age group in and around this area.

**Project Location:** The project is located at 153 Demille court in Hampton, NB. The subject property is located in a mixed commercial and residential area of Hampton. The site is bordered by Demille Court to the south and Haul Road to the north. Adjacent properties to the east and south along Demille Court and Mapleview Drive are all residentially developed with town house style structures. West of the subject property are commercial developments along Main Street. These properties are located at a significantly lower elevation than the subject and surrounding residential properties. Adjacent commercial properties include Tim Hortons, Subway, bed and breakfast, and a veterinary clinic. The Town of Hampton provides municipal sewer services to the site. The subject property and surrounding developments rely on private wells for potable domestic water. The subject property is identified by Service New Brunswick as PID 00189415. The subject property is 3 hectares in area.

**Siting Considerations:** The project location was chosen because of the current town house development under construction, the proximity to neighbouring senior community and also because the property is located within 200m of Main Street, which offers many conveniences including grocery, coffee shops, and restaurants.

The project site is not located within 30 metres of a wetland nor is the project located within Zone A or Zone B of a protected coastal area. The GeoNB mapping is shown in Appendix A.

**Physical Components and Dimensions of the Project:** A site location plan is presented in Figure 2. There was a well drilled in 2020 for the first two buildings and a hydrogeological assessment was completed with approval for connection to the current town house buildings being approved in late summer 2020. Hydraulic testing indicates that the new production well will produce a safe yield 70L per minute, see attached report.

The proponent has two existing buildings in neighbouring Towns (Rothsay/Quispamsis) with metered water. The units are of similar size (2 bedroom c/w individual laundry) with the same target client aged at 55+. Both of these buildings are metered/billed through the respective towns quarterly.

The quarterly water consumption was provided for the 38 unit building in Rothsay for 2020 and ½ 2019 (opened early 2019, has been full since mid way through 2019.) The six quarterly water consumption readings were as follows: 898, 991, 1174, 1026, 810, and 857m<sup>3</sup>. The average daily water usage from this apartment building is 10.6m<sup>3</sup>/day which equates to 280L/day/unit.

For the building in Quispamsis, it has only been full since ½ 2020. The two quarterly water consumption readings were: 990m<sup>3</sup> and 800m<sup>3</sup>. The average daily water usage from this apartment building is 9.8m<sup>3</sup>/day which equates to 260L/day/unit.

The Department of Environment and Local Government (DELG) uses the standard estimate of 450 L/day/person when estimating residential water use; however, based on the actual usage data from similar sized and equipped units housing the same targeted cliental, the standard of 450L/day/person is too high for this application based on actual consumption data. For this development a value of 450 L/day/unit would be a more realistic approach for this site, which is still over 40% higher than the actual consumption data.

Based on this data, this proposed fully developed site will require:

$$450\text{L/day/unit} \times 48 \text{ units} / 1000\text{L/m}^3 = 21.6\text{m}^3/\text{day} \text{ (15L/min)}.$$

The estimated average demand of 15L/min will be more than able to be supplied by the recently constructed well that has a safe pumping rate of at least 70L/min.

### **Construction Details:**

Construction for the two additional buildings would require digging for the foundations, pouring the concrete walls and floors and then start construction on the building. In addition, an expansion to the existing driveway will be required on the site. The area where the two additional town house buildings are proposed has been completely disturbed during the construction activities for the approved existing buildings on site. As part of the current construction activities a storm water retention pond was recently built which required the proponent to obtain a water course alteration permit. This pond is located at the lower portion of the site, which allows for the collection of surface water from the developed portion of the property. The pond was sized to account for the overall development of the property, which included four town house developments. The site servicing plans along with the details of the pond are attached. There will be no required clearing required to gain access to the proposed construction site. As part of the original development, erosion and sedimentation measures were implied by the contractor. These items include but not limited to sedimentation fence, erosion control check dams, and stabilized entrances to the construction site.

**Operation and Maintenance Details:** The proposed overall development, four 12-unit town house development will be connected to the Town of Hampton municipal sanitary system and will be provided domestic water via the recently constructed well. Hydraulic testing indicates that the new production well will produce a safe yield 70L per minute. Storm water is currently being managed as per the Town of Hampton's Storm water management guidelines (2015). Detailed storm water design brief is attached.

**Project Related Documents:** Attached there are the construction plans for the first two buildings, hydrogeological study, storm water design, WAWA permit, construction plans for the proposed two additional buildings and follow up letter re the existing well.

### 3 Description of the Existing Environment

#### Physical and Natural Features:

- The study area is located within the drainage area of Ossekeag Creek and within 2.5 kilometres of the Kennebecasis River. Regionally, the ground surface slopes westward toward Main Street and eventually several small tributaries that discharge into Ossekeag Creek. Across the subject property, the ground slopes northwesterly toward an unnamed watercourse the bisects the subject property along the northern property boundary.
- 1:10,000-scale mapping indicates that the surface elevation across the development area is ranges between approximately 34m and 12 metres above mean sea level. Surface water drainage across the majority of the proposed expansion area is northwesterly toward the unnamed watercourse.
- Shallow groundwater flow across the property is expected to follow the local topography, which slopes toward the mapped watercourse. Deeper groundwater likely flows in a similar westerly direction toward the Kennebecasis River. The area to the south and east that could potentially contribute groundwater to the study area is primarily residential with the main water consumers being the adjacent Pleasant View residential community.
- Surficial geology maps indicate that the area is underlain by late Wisconsinan age morainal sediments consisting of hummocky, ribbed and rolling ablation till some lodgement till, minor silt, sand, gravel, and boulders generally 0.5 to 3m thick (Rampton,1984).
- The regional bedrock geology is mapped as Carboniferous stratified rock belonging to the Mabou group, which is a subbasin of the Maritimes Carboniferous Basin. Mapping indicates that within the Mabou Group the site falls within the Kennebecasis Formation, which consists mainly of reddish brown, conglomerate and sandstone; minor mudstone (Barr. S.M. and White. C.E. 2001).
- There are no municipal wells, municipal wellfields, or protected watersheds within 500 metres of the subject property. Surrounding properties rely on private wells to supply potable water. Within 500 metres of the investigated area there are approximately 150 groundwater users.
- The Town of Hampton has municipal wastewater collection and treatment. There was an existing sanitary lateral at the property line from Demille Court that was extended onto property during the work for Phase I.
- There were no potential wetlands identified on the NB Department of Natural Resources (DNR) and GEONB mapping in the immediate vicinity of the site.
- The Atlantic Canada Conservation Data Centre reported the following considered rare or endangered species within 100km of the subject property:
  - 142 records of 38 vascular flora and 7 records of 6 nonvascular flora that are considered rare or endangered species
  - 325 records of 44 vertebrate, 9 records of 3 invertebrate fauna

- There were four sensitive species identified within 100km of the subject site. These included Eastern Painted Turtle, Wood Turtle, Bald Eagle, and three species of bat occurrences.
- The Atlantic Canada Conservation Data Centre reported that in the vicinity of the study area there are 3 managed areas and 5 biologically significant areas. These include but not limited to several Ducks Unlimited lands, large wetland area and Hampton Marsh Nature Preserve.

The following are some of the references and personnel that were contacted and used in order to gather information regarding the physical and natural features of the subject and surrounding properties.

1. Atlantic Canada Conservation Data Centre -ACCDC
2. Environment Canada Species at Risk website - <http://www.sararegistry.gc.ca>
3. COSEWIC. 2005. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada. Web site: <http://www.cosewic.gc.ca>
4. Canadian Wildlife Service website - <http://www.naturecanada.ca>
5. Department of Environment Government website – designated wellfields - <http://www.gnb.ca/0009/0371/0001/0003.html>, and protected watersheds - <http://www.gnb.ca/0009/0371/0004/0003.html>.

**Cultural Features:** There are no reported or observed cultural features on the subject site or adjacent properties.

**Existing and Historic Land Uses:** Historical information was obtained through a review of historical aerial photos (1945 through 2013). Historical records indicate the subject property was residentially developed since at least 1945 up until the last couple years. A farm house and detached barn area visible in all of the aerial photos up to an including the one from 2013. The surrounding residential town houses are first visible in the aerial from 2013. The surrounding land to the south and east are vacant in all the earlier aerial photos. Hall Road to the north is under construction in the aerial photo from 1993 with Main Street visible in all of the photos. The former residential home on the subject property had the driveway originally located off Main Street to the west with the driveway only visible off Demille Court in the 2013 photo. The adjacent Tim Hortons and Subway commercial developments along Main Street to the west are only first visible in the photo from 2013. There are a few smaller residential structures visible with two being the present-day veterinary clinic and bed and breakfast.

## 4 Summary of Environmental Impacts

Potential environmental impacts associated with this project include the following:

- Construction activities will require soil disturbance. The area where the proposed additional town house buildings are proposed the clearing activities have been completed. The area was disturbed during the construction activities for the current buildings and for the construction of the storm water retention pond. Existing stockpiled soil will require moving and removal off site to allow for the construction of the buildings. Soil disturbances increase the potential for erosion and sediment release.
- Throughout the construction period there is a potential for an accidental release of hazardous materials such as fuels or lubricants from the earthwork machines or the delivery vehicles.
- Impacts to the atmospheric environment include changes to air quality and noise in the construction phase of the project. Potential impacts to air quality are commonly caused by emissions from equipment or vehicles as well as by dust. Noise impacts are commonly caused by equipment as well as by activities such as blasting. There are no blasting activities proposed or required. Atmospheric environment impacts to human health may include:
  - impacts to air quality (dust or fumes including NO<sub>x</sub>, SO<sub>x</sub>, and PM<sub>2.5</sub>)
  - increased noise from construction or operations
- The proponent will ensure that activities comply with the Migratory Birds Convention Act (MBCA) and regulations. The Migratory Birds Convention Act (MBCA) protects most bird species in Canada.

## 5 Summary of Proposed Mitigation

The potential environmental impacts listed in Section 4 are discussed further below along with any proposed mitigation.

1. Accidental release of hazardous materials: In order to minimize the risk of a release of hazardous materials the following best management practices will be employed during any onsite work.
  - No refuelling of equipment will take place on site.
  - Except for fuel tanks, petroleum products will not be stored onsite.
  - Any required maintenance work would be performed offsite.

Any spills or leaks from machinery will be promptly contained and cleaned up. Actions may involve ditching, blocking drainage pathways, and using absorbent materials. In addition, any spills or leaks will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) and to the NBDELG Regional Office in Saint John (506-658-2558).

2. Erosion and Sediment Release: On site erosion and sediment control measures are currently being employed at the site. These include sedimentation fence, temporary check dams, ensuring that exposed soil is stabilized as soon as possible and that all



structures are routinely inspected especially prior to and immediately after a rain fall event.

3. Proponent will ensure that equipment used on site is in good working order to minimize air borne contaminates. Any contractor that arrives on site with equipment in disrepair will be required to exit the site and not return until the equipment is in proper working order. The proponent also realizes that the site is bordered by an existing residential community in addition to the soon to be occupied two existing town houses on the subject site. Construction activities will be carried out during normal business hours and all trades will be required to be respectful of the surrounding neighbourhood. The proponent is the project manager for this project also so he is a constant presence on site throughout the development. As such, any issues on a day to day basis can be addressed immediately.
4. As stated previously all clearing and grubbing work within the footprint of the proposed two additional town house buildings has been completed. With this work being already completed it reduces the possibility of nesting of migratory birds. There is still potential, however, and the proponent will ensure that contractors are aware and report any nesting activities.

## **6 Public Involvement**

The following stakeholders will be contacted directly via a letter in order to obtain input on the project:

- Elected officials, Town of Hampton, First Nation representatives and residents bordering the community.

The letter will outline the scope of the project and will include a schematic of the development. Contact information for any comments will also be provided. The public will be given thirty days to provide comments. Once the comments have been received, a report will be prepared regarding the public's input. The report will be submitted within sixty days of project registration.

## 7 Approval of the Undertaking

Approval will be required from the New Brunswick Department of Environment and Local Government for the increase of the pumping rate of the onsite well. Following approval from the NBDELG, the Town will issue foundation and building permits.

## 8 Funding

No applications for a grant or loan of capital funds from a government agency have or will be submitted. 697800 NB Corp. will be funding the project.

## 9 Signature



Michael Fisher, P.Eng

April 19, 2021

Date

## **APPENDIX A**

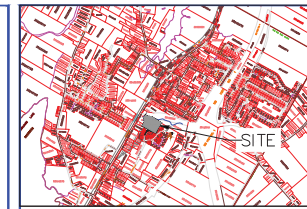
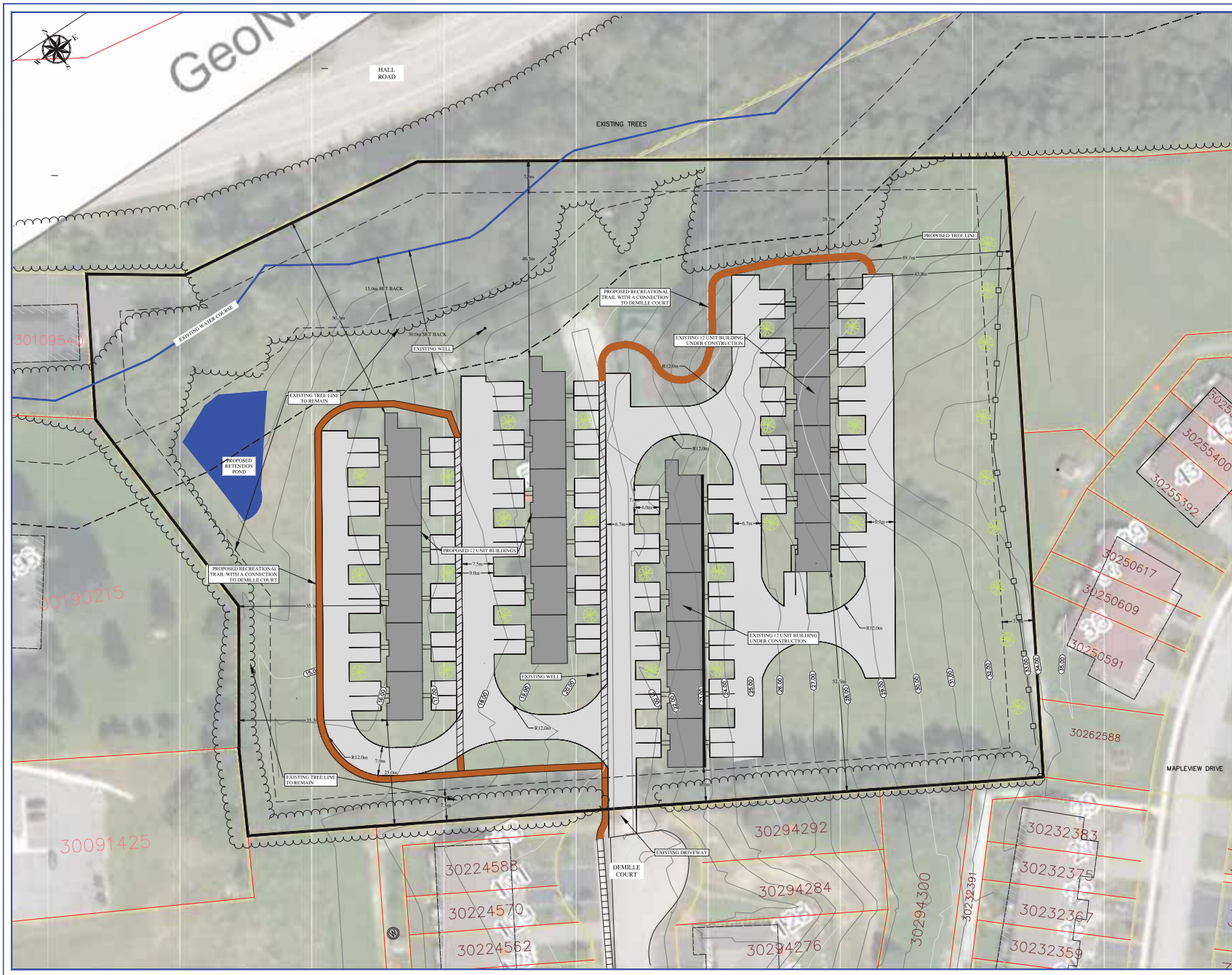
### **FIGURES**



# ESA: SITE LOCATION PLAN

LOCATION: DEMILLE COURT, HAMPTON NB	SCALE: 1:1200	PROJECT # DE144	FIGURE # <b>1</b>
DATE: APRIL 16, 2021	CHECKED BY: M.J.F	DRAWN BY: ACB	





SITE LOCATION  
SCALE - METERS 1: 30000

Notes:  
 - Subject Property: PID 00180115.  
 - Proposed Development: 4 x 12 unit townhouse  
 - Each Unit to have 2 parking stalls  
 - One proposed well for the buildings  
 - Town of Hampton municipal sanitary  
 - Existing Property: ~ 5.0ha.  
 - 3% of Property to remain undisturbed  
 - 30% of Property to be rehabilitated  
 - 2% of Property to be developed/hardscaped  
 - Eleven existing mature trees will be removed and replaced with a minimum of 24 new trees to be planted.  
 - Proposed New Tree Location

No.	Issue	Date
1	FOR TOWN APPROVAL	NOV. 2020
2	UPDATED AS PER TOWN REQUEST	JAN. 2021
3		



40 Fairfield Road  
 Lower level, New Brunswick E1J 6A2  
 Phone: 506. 862. 1100  
 Fax: 506. 862. 1180

Project Title:  
**TOWN OF HAMPTON  
 4 X 12 UNIT TOWNHOUSE  
 DEVELOPMENT**

Drawing Title:  
**SITE PLAN**

Project No.: DE144  
 Dep. No.: DE14401R2

Scale:  
**SCALE - METERS 1: 400**



Drawn By: ACB  
 Designed By: MIF  
 DWG. Design: MIF  
 Title By: MIF  
 Sheet #: C-1

## **APPENDIX B**

### **SITE PHOTOS AND SUPPORTING INFORMATION**

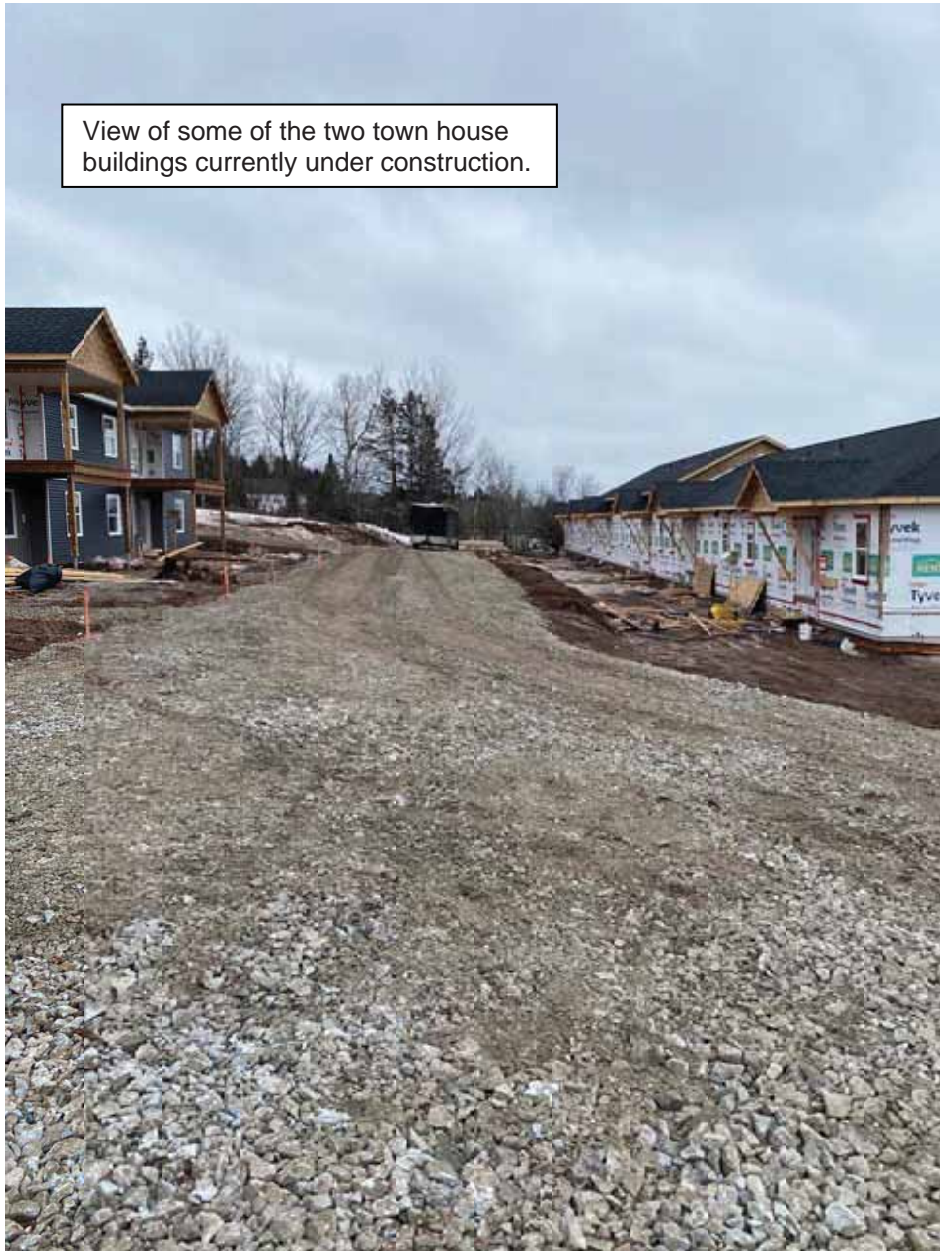
View of subject property looking West towards portion of site where two additional town house buildings are proposed.



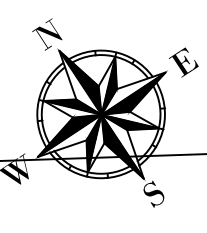
View of some of the erosion and sediment control structures currently being employed on the subject property



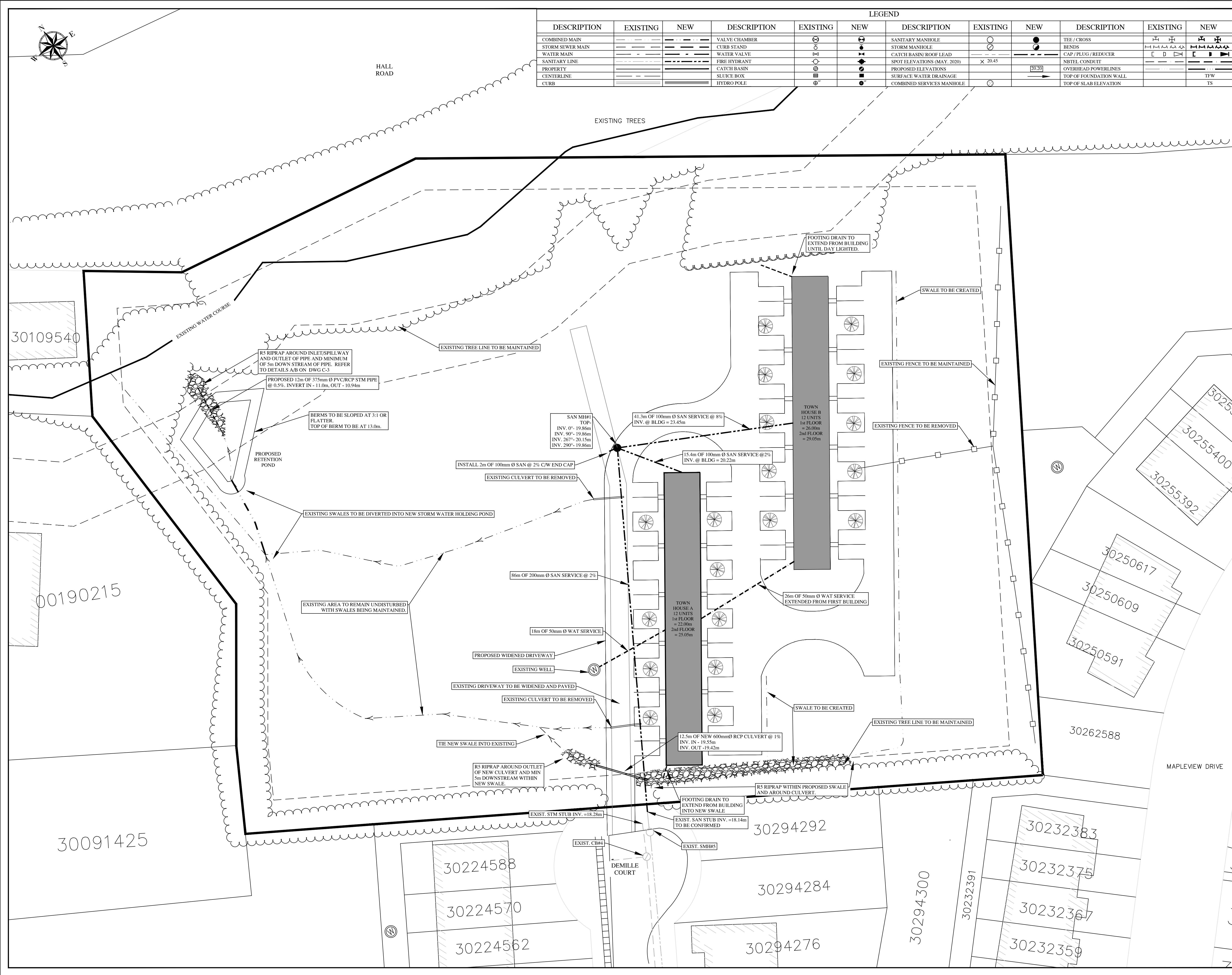
View of some of the two town house buildings currently under construction.







LEGEND											
DESCRIPTION	EXISTING	NEW	DESCRIPTION	EXISTING	NEW	DESCRIPTION	EXISTING	NEW	DESCRIPTION	EXISTING	NEW
COMBINED MAIN	---	---	VALVE CHAMBER	⊗	⊗	SANITARY MANHOLE	⊙	⊙	TEE / CROSS	⊕	⊕
STORM SEWER MAIN	---	---	CURB STAND	⊕	⊕	STORM MANHOLE	⊙	⊙	BENDS	⊕	⊕
WATER MAIN	---	---	WATER VALVE	⊕	⊕	CATCH BASIN/ ROOF LEAD	⊕	⊕	CAP / PLUG / REDUCER	⊕	⊕
SANITARY LINE	---	---	FIRE HYDRANT	⊕	⊕	SPOT ELEVATIONS (MAY, 2020)	×	×	SBTEL CONDUIT	---	---
PROPERTY CENTERLINE	---	---	CATCH BASIN	⊕	⊕	PROPOSED ELEVATIONS	⊕	⊕	OVERHEAD POWERLINES	---	---
CURB	---	---	SLUICE BOX	⊕	⊕	SURFACE WATER DRAINAGE	---	---	TOP OF FOUNDATION WALL	---	---
			HYDRO POLE	⊕	⊕	COMBINED SERVICES MANHOLE	⊙	⊙	TOP OF SLAB ELEVATION	---	---



SITE LOCATION  
SCALE - METERS 1: 30000

Notes:  
 -Subject Property: PID 00189415.  
 -Proposed Development: 2 x 12 unit townhouse  
 -Each Unit to have 2 parking stalls  
 -One proposed well for the buildings  
 -Town of Hampton municipal sanitary  
 -All work is to conform to the Town of Hampton Municipal Specifications, latest revision.  
 -Contact Town's Engineering Department prior to construction for application for a lateral service and deposit.  
 -As-built record drawings of all infrastructures installed, shall be submitted to the Town of Hampton.  
 -The developer/contractor is responsible for dust control, mud and dirt removal on roadways and road gravel maintenance for the duration of the project. Service laterals to be confirmed onsite include size and elevation.  
 -All disturbed areas shall be reinstated, as soon as possible, to previous condition or better.  
 -Insulation is required where a minimum of 1.8m of coverage is not acquired.

No.	Issue	Date
1	FOR TOWN OF HAMPTON APPROVAL	JULY 2020
2	REVISED AS PER TOWN OF HAMPTON COMMENTS	SEPT 2020
3		

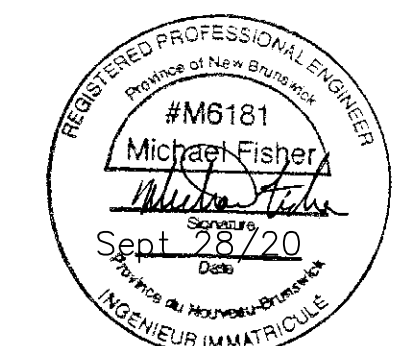


Project Title  
**TOWNHOUSE DEVELOPMENT**  
**153 DEMILLE COURT**  
**HAMPTON, NB**

Drawing Title  
**SITE SERVICING PLAN**

Project No. **DE144**  
 Dwg. No. **DE14401R1**

Scale: **SCALE - METERS 1: 400**



Const. North  
  
 Drawn By: **ACB**  
 Designed By: **MJF**  
 DWG. Design Ckd. By: **MJF**  
 Sheet #: **C-1**



SITE LOCATION  
SCALE - METERS 1: 30000

Notes:  
 -Subject Property: PID 00189415.  
 -Proposed Development: 2 x 12 unit townhouse  
 -Each Unit to have 2 parking stalls  
 -One proposed well for the buildings  
 -Town of Hampton municipal sanitary

No.	Issue	Date
1	FOR TOWN OF HAMPTON APPROVAL	JULY 2020
2	REVISED AS PER TOWN OF HAMPTON COMMENTS	SEPT 2020
3		



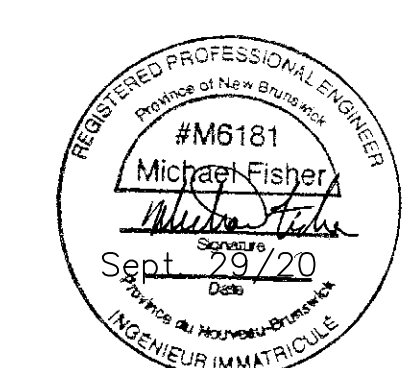
Project Title  
**TOWNHOUSE DEVELOPMENT**  
**153 DEMILLE COURT**  
**HAMPTON, NB**

