APPENDIX A

Corporate Profile from Nova Scotia Registry of Joint Stock Companies

Profile

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Profile Info | People Info | Activites Info | Related Reg's Info

PROFILE - NOVA CONSTRUCTION CO. LTD. - as of: 2020-05-09 02:48 PM

Business/Organization Name:	NOVA CONSTRUCTION CO. LTD.
Registry ID:	1022074
Type:	N.S. Limited Company
Nature of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	3098 POST ROAD, BOX 1328 ANTIGONISH NS Canada B2G 2L7
Mailing Address:	
Previous Name:	NOVA CONSTRUCTION COMPANY LIMITED

PEOPLE

Name	Position	Civic Address	Mailing Address
DONALD W CHISHOLM	Director	RR#4 ANTIGONISH NS B2G 2L2	
DONALD W. CHISHOLM	PRESIDENT	2030 ROUTE 337, HARBOUR CENTRE ANTIGONISH NS B2G 2L2	
PAUL F. WHITE	VP, ENGINEERING	156 COLDSTREAM TRURO NS B2N 5B2	
GERALD W. DUGGAN	SEC, VP & CFO	192 ST. JOSEPH'S ROAD ANTIGONISH NS B2G 2K8	
GERALD W. DUGGAN	Recognized Agent	192 ST. JOSEPH'S ROAD ANTIGONISH NS B2G 2K8	192 ST. JOSEPH'S ROAD ANTIGONISH NS B2G 2K8

ACTIVITIES

Activity	Date

Annual Statement Filed	2019-08-23
Annual Renewal	2019-08-23
Annual Statement Filed	2018-09-04
Annual Renewal	2018-09-04
Annual Statement Filed	2017-08-18
Annual Renewal	2017-08-18
Annual Renewal	2016-08-24
Annual Statement Filed	2016-08-24
Annual Statement Filed	2015-09-09
Annual Renewal	2015-09-08
Annual Renewal	2014-08-21
Annual Statement Filed	2014-08-19
Appoint an Agent	2013-12-04
Change of Directors	2013-12-04
Annual Renewal	2013-09-06
Annual Statement Filed	2013-09-06
Annual Renewal	2012-09-24
Annual Statement Filed	2012-09-24
Special Resolution	2012-06-11
Filed Document	2012-06-11
Annual Renewal	2011-08-16
Annual Statement Filed	2011-08-16
Annual Renewal	2010-09-14
Annual Statement Filed	2010-09-14
Annual Renewal	2009-09-14
Annual Statement Filed	2009-09-11
Annual Renewal	2008-08-19
Annual Statement Filed	2008-08-19
Change of Directors	2008-08-07
Special Resolution	2008-02-06
Filed Name Change	2008-01-08
Effective Date of Name Change	2008-01-08
Annual Renewal	2007-09-26
Annual Statement Filed	2007-09-25
Annual Statement Filed	2007-09-25

Annual Renewal	2006-09-25
Annual Statement Filed	2006-09-25
Annual Statement Filed	2005-09-21
Annual Renewal	2005-09-19
Annual Statement Filed	2005-09-16
Annual Renewal	2004-09-28
Annual Statement Filed	2004-09-24
Annual Renewal	2003-09-15
Annual Statement Filed	2003-09-15
Annual Statement Filed	2003-09-15
Annual Renewal	2002-08-19
Annual Statement Filed	2002-08-19
Annual Renewal	2001-08-17
Annual Statement Filed	2001-08-17
Annual Renewal	2000-08-14
Annual Statement Filed	2000-08-14
Annual Statement Filed	1999-09-22
Annual Renewal	1999-09-10
Annual Renewal	1998-08-18
Annual Statement Filed	1998-08-18
Annual Renewal	1997-08-22
Filed Debenture Supplement	1997-06-20
Special Resolution	1997-05-26
Special Resolution	1997-03-19
Filed Document	1997-03-19
Filed Debenture	1996-11-04
Annual Renewal	1996-08-30
Annual Statement Filed	1996-08-30
Annual Report Filed	1995-09-13
Change of Directors	1990-07-13
Special Resolution	1990-07-13
Registered Office Change	1988-11-21
Agent Filed	1984-07-17
Status Report Filed	1963-09-26
Certificate not produced by REGIS Filed	1963-09-20