Drawing Title  
**SITE DRAINAGE PLAN**

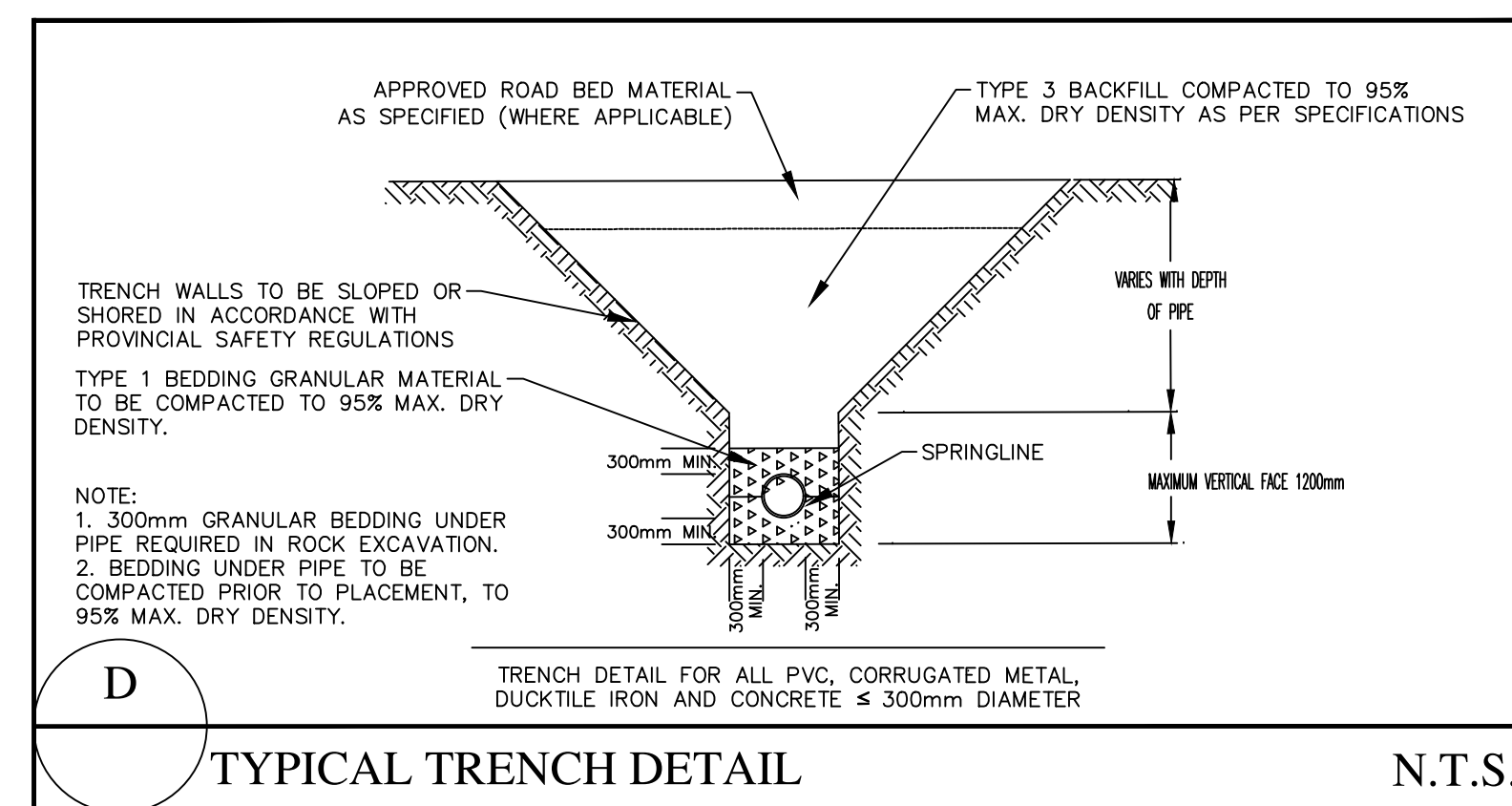
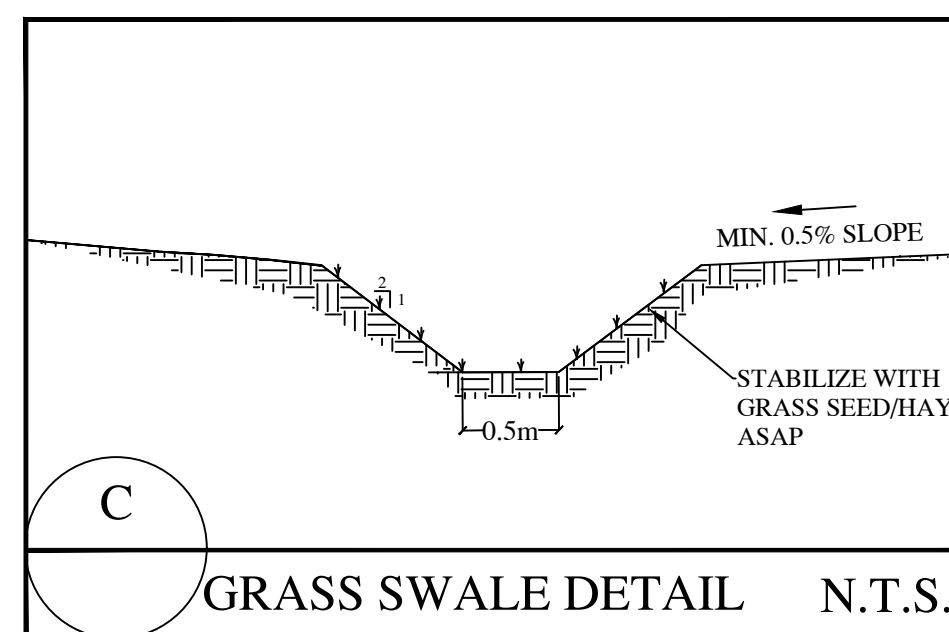
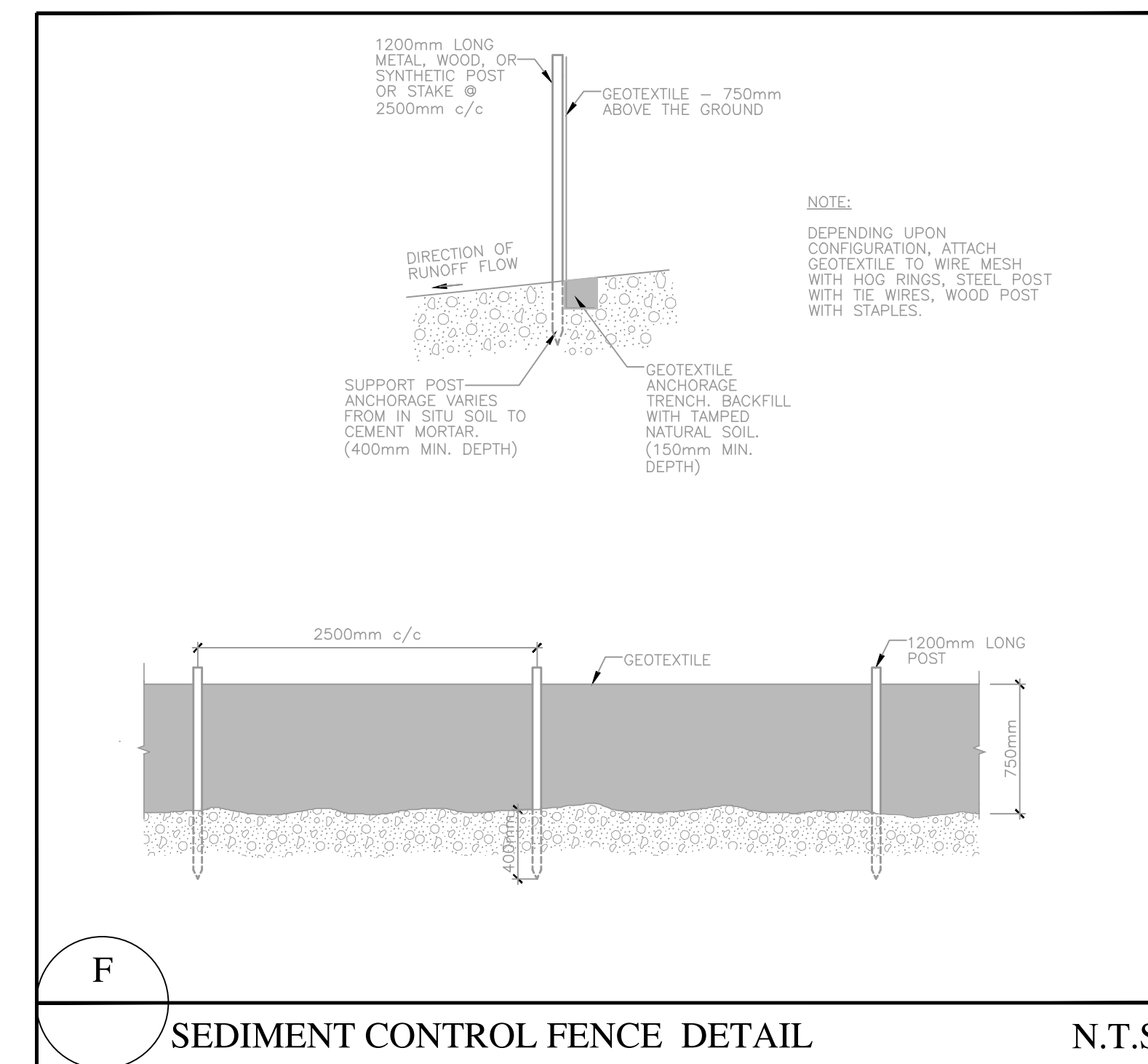
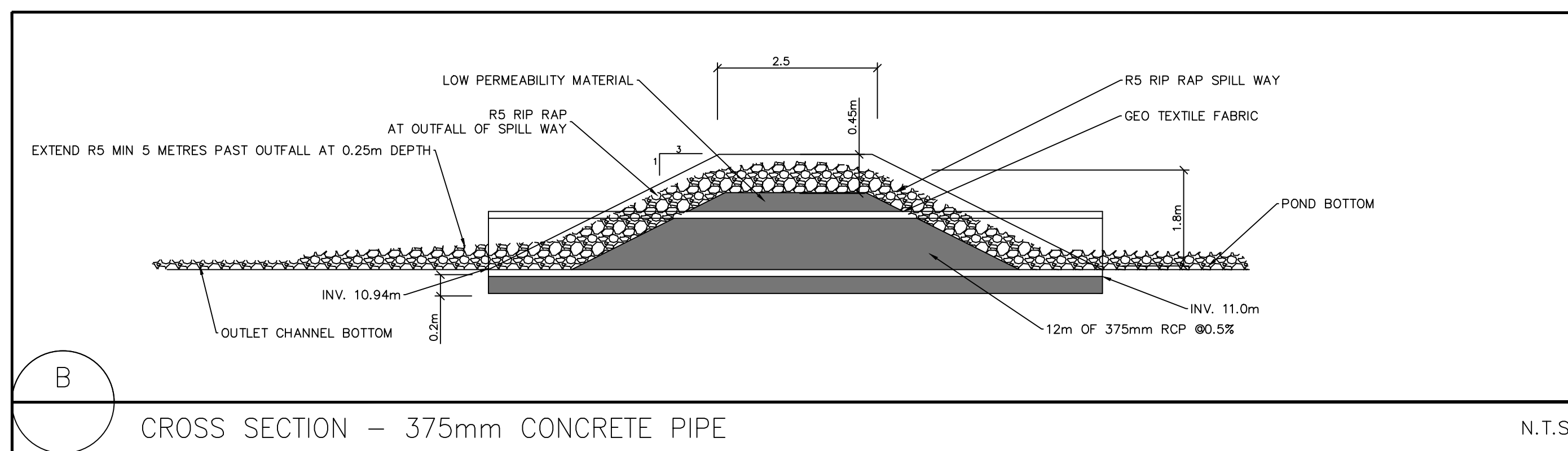
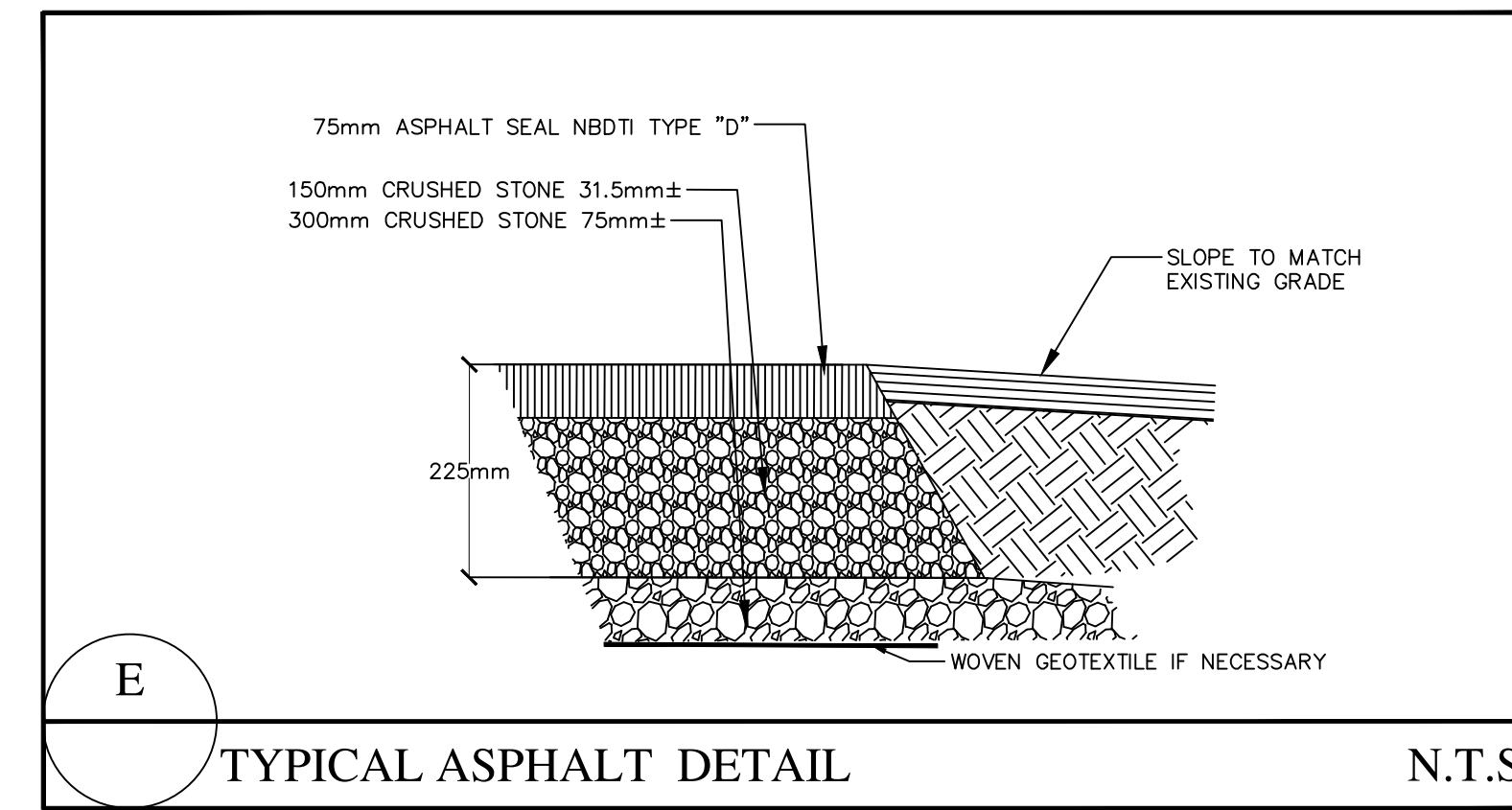
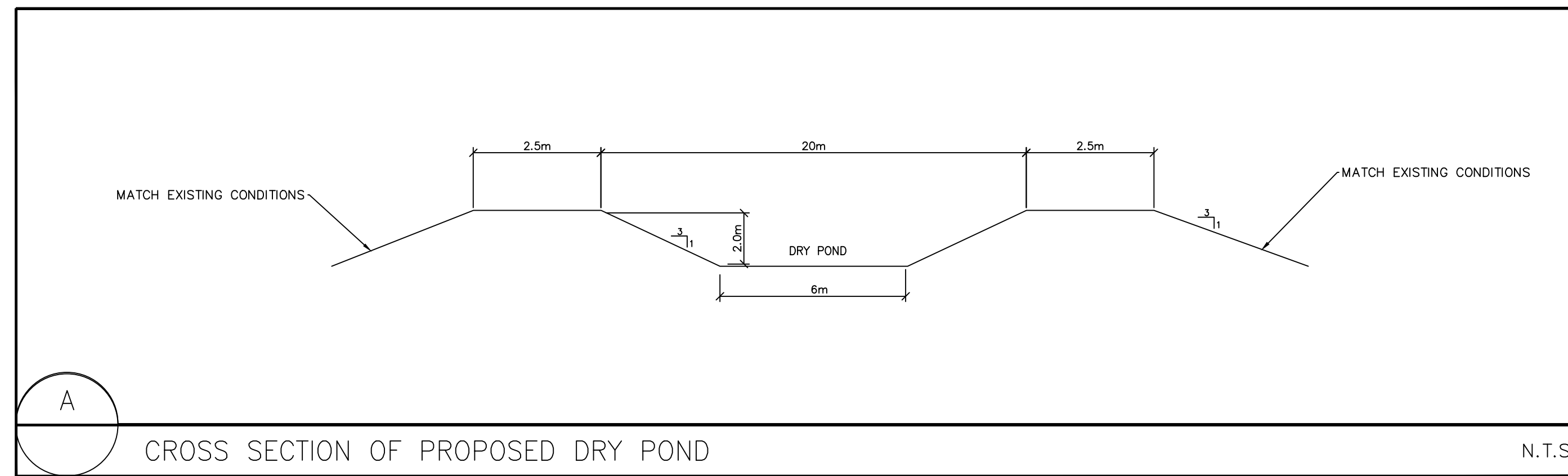
Project No. **DE144**

Dwg. No. **DE14401R1**

Scale: **SCALE - METERS 1: 400**



Const. North  
  
 Drawn By: **ACB**  
 Designed By: **MJF**  
 DWG. Design Ckd. By: **MJF**  
 Sheet #: **C-2**



No.	Issue	Date
1	REVISED AS PER TOWN OF HAMPTON COMMENTS	SEPT. 2020
2		
3		



Project Title  
**TOWNHOUSE DEVELOPMENT**  
**153 DEMILLE COURT**  
**HAMPTON, NB**

Drawing Title  
**CONSTRUCTION NOTES**  
**AND DETAILS**

Project No. **DE144**

Dwg. No. **DE14401R1**

Scale: **AS NOTED**



Const. North

Drawn By: **ACB**  
 Designed By: **MJF**  
 DWG. Design Ckd. By: **MJF**  
 Sheet #: **C-3**



## FISHER ENGINEERING LTD.

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Lower Coverdale, New Brunswick E1J 0A2  
Phone: 506.863.1991  
Fax: 506.862.1180

February 9, 2021

File DE144

Mr. Andrew Dunn  
AE Dunn consulting  
via email: andrew.dunn76@yahoo.ca

Attention: Mr. Dunn

**Re: Storm Water Design Rational for Proposed Town House Development, Hampton, NB**

The following is our revised design brief for the proposed construction of two additional 12 unit Town House buildings at 153 Demille Crt in Hampton, NB. Upon completion, the site will have a total of 4 12unit town house buildings.

The brief presents the design assumptions and calculations for the municipal infrastructure required for the project. Standard engineering practices and requirements outlined in the Town of Hampton Stormwater Management Guideline (TOHSWMG) were followed as a guideline.

### **Project Overview**

Currently the subject property (PID 00189415) is located at the end of Demille Court. The proposed project includes the construction of two additional twelve-unit town house buildings. Construction of two buildings is currently underway. The client for this project is Mr. Andrew Dunn.

### **Existing Property-**

The subject property has an area of 3.04ha and was historically occupied by a single family dwelling complete with detached barn and garage. This development (Phase II) will occupy the west side of the existing driveway on the site. This will complete the overall proposed development for the lot. As part of Phase I, a storm water retention pond was constructed with the undeveloped land remaining undisturbed and drainage patterns not be altered. As part of this final phase, drainage will be directed through several new drainage swales into the recently completed retention pond. The retention pond discharges toward an unnamed watercourse that flows along the northern property line.

### **Proposed Construction**

Following completion of this proposed second and final phase of the development. The property will have the following pervious areas:

Impervious – new asphalt driveway and parking stalls: 6588m<sup>2</sup>, Roof top: 593m<sup>2</sup> x4.

The portion of the property that will be landscaped with grass/trees and also includes the portion of the property that will remain undisturbed is (21440m<sup>2</sup>). The impervious area across the property will increase by approximately 30% as a result of the entire proposed development.

### Storm Drainage System –

The major storm system was designed to convey storm water runoff from a 1 in 100-year return period storm. To account for climate change, the historic 1 in 100yr event was multiplied by 1.2.

The rate of storm water runoff from the subject property, peak storm water flow, was determined for the 2, 5, 10, 25, 50, and 100<sup>+20%</sup>-year storms for the post development conditions. For this site, the instantaneous peak storm water flows were determined using the Rational Method. The snow storage and melt were also included within the storm water analysis.

( $Q = C \cdot A \cdot I$ ) for both the existing and post development scenarios.

For the pre development conditions, the following parameters were used:

the following parameters were used:

$C^*$  = runoff coefficient = 0.21, which is a composite value determined by:

$$C^* = \frac{\sum C^*A}{\sum A} = \frac{0.80 \cdot (480\text{m}^2) + 0.2 \cdot (29895\text{m}^2)}{30,375\text{m}^2} = 0.21$$

$A$  = area = 3.04 ha

$T_c$  = time of concentration = 8 minutes (Bransby Williams)

Rainfall intensities ( $i$ ) were obtained from the annual rainfall intensity – duration frequency curves for Saint John Area (data between 1946 and 2007).

For the post development conditions, the following parameters were used:

$C^*$  = runoff coefficient = 0.42, which is a composite value determined by:

$$C^* = \frac{\sum C^*A}{\sum A} = \frac{0.95 \cdot (6588\text{m}^2 + 593\text{m}^2 \times 4) + 0.2 \cdot (21440\text{m}^2)}{30375\text{m}^2} = 0.42$$

$T_c$  = time of concentration = 8 minutes (Bransby Williams)

Rainfall intensities ( $i$ ) were obtained from the annual rainfall intensity – duration frequency curves for Saint John Area (data between 1946 and 2007).

The pre and post development peak flows for the lot is presented in Table 1. In addition, the peak flows with retention are also shown in the tables.

Table 1: Calculated Peak Flows

Storm Event	Pre Development Peak Flow (m <sup>3</sup> /s)	Post Development Peak Flow (m <sup>3</sup> /s)	Storage Volume (m <sup>3</sup> )	Post Development Peak flow with retention(m <sup>3</sup> /s)
2-yr	0.104	0.201	115	0.102
5-yr	0.150	0.297	162	0.149
10-yr	0.180	0.358	191	0.174
25-yr	0.218	0.433	275	0.215
50-yr	0.248	0.491	260	0.239
100-yr <sup>+20%</sup>	0.331	0.656	348	0.320

To ensure that post development flows do not exceed the pre development peak flows (net zero increase), a stormwater retention pond was constructed for Phase I that collects surface water runoff from the site prior to discharging into the adjacent unnamed watercourse. As part of Phase II work new swales will be constructed around the proposed two new buildings that will convey surface water toward the recently constructed retention pond. The outlet pipe will act an inlet control devices (ICD). Temporary storm water storage will be completed within the retention pond. The 2yr and 100yr +20% storm hydrographs are attached along with the drainage plan. As shown above in Table 1, all of the peak flows for each storm event with retention are less than the pre development peak flows.

There is one proposed culvert at the entrance to the development. The proposed 600mm diameter culvert has the full flow capacity of 0.614m<sup>3</sup>/s. The 100yr+20% peak flow draining toward the proposed culvert was calculated to be 0.191m<sup>3</sup>/s. The proposed culvert can convey the 100yr+20% storm. Riprap is proposed around both the inlet and outlet ends of the culvert pipe.

The hydraulic capacity of the proposed drainage swales was evaluated based on the proposed minimum construction (0.50m bottom width, min 0.6m high and 2:1 side slopes). The peak flow was determined to be 1.59m<sup>3</sup>/s; which is more than sufficient to convey the overland flow.

I trust this meets your requirements, if you have any additional questions please let me know.

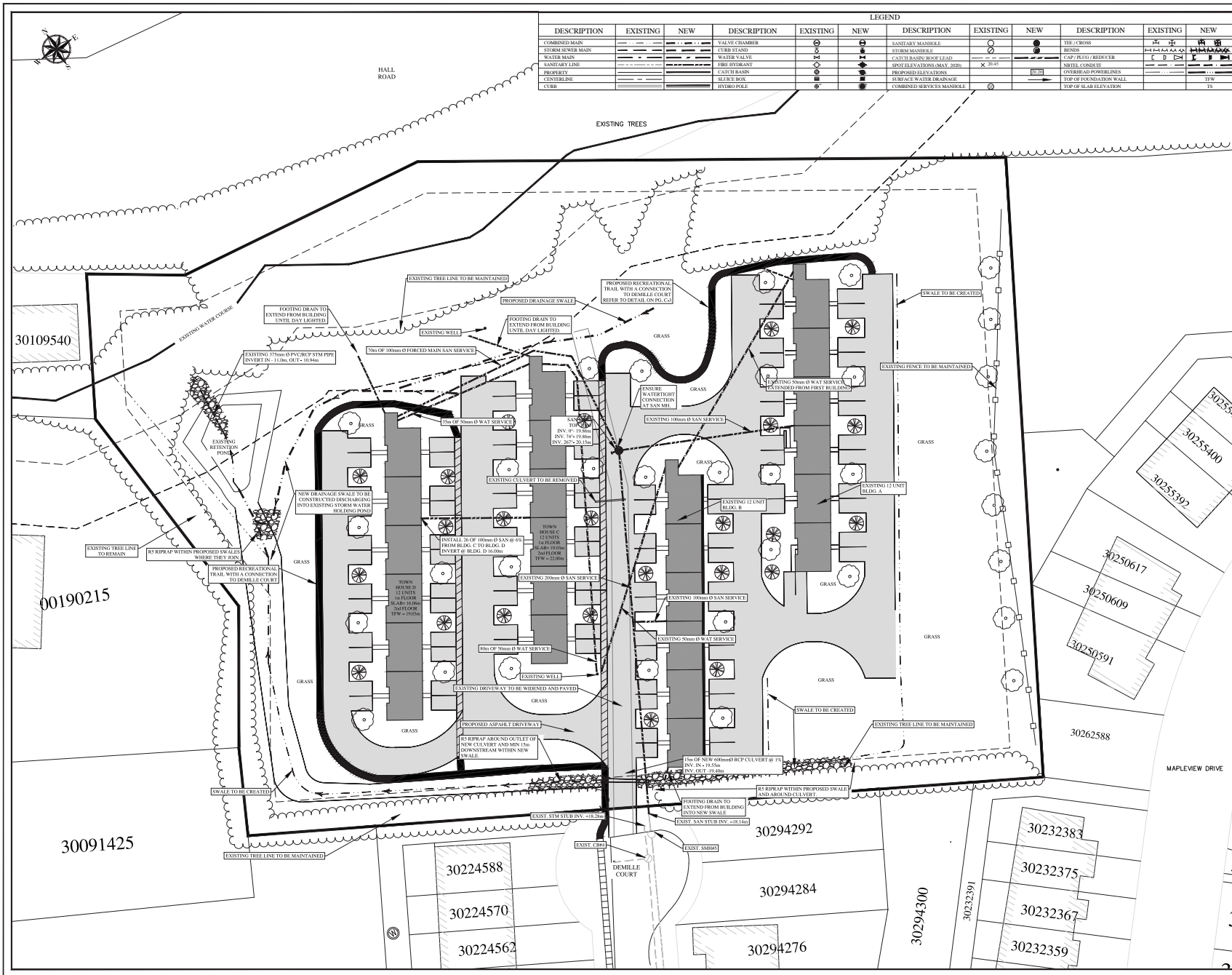
Regards,



Michael Fisher, P. Eng.  
Enclosure

## **APPENDIX A**

### SITE GRADING AND DRAINAGE PLAN



LEGEND											
DESCRIPTION	EXISTING	NEW	DESCRIPTION	EXISTING	NEW	DESCRIPTION	EXISTING	NEW	DESCRIPTION	EXISTING	NEW
COMBINED MAIN	---	---	VALVE CHAMBER	⊙	⊙	SANITARY MANHOLE	⊙	⊙	TIE / CROSS	---	---
STORM SEWER MAIN	---	---	CURB STAND	⊙	⊙	STORM MANHOLE	⊙	⊙	BRUSH	---	---
WATER MAIN	---	---	WATER VALVE	⊙	⊙	CATHERASS ROOF LEAD	---	---	CAP / FLEX / REDUCER	---	---
SANITARY LINE	---	---	FIRE HYDRANT	⊙	⊙	SPOT ELEVATIONS (MAY 2020)	⊙	⊙	SHELL CONDUIT	---	---
PROPERTY	---	---	CAULK BOSS	⊙	⊙	PROPOSED ELEVATIONS	⊙	⊙	OVERHEAD PORTLANDING	---	---
CENTRELINE	---	---	SAFETY BOX	⊙	⊙	STORM WATER DRAINAGE	---	---	TOP OF FOUNDATION WALL	---	---
CURB	---	---	HYDRO POLE	⊙	⊙	COMBINED SERVICES MANHOLE	⊙	⊙	TOP OF SLAB ELEVATION	---	---



SITE LOCATION  
SCALE - METERS 1: 30000

Notes:  
 - Subject Property: FID 0018415.  
 - Proposed Development: 2 additional 12 unit townhouse.  
 - Each Unit to have 2 parking stalls.  
 - Other proposed work for the building:  
 - Town of Hampton municipal sanitary.  
 - All work to be consistent with the Town of Hampton Municipal Specifications, latest revision.  
 - Contact Town's Engineering Department prior to connection for application for a lateral service and approp.  
 - All work to be consistent with all infrastructure installed. Shall be submitted to the Town of Hampton.  
 - The developer/contractor is responsible for final control, final and final removal of construction and final ground maintenance for the duration of the project. Service marks to be confirmed onsite include water and electricity.  
 - All disturbed areas shall be reseeded, as soon as possible, to previous condition or better.  
 - Plantations to be required where a minimum of 1.0m of coverage is not acquired.

LANDSCAPING DETAILS  
 - PROPOSED TREE  
 - Minimum 15mm in caliper and minimum branching height of 2m @ PLANTING  
 - PROPOSED SHRUBS

No.	Date	Desc
1		FOR TOWN OF HAMPTON APPROVAL
2		
3		



Project Title:  
**PHASE II TOWNHOUSE DEVELOPMENT  
 153 DEMILLE COURT  
 HAMPTON, NB**

Drawing Title:  
**SITE SERVICING AND  
 LANDSCAPING PLAN**

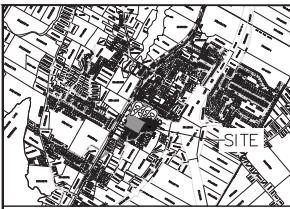
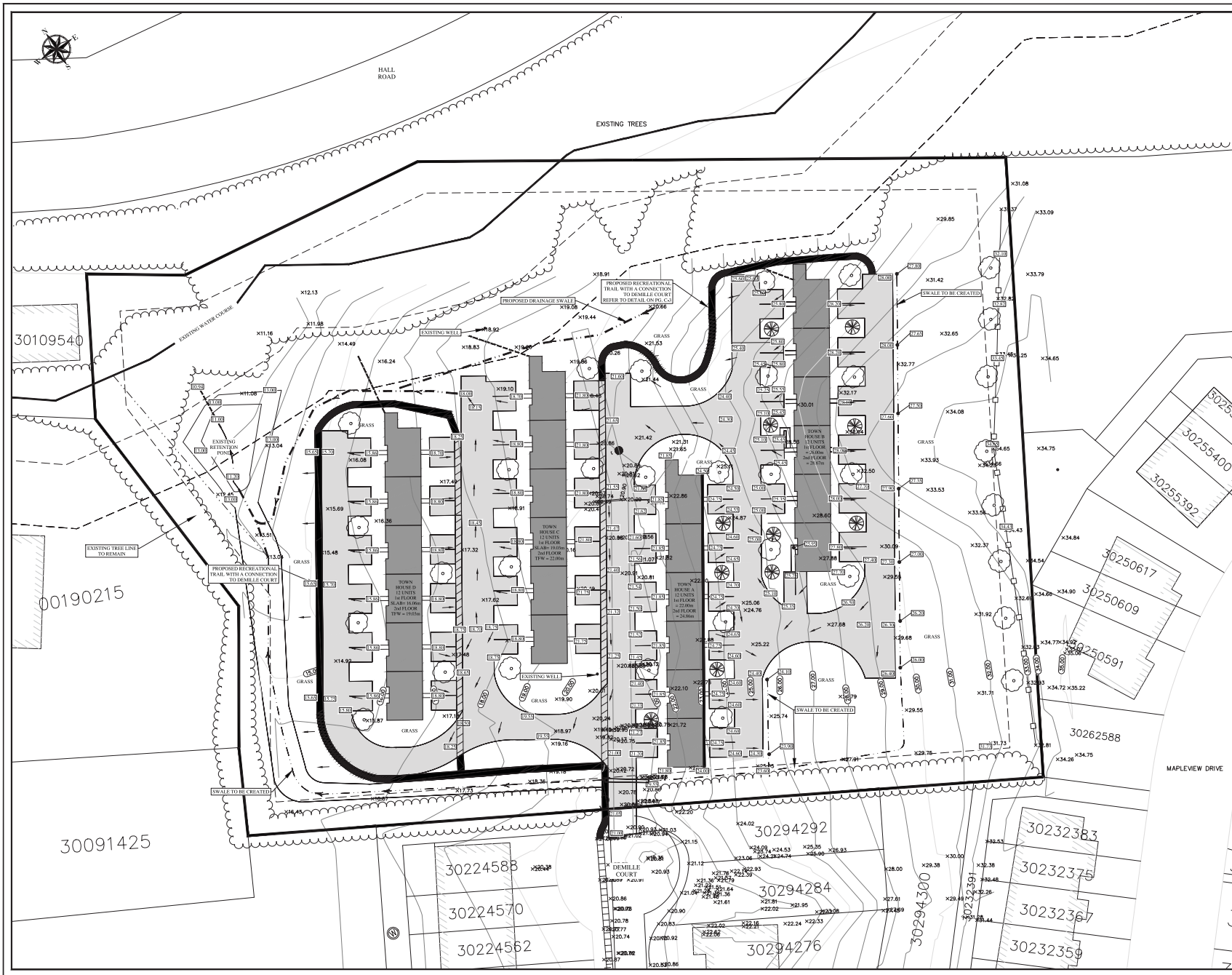
Project No.: DE144  
 Drawn No.: DE14402R0

Scale:  
 SCALE - METERS 1: 400



Drawn By: ACB  
 Designed By: MJF  
 DWG. Design: MJF  
 Title By: MJF  
 Sheet #: C-1





SITE LOCATION  
SCALE - METERS 1: 30000

Notes:  
 Subject Property: FID 00189415.  
 Proposed Development: 2 additional 12 unit townhouses for total of four buildings.  
 Each Unit to have 2 parking stalls.  
 Other proposed work for the buildings:  
 -Towers of Hampton municipal sanitary

No.	Date	Issue
1		FOR TOWN OF HAMPTON APPROVAL
2		
3		



**FISHER**  
ENGINEERING LTD.  
40 Fairfield Road  
Lower Cornwallis, New Brunswick E1J 6A2  
Phone: 506. 862. 1100  
Fax: 506. 862. 1180

Project Title:  
**PHASE II TOWNHOUSE DEVELOPMENT  
 153 DEMILLE COURT  
 HAMPTON, NB**

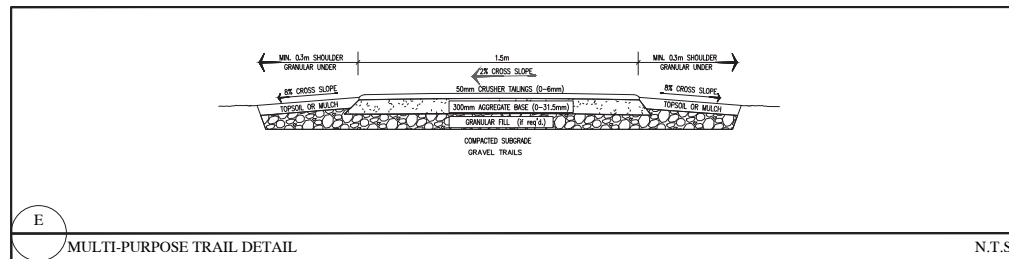
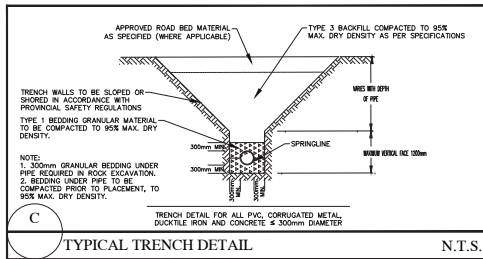
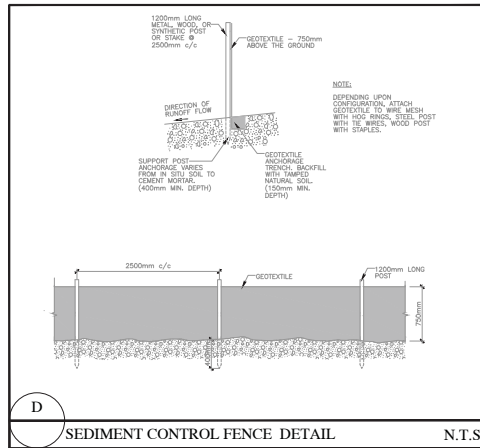
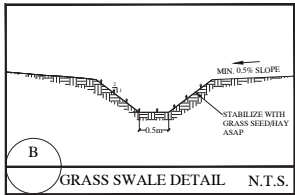
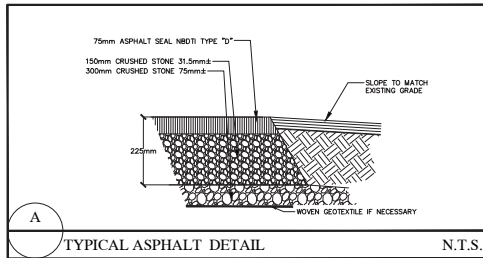
Drawing Title:  
**SITE DRAINAGE PLAN**

Project No.: DE144  
 Dwg. No.: DE14402R0

Scale:  
**SCALE - METERS 1: 400**



Drawn By: ACB  
 Designed By: MIF  
 DWG. Design: MIF  
 Title By: MIF  
 Sheet #: C-2



No.	Issue	Date
1	FOR TOWN OF HAMPTON APPROVAL	FEB. 2021
2		
3		



40 Fairfield Road  
Lower Coverdale, New Brunswick, E1J 0A2  
Phone: 506 - 863 - 1191  
Fax: 506 - 862 - 1180

Project Title  
**PHASE II TOWNHOUSE DEVELOPMENT  
153 DEMILLE COURT  
HAMPTON, NB**

Drawing Title  
**CONSTRUCTION NOTES  
AND DETAILS**

Project No. DE144

Dep. No. DE14402R0

Scale: AS NOTED



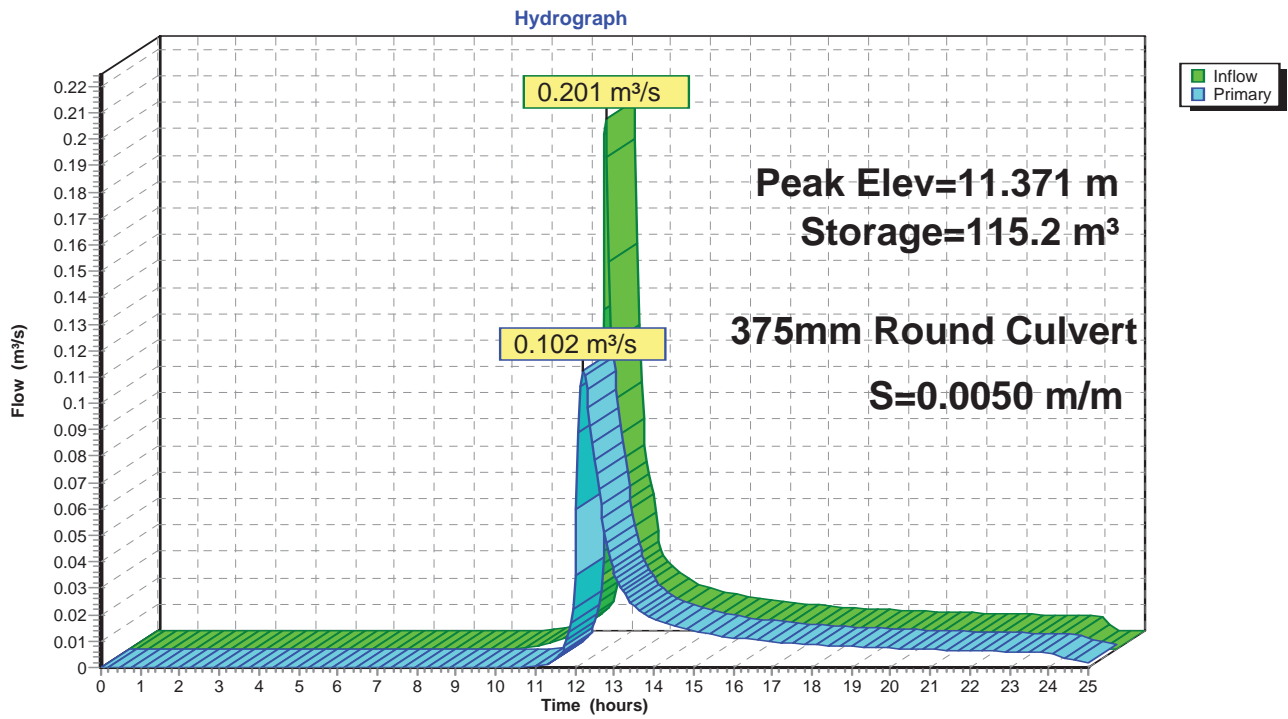
Const. North

Drawn By: ACB  
Designed By: M,JF  
DWG. Design: M,JF  
Check By: M,JF  
Sheet #: C-3

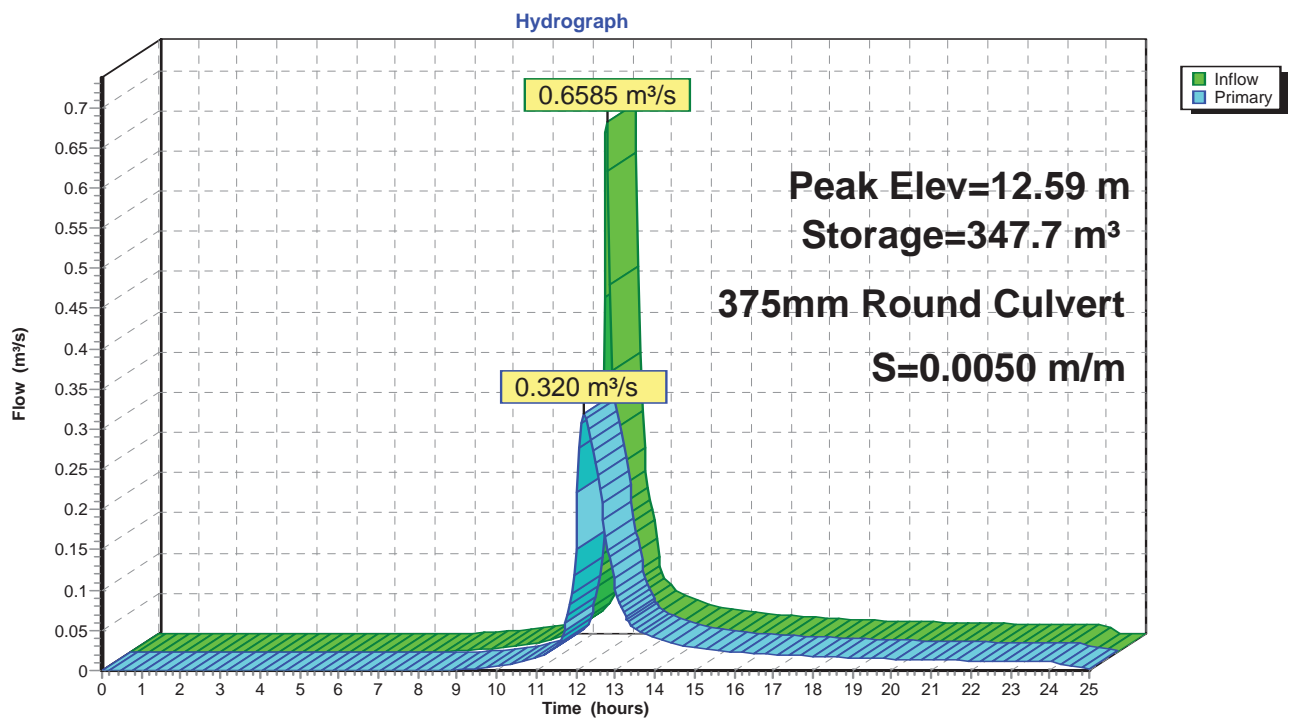
## **APPENDIX B**

2YR & 100YR<sup>+20%</sup> STORM HYDROGRAPHS

### 2yr Storm Event Retention Pond Discharge



### 100yr +20% Storm Event Retention Pond Discharge



**APPENDIX C**  
**WAWA PERMIT**



PERMIT FOR WATERCOURSE AND WETLAND ALTERATION
ALT 54014'21 Original

(Regulations 90-80 under the Clean Water Act Chapter C-6.1, Act of New Brunswick 1989)

PERMITTEE 697800 NB Corp

LOCATIONS table with columns: Latitude, Longitude, Datum, To, Latitude, Longitude, Datum. Includes affected watercourse/tributary, regions, and maps information.

PERMIT VALID FOR THIS PERIOD FROM 2021/03/19 TO 2021/09/30 (yyyy/mm/dd)

Description of Watercourse/Wetland Alteration(s):

This project consists of the soil disturbance associated with the construction of a storm water retention pond. This project is to be carried out as shown in plans prepared by Fisher Engineering Ltd. Titled "Site Drainage Plan".

This project footprint is located on PID 189415.

The Permittee may undertake only those Watercourse/Wetland Alteration(s) described above hereby approved by the Minister. Refer to Conditions of Approval stated on the attached Document "A".

Number of conditions attached to this permit: 17

Date of Issuance: 2021/03/19 (yyyy/mm/dd)

Signature of the Minister of Environment and Climate Change

**DOCUMENT "A" Attached to ALT 54014'21 Original  
CONDITIONS OF APPROVAL**

(Regulations 90-80 under the Clean Water Act Chapter C-6.1, Act of New Brunswick 1989)

---

- ( 1 ) The permittee is responsible for obtaining permission from all landowners listed on the property where the alteration is to take place before commencement of the work.
- ( 2 ) The permittee is responsible for contacting the local planning commission or City/Town prior to commencing the project to ensure that all local/municipal by-laws are adhered to. The permittee is responsible for obtaining all additional permissions and permits prior to work commencement.
- ( 3 ) Other than the alteration described on this permit, no additional alteration shall be carried out in or within 30 metres of the shoulder of the bank of a watercourse/edge of a wetland.
- ( 4 ) A copy of this permit, including the "Conditions of Approval", shall be kept at the alteration site throughout the duration of the project, and such copy shall be produced upon the request of an inspector designated to act on behalf of the Minister of Environment and Local Government, or an employee of Fisheries and Oceans Canada.
- ( 5 ) The permittee shall ensure that all persons involved in the project are aware of and comply with the scope, conditions, and environmental constraints of this permit.
- ( 6 ) This project is to be carried out as shown in plans prepared by Fisher Engineering Ltd. Titled "Site Drainage Plan".
- ( 7 ) The Department of Environment and Local Government – Saint John Office (658-2558) shall be notified at least 2 working days prior to project commencement.
- ( 8 ) When machinery is being used, an appropriate emergency spill kit shall be kept on-site and be readily deployable. Any spill, regardless of quantity, must be reported by contacting the Department of Environment and Local Government during business hours or the National Environmental Emergencies Center (1-800-565-1633) after hours.
- ( 9 ) All demolition debris, spoil, and/or cut material generated during this project shall be prevented from entering the stream flow/water column and being washed downstream. This material shall be entirely collected and disposed of outside a regulated area, in a manner acceptable to the Department of Environment and Local Government.
- ( 10 ) All materials and self-propelled equipment used shall be operated, and stored/parked in an area that prevents any deleterious substance (e.g. petroleum products, silt, etc.) from entering a watercourse/wetland.
- ( 11 ) The equipment used shall be in good working order and must not be leaking any fuel, lubricants, or hydraulic fluid.
- ( 12 ) Self-propelled equipment used shall be located outside of the wetland and/or the wetted portion of the watercourse.
- ( 13 ) Siltation prevention devices competent in quantity, design, diversity, and function to adequately prevent the alteration covered by this permit from having a negative impact on the quality of the stream flow under all runoff conditions, shall be installed prior to exposing erodible soil, and added wherever necessary to prevent sedimentation. These devices shall be maintained such that they perform their intended function until vegetation becomes re-established.
- ( 14 ) If a siltation prevention device is compromised and/or is not functioning properly, no further work shall take place until the issue is corrected.
- ( 15 ) With the exception of possible soil disturbance created by equipment working in the area surrounding the immediate footprint of the retention pond and outflow pipe, soil shall not be added or otherwise disturbed within 15 metres of the shoulder of the bank of the watercourse.
- ( 16 ) Throughout the project, all exposed erodible soil shall be temporarily stabilized with mulch, erosion control blankets or other products designed to prevent erosion and the runoff of suspended sediment into a watercourse/wetland, prior to each forecasted rain event.



**DOCUMENT "A" Attached to ALT 54014'21 Original  
CONDITIONS OF APPROVAL**

(Regulations 90-80 under the Clean Water Act Chapter C-6.1, Act of New Brunswick 1989)

---

- ( 17 ) Upon final grades being achieved, all exposed erodible soil shall be permanently stabilized with perennial vegetation native to the area and blanketed with mulch. If final grading takes place outside the growing season when perennial vegetation can become re-established, temporary stabilization shall be upgraded to perform its function throughout winter and snowmelt/spring break-up conditions. Wherever temporary over-winter stabilization is used, it shall be replaced with non-invasive perennial vegetation native to the area early in the next growing season.

**APPENDIX D**  
**ACCDC REPORT**

# DATA REPORT 6926: Hampton, NB

Prepared 8 April 2021

by J. Churchill, Data Manager

## CONTENTS OF REPORT

### 1.0 Preface

1.1 Data List

1.2 Restrictions

1.3 Additional Information

Map 1: Buffered Study Area

### 2.0 Rare and Endangered Species

2.1 Flora

2.2 Fauna

Map 2: Flora and Fauna

### 3.0 Special Areas

3.1 Managed Areas

3.2 Significant Areas

Map 3: Special Areas

### 4.0 Rare Species Lists

4.1 Fauna

4.2 Flora

4.3 Location Sensitive Species

4.4 Source Bibliography

### 5.0 Rare Species within 100 km

5.1 Source Bibliography



**Map 1.** A 100 km buffer around the study area

## 1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; [www.accdc.com](http://www.accdc.com)) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

### 1.1 DATA LIST

Included datasets:

#### Filename

HamptonNB\_6926ob.xls

HamptonNB\_6926ob100km.xls

HamptonNB\_6926msa.xls

HamptonNB\_6926ff\_py.xls

#### Contents

Rare or legally-protected Flora and Fauna in your study area

A list of Rare and legally protected Flora and Fauna within 100 km of your study area

Managed and Biologically Significant Areas in your study area

Rare Freshwater Fish in your study area (DFO database)

## 1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

- a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
- b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
- c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
- d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
- e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
- f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
- g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.

## 1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

Please direct any additional questions about AC CDC data to the following individuals:

### Plants, Lichens, Ranking Methods, All other Inquiries

Sean Blaney, Senior Scientist, Executive Director

Tel: (506) 364-2658

[sean.blaney@accdc.ca](mailto:sean.blaney@accdc.ca)

### Animals (Fauna)

John Klymko, Zoologist

Tel: (506) 364-2660

[john.klymko@accdc.ca](mailto:john.klymko@accdc.ca)

### Plant Communities

Sarah Robinson, Community Ecologist

Tel: (506) 364-2664

[sarah.robinson@accdc.ca](mailto:sarah.robinson@accdc.ca)

### Data Management, GIS

James Churchill, Data Manager

Tel: (902) 679-6146

[james.churchill@accdc.ca](mailto:james.churchill@accdc.ca)

### Billing

Jean Breau

Tel: (506) 364-2657

[jean.breau@accdc.ca](mailto:jean.breau@accdc.ca)

Questions on the biology of Federal Species at Risk can be directed to AC CDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Donna Hurlburt, NS DLF: (902) 679-6886. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NS DLF Regional Biologist:

**Western:** Emma Vost  
(902) 670-8187  
[Emma.Vost@novascotia.ca](mailto:Emma.Vost@novascotia.ca)

**Western:** Sarah Spencer  
(902) 541-0081  
[Sarah.Spencer@novascotia.ca](mailto:Sarah.Spencer@novascotia.ca)

**Central:** Shavonne Meyer  
(902) 893-0816  
[Shavonne.Meyer@novascotia.ca](mailto:Shavonne.Meyer@novascotia.ca)

**Central:** Kimberly George  
(902) 890-1046  
[Kimberly.George@novascotia.ca](mailto:Kimberly.George@novascotia.ca)

**Eastern:** Harrison Moore  
(902) 497-4119  
[Harrison.Moore@novascotia.ca](mailto:Harrison.Moore@novascotia.ca)

**Eastern:** Maureen Cameron-MacMillan  
(902) 295-2554  
[Maureen.Cameron-MacMillan@novascotia.ca](mailto:Maureen.Cameron-MacMillan@novascotia.ca)

**Eastern:** Elizabeth Walsh  
(902) 563-3370  
[Elizabeth.Walsh@novascotia.ca](mailto:Elizabeth.Walsh@novascotia.ca)

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

## 2.0 RARE AND ENDANGERED SPECIES

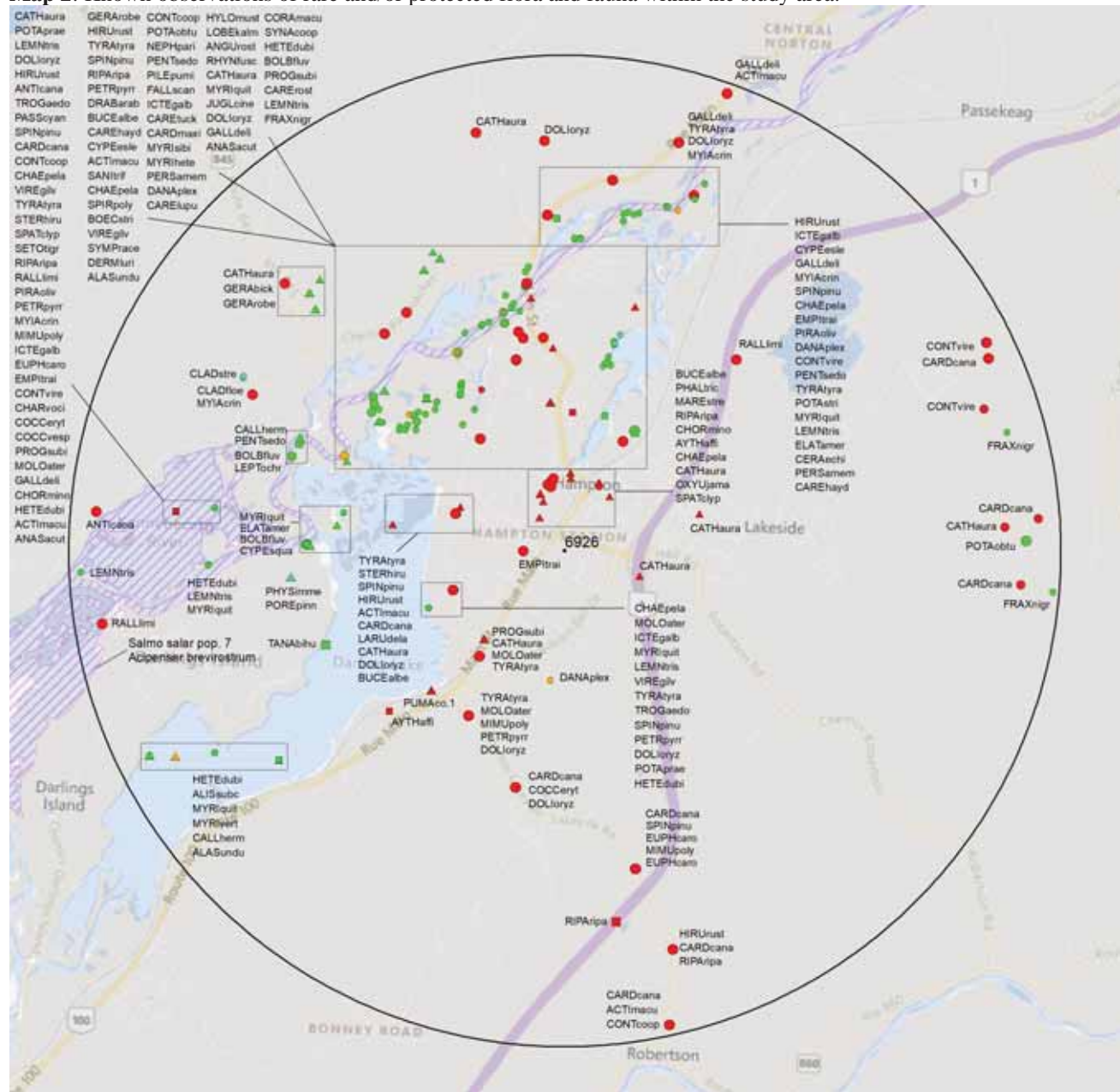
### 2.1 FLORA

The study area contains 142 records of 38 vascular, 7 records of 6 nonvascular flora (Map 2 and attached: \*ob.xls).

### 2.2 FAUNA

The study area contains 325 records of 44 vertebrate, 9 records of 3 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

**Map 2:** Known observations of rare and/or protected flora and fauna within the study area.



- RESOLUTION**
- 4.7 within 50s of kilometers
  - 4.0 within 10s of kilometers
  - 3.7 within 5s of kilometers
  - △ 3.0 within kilometers
  - △ 2.7 within 500s of meters
  - ◇ 2.0 within 100s of meters
  - ◇ 1.7 within 10s of meters

- HIGHER TAXON**
- vertebrate fauna
  - invertebrate fauna
  - vascular flora
  - nonvascular flora

### 3.0 SPECIAL AREAS

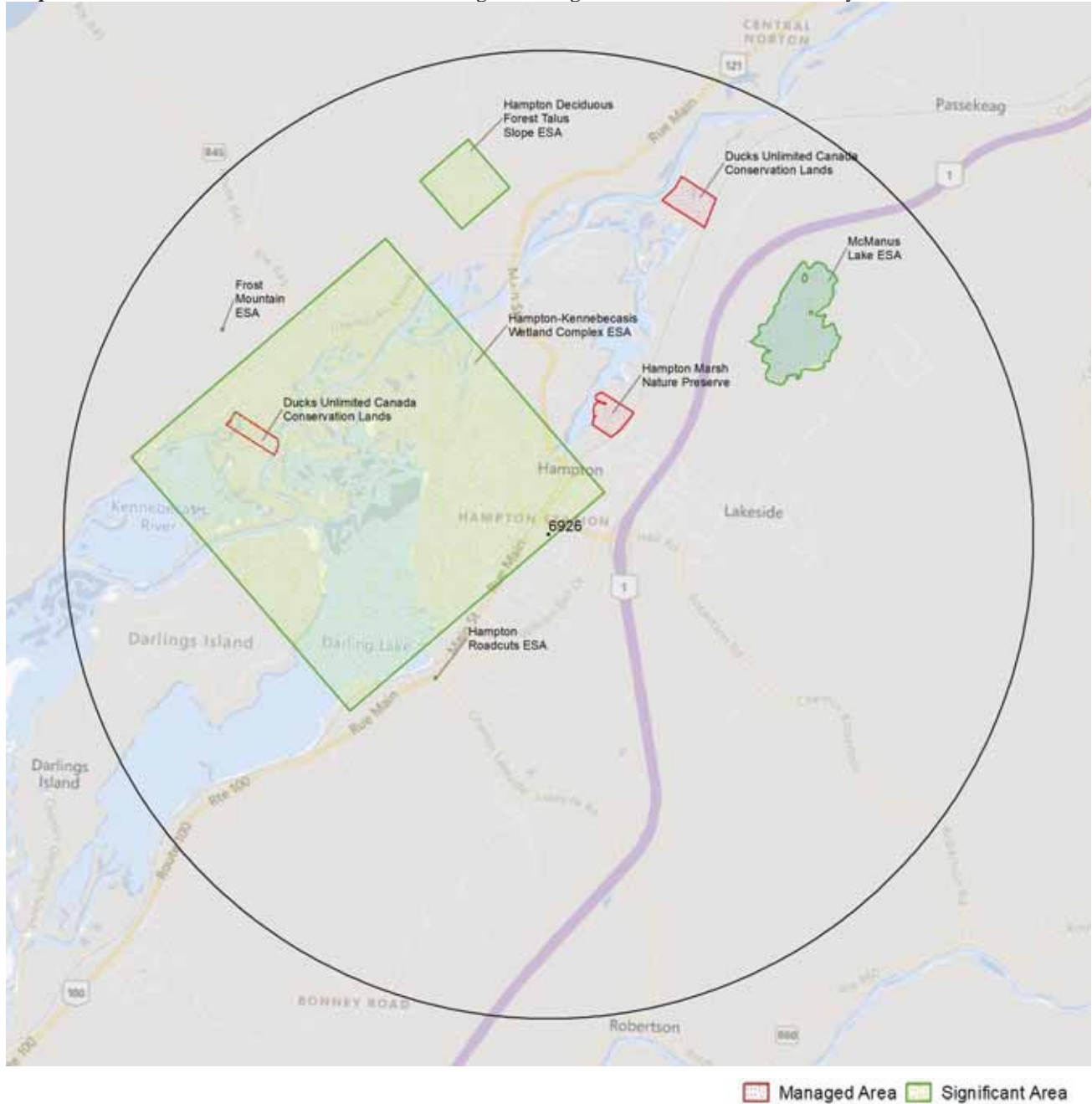
#### 3.1 MANAGED AREAS

The GIS scan identified 3 managed areas in the vicinity of the study area (Map 3 and attached file: \*msa.xls).

#### 3.2 SIGNIFICANT AREAS

The GIS scan identified 5 biologically significant sites in the vicinity of the study area (Map 3 and attached file: \*msa.xls).

**Map 3:** Boundaries and/or locations of known Managed and Significant Areas within the study area.



## 4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding “location-sensitive” species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation ( $\pm$  the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files \*ob.xls/\*ob.shp only.

### 4.1 FLORA

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
N	<i>Porella pinnata</i>	Pinnate Scalewort				S1S3	1	2.8 $\pm$ 1.0
N	<i>Physcomitrium immersum</i>	a Moss				S2	1	2.8 $\pm$ 1.0
N	<i>Cladonia strepsilis</i>	Olive Cladonia Lichen				S3	1	3.7 $\pm$ 0.0
N	<i>Cladonia floerkeana</i>	Gritty British Soldiers Lichen				S3S4	1	3.7 $\pm$ 0.0
N	<i>Nephroma parile</i>	Powdery Kidney Lichen				S3S4	1	1.9 $\pm$ 0.0
N	<i>Dermatocarpon luridum</i>	Brookside Stippleback Lichen				S3S4	2	2.2 $\pm$ 0.0
P	<i>Juglans cinerea</i>	Butternut	Endangered	Endangered	Endangered	S1	1	1.4 $\pm$ 0.0
P	<i>Fraxinus nigra</i>	Black Ash	Threatened			S4S5	3	1.4 $\pm$ 0.0
P	<i>Sanicula trifoliata</i>	Large-Fruited Sanicle				S1	1	2.5 $\pm$ 5.0
P	<i>Draba arabisans</i>	Rock Whitlow-Grass				S1	1	3.2 $\pm$ 1.0
P	<i>Alisma subcordatum</i>	Southern Water Plantain				S1	1	3.6 $\pm$ 0.0
P	<i>Potamogeton strictifolius</i>	Straight-leaved Pondweed				S1	1	3.4 $\pm$ 2.0
P	<i>Symphyotrichum racemosum</i>	Small White Aster				S2	1	2.1 $\pm$ 0.0
P	<i>Boechera stricta</i>	Drummond's Rockcress				S2	1	3.3 $\pm$ 0.0
P	<i>Persicaria amphibia</i> var. <i>emersa</i>	Long-root Smartweed				S2	14	1.9 $\pm$ 0.0
P	<i>Carex rostrata</i>	Narrow-leaved Beaked Sedge				S2	1	1.4 $\pm$ 0.0
P	<i>Cyperus squarrosus</i>	Awned Flatsedge				S2	1	2.6 $\pm$ 0.0
P	<i>Callitriche hermaphroditica</i>	Northern Water-starwort				S2S3	2	2.9 $\pm$ 1.0
P	<i>Elatine americana</i>	American Waterwort				S2S3	2	2.6 $\pm$ 0.0
P	<i>Geranium robertianum</i>	Herb Robert				S2S3	6	3.2 $\pm$ 1.0
P	<i>Myriophyllum quitense</i>	Andean Water Milfoil				S2S3	17	1.5 $\pm$ 0.0
P	<i>Potamogeton praelongus</i>	White-stemmed Pondweed				S2S3	2	1.5 $\pm$ 0.0
P	<i>Tanacetum bipinnatum</i> ssp. <i>huronense</i>	Lake Huron Tansy				S3	1	2.6 $\pm$ 10.0
P	<i>Cardamine maxima</i>	Large Toothwort				S3	3	1.5 $\pm$ 0.0
P	<i>Ceratophyllum echinatum</i>	Prickly Hornwort				S3	1	3.4 $\pm$ 2.0
P	<i>Penthorum sedoides</i>	Ditch Stonecrop				S3	7	1.9 $\pm$ 0.0
P	<i>Geranium bicknellii</i>	Bicknell's Crane's-bill				S3	1	3.7 $\pm$ 0.0
P	<i>Myriophyllum heterophyllum</i>	Variable-leaved Water Milfoil				S3	4	1.6 $\pm$ 0.0
P	<i>Myriophyllum verticillatum</i>	Whorled Water Milfoil				S3	1	3.6 $\pm$ 0.0
P	<i>Fallopia scandens</i>	Climbing False Buckwheat				S3	3	2.5 $\pm$ 0.0
P	<i>Pilea pumila</i>	Dwarf Clearweed				S3	3	1.9 $\pm$ 0.0
P	<i>Carex haydenii</i>	Hayden's Sedge				S3	5	1.9 $\pm$ 0.0
P	<i>Carex lupulina</i>	Hop Sedge				S3	2	1.4 $\pm$ 5.0
P	<i>Carex tuckermanii</i>	Tuckerman's Sedge				S3	2	2.0 $\pm$ 0.0
P	<i>Cyperus esculentus</i> var. <i>leptostachyus</i>	Perennial Yellow Nutsedge				S3	3	2.5 $\pm$ 0.0
P	<i>Rhynchospora fusca</i>	Brown Beakrush				S3	2	2.1 $\pm$ 5.0
P	<i>Bolboschoenus fluviatilis</i>	River Bulrush				S3	14	2.0 $\pm$ 0.0
P	<i>Lemna trisulca</i>	Star Duckweed				S3	15	1.5 $\pm$ 0.0
P	<i>Heteranthera dubia</i>	Water Stargrass				S3	10	1.5 $\pm$ 0.0
P	<i>Potamogeton obtusifolius</i>	Blunt-leaved Pondweed				S3	2	2.4 $\pm$ 1.0
P	<i>Lobelia kalmii</i>	Brook Lobelia				S3S4	1	2.1 $\pm$ 1.0
P	<i>Myriophyllum sibiricum</i>	Siberian Water Milfoil				S3S4	1	2.4 $\pm$ 0.0
P	<i>Spirodela polyrhiza</i>	great duckweed				S3S4	5	1.9 $\pm$ 0.0
P	<i>Corallorhiza maculata</i>	Spotted Coralroot				S3S4	1	2.1 $\pm$ 1.0

## 4.2 FAUNA

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	<i>Hylocichla mustelina</i>	Wood Thrush	Threatened	Threatened	Threatened	S1S2B,S1S2M	1	1.4 ± 7.0
A	<i>Hirundo rustica</i>	Barn Swallow	Threatened	Threatened	Threatened	S2B,S2M	8	1.2 ± 0.0
A	<i>Chaetura pelagica</i>	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	48	0.7 ± 0.0
A	<i>Riparia riparia</i>	Bank Swallow	Threatened	Threatened		S2S3B,S2S3M	11	0.7 ± 1.0
A	<i>Cardellina canadensis</i>	Canada Warbler	Threatened	Threatened	Threatened	S3B,S3M	17	1.2 ± 0.0
A	<i>Dolichonyx oryzivorus</i>	Bobolink	Threatened	Threatened	Threatened	S3B,S3M	14	1.2 ± 0.0
A	<i>Anguilla rostrata</i>	American Eel	Threatened		Threatened	S4	1	1.8 ± 0.0
A	<i>Euphagus carolinus</i>	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B,S3M	3	3.3 ± 0.0
A	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B,S3M	3	2.0 ± 0.0
A	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	Special Concern	Special Concern		S3B,S3S4N,SUM	2	3.9 ± 7.0
A	<i>Chordeiles minor</i>	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	3	0.7 ± 0.0
A	<i>Contopus virens</i>	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S4B,S4M	9	3.4 ± 0.0
A	<i>Sterna hirundo</i>	Common Tern	Not At Risk			S3B,SUM	8	1.2 ± 0.0
A	<i>Puma concolor pop. 1</i>	Eastern Cougar	Data Deficient		Endangered	SNA	1	1.9 ± 1.0
A	<i>Antigone canadensis</i>	Sandhill Crane				S1B,S1M	3	3.9 ± 7.0
A	<i>Phalaropus tricolor</i>	Wilson's Phalarope				S1B,S1M	1	0.8 ± 0.0
A	<i>Progne subis</i>	Purple Martin				S1B,S1M	4	1.2 ± 1.0
A	<i>Oxyura jamaicensis</i>	Ruddy Duck				S1B,S2S3M	3	0.4 ± 0.0
A	<i>Aythya affinis</i>	Lesser Scaup				S1B,S4M	5	0.7 ± 0.0
A	<i>Empidonax traillii</i>	Willow Flycatcher				S1S2B,S1S2M	4	0.4 ± 0.0
A	<i>Troglodytes aedon</i>	House Wren				S1S2B,S1S2M	4	1.2 ± 0.0
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S2B,S2M	5	1.9 ± 0.0
A	<i>Mareca strepera</i>	Gadwall				S2B,S3M	1	0.8 ± 0.0
A	<i>Spatula clypeata</i>	Northern Shoveler				S2S3B,S2S3M	8	0.4 ± 0.0
A	<i>Myiarchus crinitus</i>	Great Crested Flycatcher				S2S3B,S2S3M	6	3.4 ± 0.0
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B,S2S3M	7	1.2 ± 0.0
A	<i>Spinus pinus</i>	Pine Siskin				S3	8	1.2 ± 0.0
A	<i>Cathartes aura</i>	Turkey Vulture				S3B,S3M	33	0.4 ± 0.0
A	<i>Rallus limicola</i>	Virginia Rail				S3B,S3M	3	2.6 ± 0.0
A	<i>Charadrius vociferus</i>	Killdeer				S3B,S3M	2	3.9 ± 7.0
A	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo				S3B,S3M	4	2.4 ± 0.0
A	<i>Vireo gilvus</i>	Warbling Vireo				S3B,S3M	11	1.2 ± 0.0
A	<i>Piranga olivacea</i>	Scarlet Tanager				S3B,S3M	5	3.4 ± 0.0
A	<i>Passerina cyanea</i>	Indigo Bunting				S3B,S3M	1	3.9 ± 7.0
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S3B,S3M	10	1.2 ± 0.0
A	<i>Icterus galbula</i>	Baltimore Oriole				S3B,S3M	16	1.2 ± 0.0
A	<i>Setophaga tigrina</i>	Cape May Warbler				S3B,S4S5M	1	3.9 ± 7.0
A	<i>Anas acuta</i>	Northern Pintail				S3B,S5M	3	1.3 ± 0.0
A	<i>Bucephala albeola</i>	Bufflehead				S3M,S2N	7	0.8 ± 0.0
A	<i>Synaptomys cooperi</i>	Southern Bog Lemming				S3S4	2	1.5 ± 1.0
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3S4B,S3S4M	16	1.2 ± 0.0
A	<i>Actitis macularius</i>	Spotted Sandpiper				S3S4B,S5M	9	1.2 ± 0.0
A	<i>Gallinago delicata</i>	Wilson's Snipe				S3S4B,S5M	12	1.4 ± 0.0
A	<i>Larus delawarensis</i>	Ring-billed Gull				S3S4B,S5M	2	1.2 ± 0.0
I	<i>Danaus plexippus</i>	Monarch	Endangered	Special Concern	Special Concern	S3B,S3M	5	1.3 ± 0.0
I	<i>Alasmidonta undulata</i>	Triangle Floater				S3	3	2.3 ± 0.0
I	<i>Leptodea ochracea</i>	Tidewater Mucket				S3	1	2.4 ± 0.0



### 4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with “YES”.

#### New Brunswick

Scientific Name	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
<i>Chrysemys picta picta</i>	Eastern Painted Turtle			YES
<i>Chelydra serpentina</i>	Snapping Turtle	Special Concern	Special Concern	No
<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	YES
<i>Haliaeetus leucocephalus</i>	Bald Eagle		Endangered	YES
<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Endangered	No
<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	Endangered	Endangered	No
<i>Coenonympha nipisiquit</i>	Maritime Ringlet	Endangered	Endangered	No
<i>Bat hibernaculum</i> or bat species occurrence		[Endangered]'	[Endangered]'	YES

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NB Species at Risk Act.