Incorporated	1963-09-20
Old System Documents	1963-09-20
Registered	1963-09-20

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RELATED REGISTRATIONS

This Company ...	
RIVERSIDE SPEEDWAY	Registered
ANTIGONISH MALL	Registered

Profile

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PROFILE - 3326059 NOVA SCOTIA LIMITED - as of: 2019-12-13 01:10 PM

Business/Organization Name:	3326059 NOVA SCOTIA LIMITED
Registry ID:	3326059
Type:	N.S. Limited Company
Nature of Business:	
Status:	Active
Jurisdiction:	Nova Scotia
Registered Office:	3098 POST ROAD ANTIGONISH NS Canada B2G 2K3
Mailing Address:	BOX 1328 ANTIGONISH NS Canada B2G 2L7

PEOPLE

Name	Position	Civic Address	Mailing Address
DONALD W. CHISHOLM	Director	2030 ROUTE 337, HARBOUR CENTRE ANTIGONISH NS B2G 2L2	
DONALD W. CHISHOLM	PRESIDENT	2030 ROUTE 337, HARBOUR CENTRE ANTIGONISH NS B2G 2L2	
GERALD W. DUGGAN	SECRETARY, VP & CFO	192 ST. JOSEPH'S ROAD ANTIGONISH NS B2G 2K8	
GERALD W. DUGGAN	Recognized Agent	192 ST. JOSEPH'S ROAD ANTIGONISH NS B2G 2K8	192 ST. JOSEPH'S ROAD ANTIGONISH NS B2G 2K8

ACTIVITIES

Activity	Date
Appoint an Agent	2019-07-12

Address Change	2019-07-12
Change of Directors	2019-05-06
Change of Directors	2019-04-05
Appoint an Agent	2019-04-02
Change of Directors	2019-04-02
Date of Filing Amalgamation	2019-04-01
Effective Date of Amalgamation	2019-04-01

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RELATED REGISTRATIONS

This Company ...	
D. J. LOWE (1980) LIMITED	Amalgamated From
TRACTION GRIT	Registered
PARKER MOUNTAIN AGGREGATES LIMITED	Amalgamated From

APPENDIX B

Current Industrial Approval for Ongoing Activities at Seabrook Quarry (IA #2021-2794715-01)

NOVA SCOTIA

55 Starrs Rd. Unit 9
Yarmouth NS
Canada B5A 2T2

902-742-8985 P
902-742-7796 F
www.novascotia.ca

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1 s.1

APPROVAL HOLDER: NOVA CONSTRUCTION CO. LTD.

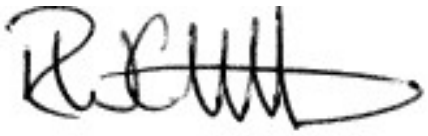
SITE PID: 30192942

APPROVAL NO: 2021-2794715-01

EXPIRY DATE: June 9, 2031

Pursuant to Part V of the Environment Act, S.N.S. 1994-95, c.1 s.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Industrial - Construction - Quarry



Administrator: Robert Cuthbert

Effective Date: February 16, 2022

The Minister's powers and responsibilities under the Act with respect to this Approval have been delegated to the Administrator named above. Therefore, any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise advised in writing.

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Department of Environment and Climate Change

Approval Holder: NOVA CONSTRUCTION CO. LTD.

Project: Seabrook Quarry 11479 Hwy 217 Seabrook

Site:

PID	Civic #	Street Name	Street Type	Community	County
30192942					

Approval No: 2021-2794715-01

File No: 92100-30-YAR-2021-2794715

Reference Documents

- Application submitted January 26, 2022 and attachments.
- Email dated May 19, 2021 from Bailee Williams RE Application # 2021-2794715-00 Seabrook Quarry - Area to Reclaim
- Survey Plan dated January 2022

1. Definitions

a. Abandonment means cessation of production of aggregate for a period of 36 months or notification of abandonment has been received by the Department in accordance with the Approval and Notification Procedures Regulations.

b. Act means Environment Act. 1994-95, c.1, s.1 , and includes, unless the context otherwise requires, the regulations made pursuant to the Act, as amended from time to time.

c. Active Area means the area occupied by the working face, disturbed areas, rehabilitated areas, any structure, processing facility, pollution abatement system, settling pond, aggregate stockpile and/or overburden associated with the Quarry and Quarry activities. The active area excludes the scale, scale house, and access roads.

d. Department means the Nova Scotia Department of Environment and Climate Change, and the contact for the Department for this approval is:
Nova