### 4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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## 5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 47248 records of 148 vertebrate and 1970 records of 93 invertebrate fauna; 7872 records of 371 vascular, 1597 records of 226 nonvascular flora (attached: \*ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs (including “location-sensitive” species). All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation ( $\pm$  the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Myotis lucifugus</i>	Little Brown Myotis	Endangered	Endangered	Endangered	S1	200	1.5 $\pm$ 1.0	NB
A	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	37	10.0 $\pm$ 1.0	NB
A	<i>Perimyotis subflavus</i>	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	54	24.0 $\pm$ 0.0	NB
A	<i>Eubalaena glacialis</i>	North Atlantic Right Whale	Endangered	Endangered	Endangered	S1	2	95.7 $\pm$ 0.0	NB
A	<i>Osmerus mordax</i> pop. 2	Lake Utopia Smelt large-bodied pop.	Endangered	Threatened	Threatened	S1	2	83.9 $\pm$ 10.0	NB
A	<i>Sterna dougallii</i>	Roseate Tern	Endangered	Endangered	Endangered	S1?B,S1?M	2	87.8 $\pm$ 0.0	NS
A	<i>Charadrius melodus melodus</i>	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B,S1M	36	31.4 $\pm$ 0.0	NB
A	<i>Dermochelys coriacea</i> (Atlantic pop.)	Leatherback Sea Turtle - Atlantic pop.	Endangered	Endangered	Endangered	S1S2N	4	32.7 $\pm$ 50.0	NB
A	<i>Salmo salar</i> pop. 1	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered	Endangered	S2	651	10.0 $\pm$ 50.0	NB
A	<i>Calidris canutus rufa</i>	Red Knot rufa ssp	Endangered	Endangered	Endangered	S2M	357	31.5 $\pm$ 0.0	NB
A	<i>Salmo salar</i> pop. 7	Atlantic Salmon - Outer Bay of Fundy pop.	Endangered	Endangered	Endangered	SNR	432	6.0 $\pm$ 0.0	NB
A	<i>Rangifer tarandus</i> pop. 2	Woodland Caribou (Atlantic-Gasp [rsie pop.]	Endangered	Endangered	Extirpated	SX	3	8.0 $\pm$ 1.0	NB
A	<i>Sturnella magna</i>	Eastern Meadowlark	Threatened	Threatened	Threatened	S1B,S1M	59	9.8 $\pm$ 0.0	NB
A	<i>Ixobrychus exilis</i>	Least Bittern	Threatened	Threatened	Threatened	S1S2B,S1S2M	41	14.2 $\pm$ 0.0	NB
A	<i>Hylocichla mustelina</i>	Wood Thrush	Threatened	Threatened	Threatened	S1S2B,S1S2M	145	1.4 $\pm$ 7.0	NB
A	<i>Antrostomus vociferus</i>	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S2B,S2M	80	24.4 $\pm$ 7.0	NB
A	<i>Hirundo rustica</i>	Barn Swallow	Threatened	Threatened	Threatened	S2B,S2M	1171	1.2 $\pm$ 0.0	NB
A	<i>Catharus bicknelli</i>	Bicknell's Thrush	Threatened	Threatened	Threatened	S2B,S2M	10	37.3 $\pm$ 7.0	NB
A	<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	Threatened	S2S3	1745	1.9 $\pm$ 1.0	NB
A	<i>Chaetura pelagica</i>	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	487	0.7 $\pm$ 0.0	NB
A	<i>Riparia riparia</i>	Bank Swallow	Threatened	Threatened	Threatened	S2S3B,S2S3M	990	0.7 $\pm$ 1.0	NB
A	<i>Acipenser oxyrinchus</i>	Atlantic Sturgeon	Threatened	Threatened	Threatened	S3	3	6.4 $\pm$ 0.0	NB
A	<i>Cardellina canadensis</i>	Canada Warbler	Threatened	Threatened	Threatened	S3B,S3M	879	1.2 $\pm$ 0.0	NB
A	<i>Dolichonyx oryzivorus</i>	Bobolink	Threatened	Threatened	Threatened	S3B,S3M	1470	1.2 $\pm$ 0.0	NB
A	<i>Limosa haemastica</i>	Hudsonian Godwit	Threatened	Threatened	Threatened	S3S4M	92	40.0 $\pm$ 0.0	NB
A	<i>Anguilla rostrata</i>	American Eel	Threatened	Threatened	Threatened	S4	7054	1.8 $\pm$ 0.0	NB
A	<i>Coturnicops noveboracensis</i>	Yellow Rail	Special Concern	Special Concern	Special Concern	S1?B,SUM	3	37.0 $\pm$ 7.0	NB
A	<i>Histrionicus histrionicus</i> pop. 1	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S1B,S1S2N,S2M	128	63.8 $\pm$ 17.0	NB
A	<i>Asio flammeus</i>	Short-eared Owl	Special Concern	Special Concern	Special Concern	S2B,S2M	21	35.5 $\pm$ 0.0	NB
A	<i>Bucephala islandica</i> (Eastern pop.)	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2M,S2N	56	10.4 $\pm$ 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Balaenoptera physalus</i>	Fin Whale	Special Concern	Special Concern		S2S3	6	33.7 ± 0.0	NB
A	<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	Special Concern	Special Concern	Special Concern	S3	11	5.8 ± 0.0	NB
A	<i>Chelydra serpentina</i>	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	72	8.1 ± 1.0	NB
A	<i>Euphagus carolinus</i>	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B,S3M	119	3.3 ± 0.0	NB
A	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B,S3M	468	2.0 ± 0.0	NB
A	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	Special Concern	Special Concern		S3B,S3S4N,SUM	322	3.9 ± 7.0	NB
A	<i>Chordeiles minor</i>	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	404	0.7 ± 0.0	NB
A	<i>Phalaropus lobatus</i>	Red-necked Phalarope	Special Concern	Special Concern		S3M	12	29.1 ± 0.0	NB
A	<i>Phocoena phocoena pop. 1</i>	Harbour Porpoise - Northwest Atlantic pop.	Special Concern		Special Concern	S4	50	32.9 ± 0.0	NB
A	<i>Chrysemys picta picta</i>	Eastern Painted Turtle	Special Concern			S4	93	2.1 ± 1.0	NB
A	<i>Contopus virens</i>	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S4B,S4M	814	3.4 ± 0.0	NB
A	<i>Podiceps auritus</i>	Horned Grebe	Special Concern	Special Concern	Special Concern	S4N,S4M	89	28.0 ± 4.0	NB
A	<i>Hemidactylium scutatum</i>	Four-toed Salamander	Not At Risk			S1?	12	57.7 ± 0.0	NB
A	<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Endangered	S1B,S3M	399	5.8 ± 0.0	NB
A	<i>Bubo scandiacus</i>	Snowy Owl	Not At Risk			S1N,S2S3M	10	8.9 ± 0.0	NB
A	<i>Accipiter cooperii</i>	Cooper's Hawk	Not At Risk			S1S2B,S1S2M	19	24.4 ± 7.0	NB
A	<i>Fulica americana</i>	American Coot	Not At Risk			S1S2B,S1S2M	37	32.5 ± 0.0	NB
A	<i>Aegolius funereus</i>	Boreal Owl	Not At Risk			S1S2B,SUM	2	26.3 ± 0.0	NB
A	<i>Sorex dispar</i>	Long-tailed Shrew	Not At Risk			S2	5	31.2 ± 1.0	NB
A	<i>Buteo lineatus</i>	Red-shouldered Hawk	Not At Risk			S2B,S2M	41	8.8 ± 1.0	NB
A	<i>Chlidonias niger</i>	Black Tern	Not At Risk			S2B,S2M	347	7.2 ± 0.0	NB
A	<i>Globicephala melas</i>	Long-finned Pilot Whale	Not At Risk			S2S3	3	28.7 ± 0.0	NB
A	<i>Lynx canadensis</i>	Canadian Lynx	Not At Risk		Endangered	S3	19	19.1 ± 1.0	NB
A	<i>Desmognathus fuscus (Quebec/New Brunswick pop.)</i>	Northern Dusky Salamander (Quebec/New Brunswick pop.)	Not At Risk			S3	54	24.0 ± 1.0	NB
A	<i>Megaptera novaeangliae</i>	Humpback Whale (NW Atlantic pop.)	Not At Risk			S3	8	87.0 ± 0.0	NS
A	<i>Sterna hirundo</i>	Common Tern	Not At Risk			S3B,SUM	188	1.2 ± 0.0	NB
A	<i>Podiceps grisegena</i>	Red-necked Grebe	Not At Risk			S3M,S2N	75	29.9 ± 2.0	NB
A	<i>Lagenorhynchus acutus</i>	Atlantic White-sided Dolphin	Not At Risk			S3S4	1	33.3 ± 1.0	NB
A	<i>Haliaeetus leucocephalus</i>	Bald Eagle	Not At Risk		Endangered	S4	1200	0.2 ± 0.0	NB
A	<i>Canis lupus</i>	Gray Wolf	Not At Risk		Extirpated	SX	4	33.0 ± 1.0	NB
A	<i>Puma concolor pop. 1</i>	Eastern Cougar	Data Deficient		Endangered	SNA	111	1.9 ± 1.0	NB
A	<i>Morone saxatilis</i>	Striped Bass	E,SC			S3	8645	33.8 ± 10.0	NB
A	<i>Odobenus rosmarus pop. 5</i>	Atlantic Walrus - Nova Scotia-Newfoundland-Gulf of St. Lawrence population (DU3)	X			SX	1	88.5 ± 5.0	NS
A	<i>Thryothorus ludovicianus</i>	Carolina Wren				S1	16	13.2 ± 0.0	NB
A	<i>Salvelinus alpinus</i>	Arctic Char				S1	3	40.9 ± 0.0	NB
A	<i>Vireo flavifrons</i>	Yellow-throated Vireo				S1?B,S1?M	16	33.5 ± 1.0	NB
A	<i>Tringa melanoleuca</i>	Greater Yellowlegs				S1?B,S5M	1071	29.1 ± 0.0	NB
A	<i>Aythya americana</i>	Redhead				S1B,S1M	8	24.4 ± 7.0	NB
A	<i>Gallinula galeata</i>	Common Gallinule				S1B,S1M	50	31.7 ± 1.0	NB
A	<i>Antigone canadensis</i>	Sandhill Crane				S1B,S1M	12	3.9 ± 7.0	NB
A	<i>Bartramia longicauda</i>	Upland Sandpiper				S1B,S1M	51	21.9 ± 0.0	NB
A	<i>Phalaropus tricolor</i>	Wilson's Phalarope				S1B,S1M	48	0.8 ± 0.0	NB
A	<i>Leucophaeus atricilla</i>	Laughing Gull				S1B,S1M	10	29.6 ± 0.0	NB
A	<i>Progne subis</i>	Purple Martin				S1B,S1M	238	1.2 ± 1.0	NB
A	<i>Oxyura jamaicensis</i>	Ruddy Duck				S1B,S2S3M	64	0.4 ± 0.0	NB
A	<i>Uria aalge</i>	Common Murre				S1B,S3N,S3M	13	48.9 ± 15.0	NB
A	<i>Aythya affinis</i>	Lesser Scaup				S1B,S4M	205	0.7 ± 0.0	NB
A	<i>Aythya marila</i>	Greater Scaup				S1B,S4M,S2N	39	15.5 ± 7.0	NB
A	<i>Eremophila alpestris</i>	Horned Lark				S1B,S4N,S5M	46	17.7 ± 7.0	NB
A	<i>Sterna paradisaea</i>	Arctic Tern				S1B,SUM	6	20.8 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Fratercula arctica</i>	Atlantic Puffin				S1B,SUN,SUM	13	48.9 ± 15.0	NB
A	<i>Chroicocephalus ridibundus</i>	Black-headed Gull				S1N,S2M	10	7.9 ± 0.0	NB
A	<i>Branta bernicla</i>	Brant				S1N,S2S3M	44	31.7 ± 0.0	NB
A	<i>Butorides virescens</i>	Green Heron				S1S2B,S1S2M	22	30.6 ± 7.0	NB
A	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron				S1S2B,S1S2M	9	8.1 ± 0.0	NB
A	<i>Empidonax traillii</i>	Willow Flycatcher				S1S2B,S1S2M	137	0.4 ± 0.0	NB
A	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow				S1S2B,S1S2M	19	37.0 ± 7.0	NB
A	<i>Troglodytes aedon</i>	House Wren				S1S2B,S1S2M	25	1.2 ± 0.0	NB
A	<i>Rissa tridactyla</i>	Black-legged Kittiwake				S1S2B,S4N,S5M	11	70.5 ± 0.0	NB
A	<i>Calidris bairdii</i>	Baird's Sandpiper				S1S2M	58	31.4 ± 0.0	NB
A	<i>Cistothorus palustris</i>	Marsh Wren				S2B,S2M	421	12.5 ± 0.0	NB
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S2B,S2M	137	1.9 ± 0.0	NB
A	<i>Toxostoma rufum</i>	Brown Thrasher				S2B,S2M	88	26.0 ± 7.0	NB
A	<i>Poocetes gramineus</i>	Vesper Sparrow				S2B,S2M	93	17.1 ± 7.0	NB
A	<i>Mareca strepera</i>	Gadwall				S2B,S3M	168	0.8 ± 0.0	NB
A	<i>Alca torda</i>	Razorbill				S2B,S3N,S3M	12	40.2 ± 0.0	NB
A	<i>Pinicola enucleator</i>	Pine Grosbeak				S2B,S4S5N,S4S5M	39	16.9 ± 0.0	NB
A	<i>Tringa solitaria</i>	Solitary Sandpiper				S2B,S5M	190	17.8 ± 7.0	NB
A	<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel				S2B,SUM	9	57.0 ± 0.0	NB
A	<i>Anser caerulescens</i>	Snow Goose				S2M	6	31.7 ± 0.0	NB
A	<i>Phalacrocorax carbo</i>	Great Cormorant				S2N,S2M	43	31.7 ± 0.0	NB
A	<i>Somateria spectabilis</i>	King Eider				S2N,S2M	5	31.7 ± 0.0	NB
A	<i>Larus hyperboreus</i>	Glaucous Gull				S2N,S2M	115	15.9 ± 14.0	NB
A	<i>Asio otus</i>	Long-eared Owl				S2S3	18	36.2 ± 0.0	NB
A	<i>Picoides dorsalis</i>	American Three-toed Woodpecker				S2S3	14	57.6 ± 0.0	NB
A	<i>Spatula clypeata</i>	Northern Shoveler				S2S3B,S2S3M	280	0.4 ± 0.0	NB
A	<i>Myiarchus crinitus</i>	Great Crested Flycatcher				S2S3B,S2S3M	327	3.4 ± 0.0	NB
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B,S2S3M	490	1.2 ± 0.0	NB
A	<i>Pluvialis dominica</i>	American Golden-Plover				S2S3M	129	30.5 ± 0.0	NB
A	<i>Calcarius lapponicus</i>	Lapland Longspur				S2S3N,SUM	20	29.6 ± 0.0	NB
A	<i>Cephus grylle</i>	Black Guillemot				S3	127	31.7 ± 0.0	NB
A	<i>Loxia curvirostra</i>	Red Crossbill				S3	167	17.8 ± 7.0	NB
A	<i>Spinus pinus</i>	Pine Siskin				S3	386	1.2 ± 0.0	NB
A	<i>Prosopium cylindraceum</i>	Round Whitefish				S3	1	58.4 ± 0.0	NB
A	<i>Salvelinus namaycush</i>	Lake Trout				S3	3	45.8 ± 0.0	NB
A	<i>Sorex maritimensis</i>	Maritime Shrew				S3	1	87.6 ± 0.0	NS
A	<i>Eptesicus fuscus</i>	Big Brown Bat				S3	48	24.4 ± 1.0	NB
A	<i>Cathartes aura</i>	Turkey Vulture				S3B,S3M	374	0.4 ± 0.0	NB
A	<i>Rallus limicola</i>	Virginia Rail				S3B,S3M	317	2.6 ± 0.0	NB
A	<i>Charadrius vociferus</i>	Killdeer				S3B,S3M	744	3.9 ± 7.0	NB
A	<i>Tringa semipalmata</i>	Willet				S3B,S3M	80	30.5 ± 0.0	NB
A	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo				S3B,S3M	177	2.4 ± 0.0	NB
A	<i>Vireo gilvus</i>	Warbling Vireo				S3B,S3M	267	1.2 ± 0.0	NB
A	<i>Piranga olivacea</i>	Scarlet Tanager				S3B,S3M	119	3.4 ± 0.0	NB
A	<i>Passerina cyanea</i>	Indigo Bunting				S3B,S3M	96	3.9 ± 7.0	NB
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S3B,S3M	310	1.2 ± 0.0	NB
A	<i>Icterus galbula</i>	Baltimore Oriole				S3B,S3M	257	1.2 ± 0.0	NB
A	<i>Somateria mollissima</i>	Common Eider				S3B,S4M,S3N	564	22.8 ± 5.0	NB
A	<i>Setophaga tigrina</i>	Cape May Warbler				S3B,S4S5M	163	3.9 ± 7.0	NB
A	<i>Anas acuta</i>	Northern Pintail				S3B,S5M	63	1.3 ± 0.0	NB
A	<i>Mergus serrator</i>	Red-breasted Merganser				S3B,S5M,S4S5N	94	15.0 ± 5.0	NB
A	<i>Arenaria interpres</i>	Ruddy Turnstone				S3M	358	30.5 ± 0.0	NB
A	<i>Phalaropus fulicarius</i>	Red Phalarope				S3M	5	57.0 ± 0.0	NB
A	<i>Melanitta americana</i>	Black Scoter				S3M,S1S2N	224	28.0 ± 4.0	NB
A	<i>Bucephala albeola</i>	Bufflehead				S3M,S2N	640	0.8 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	<i>Calidris maritima</i>	Purple Sandpiper				S3M,S3N	181	28.9 ± 6.0	NB
A	<i>Uria lomvia</i>	Thick-billed Murre				S3N,S3M	13	47.8 ± 8.0	NB
A	<i>Synaptomys cooperi</i>	Southern Bog Lemming				S3S4	95	1.5 ± 1.0	NB
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3S4B,S3S4M	683	1.2 ± 0.0	NB
A	<i>Actitis macularius</i>	Spotted Sandpiper				S3S4B,S5M	861	1.2 ± 0.0	NB
A	<i>Gallinago delicata</i>	Wilson's Snipe				S3S4B,S5M	996	1.4 ± 0.0	NB
A	<i>Larus delawarensis</i>	Ring-billed Gull				S3S4B,S5M	280	1.2 ± 0.0	NB
A	<i>Setophaga striata</i>	Blackpoll Warbler				S3S4B,S5M	59	11.1 ± 7.0	NB
A	<i>Pluvialis squatarola</i>	Black-bellied Plover				S3S4M	1058	30.5 ± 0.0	NB
A	<i>Calidris pusilla</i>	Semipalmated Sandpiper				S3S4M	1350	29.6 ± 0.0	NB
A	<i>Calidris melanotos</i>	Pectoral Sandpiper				S3S4M	226	29.6 ± 0.0	NB
A	<i>Calidris alba</i>	Sanderling				S3S4M,S1N	1084	29.9 ± 2.0	NB
A	<i>Morus bassanus</i>	Northern Gannet				SHB,S5M	74	31.7 ± 0.0	NB
	<i>Quercus macrocarpa</i> - <i>Acer rubrum</i> / <i>Onoclea sensibilis</i> - <i>Carex arcta</i> Forest	Bur Oak - Red Maple / Sensitive Fern - Northern Clustered Sedge Forest				S2	1	48.3 ± 0.0	
C	<i>Acer saccharinum</i> / <i>Onoclea sensibilis</i> - <i>Lysimachia terrestris</i> Forest	Silver Maple / Sensitive Fern - Swamp Yellow Loosestrife Forest				S3	1	61.0 ± 0.0	NB
C	<i>Acer saccharum</i> - <i>Fraxinus americana</i> / <i>Polystichum acrostichoides</i> Forest	Sugar Maple - White Ash / Christmas Fern Forest				S3S4	1	8.0 ± 0.0	NB
I	<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	Endangered	Endangered	Endangered	S1	186	43.7 ± 0.0	NB
I	<i>Gomphus ventricosus</i>	Skillet Clubtail	Endangered	Endangered	Endangered	S1S2	60	35.9 ± 0.0	NB
I	<i>Danaus plexippus</i>	Monarch	Endangered	Special Concern	Special Concern	S3B,S3M	275	1.3 ± 0.0	NB
I	<i>Bombus affinis</i>	Rusty-patched Bumble Bee	Endangered	Endangered		SH	1	80.2 ± 5.0	NB
I	<i>Ophiogomphus howei</i>	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S2	14	79.2 ± 0.0	NB
I	<i>Alasmidonta varicosa</i>	Brook Floater	Special Concern	Special Concern	Special Concern	S2	9	70.1 ± 1.0	NB
I	<i>Lampsilis cariosa</i>	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S2	104	15.5 ± 0.0	NB
I	<i>Bombus terricola</i>	Yellow-banded Bumblebee	Special Concern	Special Concern		S3?	102	8.0 ± 0.0	NB
I	<i>Coccinella transversoguttata richardsoni</i>	Transverse Lady Beetle	Special Concern			SH	2	33.3 ± 1.0	NB
I	<i>Appalachina sayana</i>	Spike-lip Crater	Not At Risk			S3?	2	25.3 ± 1.0	NB
I	<i>Conotrachelus juglandis</i>	a Weevil				S1	3	76.2 ± 0.0	NB
I	<i>Haematopota rara</i>	Shy Cleg				S1	1	80.7 ± 1.0	NB
I	<i>Lycaena dorcas</i>	Dorcas Copper				S1	1	93.6 ± 0.0	NB
I	<i>Erora laeta</i>	Early Hairstreak				S1	4	87.6 ± 7.0	NB
I	<i>Arigomphus furcifer</i>	Lilypad Clubtail				S1	20	40.4 ± 0.0	NB
I	<i>Polites origenes</i>	Crossline Skipper				S1?	8	30.7 ± 0.0	NB
I	<i>Plebejus saepiolus</i>	Greenish Blue				S1S2	5	69.2 ± 2.0	NB
I	<i>Ophiogomphus colubrinus</i>	Boreal Snaketail				S1S2	36	49.2 ± 0.0	NB
I	<i>Cicindela ancocisconensis</i>	Appalachian Tiger Beetle				S2	1	86.2 ± 0.0	NB
I	<i>Encyclops caerulea</i>	a Longhorned Beetle				S2	1	81.0 ± 0.0	NB
I	<i>Scaphinotus viduus</i>	a Ground Beetle				S2	2	21.1 ± 0.0	NB
I	<i>Brachyleptura circumdata</i>	a Longhorned Beetle				S2	6	54.1 ± 0.0	NB
I	<i>Satyrium calanus</i>	Banded Hairstreak				S2	27	38.2 ± 0.0	NB
I	<i>Satyrium calanus falacer</i>	Banded Hairstreak				S2	1	77.2 ± 1.0	NB
I	<i>Strymon melinus</i>	Grey Hairstreak				S2	4	52.9 ± 0.0	NB
I	<i>Aeshna clepsydra</i>	Mottled Darner				S2	14	17.4 ± 0.0	NB
I	<i>Somatochlora tenebrosa</i>	Clamp-Tipped Emerald				S2	8	59.3 ± 0.0	NB
I	<i>Ladona exusta</i>	White Corporal				S2	4	63.3 ± 0.0	NB
I	<i>Hetaerina americana</i>	American Rubyspot				S2	11	39.9 ± 0.0	NB
I	<i>Ischnura posita</i>	Fragile Forktail				S2	15	61.4 ± 0.0	NB
I	<i>Callophrys henrici</i>	Henry's Elfin				S2S3	16	63.6 ± 0.0	NB
I	<i>Celithemis martha</i>	Martha's Pennant				S2S3	9	28.8 ± 0.0	NB
I	<i>Sphaeroderus nitidicollis</i>	a Ground Beetle				S3	1	54.1 ± 0.0	NB
I	<i>Lepturoopsis biforis</i>	a Longhorned Beetle				S3	1	33.3 ± 1.0	NB
I	<i>Orthosoma brunneum</i>	a Longhorned Beetle				S3	3	49.0 ± 5.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
	<i>Elaphrus americanus</i>	a Ground Beetle			S3		2	62.6 ± 0.0	NB
	<i>Semanotus terminatus</i>	A Long-horned Beetle			S3		1	76.7 ± 0.0	NB
	<i>Desmocerus palliatus</i>	Elderberry Borer			S3		9	28.1 ± 0.0	NB
	<i>Agonum excavatum</i>	a Ground Beetle			S3		1	62.6 ± 0.0	NB
	<i>Clivina americana</i>	a Ground Beetle			S3		1	62.6 ± 0.0	NB
	<i>Lachnocrepis parallela</i>	a Ground Beetle			S3		1	93.0 ± 0.0	NB
	<i>Dyschirius setosus</i>	a Ground Beetle			S3		3	93.0 ± 0.0	NB
	<i>Harpalus fulvilabris</i>	a Ground Beetle			S3		1	86.6 ± 0.0	NB
	<i>Olisthopus parmatus</i>	a Ground Beetle			S3		1	54.1 ± 0.0	NB
	<i>Paratachys scitulus</i>	a Ground Beetle			S3		1	62.6 ± 0.0	NB
	<i>Amara pallipes</i>	a Ground Beetle			S3		1	92.9 ± 0.0	NB
	<i>Carabus serratus</i>	a Ground Beetle			S3		2	61.0 ± 0.0	NB
	<i>Coccinella hieroglyphica kirbyi</i>	a Ladybird Beetle			S3		1	33.3 ± 1.0	NB
	<i>Hippodamia parenthesis</i>	Parenthesis Lady Beetle			S3		8	33.3 ± 1.0	NB
	<i>Stenocorus vittiger</i>	a Longhorned Beetle			S3		1	62.6 ± 0.0	NB
	<i>Gnathacmaeops pratensis</i>	a Longhorned Beetle			S3		5	33.3 ± 1.0	NB
	<i>Pogonocherus mixtus</i>	a Longhorned Beetle			S3		1	33.3 ± 1.0	NB
	<i>Badister neopulchellus</i>	a Ground Beetle			S3		1	62.6 ± 0.0	NB
	<i>Calathus gregarius</i>	a Ground Beetle			S3		1	62.4 ± 1.0	NB
	<i>Gonioctena americana</i>	a Leaf Beetle			S3		1	92.9 ± 0.0	NB
	<i>Gonotropis dorsalis</i>	A Fungus Weevil			S3		1	76.7 ± 0.0	NB
	<i>Naemia seriata</i>	a Ladybird beetle			S3		10	51.2 ± 0.0	NB
	<i>Beckerus appressus</i>	A Click Beetle			S3		1	57.1 ± 0.0	NB
	<i>Saperda lateralis</i>	a Longhorned Beetle			S3		2	38.7 ± 0.0	NB
	<i>Trachysida aspera</i>	a Longhorned Beetle			S3		1	81.3 ± 0.0	NB
	<i>Enoclerus mutkowskii</i>	a Checkered Beetle			S3		1	91.7 ± 0.0	NB
	<i>Hesperia sassacus</i>	Indian Skipper			S3		16	30.7 ± 1.0	NB
	<i>Euphyes bimacula</i>	Two-spotted Skipper			S3		12	50.4 ± 0.0	NB
	<i>Lycaena hyllus</i>	Bronze Copper			S3		51	14.2 ± 1.0	NB
	<i>Satyrium acadica</i>	Acadian Hairstreak			S3		13	30.7 ± 0.0	NB
	<i>Callophrys polios</i>	Hoary Elfin			S3		14	33.2 ± 5.0	NB
	<i>Plebejus idas</i>	Northern Blue			S3		7	67.4 ± 0.0	NB
	<i>Plebejus idas empetri</i>	Crowberry Blue			S3		35	44.5 ± 2.0	NB
	<i>Speyeria aphrodite</i>	Aphrodite Fritillary			S3		29	12.5 ± 0.0	NB
	<i>Boloria bellona</i>	Meadow Fritillary			S3		57	27.2 ± 0.0	NB
	<i>Polygonia satyrus</i>	Satyr Comma			S3		20	38.8 ± 2.0	NB
	<i>Polygonia gracilis</i>	Hoary Comma			S3		6	46.4 ± 7.0	NB
	<i>Nymphalis l-album</i>	Compton Tortoiseshell			S3		23	25.4 ± 7.0	NB
	<i>Gomphus vastus</i>	Cobra Clubtail			S3		86	17.4 ± 0.0	NB
	<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail			S3		30	27.2 ± 0.0	NB
	<i>Gomphaeschna furcillata</i>	Harlequin Darner			S3		7	63.9 ± 0.0	NB
	<i>Dorocordulia lepida</i>	Petite Emerald			S3		25	29.0 ± 0.0	NB
	<i>Somatochlora cingulata</i>	Lake Emerald			S3		7	22.5 ± 0.0	NB
	<i>Somatochlora forcipata</i>	Forcinate Emerald			S3		9	57.8 ± 0.0	NB
	<i>Williamsonia fletcheri</i>	Ebony Boghaunter			S3		10	46.7 ± 0.0	NB
	<i>Lestes eurinus</i>	Amber-Winged Spreadwing			S3		26	47.9 ± 1.0	NB
	<i>Lestes vigilax</i>	Swamp Spreadwing			S3		25	28.7 ± 0.0	NB
	<i>Enallagma geminatum</i>	Skimming Bluet			S3		22	36.1 ± 0.0	NB
	<i>Enallagma signatum</i>	Orange Bluet			S3		21	40.7 ± 0.0	NB
	<i>Stylurus scudderi</i>	Zebra Clubtail			S3		78	17.4 ± 0.0	NB
	<i>Alasmidonta undulata</i>	Triangle Floater			S3		50	2.3 ± 0.0	NB
	<i>Leptodea ochracea</i>	Tidewater Mucket			S3		153	2.4 ± 0.0	NB
	<i>Striatura ferrea</i>	Black Striate			S3		1	79.7 ± 1.0	NB
	<i>Neohelix albolabris</i>	Whitelip			S3		2	24.0 ± 0.0	NB
	<i>Spurwinkia salsa</i>	Saltmarsh Hydrobe			S3		34	10.0 ± 0.0	NB
	<i>Pantala hymenaea</i>	Spot-Winged Glider			S3B,S3M		6	45.8 ± 1.0	NB
	<i>Satyrium liparops</i>	Striped Hairstreak			S3S4		24	17.6 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
I	<i>Cupido comyntas</i>	Eastern Tailed Blue				S3S4	55	15.9 ± 0.0	NB
N	<i>Erioderma mollissimum</i>	Graceful Felt Lichen	Endangered	Endangered	Endangered	SH	1	61.0 ± 1.0	NB
N	<i>Erioderma pedicellatum</i> (Atlantic pop.)	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	SH	2	73.2 ± 0.0	NS
N	<i>Peltigera hydrothyria</i>	Eastern Waterfan	Threatened	Threatened		S1	395	56.6 ± 0.0	NB
N	<i>Pannaria lurida</i>	Wrinkled Shingle Lichen	Threatened	Threatened		S1?	6	82.9 ± 0.0	NS
N	<i>Anzia colpodes</i>	Black-foam Lichen	Threatened	Threatened		S1S2	13	39.6 ± 0.0	NB
N	<i>Fuscopannaria leucosticta</i>	White-rimmed Shingle Lichen	Threatened			S2	12	25.4 ± 0.0	NB
N	<i>Pectenium plumbea</i>	Blue Felt Lichen	Special Concern	Special Concern	Special Concern	S1	139	73.2 ± 0.0	NS
N	<i>Pseudevernia cladonia</i>	Ghost Antler Lichen	Not At Risk			S2S3	19	19.7 ± 0.0	NB
N	<i>Bryum muehlenbeckii</i>	Muehlenbeck's Bryum Moss				S1	1	33.4 ± 1.0	NB
N	<i>Dicranoweisia crispula</i>	Mountain Thatch Moss				S1	1	67.1 ± 0.0	NB
N	<i>Didymodon rigidulus</i> var. <i>gracilis</i>	a moss				S1	1	63.7 ± 1.0	NB
N	<i>Sphagnum macrophyllum</i>	Sphagnum				S1	4	42.4 ± 0.0	NB
N	<i>Syntrichia ruralis</i>	a Moss				S1	1	36.2 ± 0.0	NB
N	<i>Coscinodon cribrosus</i>	Sieve-Toothed Moss				S1	1	35.5 ± 0.0	NB
N	<i>Collema tenax</i>	Soil Tarpaper Lichen				S1	1	71.2 ± 0.0	NS
N	<i>Sticta fuliginosa</i>	Peppered Moon Lichen				S1	8	61.7 ± 13.0	NS
N	<i>Cladonia straminea</i>	Reptilian Pixie-cup Lichen				S1	5	56.2 ± 1.0	NB
N	<i>Ephebe hispidula</i>	Dryside Rockshag Lichen				S1	1	82.5 ± 0.0	NS
N	<i>Ephebe perspinulosa</i>	Thread Lichen				S1	1	83.1 ± 0.0	NS
N	<i>Coccocarpia palmicola</i>	Salted Shell Lichen				S1	2	69.4 ± 1.0	NB
N	<i>Peltigera collina</i>	Tree Pelt Lichen				S1	1	96.3 ± 0.0	NS
N	<i>Peltigera malacea</i>	Veinless Pelt Lichen				S1	1	58.8 ± 1.0	NB
N	<i>Bryoria bicolor</i>	Electrified Horsehair Lichen				S1	1	58.8 ± 1.0	NB
N	<i>Hygrobiella laxifolia</i>	Lax Notchwort				S1?	1	56.3 ± 1.0	NB
N	<i>Bartramia ithyphylla</i>	Straight-leaved Apple Moss				S1?	2	56.3 ± 0.0	NB
N	<i>Bryum pallens</i>	a Moss				S1?	1	97.1 ± 0.0	NS
N	<i>Calliergon trifarium</i>	Three-ranked Moss				S1?	1	41.3 ± 0.0	NB
N	<i>Dichelyma falcatum</i>	a Moss				S1?	2	38.7 ± 1.0	NB
N	<i>Dicranum bonjeanii</i>	Bonjean's Broom Moss				S1?	1	79.7 ± 1.0	NB
N	<i>Dicranum condensatum</i>	Condensed Broom Moss				S1?	1	66.9 ± 0.0	NB
N	<i>Entodon brevisetus</i>	a Moss				S1?	1	62.9 ± 10.0	NB
N	<i>Eurhynchium hians</i>	Light Beaked Moss				S1?	4	34.0 ± 0.0	NB
N	<i>Homomallium adnatum</i>	Adnate Hairy-gray Moss				S1?	3	62.9 ± 10.0	NB
N	<i>Plagiothecium latebricola</i>	Alder Silk Moss				S1?	2	40.9 ± 0.0	NB
N	<i>Racomitrium ericoides</i>	a Moss				S1?	1	93.7 ± 3.0	NB
N	<i>Rhytidium rugosum</i>	Wrinkle-leaved Moss				S1?	2	36.6 ± 0.0	NB
N	<i>Seligeria recurvata</i>	a Moss				S1?	3	75.8 ± 1.0	NB
N	<i>Splachnum pennsylvanicum</i>	Southern Dung Moss				S1?	1	69.2 ± 1.0	NB
N	<i>Euopsis granatina</i>	Lesser Rockbud Lichen				S1?	1	79.6 ± 1.0	NS
N	<i>Heterodermia squamulosa</i>	Scaly Fringe Lichen				S1?	11	39.6 ± 0.0	NB
N	<i>Spilonema revertens</i>	Rock Hairball Lichen				S1?	4	82.8 ± 0.0	NS
N	<i>Peltigera venosa</i>	Fan Pelt Lichen				S1?	1	61.0 ± 0.0	NB
N	<i>Cetraria arenaria</i>	Sand-loving Icelandmoss Lichen				S1?	15	89.9 ± 0.0	NS
N	<i>Cephaloziella spinigera</i>	Spiny Threadwort				S1S2	2	84.5 ± 0.0	NB
N	<i>Cladopodiella francisci</i>	Holt's Notchwort				S1S2	4	63.7 ± 1.0	NB
N	<i>Harpanthus flotovianus</i>	Great Mountain Flapwort				S1S2	2	56.2 ± 1.0	NB
N	<i>Jungermannia obovata</i>	Egg Flapwort				S1S2	2	19.8 ± 0.0	NB
N	<i>Pallavicinia lyellii</i>	Lyell's Ribbonwort				S1S2	3	34.1 ± 1.0	NB
N	<i>Radula tenax</i>	Tenacious Scalewort				S1S2	1	67.9 ± 0.0	NB
N	<i>Reboulia hemisphaerica</i>	Purple-margined Liverwort				S1S2	1	63.6 ± 0.0	NB
N	<i>Brachythecium acuminatum</i>	Acuminate Ragged Moss				S1S2	5	35.6 ± 100.0	NB
N	<i>Bryum salinum</i>	a Moss				S1S2	2	63.6 ± 1.0	NB
N	<i>Campyllum radicale</i>	Long-stalked Fine Wet Moss				S1S2	1	80.8 ± 1.0	NB

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N	<i>Tortula obtusifolia</i>	a Moss				S1S2	1	30.0 ± 0.0	NB
N	<i>Distichium inclinatum</i>	Inclined Iris Moss				S1S2	5	63.6 ± 0.0	NB
N	<i>Ditrichum pallidum</i>	Pale Cow-hair Moss				S1S2	2	49.0 ± 1.0	NB
N	<i>Drummondia prorepens</i>	a Moss				S1S2	1	99.8 ± 0.0	NS
N	<i>Hygrohypnum bestii</i>	Best's Brook Moss				S1S2	6	44.1 ± 0.0	NB
N	<i>Sphagnum platyphyllum</i>	Flat-leaved Peat Moss				S1S2	1	83.0 ± 0.0	NS
N	<i>Timmia norvegica</i>	a moss				S1S2	3	21.8 ± 0.0	NB
N	<i>Timmia norvegica</i> var. <i>excurrens</i>	a moss				S1S2	1	63.6 ± 0.0	NB
N	<i>Tomentypnum falcifolium</i>	Sickle-leaved Golden Moss				S1S2	1	61.9 ± 1.0	NB
N	<i>Tortella humilis</i>	Small Crisp Moss				S1S2	7	55.8 ± 0.0	NB
N	<i>Pseudotaxiphyllum distichaceum</i>	a Moss				S1S2	2	69.8 ± 1.0	NB
N	<i>Hamatocaulis vernicosus</i>	a Moss				S1S2	3	21.0 ± 100.0	NB
N	<i>Bryohaplocladium microphyllum</i>	Tiny-leaved Haplocladium Moss				S1S2	1	78.4 ± 3.0	NS
N	<i>Umbilicaria vellea</i>	Grizzled Rocktripe Lichen				S1S2	1	63.7 ± 1.0	NB
N	<i>Cystocoleus ebeneus</i>	Rockgossamer Lichen				S1S2	1	79.5 ± 0.0	NS
N	<i>Peltigera scabrosa</i>	Greater Toad Pelt Lichen				S1S2	4	66.0 ± 1.0	NB
N	<i>Calypogeia neesiana</i>	Nees' Pouchwort				S1S3	1	8.8 ± 1.0	NB
N	<i>Cephalozia connivens</i>	Forcipated Pincerwort				S1S3	1	19.6 ± 0.0	NB
N	<i>Cephalozia elachista</i>	Spurred Threadwort				S1S3	1	41.6 ± 5.0	NB
N	<i>Porella pinnata</i>	Pinnate Scalewort				S1S3	1	2.8 ± 1.0	NB
N	<i>Tritomania scitula</i>	Mountain Notchwort				S1S3	1	69.7 ± 1.0	NB
N	<i>Amphidium mougeotii</i>	a Moss				S2	13	20.4 ± 1.0	NB
N	<i>Anomodon viticulosus</i>	a Moss				S2	8	9.8 ± 0.0	NB
N	<i>Cirriophyllum piliferum</i>	Hair-pointed Moss				S2	4	40.8 ± 0.0	NB
N	<i>Dicranella palustris</i>	Drooping-Leaved Fork Moss				S2	10	16.2 ± 100.0	NB
N	<i>Didymodon ferrugineus</i>	a moss				S2	2	10.4 ± 1.0	NB
N	<i>Ditrichum flexicaule</i>	Flexible Cow-hair Moss				S2	1	20.4 ± 1.0	NB
N	<i>Anomodon tristis</i>	a Moss				S2	4	62.6 ± 10.0	NB
N	<i>Hypnum pratense</i>	Meadow Plait Moss				S2	1	38.5 ± 0.0	NB
N	<i>Isopterygiopsis pulchella</i>	Neat Silk Moss				S2	8	62.9 ± 0.0	NB
N	<i>Isothecium myosuroides</i>	Slender Mouse-tail Moss				S2	3	20.4 ± 1.0	NB
N	<i>Meesia triquetra</i>	Three-ranked Cold Moss				S2	2	35.6 ± 100.0	NB
N	<i>Physcomitrium immersum</i>	a Moss				S2	7	2.8 ± 1.0	NB
N	<i>Platydictya jungermannioides</i>	False Willow Moss				S2	5	56.8 ± 0.0	NB
N	<i>Pohlia elongata</i>	Long-necked Nodding Moss				S2	10	55.8 ± 0.0	NB
N	<i>Seligeria calcarea</i>	Chalk Brittle Moss				S2	3	20.4 ± 1.0	NB
N	<i>Sphagnum centrale</i>	Central Peat Moss				S2	6	55.8 ± 0.0	NB
N	<i>Sphagnum lindbergii</i>	Lindberg's Peat Moss				S2	8	24.5 ± 5.0	NB
N	<i>Sphagnum flexuosum</i>	Flexuous Peatmoss				S2	2	63.4 ± 0.0	NB
N	<i>Tayloria serrata</i>	Serrate Trumpet Moss				S2	8	27.6 ± 1.0	NB
N	<i>Tetradontium brownianum</i>	Little Georgia				S2	7	62.5 ± 10.0	NB
N	<i>Tetraplodon mnioides</i>	Entire-leaved Nitrogen Moss				S2	3	63.0 ± 0.0	NB
N	<i>Thamnobryum alleghaniense</i>	a Moss				S2	15	21.8 ± 0.0	NB
N	<i>Tortula mucronifolia</i>	Mucronate Screw Moss				S2	1	35.1 ± 0.0	NB
N	<i>Ulota phyllantha</i>	a Moss				S2	6	63.3 ± 1.0	NB
N	<i>Anomobryum filiforme</i>	a moss				S2	5	32.7 ± 0.0	NB
N	<i>Cladonia macrophylla</i>	Fig-leaved Lichen				S2	3	65.5 ± 1.0	NB
N	<i>Leptogium corticola</i>	Blistered Jellyskin Lichen				S2	2	61.8 ± 0.0	NB
N	<i>Nephroma laevigatum</i>	Mustard Kidney Lichen				S2	5	71.1 ± 0.0	NS
N	<i>Peltigera lepidophora</i>	Scaly Pelt Lichen				S2	2	61.0 ± 0.0	NB
N	<i>Andreaea rothii</i>	a Moss				S2?	6	28.2 ± 0.0	NB
N	<i>Anomodon minor</i>	Blunt-leaved Anomodon Moss				S2?	1	68.2 ± 1.0	NB
N	<i>Brachythecium digastrum</i>	a Moss				S2?	2	37.6 ± 0.0	NB



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N	<i>Bryum pallescens</i>	Pale Bryum Moss				S2?	2	34.4 ± 1.0	NB
N	<i>Dichelyma capillaceum</i>	Hairlike Dichelyma Moss				S2?	1	63.3 ± 3.0	NB
N	<i>Dicranum spurium</i>	Spurred Broom Moss				S2?	4	57.0 ± 0.0	NB
N	<i>Hygrohypnum montanum</i>	a Moss				S2?	2	41.6 ± 1.0	NB
N	<i>Schistostega pennata</i>	Luminous Moss				S2?	3	16.2 ± 100.0	NB
N	<i>Seligeria campylopoda</i>	a Moss				S2?	1	21.0 ± 100.0	NB
N	<i>Seligeria diversifolia</i>	a Moss				S2?	2	32.7 ± 0.0	NB
N	<i>Sphagnum angermanicum</i>	a Peatmoss				S2?	3	60.1 ± 10.0	NB
N	<i>Trichodon cylindricus</i>	Cylindric Hairy-teeth Moss				S2?	3	75.8 ± 10.0	NB
N	<i>Plagiomnium rostratum</i>	Long-beaked Leafy Moss				S2?	7	21.8 ± 0.0	NB
N	<i>Ramalina labiosorediata</i>	Chalky Ramalina Lichen				S2?	1	66.4 ± 1.0	NB
N	<i>Collema leptaleum</i>	Crumpled Bat's Wing Lichen				S2?	1	97.3 ± 0.0	NB
N	<i>Nephroma arcticum</i>	Arctic Kidney Lichen				S2?	1	59.1 ± 1.0	NB
N	<i>Bryum uliginosum</i>	a Moss				S2S3	2	24.0 ± 4.0	NB
N	<i>Calliergonella cuspidata</i>	Common Large Wetland Moss				S2S3	16	23.0 ± 0.0	NB
N	<i>Campyllum polygamum</i>	a Moss				S2S3	1	58.5 ± 0.0	NB
N	<i>Palustriella falcata</i>	a Moss				S2S3	3	20.4 ± 1.0	NB
N	<i>Didymodon rigidulus</i>	Rigid Screw Moss				S2S3	11	33.8 ± 0.0	NB
N	<i>Ephemerum serratum</i>	a Moss				S2S3	5	35.8 ± 0.0	NB
N	<i>Fissidens bushii</i>	Bush's Pocket Moss				S2S3	6	33.8 ± 0.0	NB
N	<i>Hypnum cupressiforme</i> var. <i>filiforme</i>	a Moss				S2S3	1	83.1 ± 0.0	NS
N	<i>Neckera complanata</i>	a Moss				S2S3	7	20.4 ± 1.0	NB
N	<i>Orthotrichum speciosum</i>	Showy Bristle Moss				S2S3	4	83.8 ± 0.0	NS
N	<i>Orthotrichum speciosum</i> var. <i>elegans</i>	a Moss				S2S3	1	69.2 ± 0.0	NB
N	<i>Pohlia prolifera</i>	Cottony Nodding Moss				S2S3	5	63.3 ± 1.0	NB
N	<i>Racomitrium fasciculare</i>	a Moss				S2S3	3	56.2 ± 0.0	NB
N	<i>Racomitrium affine</i>	a Moss				S2S3	1	65.8 ± 1.0	NB
N	<i>Saelania glaucescens</i>	Blue Dew Moss				S2S3	2	67.1 ± 0.0	NB
N	<i>Scorpidium scorpioides</i>	Hooked Scorpion Moss				S2S3	4	23.0 ± 0.0	NB
N	<i>Sphagnum subfulvum</i>	a Peatmoss				S2S3	4	61.9 ± 1.0	NB
N	<i>Taxiphyllum deplanatum</i>	Imbricate Yew-leaved Moss				S2S3	3	67.4 ± 1.0	NB
N	<i>Zygodon viridissimus</i>	a Moss				S2S3	2	67.4 ± 1.0	NB
N	<i>Schistidium agassizii</i>	Elf Bloom Moss				S2S3	5	56.3 ± 0.0	NB
N	<i>Loeskeobryum brevirostre</i>	a Moss				S2S3	14	20.4 ± 1.0	NB
N	<i>Cyrtomnium hymenophylloides</i>	Short-pointed Lantern Moss				S2S3	7	34.6 ± 0.0	NB
N	<i>Cladonia acuminata</i>	Scantly Clad Pixie Lichen				S2S3	2	61.0 ± 1.0	NB
N	<i>Cladonia ramulosa</i>	Bran Lichen				S2S3	4	63.9 ± 1.0	NB
N	<i>Cladonia sulphurina</i>	Greater Sulphur-cup Lichen				S2S3	5	57.8 ± 0.0	NB
N	<i>Parmeliopsis ambigua</i>	Green Starburst Lichen				S2S3	1	58.4 ± 1.0	NB
N	<i>Sphaerophorus globosus</i>	Northern Coral Lichen				S2S3	6	57.1 ± 1.0	NB
N	<i>Cynodontium tenellum</i>	Delicate Dogtooth Moss				S3	1	69.8 ± 1.0	NB
N	<i>Hypnum curvifolium</i>	Curved-leaved Plait Moss				S3	16	56.2 ± 0.0	NB
N	<i>Tortella fragilis</i>	Fragile Twisted Moss				S3	1	63.6 ± 0.0	NB
N	<i>Schistidium maritimum</i>	a Moss				S3	7	63.3 ± 1.0	NB
N	<i>Hymenostylium recurvirostre</i>	Hymenostylium Moss				S3	10	63.3 ± 1.0	NB
N	<i>Solorina saccata</i>	Woodland Owl Lichen				S3	7	58.4 ± 1.0	NB
N	<i>Normandina pulchella</i>	Rimmed Elf-ear Lichen				S3	11	59.7 ± 1.0	NB
N	<i>Cladonia farinacea</i>	Farinose Pixie Lichen				S3	5	65.5 ± 1.0	NB
N	<i>Cladonia strepsilis</i>	Olive Cladonia Lichen				S3	3	3.7 ± 0.0	NB
N	<i>Hypotrachyna catawbiensis</i>	Powder-tipped Antler Lichen				S3	3	75.9 ± 0.0	NS
N	<i>Leptogium lichenoides</i>	Tattered Jellyskin Lichen				S3	7	61.0 ± 0.0	NB
N	<i>Nephroma bellum</i>	Naked Kidney Lichen				S3	3	57.1 ± 1.0	NB
N	<i>Nephroma resupinatum</i>	a lichen				S3	1	84.0 ± 0.0	NS
N	<i>Peltigera degenii</i>	Lustrous Pelt Lichen				S3	3	58.1 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	<i>Usnea strigosa</i>	Bushy Beard Lichen				S3	14	14.2 ± 0.0	NB
N	<i>Leptogium laceroides</i>	Short-bearded Jellyskin Lichen				S3	2	63.5 ± 1.0	NB
N	<i>Peltigera membranacea</i>	Membranous Pelt Lichen				S3	10	34.6 ± 0.0	NB
N	<i>Cladonia carneola</i>	Crowned Pixie-cup Lichen				S3	2	65.5 ± 1.0	NB
N	<i>Cladonia deformis</i>	Lesser Sulphur-cup Lichen				S3	8	56.2 ± 1.0	NB
N	<i>Aulacomnium androgynum</i>	Little Groove Moss				S3?	7	20.4 ± 1.0	NB
N	<i>Dicranella rufescens</i>	Red Forklet Moss				S3?	2	63.6 ± 0.0	NB
N	<i>Rhytidiadelphus loreus</i>	Lanky Moss				S3?	3	63.7 ± 1.0	NB
N	<i>Sphagnum lescurii</i>	a Peatmoss				S3?	9	19.5 ± 0.0	NB
N	<i>Sphagnum inundatum</i>	a Sphagnum				S3?	2	14.5 ± 0.0	NB
N	<i>Leptogium subtile</i>	Appressed Jellyskin Lichen				S3?	5	26.6 ± 0.0	NB
N	<i>Rostania occultata</i>	Crusted Tarpaper Lichen				S3?	3	83.9 ± 0.0	NS
N	<i>Stereocaulon subcoralloides</i>	Coralloid Foam Lichen				S3?	1	66.4 ± 1.0	NB
N	<i>Anomodon rugelii</i>	Rugel's Anomodon Moss				S3S4	3	83.5 ± 0.0	NS
N	<i>Barbula convoluta</i>	Lesser Bird's-claw Beard Moss				S3S4	3	79.8 ± 0.0	NS
N	<i>Brachythecium velutinum</i>	Velvet Ragged Moss				S3S4	2	56.7 ± 1.0	NB
N	<i>Calliergon giganteum</i>	Giant Spear Moss				S3S4	1	82.7 ± 0.0	NS
N	<i>Dicranella cerviculata</i>	a Moss				S3S4	5	61.1 ± 2.0	NB
N	<i>Dicranella varia</i>	a Moss				S3S4	1	92.3 ± 3.0	NS
N	<i>Dicranum majus</i>	Greater Broom Moss				S3S4	21	61.0 ± 0.0	NB
N	<i>Dicranum leioneuron</i>	a Dicranum Moss				S3S4	1	61.1 ± 0.0	NB
N	<i>Encalypta ciliata</i>	Fringed Extinguisher Moss				S3S4	1	63.8 ± 0.0	NB
N	<i>Fissidens bryoides</i>	Lesser Pocket Moss				S3S4	5	9.5 ± 5.0	NB
N	<i>Helodium blandowii</i>	Wetland-plume Moss				S3S4	2	29.1 ± 0.0	NB
N	<i>Heterocladium dimorphum</i>	Dimorphous Tangle Moss				S3S4	5	66.5 ± 0.0	NB
N	<i>Isopterygiopsis muelleriana</i>	a Moss				S3S4	21	20.4 ± 1.0	NB
N	<i>Myurella julacea</i>	Small Mouse-tail Moss				S3S4	4	20.4 ± 1.0	NB
N	<i>Physcomitrium pyriforme</i>	Pear-shaped Urn Moss				S3S4	10	32.9 ± 0.0	NB
N	<i>Pogonatum dentatum</i>	Mountain Hair Moss				S3S4	4	63.4 ± 0.0	NB
N	<i>Sphagnum compactum</i>	Compact Peat Moss				S3S4	1	97.3 ± 0.0	NS
N	<i>Sphagnum quinquefarium</i>	Five-ranked Peat Moss				S3S4	5	20.4 ± 1.0	NB
N	<i>Sphagnum torreyanum</i>	a Peatmoss				S3S4	5	45.2 ± 0.0	NB
N	<i>Sphagnum austinii</i>	Austin's Peat Moss				S3S4	2	47.4 ± 1.0	NB
N	<i>Sphagnum contortum</i>	Twisted Peat Moss				S3S4	2	22.9 ± 0.0	NB
N	<i>Splachnum rubrum</i>	Red Collar Moss				S3S4	1	30.2 ± 1.0	NB
N	<i>Tetraphis geniculata</i>	Geniculate Four-tooth Moss				S3S4	15	40.0 ± 0.0	NB
N	<i>Tetraplodon angustatus</i>	Toothed-leaved Nitrogen Moss				S3S4	3	27.7 ± 0.0	NB
N	<i>Weissia controversa</i>	Green-Cushioned Weissia				S3S4	6	19.9 ± 1.0	NB
N	<i>Abietinella abietina</i>	Wiry Fern Moss				S3S4	1	63.6 ± 0.0	NB
N	<i>Trichostomum tenuirostre</i>	Acid-Soil Moss				S3S4	7	33.8 ± 0.0	NB
N	<i>Pannaria rubiginosa</i>	Brown-eyed Shingle Lichen				S3S4	5	26.6 ± 0.0	NB
N	<i>Pseudocyphellaria holarctica</i>	Yellow Specklebelly Lichen				S3S4	46	40.7 ± 0.0	NB
N	<i>Ramalina thrausta</i>	Angelhair Ramalina Lichen				S3S4	11	56.2 ± 1.0	NB
N	<i>Hypogymnia vittata</i>	Slender Monk's Hood Lichen				S3S4	25	57.1 ± 1.0	NB
N	<i>Leptogium teretiusculum</i>	Beaded Jellyskin Lichen				S3S4	6	83.9 ± 0.0	NS
N	<i>Cladonia terrae-novae</i>	Newfoundland Reindeer Lichen				S3S4	2	58.8 ± 0.0	NB
N	<i>Cladonia floerkeana</i>	Gritty British Soldiers Lichen				S3S4	5	3.7 ± 0.0	NB
N	<i>Vahlia leucophaea</i>	Shelter Shingle Lichen				S3S4	4	77.1 ± 0.0	NB
N	<i>Xylopsora friesii</i>	a Lichen				S3S4	1	63.7 ± 1.0	NB
N	<i>Montanelia panniformis</i>	Shingled Camouflage Lichen				S3S4	4	58.8 ± 1.0	NB
N	<i>Nephroma parile</i>	Powdery Kidney Lichen				S3S4	11	1.9 ± 0.0	NB
N	<i>Protopannaria pezizoides</i>	Brown-gray Moss-shingle Lichen				S3S4	19	34.8 ± 0.0	NB
N	<i>Usnea subrubicunda</i>	Reddish Beard Lichen				S3S4	2	72.2 ± 3.0	NS

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N	<i>Fuscopannaria sorediata</i>	a Lichen				S3S4	1	87.9 ± 1.0	NB
N	<i>Stereocaulon paschale</i>	Easter Foam Lichen				S3S4	1	71.4 ± 1.0	NS
N	<i>Pannaria conoplea</i>	Mealy-rimmed Shingle Lichen				S3S4	7	61.8 ± 0.0	NB
N	<i>Physcia tenella</i>	Fringed Rosette Lichen				S3S4	1	69.1 ± 0.0	NB
N	<i>Anaptychia palmulata</i>	Shaggy Fringed Lichen				S3S4	16	63.1 ± 0.0	NB
N	<i>Peltigera neopolydactyla</i>	Undulating Pelt Lichen				S3S4	9	58.1 ± 1.0	NB
N	<i>Cladonia cariosa</i>	Lesser Ribbed Pixie Lichen				S3S4	3	67.8 ± 1.0	NB
N	<i>Hypocenomyce scalaris</i>	Common Clam Lichen				S3S4	1	66.4 ± 1.0	NB
N	<i>Dermatocarpon luridum</i>	Brookside Stippleback Lichen				S3S4	60	2.2 ± 0.0	NB
N	<i>Grimmia anodon</i>	Toothless Grimmia Moss				SH	2	32.8 ± 10.0	NB
N	<i>Leucodon brachypus</i>	a Moss				SH	6	64.0 ± 0.0	NB
N	<i>Thelia hirtella</i>	a Moss				SH	1	35.6 ± 100.0	NB
N	<i>Cyрто-hyprnum minutulum</i>	Tiny Cedar Moss				SH	3	59.5 ± 10.0	NB
P	<i>Juglans cinerea</i>	Butternut	Endangered	Endangered	Endangered	S1	157	1.4 ± 0.0	NB
P	<i>Polemonium vanbruntiae</i>	Van Brunt's Jacob's-ladder	Threatened	Threatened	Threatened	S1	74	66.0 ± 0.0	NB
P	<i>Fraxinus nigra</i>	Black Ash	Threatened			S4S5	227	1.4 ± 0.0	NB
P	<i>Isoetes prototypus</i>	Prototype Quillwort	Special Concern	Special Concern	Endangered	S2	26	35.2 ± 0.0	NB
P	<i>Symphotrichum anticostense</i>	Anticosti Aster	Special Concern	Special Concern	Endangered	S2S3	6	33.8 ± 0.0	NB
P	<i>Pterospora andromedea</i>	Woodland Pinedrops			Endangered	S1	19	88.4 ± 0.0	NB
P	<i>Cryptotaenia canadensis</i>	Canada Honewort				S1	1	33.8 ± 1.0	NB
P	<i>Sanicula trifoliata</i>	Large-Fruited Sanicle				S1	1	2.5 ± 5.0	NB
P	<i>Antennaria parlinii ssp. fallax</i>	Parlin's Pussytoes				S1	5	30.7 ± 1.0	NB
P	<i>Antennaria howellii ssp. petaloidea</i>	Pussy-Toes				S1	2	35.2 ± 5.0	NB
P	<i>Bidens discoides</i>	Swamp Beggarticks				S1	4	54.3 ± 0.0	NB
P	<i>Pseudognaphalium obtusifolium</i>	Eastern Cudweed				S1	7	61.2 ± 0.0	NB
P	<i>Helianthus decapetalus</i>	Ten-rayed Sunflower				S1	14	91.7 ± 0.0	NB
P	<i>Hieracium paniculatum</i>	Panicled Hawkweed				S1	16	16.2 ± 0.0	NB
P	<i>Hieracium robinsonii</i>	Robinson's Hawkweed				S1	11	56.3 ± 0.0	NB
P	<i>Solidago multiradiata</i>	Multi-rayed Goldenrod				S1	19	95.4 ± 0.0	NB
P	<i>Cardamine parviflora</i>	Small-flowered Bittercress				S1	10	13.7 ± 0.0	NB
P	<i>Cardamine concatenata</i>	Cut-leaved Toothwort				S1	3	73.5 ± 0.0	NB
P	<i>Draba arabisans</i>	Rock Whitlow-Grass				S1	27	3.2 ± 1.0	NB
P	<i>Draba cana</i>	Lance-leaved Draba				S1	10	87.2 ± 0.0	NB
P	<i>Draba glabella</i>	Rock Whitlow-Grass				S1	14	20.4 ± 1.0	NB
P	<i>Mononeuria groenlandica</i>	Greenland Stitchwort				S1	2	45.5 ± 0.0	NB
P	<i>Chenopodium simplex</i>	Maple-leaved Goosefoot				S1	11	40.6 ± 1.0	NB
P	<i>Blitum capitatum</i>	strawberry-blite				S1	4	8.7 ± 1.0	NB
P	<i>Suaeda rolandii</i>	Roland's Sea-Blite				S1	4	69.3 ± 0.0	NB
P	<i>Hypericum virginicum</i>	Virginia St. John's-wort				S1	2	28.8 ± 0.0	NB
P	<i>Corema conradii</i>	Broom Crowberry				S1	28	35.2 ± 10.0	NB
P	<i>Vaccinium boreale</i>	Northern Blueberry				S1	2	64.0 ± 0.0	NB
P	<i>Vaccinium corymbosum</i>	Highbush Blueberry				S1	1	93.7 ± 13.0	NS
P	<i>Hylodesmum glutinosum</i>	Large Tick-trefoil				S1	15	93.8 ± 0.0	NS
P	<i>Lespedeza capitata</i>	Round-headed Bush-clover				S1	11	47.5 ± 0.0	NB
P	<i>Gentiana rubricaulis</i>	Purple-stemmed Gentian				S1	2	75.7 ± 0.0	NB
P	<i>Lomatogonium rotatum</i>	Marsh Felwort				S1	3	95.6 ± 0.0	NB
P	<i>Proserpinaca pectinata</i>	Comb-leaved Mermaidweed				S1	2	67.3 ± 0.0	NB
P	<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint				S1	4	12.4 ± 0.0	NB
P	<i>Polygonum douglasii</i>	Douglas Knotweed				S1	1	36.5 ± 0.0	NB
P	<i>Lysimachia quadrifolia</i>	Whorled Yellow Loosestrife				S1	14	12.7 ± 0.0	NB
P	<i>Primula laurentiana</i>	Laurentian Primrose				S1	54	57.6 ± 0.0	NB
P	<i>Ranunculus sceleratus</i>	Cursed Buttercup				S1	6	39.8 ± 0.0	NB
P	<i>Amelanchier fernaldii</i>	Fernald's Serviceberry				S1	1	89.7 ± 1.0	NB

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P	<i>Crataegus jonesiae</i>	Jones' Hawthorn				S1	4	78.4 ± 1.0	NB
P	<i>Dryas integrifolia</i>	Entire-leaved Mountain Avens				S1	15	96.9 ± 0.0	NB
P	<i>Potentilla canadensis</i>	Canada Cinquefoil				S1	1	72.2 ± 0.0	NB
P	<i>Galium brevipes</i>	Limestone Swamp Bedstraw				S1	1	90.6 ± 5.0	NB
P	<i>Salix myrtilifolia</i>	Blueberry Willow				S1	25	97.6 ± 0.0	NB
P	<i>Saxifraga paniculata</i> ssp. <i>laestadii</i>	Laestadius' Saxifrage				S1	47	20.1 ± 0.0	NB
P	<i>Agalinis tenuifolia</i>	Slender Agalinis				S1	9	74.4 ± 0.0	NB
P	<i>Agalinis purpurea</i> var. <i>parviflora</i>	Small-flowered Purple False Foxglove				S1	10	11.0 ± 1.0	NB
P	<i>Gratiola lutea</i>	Golden Hedge-hyssop				S1	2	45.2 ± 0.0	NB
P	<i>Pedicularis canadensis</i>	Canada Lousewort				S1	4	83.1 ± 0.0	NB
P	<i>Viola sagittata</i> var. <i>ovata</i>	Arrow-Leaved Violet				S1	30	82.0 ± 0.0	NS
P	<i>Alisma subcordatum</i>	Southern Water Plantain				S1	4	3.6 ± 0.0	NB
P	<i>Carex atlantica</i> ssp. <i>atlantica</i>	Atlantic Sedge				S1	4	44.9 ± 0.0	NB
P	<i>Carex backii</i>	Rocky Mountain Sedge				S1	8	35.6 ± 0.0	NB
P	<i>Carex merritt-feraldii</i>	Merritt Fernald's Sedge				S1	1	71.6 ± 0.0	NB
P	<i>Carex scirpoidea</i>	Scirpuslike Sedge				S1	6	34.1 ± 0.0	NB
P	<i>Carex sterilis</i>	Sterile Sedge				S1	2	69.6 ± 2.0	NB
P	<i>Carex grisea</i>	Inflated Narrow-leaved Sedge				S1	13	7.6 ± 0.0	NB
P	<i>Carex saxatilis</i>	Russet Sedge				S1	14	11.8 ± 10.0	NB
P	<i>Cyperus diandrus</i>	Low Flatsedge				S1	7	74.4 ± 1.0	NB
P	<i>Cyperus lupulinus</i>	Hop Flatsedge				S1	30	44.5 ± 0.0	NB
P	<i>Cyperus lupulinus</i> ssp. <i>macilentus</i>	Hop Flatsedge				S1	31	43.7 ± 0.0	NB
P	<i>Rhynchospora capillacea</i>	Slender Beakrush				S1	3	92.9 ± 0.0	NB
P	<i>Scirpus pendulus</i>	Hanging Bulrush				S1	6	38.5 ± 0.0	NB
P	<i>Sisyrinchium angustifolium</i>	Narrow-leaved Blue-eyed-grass				S1	13	36.2 ± 1.0	NB
P	<i>Juncus greenii</i>	Greene's Rush				S1	1	79.1 ± 0.0	NB
P	<i>Juncus subtilis</i>	Creeping Rush				S1	1	28.8 ± 5.0	NB
P	<i>Allium canadense</i>	Canada Garlic				S1	11	12.9 ± 0.0	NB
P	<i>Goodyera pubescens</i>	Downy Rattlesnake-Plantain				S1	16	47.7 ± 0.0	NB
P	<i>Malaxis monophyllos</i> var. <i>brachypoda</i>	North American White Adder's-mouth				S1	1	72.0 ± 0.0	NS
P	<i>Malaxis monophyllos</i>	White Adder's-mouth				S1	1	80.9 ± 0.0	NB
P	<i>Platanthera flava</i>	Southern Rein-Orchid				S1	1	80.9 ± 0.0	NB
P	<i>Platanthera flava</i> var. <i>herbiola</i>	Pale Green Orchid				S1	26	62.3 ± 1.0	NB
P	<i>Platanthera macrophylla</i>	Large Round-Leaved Orchid				S1	11	28.8 ± 0.0	NB
P	<i>Spiranthes casei</i>	Case's Ladies'-Tresses				S1	6	88.6 ± 0.0	NB
P	<i>Bromus pubescens</i>	Hairy Wood Brome Grass				S1	6	48.1 ± 0.0	NB
P	<i>Cinna arundinacea</i>	Sweet Wood Reed Grass				S1	5	14.7 ± 0.0	NB
P	<i>Danthonia compressa</i>	Flattened Oat Grass				S1	17	36.4 ± 1.0	NB
P	<i>Dichanthelium dichotomum</i>	Forked Panic Grass				S1	1	11.4 ± 1.0	NB
P	<i>Festuca subverticillata</i>	Nodding Fescue				S1	2	74.5 ± 1.0	NS
P	<i>Glyceria obtusa</i>	Atlantic Manna Grass				S1	2	65.1 ± 0.0	NB
P	<i>Sporobolus compositus</i>	Rough Dropseed				S1	17	91.5 ± 0.0	NB
P	<i>Potamogeton friesii</i>	Fries' Pondweed				S1	6	35.6 ± 5.0	NB
P	<i>Potamogeton nodosus</i>	Long-leaved Pondweed				S1	8	43.2 ± 0.0	NB
P	<i>Potamogeton strictifolius</i>	Straight-leaved Pondweed				S1	2	3.4 ± 2.0	NB
P	<i>Xyris difformis</i>	Bog Yellow-eyed-grass				S1	3	28.9 ± 0.0	NB
P	<i>Asplenium ruta-muraria</i> var. <i>cryptolepis</i>	Wallrue Spleenwort				S1	4	20.1 ± 0.0	NB
P	<i>Cystopteris laurentiana</i>	Laurentian Bladder Fern				S1	1	36.3 ± 1.0	NB
P	<i>Dryopteris clintoniana</i>	Clinton's Wood Fern				S1	1	99.7 ± 0.0	NB

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P	<i>Dryopteris filix-mas</i> ssp. <i>brittonii</i>	Britton's Male Fern				S1	2	83.9 ± 1.0	NB
P	<i>Huperzia selago</i>	Northern Firmoss				S1	1	71.4 ± 1.0	NS
P	<i>Sceptridium oneidense</i>	Blunt-lobed Moonwort				S1	4	59.3 ± 5.0	NB
P	<i>Schizaea pusilla</i>	Little Curlygrass Fern				S1	31	41.7 ± 0.0	NB
P	<i>Cuscuta campestris</i>	Field Dodder				S1?	3	45.4 ± 5.0	NB
P	<i>Polygonum aviculare</i> ssp. <i>neglectum</i>	Narrow-leaved Knotweed				S1?	4	77.6 ± 0.0	NB
P	<i>Carex laxiflora</i>	Loose-Flowered Sedge				S1?	2	71.6 ± 7.0	NS
P	<i>Wolffia columbiana</i>	Columbian Watermeal				S1?	6	56.7 ± 0.0	NB
P	<i>Micranthes virginiensis</i>	Early Saxifrage				S1S2	14	88.5 ± 0.0	NB
P	<i>Potamogeton bicupulatus</i>	Snailseed Pondweed				S1S2	5	49.0 ± 0.0	NB
P	<i>Selaginella rupestris</i>	Rock Spikemoss				S1S2	16	36.1 ± 0.0	NB
P	<i>Coryphopteris simulata</i>	Bog Fern				S1S2	20	48.6 ± 0.0	NB
P	<i>Cuscuta cephalanthi</i>	Buttonbush Dodder				S1S3	2	21.1 ± 0.0	NB
P	<i>Spiranthes arcisepala</i>	Appalachian Ladies'-tresses				S1S3	11	39.5 ± 0.0	NB
P	<i>Spiranthes incurva</i>	Sphinx Ladies'-tresses				S1S3	1	93.2 ± 0.0	NB
P	<i>Neottia bifolia</i>	Southern Twayblade			Endangered	S2	21	63.8 ± 0.0	NB
P	<i>Osmorhiza longistylis</i>	Smooth Sweet Cicely				S2	2	98.0 ± 5.0	NB
P	<i>Sanicula odorata</i>	Clustered Sanicle				S2	1	98.0 ± 0.0	NB
P	<i>Solidago racemosa</i>	Racemose Goldenrod				S2	14	90.7 ± 0.0	NB
P	<i>Ionactis linariifolia</i>	Flax-leaved Aster				S2	1	85.3 ± 0.0	NB
P	<i>Symphotrichum racemosum</i>	Small White Aster				S2	11	2.1 ± 0.0	NB
P	<i>Pseudognaphalium macounii</i>	Macoun's Cudweed				S2	7	35.5 ± 0.0	NB
P	<i>Impatiens pallida</i>	Pale Jewelweed				S2	10	34.5 ± 0.0	NB
P	<i>Alnus serrulata</i>	Smooth Alder				S2	12	31.6 ± 0.0	NB
P	<i>Betula minor</i>	Dwarf White Birch				S2	1	98.4 ± 0.0	NB
P	<i>Boecheria stricta</i>	Drummond's Rockcress				S2	25	3.3 ± 0.0	NB
P	<i>Sagina nodosa</i>	Knotted Pearlwort				S2	9	69.8 ± 1.0	NB
P	<i>Sagina nodosa</i> ssp. <i>borealis</i>	Knotted Pearlwort				S2	1	53.1 ± 0.0	NB
P	<i>Stellaria longifolia</i>	Long-leaved Starwort				S2	8	16.6 ± 1.0	NB
P	<i>Atriplex glabriuscula</i> var. <i>franktonii</i>	Frankton's Saltbush				S2	4	29.9 ± 1.0	NB
P	<i>Oxybasis rubra</i>	Red Goosefoot				S2	4	31.8 ± 1.0	NB
P	<i>Hypericum x dissimulatum</i>	Disguised St. John's-wort				S2	3	63.3 ± 0.0	NB
P	<i>Triosteum aurantiacum</i>	Orange-fruited Tinker's Weed				S2	12	71.1 ± 0.0	NB
P	<i>Viburnum lentago</i>	Nannyberry				S2	15	60.5 ± 0.0	NB
P	<i>Viburnum recognitum</i>	Northern Arrow-Wood				S2	2	89.0 ± 0.0	NB
P	<i>Shepherdia canadensis</i>	Soapberry				S2	41	96.9 ± 0.0	NB
P	<i>Astragalus eucosmus</i>	Elegant Milk-vetch				S2	10	9.9 ± 0.0	NB
P	<i>Oxytropis campestris</i>	Field Locoweed				S2	2	85.9 ± 0.0	NS
P	<i>Oxytropis campestris</i> var. <i>johannensis</i>	Field Locoweed				S2	33	21.1 ± 50.0	NB
P	<i>Quercus macrocarpa</i>	Bur Oak				S2	95	9.9 ± 0.0	NB
P	<i>Gentiana linearis</i>	Narrow-Leaved Gentian				S2	5	80.2 ± 5.0	NB
P	<i>Myriophyllum humile</i>	Low Water Milfoil				S2	9	54.5 ± 1.0	NB
P	<i>Proserpinaca palustris</i>	Marsh Mermaidweed				S2	19	14.5 ± 0.0	NB
P	<i>Hedeoma pulegioides</i>	American False Pennyroyal				S2	12	12.4 ± 1.0	NB
P	<i>Nuphar x rubrodiscalis</i>	Red-disk Yellow Pond-lily				S2	12	15.3 ± 0.0	NB
P	<i>Aphyllon uniflorum</i>	One-flowered Broomrape				S2	14	10.1 ± 1.0	NB
P	<i>Polygaloides paucifolia</i>	Fringed Milkwort				S2	19	44.8 ± 1.0	NB
P	<i>Persicaria amphibia</i> var. <i>emersa</i>	Long-root Smartweed				S2	50	1.9 ± 0.0	NB
P	<i>Persicaria careyi</i>	Carey's Smartweed				S2	14	12.4 ± 5.0	NB
P	<i>Podostemum ceratophyllum</i>	Horn-leaved Riverweed				S2	8	60.8 ± 0.0	NB
P	<i>Anemone multifida</i>	Cut-leaved Anemone				S2	1	93.9 ± 0.0	NB

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P	<i>Anemone parviflora</i>	Small-flowered Anemone			S2		9	97.6 ± 0.0	NB
P	<i>Hepatica americana</i>	Round-lobed Hepatica			S2		37	22.8 ± 1.0	NB
P	<i>Ranunculus flabellaris</i>	Yellow Water Buttercup			S2		18	26.1 ± 0.0	NB
P	<i>Crataegus scabrada</i>	Rough Hawthorn			S2		9	12.3 ± 1.0	NB
P	<i>Crataegus succulenta</i>	Fleshy Hawthorn			S2		1	80.8 ± 5.0	NB
P	<i>Cephalanthus occidentalis</i>	Common Buttonbush			S2		21	40.9 ± 0.0	NB
P	<i>Agalinis neoscotica</i>	Nova Scotia Agalinis			S2		7	84.2 ± 0.0	NB
P	<i>Euphrasia randii</i>	Rand's Eyebright			S2		12	50.2 ± 0.0	NB
P	<i>Scrophularia lanceolata</i>	Lance-leaved Figwort			S2		7	12.4 ± 0.0	NB
P	<i>Dirca palustris</i>	Eastern Leatherwood			S2		16	51.1 ± 1.0	NB
P	<i>Phryma leptostachya</i>	American Lopseed			S2		4	94.5 ± 1.0	NB
P	<i>Verbena urticifolia</i>	White Vervain			S2		14	88.5 ± 2.0	NB
P	<i>Viola novae-angliae</i>	New England Violet			S2		13	14.1 ± 0.0	NB
P	<i>Symplocarpus foetidus</i>	Eastern Skunk Cabbage			S2		81	5.8 ± 5.0	NB
P	<i>Carex comosa</i>	Bearded Sedge			S2		10	83.2 ± 1.0	NS
P	<i>Carex granularis</i>	Limestone Meadow Sedge			S2		7	33.7 ± 5.0	NB
P	<i>Carex gynocrates</i>	Northern Bog Sedge			S2		1	36.4 ± 1.0	NB
P	<i>Carex hirtifolia</i>	Pubescent Sedge			S2		5	13.9 ± 0.0	NB
P	<i>Carex livida</i>	Livid Sedge			S2		2	21.0 ± 0.0	NB
P	<i>Carex plantaginea</i>	Plantain-Leaved Sedge			S2		5	61.9 ± 0.0	NB
P	<i>Carex rostrata</i>	Narrow-leaved Beaked Sedge			S2		2	1.4 ± 0.0	NB
P	<i>Carex salina</i>	Saltmarsh Sedge			S2		2	36.6 ± 1.0	NB
P	<i>Carex sprengeii</i>	Longbeak Sedge			S2		4	29.4 ± 0.0	NB
P	<i>Carex tenuiflora</i>	Sparse-Flowered Sedge			S2		2	66.0 ± 10.0	NB
P	<i>Carex albicans</i>	White-tinged Sedge			S2		1	71.7 ± 0.0	NS
P	<i>Carex albicans</i> var. <i>emmonsii</i>	White-tinged Sedge			S2		8	35.3 ± 0.0	NB
P	<i>Cyperus squarrosus</i>	Awned Flatsedge			S2		46	2.6 ± 0.0	NB
P	<i>Eriophorum gracile</i>	Slender Cottongrass			S2		9	36.9 ± 0.0	NB
P	<i>Elodea nuttallii</i>	Nuttall's Waterweed			S2		7	14.7 ± 0.0	NB
P	<i>Juncus vaseyi</i>	Vasey Rush			S2		6	64.3 ± 0.0	NB
P	<i>Allium tricoccum</i>	Wild Leek			S2		60	9.9 ± 0.0	NB
P	<i>Najas gracillima</i>	Thread-Like Naiad			S2		6	53.7 ± 0.0	NB
P	<i>Galearis rotundifolia</i>	Small Round-leaved Orchid			S2		3	92.0 ± 0.0	NB
P	<i>Calypso bulbosa</i>	Calypso			S2		2	57.6 ± 0.0	NB
P	<i>Calypso bulbosa</i> var. <i>americana</i>	Calypso			S2		5	22.4 ± 0.0	NB
P	<i>Coeloglossum viride</i>	Long-bracted Frog Orchid			S2		10	7.7 ± 5.0	NB
P	<i>Cypripedium parviflorum</i> var. <i>makasin</i>	Small Yellow Lady's-Slipper			S2		7	11.0 ± 1.0	NB
P	<i>Spiranthes lucida</i>	Shining Ladies'-Tresses			S2		14	5.4 ± 5.0	NB
P	<i>Spiranthes ochroleuca</i>	Yellow Ladies'-tresses			S2		7	60.8 ± 0.0	NB
P	<i>Dichanthelium linearifolium</i>	Narrow-leaved Panic Grass			S2		15	24.7 ± 0.0	NB
P	<i>Elymus canadensis</i>	Canada Wild Rye			S2		18	63.5 ± 1.0	NB
P	<i>Leersia virginica</i>	White Cut Grass			S2		42	25.8 ± 0.0	NB
P	<i>Piptatheropsis canadensis</i>	Canada Ricegrass			S2		6	51.4 ± 0.0	NB
P	<i>Puccinellia phryganodes</i> ssp. <i>neoarctica</i>	Creeping Alkali Grass			S2		5	66.2 ± 0.0	NB
P	<i>Poa glauca</i>	Glaucous Blue Grass			S2		18	35.5 ± 2.0	NB
P	<i>Puccinellia nutkaensis</i>	Alaska Alkaligrass			S2		5	41.2 ± 1.0	NB
P	<i>Schizachyrium scoparium</i>	Little Bluestem			S2		54	15.3 ± 0.0	NB
P	<i>Zizania aquatica</i> var. <i>aquatica</i>	Eastern Wild Rice			S2		5	14.5 ± 0.0	NB
P	<i>Piptatheropsis pungens</i>	Slender Ricegrass			S2		4	67.3 ± 0.0	NB
P	<i>Potamogeton vaseyi</i>	Vasey's Pondweed			S2		5	35.6 ± 1.0	NB
P	<i>Asplenium trichomanes</i>	Maidenhair Spleenwort			S2		22	33.8 ± 0.0	NB
P	<i>Anchistea virginica</i>	Virginia chain fern			S2		13	82.1 ± 0.0	NB

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P	<i>Woodsia alpina</i>	Alpine Cliff Fern			S2		11	20.1 ± 0.0	NB
P	<i>Diphasiastrum sitchense</i>	Sitka Ground-cedar			S2		1	87.2 ± 5.0	NB
P	<i>Selaginella selaginoides</i>	Low Spikemoss			S2		12	35.5 ± 6.0	NB
P	<i>Toxicodendron radicans</i> var. <i>radicans</i>	Eastern Poison Ivy			S2?		14	13.9 ± 0.0	NB
P	<i>Symphyotrichum novi-belgii</i> var. <i>crenifolium</i>	New York Aster			S2?		6	33.2 ± 0.0	NB
P	<i>Humulus lupulus</i> var. <i>lupuloides</i>	Common Hop			S2?		4	78.1 ± 0.0	NB
P	<i>Rubus x recurvicaulis</i>	arching dewberry			S2?		5	16.3 ± 1.0	NB
P	<i>Galium obtusum</i>	Blunt-leaved Bedstraw			S2?		5	14.6 ± 1.0	NB
P	<i>Salix myricoides</i>	Bayberry Willow			S2?		7	61.2 ± 0.0	NB
P	<i>Platanthera huronensis</i>	Fragrant Green Orchid			S2?		4	59.7 ± 0.0	NB
P	<i>Solidago altissima</i>	Tall Goldenrod			S2S3		6	10.7 ± 1.0	NB
P	<i>Callitriche hermaphroditica</i>	Northern Water-starwort			S2S3		8	2.9 ± 1.0	NB
P	<i>Lonicera oblongifolia</i>	Swamp Fly Honeysuckle			S2S3		1	48.9 ± 6.0	NB
P	<i>Elatine americana</i>	American Waterwort			S2S3		7	2.6 ± 0.0	NB
P	<i>Bartonia paniculata</i>	Branched Bartonia			S2S3		1	45.1 ± 0.0	NB
P	<i>Bartonia paniculata</i> ssp. <i>iodandra</i>	Branched Bartonia			S2S3		38	38.0 ± 1.0	NB
P	<i>Geranium robertianum</i>	Herb Robert			S2S3		45	3.2 ± 1.0	NB
P	<i>Myriophyllum quitense</i>	Andean Water Milfoil			S2S3		71	1.5 ± 0.0	NB
P	<i>Epilobium coloratum</i>	Purple-veined Willowherb			S2S3		12	33.0 ± 1.0	NB
P	<i>Rumex persicarioides</i>	Peach-leaved Dock			S2S3		1	99.5 ± 1.0	NB
P	<i>Rumex pallidus</i>	Seabeach Dock			S2S3		7	32.6 ± 0.0	NB
P	<i>Rumex occidentalis</i>	Western Dock			S2S3		1	77.7 ± 1.0	NB
P	<i>Rubus pensilvanicus</i>	Pennsylvania Blackberry			S2S3		23	32.5 ± 0.0	NB
P	<i>Galium labradoricum</i>	Labrador Bedstraw			S2S3		3	62.6 ± 0.0	NB
P	<i>Carex adusta</i>	Lesser Brown Sedge			S2S3		8	16.8 ± 1.0	NB
P	<i>Corallorhiza maculata</i> var. <i>occidentalis</i>	Spotted Coralroot			S2S3		12	51.7 ± 1.0	NB
P	<i>Corallorhiza maculata</i> var. <i>maculata</i>	Spotted Coralroot			S2S3		7	17.3 ± 1.0	NB
P	<i>Neottia auriculata</i>	Auricled Twayblade			S2S3		9	39.0 ± 1.0	NB
P	<i>Spiranthes cernua</i>	Nodding Ladies'-Tresses			S2S3		25	51.3 ± 1.0	NB
P	<i>Eragrostis pectinacea</i>	Tufted Love Grass			S2S3		12	14.0 ± 1.0	NB
P	<i>Stuckenia filiformis</i>	Thread-leaved Pondweed			S2S3		6	20.7 ± 0.0	NB
P	<i>Potamogeton praelongus</i>	White-stemmed Pondweed			S2S3		11	1.5 ± 0.0	NB
P	<i>Isoetes tuckermanii</i> ssp. <i>acadiensis</i>	Acadian Quillwort			S2S3		8	69.4 ± 0.0	NB
P	<i>Ophioglossum pusillum</i>	Northern Adder's-tongue			S2S3		8	35.7 ± 1.0	NB
P	<i>Panax trifolius</i>	Dwarf Ginseng			S3		32	35.7 ± 0.0	NB
P	<i>Arnica lanceolata</i>	Lance-leaved Arnica			S3		1	99.6 ± 0.0	NB
P	<i>Artemisia campestris</i> ssp. <i>caudata</i>	Tall Wormwood			S3		124	40.7 ± 0.0	NB
P	<i>Artemisia campestris</i>	Field Wormwood			S3		24	43.3 ± 0.0	NB
P	<i>Erigeron hyssopifolius</i>	Hyssop-leaved Fleabane			S3		98	13.5 ± 0.0	NB
P	<i>Nabalus racemosus</i>	Glaucous Rattlesnakeroot			S3		72	12.9 ± 0.0	NB
P	<i>Tanacetum bipinnatum</i> ssp. <i>huronense</i>	Lake Huron Tansy			S3		24	2.6 ± 10.0	NB
P	<i>Symphyotrichum boreale</i>	Boreal Aster			S3		13	10.3 ± 0.0	NB
P	<i>Betula pumila</i>	Bog Birch			S3		16	54.3 ± 0.0	NB
P	<i>Turritis glabra</i>	Tower Mustard			S3		1	50.4 ± 0.0	NB
P	<i>Arabis pycnocarpa</i>	Cream-flowered Rockcress			S3		24	13.7 ± 1.0	NB
P	<i>Cardamine maxima</i>	Large Toothwort			S3		42	1.5 ± 0.0	NB
P	<i>Subularia aquatica</i> ssp. <i>americana</i>	American Water Awlwort			S3		14	55.6 ± 0.0	NB
P	<i>Lobelia cardinalis</i>	Cardinal Flower			S3		270	62.5 ± 0.0	NB

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P	<i>Stellaria humifusa</i>	Saltmarsh Starwort			S3		16	40.4 ± 0.0	NB
P	<i>Ceratophyllum echinatum</i>	Prickly Hornwort			S3		21	3.4 ± 2.0	NB
P	<i>Hudsonia tomentosa</i>	Woolly Beach-heath			S3		3	50.4 ± 0.0	NB
P	<i>Cornus obliqua</i>	Silky Dogwood			S3		86	15.3 ± 0.0	NB
P	<i>Crassula aquatica</i>	Water Pygmyweed			S3		3	26.6 ± 0.0	NB
P	<i>Rhodiola rosea</i>	Roseroot			S3		91	11.4 ± 5.0	NB
P	<i>Penthorum sedoides</i>	Ditch Stonecrop			S3		86	1.9 ± 0.0	NB
P	<i>Elatine minima</i>	Small Waterwort			S3		22	11.0 ± 0.0	NB
P	<i>Astragalus alpinus</i>	Alpine Milk-vetch			S3		1	90.6 ± 0.0	NB
P	<i>Astragalus alpinus var. brunetianus</i>	Alpine Milk-Vetch			S3		2	90.8 ± 0.0	NB
P	<i>Hedysarum americanum</i>	Alpine Hedysarum			S3		2	10.5 ± 0.0	NB
P	<i>Gentianella amarella ssp. acuta</i>	Northern Gentian			S3		3	34.7 ± 5.0	NB
P	<i>Geranium bicknellii</i>	Bicknell's Crane's-bill			S3		23	3.7 ± 0.0	NB
P	<i>Myriophyllum farwellii</i>	Farwell's Water Milfoil			S3		18	31.8 ± 0.0	NB
P	<i>Myriophyllum heterophyllum</i>	Variable-leaved Water Milfoil			S3		82	1.6 ± 0.0	NB
P	<i>Myriophyllum verticillatum</i>	Whorled Water Milfoil			S3		23	3.6 ± 0.0	NB
P	<i>Teucrium canadense</i>	Canada Germander			S3		3	87.2 ± 5.0	NS
P	<i>Stachys hispida</i>	Smooth Hedge-Nettle			S3		12	8.5 ± 0.0	NB
P	<i>Utricularia radiata</i>	Little Floating Bladderwort			S3		38	40.8 ± 0.0	NB
P	<i>Nuphar microphylla</i>	Small Yellow Pond-lily			S3		27	13.6 ± 1.0	NB
P	<i>Epilobium hornemannii</i>	Hornemann's Willowherb			S3		7	57.6 ± 0.0	NB
P	<i>Epilobium hornemannii ssp. hornemannii</i>	Hornemann's Willowherb			S3		1	58.9 ± 0.0	NB
P	<i>Epilobium strictum</i>	Downy Willowherb			S3		18	7.8 ± 0.0	NB
P	<i>Polygala sanguinea</i>	Blood Milkwort			S3		45	34.5 ± 0.0	NB
P	<i>Persicaria arifolia</i>	Halberd-leaved Tearthumb			S3		28	26.3 ± 0.0	NB
P	<i>Persicaria punctata</i>	Dotted Smartweed			S3		8	53.8 ± 0.0	NB
P	<i>Fallopia scandens</i>	Climbing False Buckwheat			S3		43	2.5 ± 0.0	NB
P	<i>Littorella americana</i>	American Shoreweed			S3		23	13.2 ± 1.0	NB
P	<i>Primula mistassinica</i>	Mistassini Primrose			S3		12	10.2 ± 0.0	NB
P	<i>Pyrola minor</i>	Lesser Pyrola			S3		5	34.3 ± 1.0	NB
P	<i>Clematis occidentalis</i>	Purple Clematis			S3		29	29.5 ± 0.0	NB
P	<i>Ranunculus gmelinii</i>	Gmelin's Water Buttercup			S3		32	14.5 ± 1.0	NB
P	<i>Thalictrum confine</i>	Northern Meadow-rue			S3		82	10.3 ± 0.0	NB
P	<i>Amelanchier canadensis</i>	Canada Serviceberry			S3		19	20.1 ± 1.0	NB
P	<i>Rosa palustris</i>	Swamp Rose			S3		26	21.5 ± 5.0	NB
P	<i>Rubus occidentalis</i>	Black Raspberry			S3		23	16.7 ± 0.0	NB
P	<i>Sanguisorba canadensis</i>	Canada Burnet			S3		17	64.7 ± 0.0	NB
P	<i>Galium boreale</i>	Northern Bedstraw			S3		5	24.3 ± 1.0	NB
P	<i>Salix nigra</i>	Black Willow			S3		171	11.6 ± 1.0	NB
P	<i>Salix pedicellaris</i>	Bog Willow			S3		50	14.5 ± 0.0	NB
P	<i>Salix interior</i>	Sandbar Willow			S3		34	41.6 ± 0.0	NB
P	<i>Comandra umbellata</i>	Bastard's Toadflax			S3		1	50.3 ± 10.0	NB
P	<i>Parnassia glauca</i>	Fen Grass-of-Parnassus			S3		1	94.7 ± 10.0	NB
P	<i>Boehmeria cylindrica</i>	Small-spike False-nettle			S3		54	53.9 ± 0.0	NB
P	<i>Pilea pumila</i>	Dwarf Clearweed			S3		45	1.9 ± 0.0	NB
P	<i>Viola adunca</i>	Hooked Violet			S3		8	35.8 ± 1.0	NB
P	<i>Viola nephrophylla</i>	Northern Bog Violet			S3		22	10.3 ± 0.0	NB
P	<i>Carex arcta</i>	Northern Clustered Sedge			S3		54	13.7 ± 0.0	NB
P	<i>Carex capillaris</i>	Hairlike Sedge			S3		23	26.3 ± 0.0	NB
P	<i>Carex chordorrhiza</i>	Creeping Sedge			S3		25	40.7 ± 0.0	NB
P	<i>Carex conoidea</i>	Field Sedge			S3		19	10.7 ± 1.0	NB
P	<i>Carex eburnea</i>	Bristle-leaved Sedge			S3		18	14.5 ± 0.0	NB
P	<i>Carex exilis</i>	Coastal Sedge			S3		110	20.2 ± 0.0	NB
P	<i>Carex garberi</i>	Garber's Sedge			S3		2	10.5 ± 0.0	NB
P	<i>Carex haydenii</i>	Hayden's Sedge			S3		89	1.9 ± 0.0	NB



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P	<i>Carex lupulina</i>	Hop Sedge				S3	91	1.4 ± 5.0	NB
P	<i>Carex michauxiana</i>	Michaux's Sedge				S3	69	21.0 ± 0.0	NB
P	<i>Carex ormostachya</i>	Necklace Spike Sedge				S3	10	40.5 ± 1.0	NB
P	<i>Carex rosea</i>	Rosy Sedge				S3	32	5.3 ± 0.0	NB
P	<i>Carex tenera</i>	Tender Sedge				S3	50	11.5 ± 0.0	NB
P	<i>Carex tuckermanii</i>	Tuckerman's Sedge				S3	88	2.0 ± 0.0	NB
P	<i>Carex wiegandii</i>	Wiegand's Sedge				S3	142	35.7 ± 1.0	NB
P	<i>Carex recta</i>	Estuary Sedge				S3	8	41.1 ± 0.0	NB
P	<i>Carex atratiformis</i>	Scabrous Black Sedge				S3	1	35.5 ± 0.0	NB
P	<i>Cyperus dentatus</i>	Toothed Flatsedge				S3	223	12.4 ± 0.0	NB
P	<i>Cyperus esculentus</i>	Perennial Yellow Nutsedge				S3	11	42.7 ± 0.0	NB
P	<i>Cyperus esculentus</i> var. <i>leptostachyus</i>	Perennial Yellow Nutsedge				S3	71	2.5 ± 0.0	NB
P	<i>Eleocharis intermedia</i>	Matted Spikerush				S3	2	48.3 ± 0.0	NB
P	<i>Eleocharis quinqueflora</i>	Few-flowered Spikerush				S3	8	21.0 ± 0.0	NB
P	<i>Rhynchospora capitellata</i>	Small-headed Beakrush				S3	24	45.3 ± 0.0	NB
P	<i>Rhynchospora fusca</i>	Brown Beakrush				S3	30	2.1 ± 5.0	NB
P	<i>Trichophorum clintonii</i>	Clinton's Clubrush				S3	49	26.3 ± 0.0	NB
P	<i>Bolboschoenus fluviatilis</i>	River Bulrush				S3	58	2.0 ± 0.0	NB
P	<i>Schoenoplectus torreyi</i>	Torrey's Bulrush				S3	41	15.4 ± 0.0	NB
P	<i>Lemna trisulca</i>	Star Duckweed				S3	31	1.5 ± 0.0	NB
P	<i>Triantha glutinosa</i>	Sticky False-Asphodel				S3	9	10.4 ± 0.0	NB
P	<i>Cypripedium reginae</i>	Showy Lady's-Slipper				S3	8	26.0 ± 10.0	NB
P	<i>Liparis loeselii</i>	Loesel's Twayblade				S3	19	20.1 ± 0.0	NB
P	<i>Platanthera blephariglottis</i>	White Fringed Orchid				S3	66	55.7 ± 0.0	NB
P	<i>Platanthera grandiflora</i>	Large Purple Fringed Orchid				S3	59	18.8 ± 0.0	NB
P	<i>Bromus latiglumis</i>	Broad-Glumed Brome				S3	23	33.6 ± 2.0	NB
P	<i>Calamagrostis pickeringii</i>	Pickering's Reed Grass				S3	113	21.0 ± 0.0	NB
P	<i>Dichanthelium depauperatum</i>	Starved Panic Grass				S3	36	44.2 ± 0.0	NB
P	<i>Dichanthelium depauperatum</i> var. 1	Starved Panic Grass				S3	1	59.7 ± 0.0	NB
P	<i>Muhlenbergia richardsonis</i>	Mat Muhly				S3	9	91.7 ± 0.0	NB
P	<i>Heteranthera dubia</i>	Water Stargrass				S3	59	1.5 ± 0.0	NB
P	<i>Potamogeton obtusifolius</i>	Blunt-leaved Pondweed				S3	14	2.4 ± 1.0	NB
P	<i>Potamogeton richardsonii</i>	Richardson's Pondweed				S3	35	13.0 ± 0.0	NB
P	<i>Xyris montana</i>	Northern Yellow-Eyed-Grass				S3	28	22.9 ± 0.0	NB
P	<i>Zannichellia palustris</i>	Horned Pondweed				S3	7	13.8 ± 0.0	NB
P	<i>Adiantum pedatum</i>	Northern Maidenhair Fern				S3	16	22.8 ± 1.0	NB
P	<i>Cryptogramma stelleri</i>	Steller's Rockbrake				S3	2	16.6 ± 1.0	NB
P	<i>Asplenium viride</i>	Green Spleenwort				S3	23	19.8 ± 0.0	NB
P	<i>Dryopteris fragrans</i>	Fragrant Wood Fern				S3	66	30.6 ± 1.0	NB
P	<i>Dryopteris goldiana</i>	Goldie's Woodfern				S3	7	93.9 ± 5.0	NB
P	<i>Woodsia glabella</i>	Smooth Cliff Fern				S3	65	25.8 ± 1.0	NB
P	<i>Equisetum palustre</i>	Marsh Horsetail				S3	9	26.5 ± 0.0	NB
P	<i>Isoetes tuckermanii</i> ssp. <i>tuckermanii</i>	Tuckerman's Quillwort				S3	22	14.5 ± 1.0	NB
P	<i>Isoetes tuckermanii</i>	Tuckerman's Quillwort				S3	1	91.4 ± 0.0	NB
P	<i>Diphasiastrum x sabinifolium</i>	Savin-leaved Ground-cedar				S3	18	31.9 ± 0.0	NB
P	<i>Huperzia appressa</i>	Mountain Firmoss				S3	38	31.6 ± 1.0	NB
P	<i>Sceptridium dissectum</i>	Dissected Moonwort				S3	28	14.3 ± 0.0	NB
P	<i>Botrychium lanceolatum</i>	Triangle Moonwort				S3	1	21.6 ± 0.0	NB
P	<i>Botrychium lanceolatum</i> ssp. <i>angustisegmentum</i>	Narrow Triangle Moonwort				S3	13	35.4 ± 0.0	NB
P	<i>Botrychium simplex</i>	Least Moonwort				S3	5	57.4 ± 0.0	NB
P	<i>Polypodium appalachianum</i>	Appalachian Polypody				S3	36	27.5 ± 0.0	NB
P	<i>Utricularia resupinata</i>	Inverted Bladderwort				S3?	16	20.3 ± 1.0	NB
P	<i>Crataegus submollis</i>	Quebec Hawthorn				S3?	13	6.8 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	<i>Mertensia maritima</i>	Sea Lungwort				S3S4	31	28.4 ± 0.0	NB
P	<i>Lobelia kalmii</i>	Brook Lobelia				S3S4	17	2.1 ± 1.0	NB
P	<i>Suaeda calceoliformis</i>	Horned Sea-blite				S3S4	6	30.2 ± 0.0	NB
P	<i>Myriophyllum sibiricum</i>	Siberian Water Milfoil				S3S4	37	2.4 ± 0.0	NB
P	<i>Stachys pilosa</i>	Hairy Hedge-Nettle				S3S4	6	26.3 ± 0.0	NB
P	<i>Utricularia gibba</i>	Humped Bladderwort				S3S4	31	26.7 ± 0.0	NB
P	<i>Rumex fueginus</i>	Tierra del Fuego Dock				S3S4	7	90.8 ± 0.0	NB
P	<i>Drymocallis arguta</i>	Tall Wood Beauty				S3S4	29	11.0 ± 0.0	NB
P	<i>Rubus chamaemorus</i>	Cloudberry				S3S4	90	20.0 ± 1.0	NB
P	<i>Geocaulon lividum</i>	Northern Comandra				S3S4	14	25.8 ± 0.0	NB
P	<i>Juniperus horizontalis</i>	Creeping Juniper				S3S4	13	41.2 ± 1.0	NB
P	<i>Cladium mariscoides</i>	Smooth Twigrush				S3S4	55	23.1 ± 0.0	NB
P	<i>Eriophorum russeolum</i>	Russet Cottongrass				S3S4	20	44.3 ± 1.0	NB
P	<i>Triglochin gaspensis</i>	Gasp  ← Arrowgrass				S3S4	14	39.8 ± 1.0	NB
P	<i>Spirodela polyrhiza</i>	great duckweed				S3S4	41	1.9 ± 0.0	NB
P	<i>Corallorhiza maculata</i>	Spotted Coralroot				S3S4	28	2.1 ± 1.0	NB
P	<i>Calamagrostis stricta</i>	Slim-stemmed Reed Grass				S3S4	9	5.9 ± 0.0	NB
P	<i>Distichlis spicata</i>	Salt Grass				S3S4	4	39.4 ± 0.0	NB
P	<i>Potamogeton oakesianus</i>	Oakes' Pondweed				S3S4	42	17.4 ± 5.0	NB
P	<i>Montia fontana</i>	Water Blinks				SH	3	85.3 ± 0.0	NS
P	<i>Solidago caesia</i>	Blue-stemmed Goldenrod				SX	2	32.9 ± 1.0	NB
P	<i>Celastrus scandens</i>	Climbing Bittersweet				SX	2	93.9 ± 1.0	NB
P	<i>Carex swanii</i>	Swan's Sedge				SX	21	77.8 ± 2.0	NS

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The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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**APPENDIX E**  
**HYDROGEOLOGICAL INFORMATION**





## FISHER ENGINEERING LTD.

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40 Fairfield Road  
Lower Coverdale, New Brunswick E1J 0A2  
Phone: 506.863.1991

February 9, 2021

File: DE144

Mr. Andrew Dunn  
AE Dunn consulting  
via email: andrew.dunn76@yahoo.ca

Attention: Mr. Dunn

**RE: PROPOSED TOWNHOUSE DEVELOPMENT, PID 00189415  
HYDROGEOLOGICAL STUDY – UPDATE**

---

At the request of the developer Mr. Dunn, Fisher Engineering Ltd. completed a review of the hydrogeological study completed for the originally proposed two, 12-unit townhouse development on PID 00189415 in Hampton, NB. The review was requested as the developer would like to build two additional town house buildings to match the two currently under construction. This would bring the total number of units to 48.

The original hydrogeological study dated June 2/2020 concluded that there was a high probability of obtaining an adequate quantity of water to support the proposed development and that the development will not aggravate existing, or create new water supply problems. As stated, at that time the proposed development included 2 x 12-unit town house buildings for a total of 24units. The estimated water requirement for the originally proposed development was 15 L/min, based on a per person water usage of 450 Litres per day and an average of 2 people per household. The target tenants are mature seniors so 2 persons / unit is reasonable. The proposed expansion of this development to four buildings will increase the estimated water requirements to 30 L/min.

Based on the hydraulic testing, the production well (TW20-1) can supply a safe yield of at least 70L/min, which is more than double the required flow for the entire four building town house development. Drillers safe yield was estimated to be 113.5L/min and drawdown data indicated a safe yield over 200L/min. This production well will have no problem supplying water to the entire site with the proposed four townhouse buildings.

The conclusion stated in the report that the drilling and hydraulic testing activities indicate that groundwater withdrawals from the proposed town house development will not exceed the long-term safe yield of the aquifers and will not aggravate existing, or create new water supply problems for existing users in the area are still valid with the addition of two more 12unit townhouse buildings.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.

A handwritten signature in black ink that reads 'Michael Fisher'.

Michael Fisher, P.Eng.  
Hydrogeologist

**From:** [michael@fisherengineeringltd.com](mailto:michael@fisherengineeringltd.com)  
**To:** "Doucet, Pierre (ELG/EGL)"  
**Cc:** [andrew.dunn76@yahoo.ca](mailto:andrew.dunn76@yahoo.ca)  
**Subject:** RE: water report  
**Date:** March-02-21 5:10:00 PM

---

Pierre,

I spoke with the developer and he was quite disappointed when I explained the process for the EIA. In particular is the timing as he had crews lined up to start foundation excavating for the end of March. I advised him that it was the water that triggered the EIA and he pointed out that he has two existing buildings in neighbouring Towns (Rothsay/Quispamsis) with metered water.

The units are of similar size (2 bedroom c/w individual laundry) with the same target client aged at 55+. Both of these buildings are metered/billed through the respective towns quarterly. The quarterly water consumption was provided for the 38 unit building in Rothsay for 2020 and ½ 2019 (opened early 2019, has been full since mid way through 2019.)

The six quarterly water consumption readings were as follows:

898,991,1174,1026,810,857m<sup>3</sup>.

The average daily water usage from this apartment building is 10.6m<sup>2</sup>/day which equates to **280L/day/unit**.

For the building in Quispamsis, it has only been full since ½ 2020. The two quarterly water consumption readings were:

990 and 800m<sup>3</sup>.

The average daily water usage from this apartment building is 9.8m<sup>2</sup>/day which equates to **260L/day/unit**.

I realize that Department of Environment and Local Government (DELG) uses the standard estimate of 450 L/day/person when estimating residential water use; however, based on the actual usage data from similar sized and equipped units housing the same targeted client, the standard of 450L/day/person is too high for this application based on actual consumption data. I would suggest that **450 L/day/unit** would be a more realistic approach for this site and this is still over 40% higher than the actual consumption data.

Based on this data, this proposed fully developed site will require 21.6m<sup>3</sup>/day (450L/day/unit x 48 units). This was the original estimated demand (15L/s) that was used for the first two 12 unit buildings that was approved following the initial hydraulic testing and also approved for the 7.5igpm flow restrictor. The actual water consumption data suggests that this proposed 48 unit development can be adequately supplied with the storage and the 7.5igpm flow restrictor.

Pierre, can you please take this additional information into consideration re the requirement for registering this project through the EIA process?

Please feel free to contact me to discuss.

Regards

**Michael Fisher, P.Eng**  
Fisher Engineering Ltd.  
40 Fairfield Road  
Lower Coverdale, NB  
E1J 0A2  
506-863-1991 (p)

---

**From:** michael@fisherengineeringltd.com <michael@fisherengineeringltd.com>  
**Sent:** March-01-21 3:22 PM  
**To:** 'Doucet, Pierre (ELG/EGL)' <Pierre.Doucet@gnb.ca>  
**Subject:** RE: water report

Thanks for the clarification Pierre. The developer now has to decide if he wants to move forward with the next two buildings. I will be in touch if he does.  
Cheers

**Michael Fisher, P.Eng**  
Fisher Engineering Ltd.  
40 Fairfield Road  
Lower Coverdale, NB  
E1J 0A2  
506-863-1991 (p)

---

**From:** Doucet, Pierre (ELG/EGL) <[Pierre.Doucet@gnb.ca](mailto:Pierre.Doucet@gnb.ca)>  
**Sent:** March-01-21 10:46 AM  
**To:** [michael@fisherengineeringltd.com](mailto:michael@fisherengineeringltd.com); Gilliss, Mallory (ELG/EGL) <[Mallory.Gilliss@gnb.ca](mailto:Mallory.Gilliss@gnb.ca)>  
**Cc:** [richard.malone@townofhampton.ca](mailto:richard.malone@townofhampton.ca); [andrew.dunn76@yahoo.ca](mailto:andrew.dunn76@yahoo.ca); Arthur McCarthy <[amccarthy@townofhampton.ca](mailto:amccarthy@townofhampton.ca)>  
**Subject:** RE: water report

Hi Michael,

The Department of Environment and Local Government (DELG) uses the standard estimate of 450 L/day/person when estimating residential water use. DELG also uses the number of bedrooms per unit plus one person to estimate the number of users per unit. It is assumed that these would be

**HYDROGEOLOGICAL STUDY  
TOWN HOUSE DEVELOPMENT PID 00189415**

***Prepared For:***  
**ANDREW DUNN**

***Prepared By:***  
**FISHER ENGINEERING LTD.**



**File: DE144**  
**Date: July 2020**



## FISHER ENGINEERING LTD.

---

40 Fairfield Road  
Lower Coverdale, New Brunswick E1J 0A2  
Phone: 506.863.1991

July 2, 2020

File: DE144

Mr. Andrew Dunn  
AE Dunn consulting  
via email: andrew.dunn76@yahoo.ca

Attention: Mr. Dunn

**RE: PROPOSED TOWNHOUSE DEVELOPMENT, PID 00189415  
HYDROGEOLOGICAL STUDY**

---

Enclosed is our hydrogeological study for a proposed townhouse development on PID 00189415 in Hampton, NB. The study was one of the Town's requirement following the planning advisory approval dated February 19, 2020.

This investigation has determined that there is a high probability of obtaining an adequate quantity of water to support the proposed development and that the development will not aggravate existing, or create new water supply problems.

If you have any questions regarding this report, please do not hesitate to contact the undersigned.



Michael Fisher, P.Eng.  
Hydrogeologist

MJF/

Enclosures

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## **1.0 INTRODUCTION**

Fisher Engineering was retained by Andrew Dunn to complete a hydrogeological assessment for a proposed town house development in Hampton, New Brunswick. The assessment was required as part of the Planning Advisory Committee approval requirements.

The project currently as proposed is for two 12 unit town house building to be constructed on PID 00189415, which is located at the end of DeMille Court. The development will have private driveway access of DeMille Court and will have access to municipal sewer and storm infrastructure that is also located within DeMille Court.

There are no plans to subdivide the lot. Both building will be owned by the developer and the units rented to mature senior tenants. The plan is to have one well provide potable water to both buildings. The estimated water requirement for the proposed development is 15 L/min, which is based on a per person water usage of 450 Litres per day and an average of 2 people per household. The target tenants are mature seniors so 2 persons / unit is reasonable.

The assessment consisted of drilling test wells and performing a hydraulic test. Drilling and hydraulic testing procedures followed the NBDELG 2017 Water Supply Source Assessment Guidelines (WSSA). Drilling was carried out to not interfere with the proposed building layout and also to enable the use of an existing well on site for monitoring purposes. There are no watercourses within 30 m of the drilled test well. In addition to the test well drilled as part of this work, a previous hydrogeological assessment completed on a neighbouring property was provided for review. This neighbouring property was part of an environmental impact assessment (4561-3-1139) that received a determination in January 2008 for a proposed single family development (Pleasant View Estates).



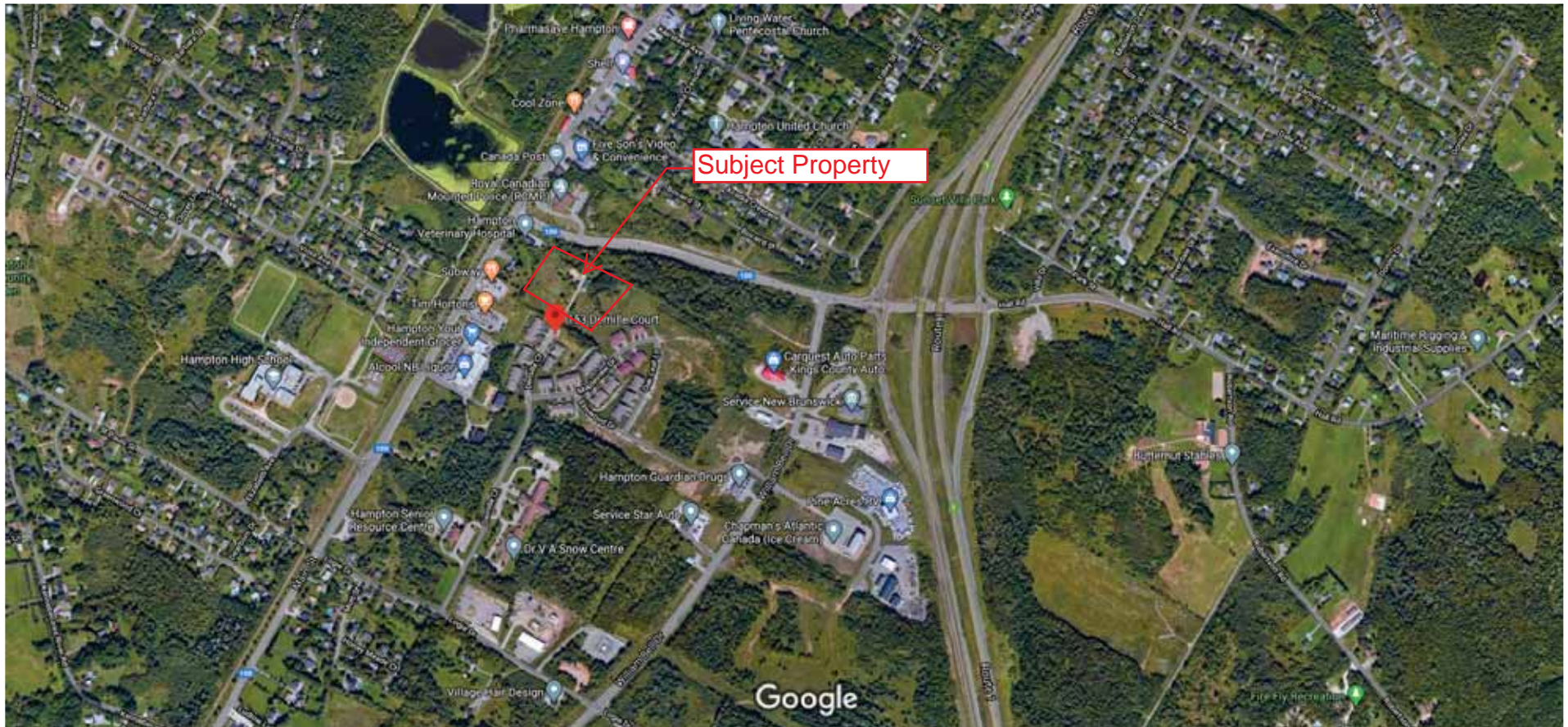
## **2.0 SITE DESCRIPTION**

The subject property is located within the Town of Hampton Limits and is identified by Service New Brunswick as PID 00189415 and covers an approximate area of 3.01 hectares. The site location, as well as the proposed development is shown in Figure 1. The development area extends northward from the end of DeMille Court.

The existing property was historically developed with a single family dwelling and a detached barn with the remaining area vacant and either tree covered or overgrown grass. The former structures were burnt and removed from the property within the last five years. The site has been vacant since that time.

Currently construction of the town houses is scheduled to be started this summer. The developer is planning on taking advantage of the slope across the site to enable all of the units to be one level for ease of accessibility for seniors. There is a mapped watercourse that flows along the northern property line. All of the proposed work is located beyond the 30m setback from the watercourse. Development along DeMille Court and Mapleview Drive to the south and east is Pleasant view Estates. The senior community is comprised of two and four unit townhouses that are individually owned. West of the site along Main Street are commercial developments including a veterinary clinic, small bed and breakfast and a Tim Hortons. There are no municipal wells, municipal wellfields, or protected watersheds within 500 metres of the subject property. Surrounding properties rely on private wells to supply potable water. Within 500 metres of the investigated area there are approximately 150 groundwater users.

FIGURE 1: SITE LOCATION PLAN  
153 DEMILLE CRT.



## **2.1 Interviews**

Several local residents from the area residing within the adjacent senior community subdivision were contacted to gather information on their water to identify if any water quality or quantity issues are or have been present in the past. There were no complaints or reports of water shortage or quality issues from the residents that were interviewed. Several of the residents stated that there was amply water for the area. The adjacent community is actually serviced with nine private wells. The wells are owned and maintained by the community. The resident who is in charge of the system was interviewed and stated that they have never had any water issues beyond the typical maintenance, pump replacement, etc. There are water softeners located within each well house on all of the wells due to reported hard water. The water softeners were supplied and maintained by the local Culligain Water supplier. That is the only treatment that is reportedly completed on the water system for the adjacent community.

Mike Steeves from E.R. Steeves Well Drillers stated that wells drilled in the immediate area have good yields with quality that is acceptable. Mr. Steeves has drilled several of the wells for the commercial developments west of the subject property, including the Tim Hortons. At that property there is reportedly an overflow with several other wells in the area reportedly having an overflow.

### **3.0 HYDROGEOLOGICAL CONDITIONS**

#### **3.1 Topography**

The study area is located within the drainage area of Ossekeag Creek and within 2.5 kilometres of the Kennebecasis River. Regionally, the ground surface slopes westward toward Main Street and eventually several small tributaries that discharge into Ossekeag Creek. Across the subject property, the ground slopes northwesterly toward an unnamed watercourse that bisects the subject property along the northern property boundary.

1:10,000-scale mapping indicates that the surface elevation across the development area ranges between approximately 34m and 12 metres above mean sea level. Surface water drainage across the majority of the proposed expansion area is northwesterly toward the unnamed watercourse.

Shallow groundwater flow across the property is expected to follow the local topography, which slopes toward the mapped watercourse. Deeper groundwater likely flows in a similar westerly direction toward the Kennebecasis River. The area to the south and east that could potentially contribute groundwater to the study area is primarily residential with the main water consumers being the adjacent Pleasant View residential community.

#### **3.2 Geology**

The regional bedrock geology is mapped as Carboniferous stratified rock belonging to the Mabou group, which is a subbasin of the Maritimes Carboniferous Basin. Mapping indicates that within the Mabou Group the site falls within the Kennebecasis Formation, which consists mainly of reddish brown, conglomerate and sandstone; minor mudstone (Barr. S.M. and White. C.E. 2001).

Surficial geology maps indicate that the area is underlain by late Wisconsinan age morainal sediments consisting of hummocky, ribbed and rolling ablation till, some lodgement till, minor silt, sand, gravel, and boulders generally thicker than 1.5m (Rampton, 1984).

### 3.3 Hydrogeological Considerations

Available domestic well logs were obtained from the NBDELG for a 500m radius around the site. A summary of the well logs is presented in the attached Table A1 in Appendix A. Well data indicate that yields in this area range from 268.7L/min to 2.3L/min. Of the 15 well logs reviewed, the median yield (driller estimated yield) was 34L/min and the average was 67L/min. Well depths range from 144.8m to 30.5m with a median depth of 78.5m. A summary of the production wells for the adjacent residential subdivision presented in the EIA (4561-3-1139) indicated that the average well depth is 90.4m +/- 11.86m with the average well drillers estimated safe yield of 156.6L /min.

### 3.4 Recharge

Potential recharge sources to the wells in the immediate area include: direct infiltration from precipitation and groundwater flow from upland areas. Table 1 shows the hydrologic budget for the subject and surrounding area. The precipitation data is based on data collected across the province from 1981 to 2010.

Table 1 Hydrologic Budget for the Subject Property and Surrounding Area

Precipitation mm	Evapo-Transpiration mm	Infiltration mm	Runoff mm
1200	420	180	600
100%	35%	15%	50%

An annual infiltration rate of 180 mm is considered to be relatively conservative but reasonable for the area in the absence of any field data. Based on the size of the lot, the available recharge on an average annual basis would be as follows:

$$\text{Recharge} = \text{lot area (3.04ha)} * \text{Infiltration (15\%)} * \text{Annual Precipitation (1.2m)} = 5472\text{m}^3/\text{year}$$

Therefore, the estimated recharge over the subject property on an average annual basis is 10.4L/min. This is two thirds of the estimated required amount of 15L/min for the proposed town house development. In reality, throughflow from upland areas will also contribute groundwater to the area and the nearby Kennebecasis River may also provide some recharge to bedrock aquifers.

#### 4.0 TEST DRILLING PROGRAM

##### 4.1 Drilling Activities

A single test well was constructed in May 2020 by E.R. Steeves under the supervision of Fisher Engineering personnel. The test well location along with the existing well are shown on Figure 2, which also presents the proposed development plan. The test well is 150mm in diameter with the existing well being 125mm in diameter. The well log for the test well is attached in Appendix B. A brief summary of the wells is provided in Table 2.

Table 2 Test Well Summary

Well ID	Date Drilled	Well Depth (m)	Casing Depth (m)	Driller's Estimated Safe Yield (L/min)	Static Water Level (mbtoc)/ Elevation <sup>2</sup> (m) on May 27/20	Primary Geological Units
TW20-1	May 15/20	85.3	10.06	113.5	0 / 20	Sandstone/shale
Existing Well (TW20-2)	n/a	25.9	n/a	8.5	2.41 / 17.09	na

Notes:

<sup>2</sup> Geodetic elevation

igpm – imperial gallons per minute

mbtoc – metres below top of casing

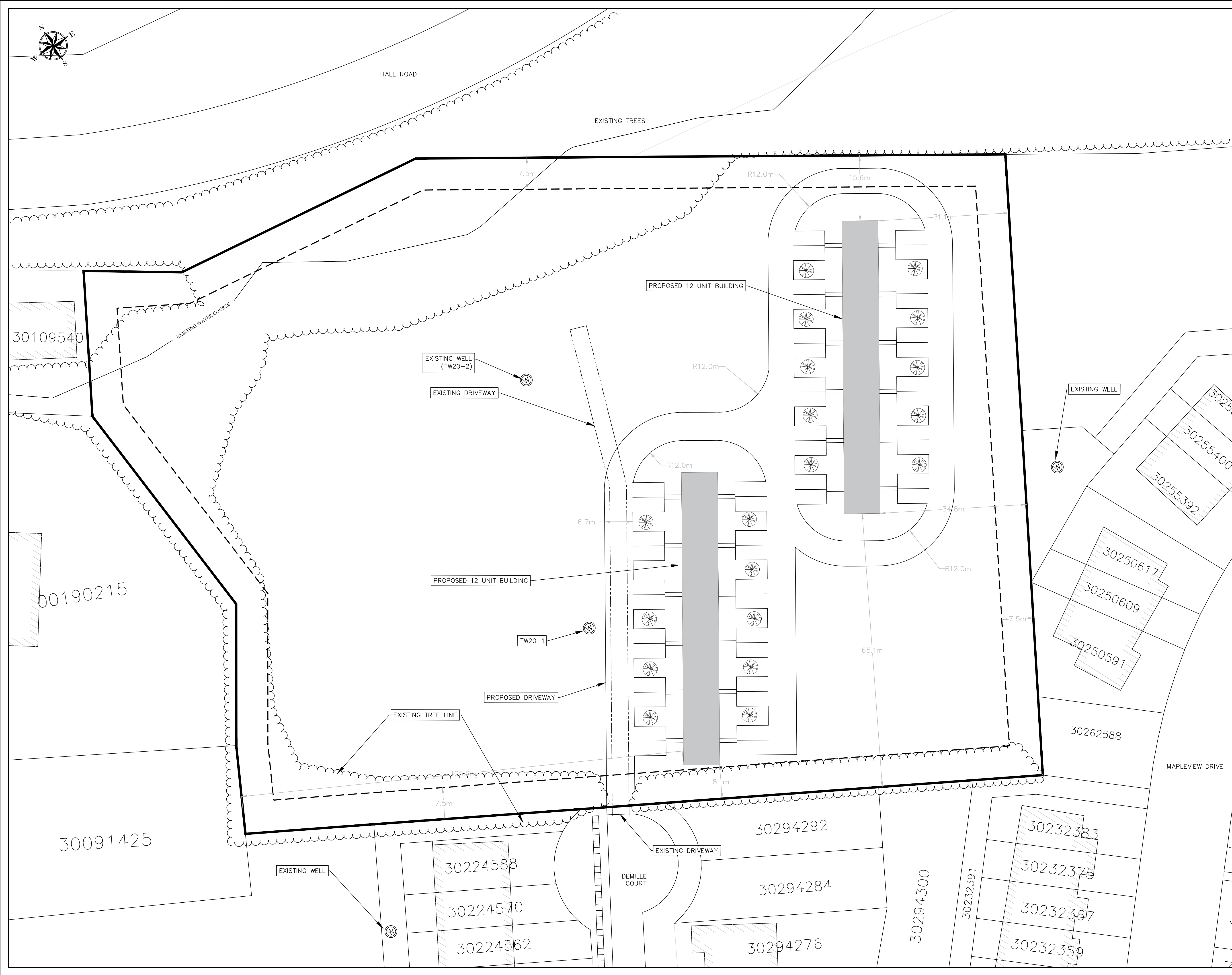
The results of the drilling indicate that the dominant bedrock type at the test well location was a brown sandstone, with intermittent layers of shale. All of the water bearing fractures in the test well were encountered at depths greater than 61m below the ground surface (bgs). The test well drilled on site has similar characteristics of the wells drilled on the adjacent residential subdivision (average 90.4m well depths and 156.6L/min safe yield).

#### **4.2 Hydraulic testing – TW20-1**

A twenty-four hour Hydraulic test was performed at well TW20-1 starting on May 27<sup>th</sup>, 2020<sup>th</sup>. Groundwater from TW20-1 was discharged through a 50mm hose at an approximate distance of 30 metres from the well. The site topography slopes away from the test well so that there would be no concern of re-entry of test water into TW20-1.

The water requirement for the proposed two 12-unit town house development is estimated at 15L/min based on a per person water use of 450L per day with an average household of two people.

Hydraulic testing activities were conducted in early May, which is typically not a low groundwater recharge period; however, seasonably low recharge conditions were noted in 2020 and according to Environment Canada, there was less than 1mm of precipitation for 10 days prior to the hydraulic testing. New Brunswick water quantity information stated that groundwater levels in the southeastern portion of the province were below normal for the month. The above information suggests that the pumping test was carried out under suitable conditions.



SITE LOCATION  
SCALE - METERS 1: 30000

Notes:  
 -Subject Property: PID 00189415.  
 -Proposed Development: 2 x 12 unit townhouse  
 -Each Unit to have 2 parking stalls  
 -One proposed well for the buildings  
 -Town of Hampton municipal sanitary

No.	Issue	Date
1	FOR TOWN OF HAMPTON APPROVAL	MAY 2020
2		
3		



Project Title  
 TOWN OF HAMPTON  
 2 X 12 UNIT TOWNHOUSE  
 DEVELOPMENT

Drawing Title  
 FIGURE 2 SITE PLAN  
 SHOWING TEST WELL LOCATIONS

Project No. DE144

Dwg. No. DE14401R0

Scale: SCALE - METERS 1: 400

Const. North

Drawn By: ACB  
 Designed By: MJF  
 DWG. Design Ckd. By: MJF  
 Sheet #: C-1



#### **4.2.1 24-Hour Constant Rate Pumping Test**

The drillers estimated safe yield from TW20-1 is 113.5L/min, which is more than the estimated requirement for the proposed development (15L/min). Therefore, it was determined that a pumping rate of 70L/min would be a suitable pumping rate for the 24hr test.

At the start of the 24-hour pumping test the static level in TW20-1 was actually overflowing at approximately 1L/min. A plug and extension to the casing installed to establish the static level at 3.5 metres above the top of casing. The pump was set to a depth of 30 metres. The average flow rate measured over the duration of the test was 70L/min. The flow rate was measured with an inline pressure metre and also intermittently with a 100L bucket. Fluctuations to the pumping rate were within five percent throughout the testing period. Table 3 identifies the observation wells monitored during the test. Data loggers were installed in the pumping well and the observation well TW20-2 to assist with monitoring. The field data is attached in Appendix C.

Water samples were collected four hours, twelve hours and just before the end of pumping from TW20-1 and submitted to RPC in Moncton for analysis.

Table 3 Wells Monitored During Pumping Test

Well ID	Distance from Pumping Well (m)	Maximum Drawdown (m)
TW20-1	Pumping Well	15.1
TW20-2	85	0.34m

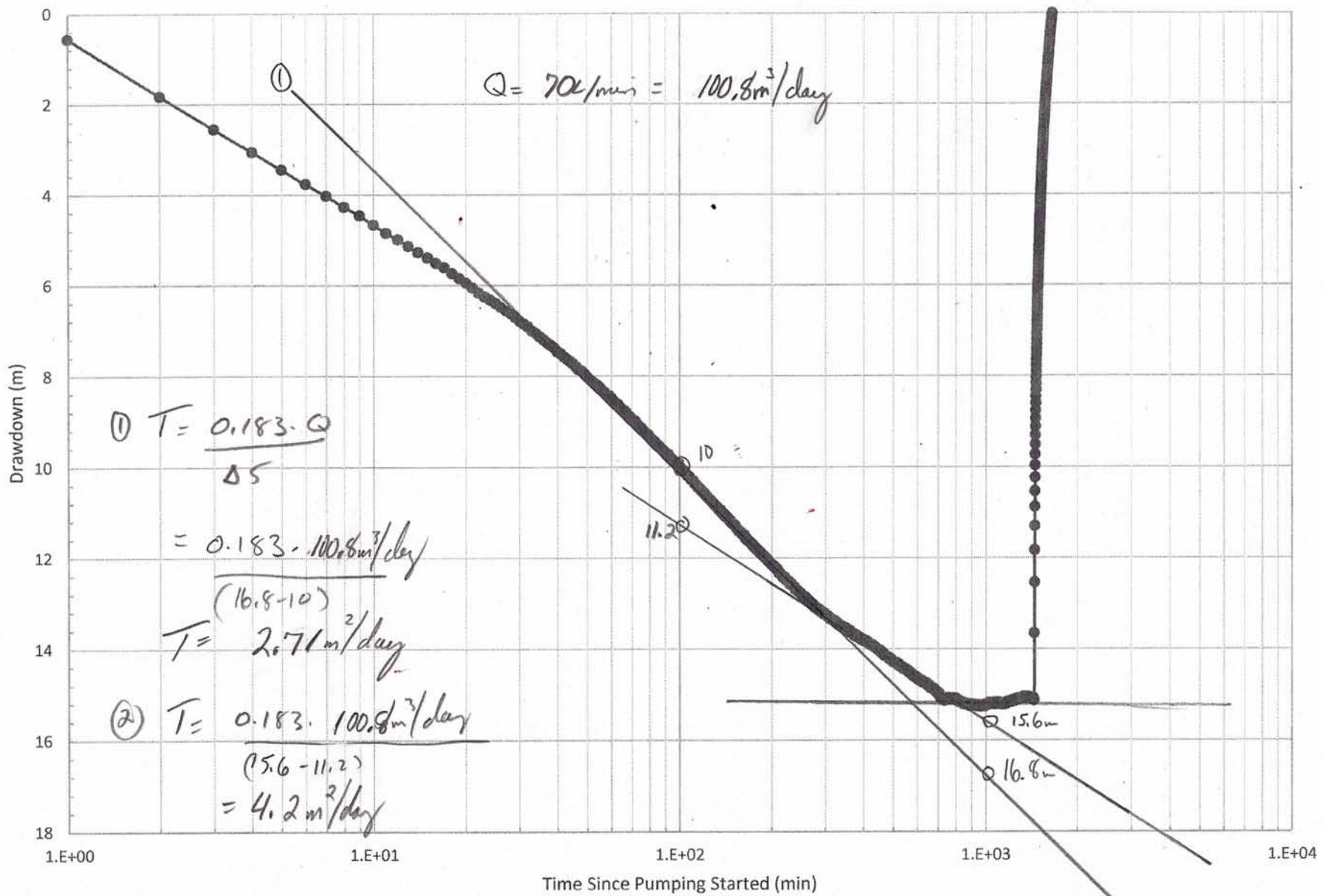
The maximum drawdown recorded in the pumping well and observation well over the 24-hour period is presented in Table 3. Approximately half way through the pumping test, the drawdown stabilizing indicating a potential recharge boundary. Following the pumping test, recovery measurements were recorded for less than four hours as the water level in TW20-1 exceeded 95% recovery. Recovery in the observation well were slower with only 35% recovery occurring within 24hrs of shutting off the pump.

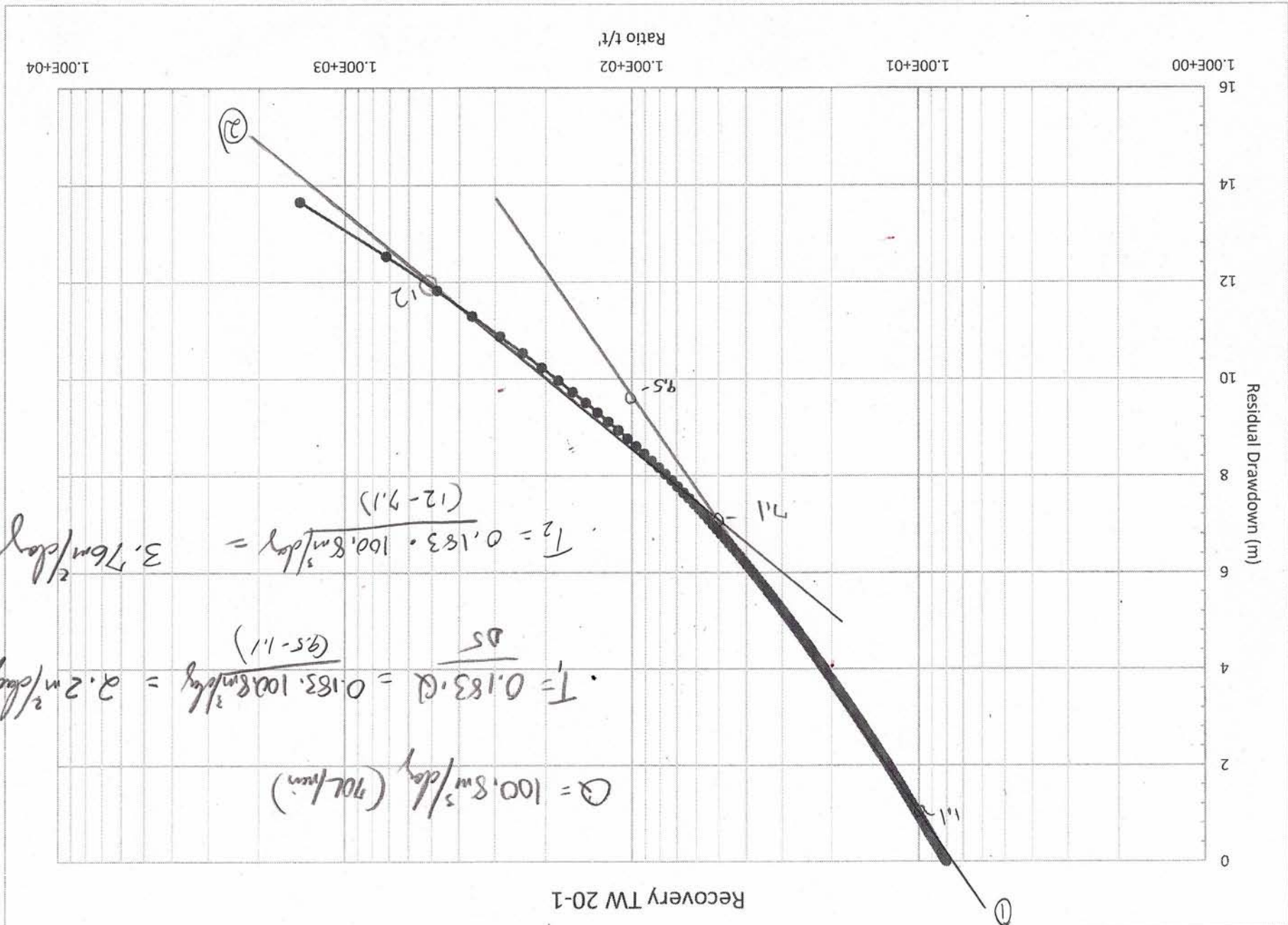
The drawdown versus time graphs (semi-log) for the pumping well, recovery, and observation well TW20-2 are presented in Figures 3 through Figure 5. The pumping activities at TW20-1 only had a 0.34m drawdown in the closest observation well TW20-2.

The drawdown curves for the pumping well indicate that a potential recharge boundary was reached prior to the end of pumping. Theis and Cooper-Jacob methods were used to analyze the drawdown and recovery data from the pumping and observation well. The calculated transmissivity of the aquifer ranged from  $2.5 \times 10^{-5} \text{ m}^2/\text{s}$  to  $5.6 \times 10^{-3} \text{ m}^2/\text{s}$ . The transmissivity values varied slightly between the pumping well and the observation well, however they both correspond to a relatively good aquifer. Storativity value computed from the observation well data was  $1.2 \times 10^{-3}$ .

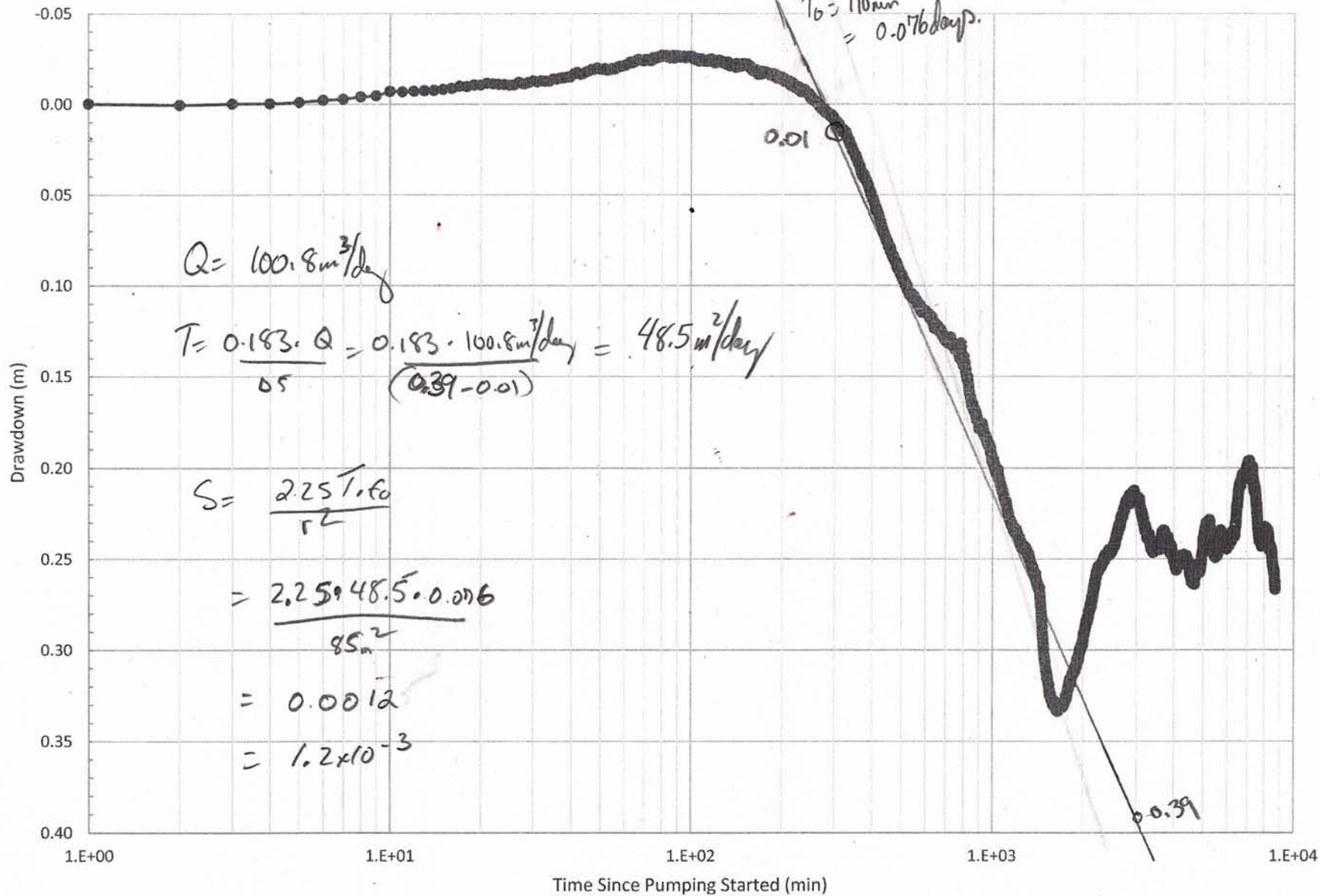
Distance drawdown data from the observation wells indicate that the radius of influence in the area around TW20-1 is less than 100metres. There are no wells located within 100m of the proposed production well (TW20-1) besides the existing well on the subject property.

### Pumping Well TW20-1 Overall





Observation Well TW20-2 Overall



#### **4.2.2 Well Safe Yield**

Based on the drawdown data and the average pumping rate throughout the test, the specific capacity of well TW20-1 is calculated as 3.76L/min/ per metre of drawdown. The distance from the static water level to the top of the water bearing fracture is 65 metres. Therefore, the specific capacity gives a long-term safe yield of 244L/min/day. Based on the well safe yield along, this well will have no problem suppling the water requirement for the proposed town house development, which is estimated to be 15L/min (24units x 450L/day/person x 2 people/unit).

### **4.3 Groundwater Chemistry**

A groundwater sample was collected at 4hrs, 12hrs and just prior to shutting the pump off at 24hours from TW20-1 and submitted to RPC Lab in Moncton for general chemistry, trace metals and bacteria analysis. The laboratory certificates are attached in Appendix D.

All of the parameters in the samples collected from the test well meet the New Brunswick Health Advisor Limits except for manganese and total dissolved solids, which were elevated in all three samples. The manganese levels were 0.059, 0.057 and 0.057mg/L compared to the aesthetic guideline of 0.02. The elevated TDS values are likely associated with the fact that the wells in the area have been found to have hard water. Hard water is associated with elevated levels of dissolved calcium and magnesium, which are found in all three samples.

In addition to the three water samples collected, water quality data was obtained from the New Brunswick Department of the Environment for the surrounding area (500m). The results are summarized in Table D1 in Appendix D. Results are compared to the Canadian Drinking Water Quality Guidelines.

Overall, water quality in the surrounding area is some what comparable to the water quality encountered in the test well sampled. Most parameters did meet drinking water standards, however there were elevated parameters that were not encountered in the test well. Iron exceeded the aesthetic guideline in five of the six full sample reports. There were also two wells that high uranium. An elevated turbidity level was also measured in one sample. This is most likely attributed to the well not being fully developed. Turbidity levels typically decrease following the installation of a new well with extended use.

The analytical data reviewed indicates that the test well, if used for the town house development will likely require a water softener similar to the surrounding wells.

#### **4.4 Groundwater Under the Direct Influence of Surface Water (GUDI)**

The new well #20-1 was evaluated for the potential influence of surface water or shallow groundwater on the proposed groundwater resource. There are several screening indicators that can be examined to determine the potential for GUDI.

The first is how sensitive the well is based on type, i.e. spring, infiltration gallery, horizontal collection well, or wells in an unconfined aquifer are susceptible to having a direct surface water influence. The data indicates that the aquifer that well #20-1 is tapped into is a semi confined to confined aquifer suggesting a reduced possibility of being GUDI.

The second indicator is how close the well is in proximity to a surface water body. The closest water body to well #20-1 is an unnamed tributary to Ossekeag Creek that bisects the northern portion of the subject property. The unnamed tributary is located approximately 100m from the well. Now while semi confined and confined aquifers are typically less susceptible to surface water it is noteworthy to mention the distance between the nearest surface water body.

The third indicator is well construction. According to the well log, bedrock was encountered at 20 feet below the ground surface and that 33 feet of steel casing was installed and the casing was grouted in place. Also, the ground around the well is sloped away from the well preventing surface water from being directed towards the casing.

The fourth indicator is the water quality. No bacteria including E. coli were detected in any of the samples collected from the well during the pumping activities. The hardness levels in the groundwater samples are also higher than what would be expected if the well was being GUDI.

Based on the above screening criteria, well #20-1 does not appear to have the potential to be under the direct influence of surface water.



## 5.0 SUMMARY OF FINDINGS

Drilling and hydraulic testing were performed across the subject property in May of 2020. The work was required to determine if the surrounding groundwater resource was sufficient to handle the proposed townhouse development on the subject property (153 DeMille Court), while not affecting the existing groundwater users. The findings of the work are presented below.

- ❑ One test well was drilled on the property in May 2020. Access to an existing well on the subject property was made available for testing and also information on a previous hydrogeological assessment completed for a neighbouring residential development was made available for review.
- ❑ The test well ranged in depths between 26 and 85 metres.
- ❑ The bedrock beneath the subject property mainly consisted of brown sandstone with intermittent layers of shale.
- ❑ The regional bedrock geology is mapped as Carboniferous stratified rock belonging to the Mabou group, which is a subbasin of the Maritimes Carboniferous Basin. Mapping indicates that within the Mabou Group the site falls within the Kennebecasis Formation, which consists mainly of reddish brown, conglomerate and sandstone; minor mudstone (Barr. S.M. and White. C.E. 2001).
- ❑ The main water bearing fractures encountered in the test well were well below the static water levels recorded.
- ❑ Static water levels ranged from 0m to 2.41 metres below the top of casing.
- ❑ The drillers estimated safe yield for the test well TW20-1 was 113.5L/min.
- ❑ A 24-hour constant rate pumping test (70L/min) was performed at well TW20-1 with observation data collected from an existing well on the subject property.
- ❑ The Theis and Cooper-Jacob analytical methods were used to evaluate the drawdown and recovery data from the pumping well.
- ❑ The transmissivity value for the aquifer calculated from the test data was about  $3.5\text{m}^2/\text{day}$  with a storativity of  $1.2 \times 10^{-3}$ . In addition, transmissivity value published by others during work on the adjacent residential subdivision (EIA 4561-3-1139) had stated the aquifer tested during that work yielded a transmissivity value of  $14\text{m}^2/\text{day}$  and a storativity value of  $6 \times 10^{-6}$ .
- ❑ The storativity values indicate semi-confined to confined conditions. In addition, the

water fracture zones continue to be much lower than the static water levels.

- ❑ Distance drawdown data indicates that the radius of influence within the formation is less than 100 metres. There was only 0.34m of drawdown recorded in the observation well, TW20-2.
- ❑ The drawdown was stabilizing at approximately 15 metres of drawdown indicating that a recharge boundary was encountered.
- ❑ Safe yield estimate based on the specific capacity of the pumping well suggest that the bedrock formation is capable to sustain a long-term safe yield of 244L/min/day. This exceeds the 15L/min (24units x 0.45 m<sup>3</sup>/person/day x 2 people/unit) required for the proposed Town house development.
- ❑ Overall, the water quality in the samples collected is good with all of the analyzed parameters meeting drinking water guidelines except for manganese and that the water is hard.

The pumping data shows that the groundwater obtained from the bedrock formation at the test well location have little hydraulic connection with less than 0.35metres of drawdown observed in TW20-2 which was located 85metres away. This is not uncommon of the Maritimes Carboniferous Basin, which is highly stratified with each strata being of small lateral extent and of various permeability. Well yields reported in the immediate area (500m) are similar to the results obtained in the test well drilled on the subject property.

Work by others within the adjacent subdivision as part of the EIA (4561-3-1139) stated that the production well tested in 2007 could safely supply a pumping rate of 83L/min. Which was stated as being 163% of the amount required for the fully occupied Phase II development of the adjacent residential subdivision. This well alone could therefore supply the residential subdivision along with the proposed town house development.

## **6.0 CONCLUSION AND RECOMMENDATIONS**

In our professional opinion, the drilling and hydraulic testing activities indicate that groundwater withdrawals from the proposed town house development will not exceed the long-term safe yield of the aquifers and will not aggravate existing, or create new water supply problems for existing users in the area. The test well (TW20-1) can supply both town house buildings with a safe yield of at least 70L/min, which is more than four times the required flow for the proposed town house development. Drillers safe yield was estimated to be 113.5L/min and drawdown data indicated a safe yield over 200L/min. This production well will have no problem supplying water to the proposed development. Two additional town houses could easily be supplied by this well in the future if the developer every decides to expand this development.

Water quality results from the test well was better than the NBDELG water quality data from the surrounding wells. Overall, the water quality in the area is good with only a few parameters exceeding the drinking water guidelines. Elevated water quality parameters include iron, manganese, turbidity, TDS, and uranium were reported in surrounding wells, while the only parameters that exceeded the water quality guideline in the production well was manganese and TDS. The manganese exceedances were above the aesthetic guideline of 0.02mg/L. All of the levels were below the maximum acceptable level of 0.12mg/L. The elevated TDS is commonly found in hard water. The water quality data indicates that the production well (TW20-1) will likely require treatment to reduce the hardness and potentially reduce the manganese levels in order to produce potable water that is acceptable to tenants. There are commercially available treatment systems that can effectively remove the above noted parameters at reasonable costs.

If additional wells are drilled on this property, all wells are to be installed as per provincial regulations (90-79, 93-203) and it is recommended that homeowners install, operate and maintain their wells in accordance with good practice procedures as outlined in the guide "All about your Well", ([www.nbeia.nb.ca/pdf/well%20pubeng.pdf](http://www.nbeia.nb.ca/pdf/well%20pubeng.pdf))

## **7.0 REFERENCES**

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**APPENDIX A**

**TABLE A1**

Table 1A Well Log Summary 500m Radius for PID 00189415

Well Report	Well	Casing	Rock	Yield	Rock Type
	Depths (m)			L/min	
148	30.5	6.1	2.4	91.0	Sandstone
12675	91.4	13.4	18.3	59.2	Sandstone & Shale
15259	62.5	12.2	5.5	22.8	Sandstone
15827	144.8	14.0		113.8	Sandstone
16944	88.4	6.1	0.9	159.3	Sandstone
18555	38.1	10.1	6.1	54.6	Sandstone
26161	88.4	12.2	3.7	36.4	Sandstone
26481	45.7	12.2	7.0	18.2	Sandstone
29083	121.9	18.3	10.7	268.7	Sandstone
29085	91.4	18.3	9.1	29.0	Conglomerate
29301	68.6	9.8	6.1	22.8	Sandstone
29323	56.4	6.1	0.9	31.9	Sandstone
32068	32.0	9.5	8.5	27.3	Sandstone
35751	144.8	18.3	11.6	2.3	Conglomerate

Max	144.8	18.3	18.3	269
Min	30.5	6.1	0.9	2
Average	78.9	11.9	7.0	67
Median	78.5	12.2	6.1	34

**APPENDIX B**

**WELL LOGS**

OFFICE USE ONLY  
FIELD NO. HEALTH CODE LAB NO. SAMPLE RECEIVED DATE  
HEALTH OFFICE EVENT NO. YR MO DAY

SAMPLE RECEIVED BY

TESTING VOUCHER INFORMATION MANDATORY FOR WATER TEST  
SEE BACK FOR DETAILS PLEASE PRINT  
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING  
FIRST NAME LAST NAME

P.I.D. NO. WELL I.D. NO.  
302198020038874

ADDRESS (MAIL RESULTS TO)  
CITY/TOWN/VILLAGE PROV. POSTAL CODE

WELL OWNER INFORMATION  
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING  
FIRST NAME LAST NAME  
697800 NB CORP

DAYTIME PHONE FAX NO.  
TEL NO. SAMPLE COLLECTED YR MO DAY HR MIN AM PM

ADDRESS  
62 CHAMBERLAIN RD  
CITY/TOWN/VILLAGE PROVINCE POSTAL CODE  
QUISPAMIS NB E2G1C1

DO YOU NEED A SAMPLE FOR YOUR MORTGAGE? SEE BACK FOR DETAILS

WELL LOCATION: SAME AS ABOVE OR CIVIC NUMBER STREET NAME  
153 DEMILLE CT

IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:  
ATTENTION OF:

WELL PAID FOR BY PROVINCIAL DEPT OF  
WELL ON RESERVE? WELL ALREADY TAGGED? OLD WELL I.D.  
YES  NO  YES  NO

TEL NO. FAX NO.  
SIGNATURE OF WELL OWNER

DRILLER'S LOG  
FROM (FT.) TO (FT.) COLOUR ROCK TYPE  
Ground Level 20 Brown ch  
20 280 Brown Shale + seams shale

WAS THE COST OF THIS WELL FINANCED BY NB HOUSING?  
YES  NO

WELL / WATER USE:  
INDUSTRIAL  ABANDONED  DOMESTIC   
EXPLORATORY  MUNICIPAL  MONITORING   
HEAT PUMP  OBSERVATION  OTHER

TYPE OF WORK COMPLETED: NEW WELL  DEEPEMED   
OTHER:

METHOD:  
CABLE TOOL  ROTARY  OTHER

CASING INSTALLED:  
LENGTH OF CASING ABOVE GROUND: 2 FT. IN.  
STEEL: 6 IN DIAM. FROM 0 FT. TO 33 FT.  
PVC: IN DIAM. FROM FT. TO FT.  
SLOTTED IN DIAM. FROM FT. TO FT.  
SCREENS: TYPE: SLOT SIZE IN DIAM. FROM FT. TO FT.  
DRIVE SHOE: YES  NO

SETBACKS: SEE BACK FOR DETAILS  
SEPTIC TANK (1) FT. SEPTIC TANK (2) FT. FIELD (1) FT. FIELD (2) FT.  
\*RIGHT OF WAY OF ANY PUBLIC ROAD (1) 120 ROAD (2) CENTER OF ROAD (1) 153 (2)  
SETBACKS MEASURED (NEW CONSTRUCTION)  
APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER (EXISTING CONST.)

FLOWING WELL? YES  NO  IF YES - RATE: igpm (approx.)

AQUIFER TEST: METHOD: AIR  BAILER  PUMP   
INITIAL WATER LEVEL: 280 FT BELOW TOP OF CASING  
PUMPING RATE: 25 igpm DURATION: 1 hrs. min.  
FINAL WATER LEVEL: 10 FT. BELOW TOP OF CASING

ESTIMATED SAFE YIELD: 25 igpm  
WELL GROUTED? YES  NO   
FROM FT. TO FT. GROUT TYPE:

DRILLING FLUIDS USED: YES  NO   
TYPE:

IF INSUFFICIENT SPACE PLEASE USE ADDITIONAL SHEETS  
TOTAL WELL DEPTH: 280 FT. DEPTH TO BEDROCK: 20 FT.  
WATER BEARING 1 4 igpm AT 205 FT. 2 6 igpm AT 230 FT.  
FRACTURE ZONES: 3 8 igpm AT 250 FT. 4 2 igpm AT 265 FT.

PUMP INSTALLATION: INSTALLED  NOT INSTALLED   
PUMP INTAKE SETTING: 200 FT. BELOW TOP OF CASING (Recommended)  
PUMP TYPE: SUBMERSIBLE  JET  TURBINE   
OTHER  
WELL DISINFECTED? YES  NO   
TYPE Bleach

DRILLER'S COMMENTS  
Well drilled on vacant lot

DRILLING COMPANY: E R Steeves  
COMPLETION DATE: 200321 YR MO DAY  
LICENSE NO. 100

G.P.S. (OPTIONAL)

I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT.

Signature of Driller

Signature of Helper

- WHITE - NBELG
- BLUE - Homeowner / Voucher
- YELLOW - Homeowner
- PINK - Drilling Company

KEEP THIS REPORT WITH YOUR



**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Work Type	Drill Method	Work Completed
Well Use	New Well	Cable Tool	08/26/2002
Drinking Water, Municipal			

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
148	Steel	15.24cm	0m	6.10m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Bailer	7.62m	91 lpm	0hr 30min	0m	0 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting	Drilling Fluids Used	Disinfectant	Pump Installed
There is no Grout information.	None	N/A	N/A
		Qty 0L	Intake Setting (BTC) 0m

Driller's Log					Overall Well Depth 30.48m
Well Log	From	End	Colour	Rock Type	
148	0m	2.44m	Brown	Mud	Bedrock Level 2.44m
148	2.44m	30.48m	Red	Sandstone	

Water Bearing Fracture Zone		
Well Log	Depth	Rate
148	15.24m	22.75 lpm
148	24.38m	68.25 lpm

Setbacks
There is no Setback information.

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	09/28/2006

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
12675	Steel	15.24cm	0m	18.29m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	91.44m	59.15 lpm	1hr 02min	0m	59.15 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	N/A	N/A
	Qty 0L	Intake Setting (BTC) 0m

Driller's Log				
Well Log	From	End	Colour	Rock Type
12675	0m	13.41m	Brown	Gravel
12675	13.41m	91.44m	Red	Sandstone and Shale

Overall Well Depth  
91.44m  
Bedrock Level  
13.41m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
12675	42.06m	4.55 lpm
12675	60.96m	4.55 lpm
12675	68.58m	13.65 lpm
12675	85.34m	36.4 lpm

Setbacks
There is no Setback information.

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	05/10/2007

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
15259	Steel	15.24cm	0m	12.19m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	25.91m	22.75 lpm	1hr	4.57m	22.75 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

<b>Well Grouting</b>
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	Submersible
	Qty 0L	Intake Setting (BTC)
		57.91m

Driller's Log				
Well Log	From	End	Colour	Rock Type
15259	0m	5.49m	Brown	Clay
15259	5.49m	30.48m	Red	Shale
15259	30.48m	47.24m	Red	Sandstone
15259	47.24m	50.29m	Red	Shale
15259	50.29m	62.48m	Red	Sandstone

Overall Well Depth  
62.48m  
Bedrock Level  
5.49m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
15259	25.91m	4.55 lpm
15259	56.39m	18.2 lpm

Setbacks		
Well Log	Distance	Setback From
15259	4.57m	Right of any Public Way Road
15259	21.34m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	02/15/2007

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
16944	Steel	15.24cm	0m	6.10m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	6.10m	159.25 lpm	1hr 15min	6.10m	159.25 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	Submersible
	Qty 0L	Intake Setting (BTC)
		76.20m

Driller's Log				
Well Log	From	End	Colour	Rock Type
16944	0m	0.91m	Brown	Soil
16944	0.91m	88.39m	Red	Sandstone

Overall Well Depth  
88.39m  
Bedrock Level  
0.91m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
16944	12.19m	22.75 lpm
16944	42.37m	63.7 lpm
16944	35.05m	45.5 lpm
16944	69.19m	18.2 lpm

Setbacks		
Well Log	Distance	Setback From
16944	30.48m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	04/10/2006

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
18555	Steel	15.24cm	0m	10.06m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	2.44m	54.6 lpm	1hr 15min	2.44m	54.6 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

<b>Well Grouting</b>
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	Submersible
	Qty 0L	Intake Setting (BTC)
		22.86m

Driller's Log				
Well Log	From	End	Colour	Rock Type
18555	0m	1.83m	Brown	Fill
18555	1.83m	6.10m	Brown	Mud
18555	6.10m	38.10m	Brown	Sandstone

Overall Well Depth  
38.10m  
Bedrock Level  
6.10m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
18555	20.73m	9.1 lpm
18555	35.05m	36.4 lpm
18555	18.29m	9.1 lpm

Setbacks		
Well Log	Distance	Setback From
18555	27.43m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	10/21/2010

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
26161	Steel	15.24cm	0m	12.19m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	0m	36.4 lpm	0hr 30min	0m	36.4 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

<b>Well Grouting</b>
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	N/A
	Qty 0L	Intake Setting (BTC)
		54.86m

Driller's Log				
Well Log	From	End	Colour	Rock Type
26161	0m	3.66m	Brown	Soil
26161	3.66m	88.39m	Red	Sandstone

Overall Well Depth  
88.39m  
Bedrock Level  
3.66m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
26161	54.86m	13.65 lpm
26161	85.34m	22.75 lpm

Setbacks		
Well Log	Distance	Setback From
26161	32.00m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	06/30/2011

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
26481	Steel	15.24cm	0m	12.19m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	45.72m	18.2 lpm	1hr 01min	6.71m	18.2 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	Submersible
	Qty 0L	Intake Setting (BTC)
		41.15m

Driller's Log				
Well Log	From	End	Colour	Rock Type
26481	0m	7.01m	Brown	Mud and Stones
26481	7.01m	45.72m	Red	Sandstone

Overall Well Depth  
45.72m  
Bedrock Level  
7.01m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
26481	30.48m	3.41 lpm
26481	39.32m	14.79 lpm

Setbacks		
Well Log	Distance	Setback From
26481	29.57m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Non-Drinking Water, Exploratory	New Well	Rotary	08/01/2012

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
29083	Steel	15.24cm	0m	18.29m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	121.92m	268.72 lpm	1hr	0m	268.72 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	N/A	Submersible
	Qty 0L	Intake Setting (BTC)
		115.82m

Driller's Log				
Well Log	From	End	Colour	Rock Type
29083	0m	10.67m	Brown and red	Sand and Gravel
29083	10.67m	18.29m	Orange and red	Conglomerate
29083	18.29m	27.43m	Red and purple	Sandstone
29083	27.43m	88.39m	Red and purple	Conglomerate
29083	88.39m	121.92m	Red and purple	Sandstone

Overall Well Depth  
121.92m  
Bedrock Level  
10.67m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
29083	27.43m	113.75 lpm
29083	36.58m	7.33 lpm
29083	88.39m	149.47 lpm

Setbacks		
Well Log	Distance	Setback From
29083	18.29m	Right of any Public Way Road
29083	28.35m	Center of road



**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Non-Drinking Water, Exploratory	New Well	Rotary	08/03/2012

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
29085	Steel	15.24cm	0m	18.29m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	91.44m	29.03 lpm	1hr	0m	29.03 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	N/A	Submersible
	Qty 0L	Intake Setting (BTC)
		85.34m

Driller's Log				
Well Log	From	End	Colour	Rock Type
29085	0m	9.14m	Brown and red	Sand and Gravel
29085	9.14m	88.39m	Red and purple	Conglomerate
29085	88.39m	91.44m	Red and purple	Sandstone

Overall Well Depth  
91.44m  
Bedrock Level  
9.14m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
29085	27.43m	24.12 lpm
29085	79.25m	4.91 lpm

Setbacks		
Well Log	Distance	Setback From
29085	16.76m	Right of any Public Way Road
29085	26.82m	Center of road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	09/21/2011

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
29301	Steel	15.24cm	0m	9.75m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	6.10m	22.75 lpm	1hr 45min	6.10m	22.75 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting	Drilling Fluids Used	Disinfectant	Pump Installed
	None	Bleach (Javex)	N/A
There is no Grout information.		Qty 0L	Intake Setting (BTC) 53.34m

Driller's Log					Overall Well Depth
Well Log	From	End	Colour	Rock Type	
29301	0m	6.10m	Brown	Mud	68.58m
29301	6.10m	68.58m	Brown	Sandstone	Bedrock Level 6.10m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
29301	60.96m	9.1 lpm
29301	65.53m	13.65 lpm

Setbacks		
Well Log	Distance	Setback From
29301	60.96m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	04/26/2012

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
29323	Steel	15.24cm	0m	6.10m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	9.14m	318.5 lpm	1hr 15min	9.14m	31.85 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	Submersible
	Qty 0L	Intake Setting (BTC)
		35.05m

Driller's Log				
Well Log	From	End	Colour	Rock Type
29323	0m	0.91m	Brown	Soil
29323	0.91m	56.39m	Red	Sandstone

Overall Well Depth  
56.39m  
Bedrock Level  
0.91m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
29323	24.38m	4.55 lpm
29323	51.82m	18.2 lpm
29323	35.05m	9.1 lpm

Setbacks		
Well Log	Distance	Setback From
29323	22.56m	Right of any Public Way Road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	09/30/2013

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
32068	Steel	15.24cm	0m	9.45m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	2.44m	27.3 lpm	1hr 10min	2.44m	27.3 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	N/A
	Qty 0L	Intake Setting (BTC)
		0m

Driller's Log				
Well Log	From	End	Colour	Rock Type
32068	0m	6.10m	Brown	Sand
32068	6.10m	8.53m	Brown	Clay
32068	8.53m	32.00m	Brown	Sandstone

Overall Well Depth  
32.00m  
Bedrock Level  
0m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
32068	19.81m	13.65 lpm
32068	30.18m	13.65 lpm

Setbacks		
Well Log	Distance	Setback From
32068	39.62m	Center of road

**Well Driller's Report**

Date printed 5/7/2020

Drilled by	Well Use	Work Type	Drill Method	Work Completed
	Drinking Water, Domestic	New Well	Rotary	10/10/2017

Casing Information		Casing above ground			Drive Shoe Used?
Well Log	Casing Type	Diameter	From	End	Slotted?
35751	Steel	15.24cm	0m	18.29m	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
Air	144.78m	2.28 lpm	2hrs 01min	10.67m	2.28 lpm	No	0 lpm
<i>(BTC - Below top of casing)</i>							

Well Grouting
There is no Grout information.

Drilling Fluids Used	Disinfectant	Pump Installed
None	Bleach (Javex)	Submersible
	Qty 0L	Intake Setting (BTC)
		106.68m

Driller's Log				
Well Log	From	End	Colour	Rock Type
35751	0m	11.58m	Brown	Mud and Gravel
35751	11.58m	144.78m	Red	Conglomerate

Overall Well Depth  
144.78m  
Bedrock Level  
11.58m

Water Bearing Fracture Zone		
Well Log	Depth	Rate
35751	138.68m	2.28 lpm
35751	140.21m	1.14 lpm

Setbacks		
Well Log	Distance	Setback From
35751	21.34m	Right of any Public Way Road
35751	31.39m	Center of road

**APPENDIX C**

**FIELD DATA**

24hr Constant Rate Test TW20-1  
(Pumping Well)

Time Since Pumping Started (min)	Drawdown (m)
0	
1	0.55
2	1.82
3	2.55
4	3.06
5	3.44
6	3.76
7	4.02
8	4.27
9	4.45
10	4.66
11	4.85
12	4.99
13	5.13
14	5.27
15	5.39
16	5.51
17	5.60
18	5.73
19	5.84
20	5.94
21	6.05
22	6.16
23	6.25
24	6.32
25	6.40
26	6.48
27	6.56
28	6.62
29	6.70
30	6.79
31	6.85
32	6.91
33	7.00
34	7.06
35	7.13
36	7.19
37	7.27
38	7.32
39	7.38
40	7.47
41	7.51
42	7.57
43	7.63
44	7.67
45	7.73
46	7.80
47	7.86
48	7.88
49	7.95
50	8.02
51	8.07
52	8.12
53	8.17
54	8.20
55	8.25
56	8.31
57	8.35
58	8.41

24hr Constant Rate Test TW20-2  
(Observation Well)

Time Since Pumping Started (min)	Drawdown (m)
0	
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00
6	0.00
7	0.00
8	0.00
9	0.00
10	-0.01
11	-0.01
12	-0.01
13	-0.01
14	-0.01
15	-0.01
16	-0.01
17	-0.01
18	-0.01
19	-0.01
20	-0.01
21	-0.01
22	-0.01
23	-0.01
24	-0.01
25	-0.01
26	-0.01
27	-0.01
28	-0.01
29	-0.01
30	-0.01
31	-0.01
32	-0.01
33	-0.01
34	-0.01
35	-0.01
36	-0.01
37	-0.01
38	-0.01
39	-0.01
40	-0.02
41	-0.02
42	-0.02
43	-0.02
44	-0.02
45	-0.02
46	-0.02
47	-0.02
48	-0.02
49	-0.02
50	-0.02
51	-0.02
52	-0.02
53	-0.02
54	-0.02
55	-0.02
56	-0.02
57	-0.02
58	-0.02

24hr Constant Rate Test TW20-1  
(Pumping Well)

Time Since Pumping Started (min)	Drawdown (m)
59	8.43
60	8.49
80	9.33
100	9.98
120	10.57
140	11.04
160	11.47
180	11.82
200	12.15
220	12.42
240	12.69
300	13.24
360	13.59
420	13.89
480	14.18
540	14.42
600	14.63
660	14.83
720	15.07
780	15.08
840	15.19
900	15.22
960	15.25
1020	15.21
1080	15.19
1140	15.20
1200	15.16
1260	15.10
1320	15.08
1380	15.06
1440	15.11
1441	13.65
1442	12.53
1443	11.83
1444	11.30
1445	10.88
1446	10.53
1447	10.23
1448	9.97
1449	9.73
1450	9.51
1451	9.30
1452	9.11
1453	8.93
1454	8.77
1455	8.60
1456	8.45
1457	8.30
1458	8.16
1459	8.03
1460	7.90
1461	7.77
1462	7.65
1463	7.53
1464	7.42
1465	7.30
1466	7.20
1467	7.09
1468	6.99

24hr Constant Rate Test TW20-2  
(Observation Well)

Time Since Pumping Started (min)	Drawdown (m)
59	-0.02
60	-0.02
80	-0.03
100	-0.03
120	-0.02
140	-0.02
160	-0.02
180	-0.02
200	-0.01
220	-0.01
240	-0.01
300	0.01
360	0.03
420	0.06
480	0.09
540	0.11
600	0.11
660	0.12
720	0.13
780	0.14
840	0.16
900	0.18
960	0.19
1020	0.20
1080	0.21
1140	0.23
1200	0.23
1260	0.24
1320	0.25
1380	0.26
1440	0.27
1441	0.27
1442	0.27
1443	0.27
1444	0.27
1445	0.27
1446	0.27
1447	0.27
1448	0.27
1449	0.27
1450	0.27
1451	0.27
1452	0.28
1453	0.28
1454	0.28
1455	0.28
1456	0.28
1457	0.28
1458	0.28
1459	0.28
1460	0.28
1461	0.28
1462	0.28
1463	0.28
1464	0.28
1465	0.28
1466	0.29
1467	0.29
1468	0.29



24hr Constant Rate Test TW20-1  
(Pumping Well)

Time Since Pumping Started (min)	Drawdown (m)
1469	6.89
1470	6.79
1471	6.69
1472	6.60
1473	6.51
1474	6.42
1475	6.33
1476	6.24
1477	6.16
1478	6.08
1479	6.00
1480	5.92
1481	5.84
1482	5.77
1483	5.69
1484	5.61
1485	5.55
1486	5.47
1487	5.40
1488	5.34
1489	5.26
1490	5.20
1491	5.13
1492	5.07
1493	5.00
1494	4.94
1495	4.88
1496	4.82
1497	4.76
1498	4.70
1499	4.63
1500	4.58
1510	4.04
1520	3.57
1530	3.15
1540	2.76
1560	2.08
1580	1.48
1600	0.95
1620	0.49
1640	0.09
1641	0.07
1642	0.05
1643	0.03
1644	0.01
1645	0.00

24hr Constant Rate Test TW20-2  
(Observation Well)

Time Since Pumping Started (min)	Drawdown (m)
1469	0.29
1470	0.29
1471	0.29
1472	0.29
1473	0.29
1474	0.29
1475	0.29
1476	0.29
1477	0.29
1478	0.29
1479	0.29
1480	0.30
1481	0.29
1482	0.30
1483	0.30
1484	0.30
1485	0.30
1486	0.30
1487	0.30
1488	0.30
1489	0.30
1490	0.30
1491	0.30
1492	0.30
1493	0.30
1494	0.30
1495	0.30
1496	0.30
1497	0.30
1498	0.30
1499	0.31
1500	0.31
1510	0.31
1520	0.31
1530	0.31
1540	0.32
1560	0.32
1580	0.33
1600	0.33
1620	0.33
1640	0.33
1641	0.33
1642	0.33
1643	0.33
1644	0.33
1645	0.33
1680	0.33
1740	0.33
1800	0.32
1860	0.31
1920	0.31
1980	0.30
2040	0.29
2100	0.28
2160	0.27
2220	0.26
2280	0.25
2360	0.25
2420	0.25

24hr Constant Rate Test TW20-1  
(Pumping Well)

Time Since Pumping Started (min)	Drawdown (m)
-------------------------------------	--------------

24hr Constant Rate Test TW20-2  
(Observation Well)

Time Since Pumping Started (min)	Drawdown (m)
2480	0.25
2540	0.24
2600	0.23
2660	0.23
2720	0.22
2780	0.22
2840	0.22
2880	0.22

**APPENDIX D**

**GROUNDWATER CHEMISTRY RESULTS**

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
Fisher Engineering Ltd  
P.O. Box 2663  
Moncton, NB E1C 8N6



115A Harrisville Blvd  
Moncton NB  
Canada E1H 3T3  
Tel: 506.855.6472  
Fax: 506.855.8294  
www.rpc.ca

Attention: Michael Fisher

**Project/Job #: DE144**

Location: Hampton

### Examination of Water/Examen de l'eau

RPC Sample ID/No. d'échantillon de RPC:				353996-1
Client Sample ID/ID d'échantillon du client:				0400 Hrs
Date collected/Date du prélèvement:				27-May-20
Time sampled/Heure du prélèvement:				1:15:00 PM
Analytes/Paramètre(s)	Method Méthode	Date Analyzed Date Analysé	Units Unités	
Total Coliforms/Coliformes totaux	MB02	27-May-20	cfu/100mL	0
E. coli	MB02	27-May-20	cfu/100mL	0

This report relates only to the sample(s) and information provided to the laboratory.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

#### LEGEND:

RL/SD = Reporting Limit/Seuil de déclaration cfu/ufc = Colony Forming Units/Unités formant des colonies

MPN/NPP = Most Probable Number/Nombre Plus Probable A = Absence P = Presence/Présence

Michael Lawlor  
Lab Supervisor  
Moncton Laboratory/Laboratoire de Moncton

Nadine Godin  
Microbiology Technician  
Moncton Laboratory/Laboratoire de Moncton

Report ID: 353996-IAS  
 Report Date: 04-Jun-20  
 Date Received: 27-May-20

**CERTIFICATE OF ANALYSIS**

for  
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 Fax: 506.452.0594  
 www.rpc.ca

Attention: Michael Fisher

**Project #: DE144**

Location: Hampton

**Analysis of Potable Water**

RPC Sample ID:					353996-1
Client Sample ID:					0400 Hrs
Date Sampled:					27-May-20
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	51
Chloride	mg/L	0.5	-	250	187
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	1100
Fluoride	mg/L	0.05	1.5	-	1.10
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	< 0.05
pH	units	-	-	-	7.8
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.5
Sulfate	mg/L	1	-	500	200
Total Organic Carbon	mg/L	0.5	-	-	0.8
Turbidity	NTU	0.1	-	-	0.6
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	337
TDS (calc)	mg/L	-	-	500	645
Saturation pH (5°C)	units	-	-	-	7.9
Langelier Index (5°C)	-	-	-	-	-0.09

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality.

Peter Crowhurst  
 Director  
 Inorganic Analytical Chemistry

Krista Skinner  
 Chemical Technician  
 Inorganic Analytical Chemistry

Report ID: 353996-IAS  
 Report Date: 04-Jun-20  
 Date Received: 27-May-20

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 Fax: 506.452.0594  
 www.rpc.ca

Attention: Michael Fisher

**Project #: DE144**

Location: Hampton

**Analysis of Metals in Potable Water**

RPC Sample ID:					353996-1
Client Sample ID:					0400 Hrs
Date Sampled:					27-May-20
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.011
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	2	-	0.011
Boron	mg/L	0.001	5	-	0.327
Cadmium	mg/L	0.00001	0.005	-	0.00002
Calcium	mg/L	0.05	-	-	133.
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	2	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.005	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.149
Magnesium	mg/L	0.01	-	-	1.27
Manganese	mg/L	0.001	0.12	0.02	0.059
Molybdenum	mg/L	0.0001	-	-	0.0557
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.70
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	79.9
Strontium	mg/L	0.001	7	-	4.10
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	0.0038
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001

Report ID: 353996-IAS  
Report Date: 04-Jun-20  
Date Received: 27-May-20

## CERTIFICATE OF ANALYSIS

for  
Fisher Engineering Ltd  
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### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivativization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2120 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter - Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report/Rapport: 354143-MB  
Date: 29-May-20  
Date Received/Reçu: 28-May-20

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

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Tel: 506.855.6472  
Fax: 506.855.8294  
www.rpc.ca

Attention: Michael Fisher

**Project/Job #: DE144**

Location: Hampton

**Examination of Water/Examen de l'eau**

RPC Sample ID/No. d'échantillon de RPC:				354143-1	354143-2
Client Sample ID/ID d'échantillon du client:				12:00 Hrs	24:00 Hrs
Date collected/Date du prélèvement:				27-May-20	28-May-20
Time sampled/Heure du prélèvement:				9:15:00 PM	9:15:00 AM
Analytes/Paramètre(s)	Method Méthode	Date Analyzed Date Analysé	Units Unités		
Total Coliforms/Coliformes totaux	MB02	28-May-20	cfu/100mL	0	0
E. coli	MB02	28-May-20	cfu/100mL	0	0

This report relates only to the sample(s) and information provided to the laboratory.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

**LEGEND:**

RL/SD = Reporting Limit/Seuil de déclaration cfu/ufc = Colony Forming Units/Unités formant des colonies

MPN/NPP = Most Probable Number/Nombre Plus Probable A = Absence P = Presence/Présence



Michael Lawlor  
Lab Supervisor  
Moncton Laboratory/Laboratoire de Moncton



Nadine Godin  
Microbiology Technician  
Moncton Laboratory/Laboratoire de Moncton



Report ID: 354143-IAS  
 Report Date: 04-Jun-20  
 Date Received: 28-May-20

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 www.rpc.ca

Attention: Michael Fisher

**Project #: DE144**

Location: Hampton

**Analysis of Potable Water**

RPC Sample ID:					354143-1
Client Sample ID:					12:00 Hrs
Date Sampled:					27-May-20
<b>Analytes</b>	<b>Units</b>	<b>RL</b>	<b>MAC</b>	<b>AO</b>	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	54
Chloride	mg/L	0.5	-	250	202
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	1100
Fluoride	mg/L	0.05	1.5	-	1.07
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	< 0.05
pH	units	-	-	-	7.8
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.4
Sulfate	mg/L	1	-	500	190
Total Organic Carbon	mg/L	0.5	-	-	0.9
Turbidity	NTU	0.1	-	-	0.3
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	337
TDS (calc)	mg/L	-	-	500	651
Saturation pH (5°C)	units	-	-	-	7.9
Langelier Index (5°C)	-	-	-	-	-0.06

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality.

Peter Crowhurst  
 Director  
 Inorganic Analytical Chemistry

Krista Skinner  
 Chemical Technician  
 Inorganic Analytical Chemistry

Report ID: 354143-IAS  
 Report Date: 04-Jun-20  
 Date Received: 28-May-20

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Attention: Michael Fisher

**Project #: DE144**

Location: Hampton

**Analysis of Potable Water**

RPC Sample ID:					354143-2
Client Sample ID:					24:00 Hrs
Date Sampled:					28-May-20
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	54
Chloride	mg/L	0.5	-	250	195
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	1080
Fluoride	mg/L	0.05	1.5	-	1.03
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	< 0.05
pH	units	-	-	-	7.8
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.7
Sulfate	mg/L	1	-	500	190
Total Organic Carbon	mg/L	0.5	-	-	0.7
Turbidity	NTU	0.1	-	-	0.2
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	332
TDS (calc)	mg/L	-	-	500	641
Saturation pH (5°C)	units	-	-	-	7.9
Langelier Index (5°C)	-	-	-	-	-0.07

This report relates only to the sample(s) and information provided to the laboratory.

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Guidelines are from Guidelines for Canadian Drinking Water Quality.

Report ID: 354143-IAS  
 Report Date: 04-Jun-20  
 Date Received: 28-May-20

**CERTIFICATE OF ANALYSIS**

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Attention: Michael Fisher

**Project #: DE144**

Location: Hampton

**Analysis of Metals in Potable Water**

RPC Sample ID:					354143-1
Client Sample ID:					12:00 Hrs
Date Sampled:					27-May-20
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.004
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	2	-	0.010
Boron	mg/L	0.001	5	-	0.326
Cadmium	mg/L	0.00001	0.005	-	0.00001
Calcium	mg/L	0.05	-	-	133.
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	2	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.005	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.148
Magnesium	mg/L	0.01	-	-	1.26
Manganese	mg/L	0.001	0.12	0.02	0.057
Molybdenum	mg/L	0.0001	-	-	0.0544
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.69
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	78.2
Strontium	mg/L	0.001	7	-	4.09
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	0.0044
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001

Report ID: 354143-IAS  
 Report Date: 04-Jun-20  
 Date Received: 28-May-20

**CERTIFICATE OF ANALYSIS**

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 www.rpc.ca

Attention: Michael Fisher

**Project #: DE144**

Location: Hampton

**Analysis of Metals in Potable Water**

RPC Sample ID:					354143-2
Client Sample ID:					24:00 Hrs
Date Sampled:					28-May-20
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.001
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	2	-	0.010
Boron	mg/L	0.001	5	-	0.322
Cadmium	mg/L	0.00001	0.005	-	0.00001
Calcium	mg/L	0.05	-	-	131.
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	2	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.005	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.145
Magnesium	mg/L	0.01	-	-	1.25
Manganese	mg/L	0.001	0.12	0.02	0.057
Molybdenum	mg/L	0.0001	-	-	0.0532
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.69
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	77.2
Strontium	mg/L	0.001	7	-	4.19
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	0.0048
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001

Report ID: 354143-IAS  
Report Date: 04-Jun-20  
Date Received: 28-May-20

## CERTIFICATE OF ANALYSIS

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Fax: 506.452.0594  
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### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2120 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter - Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES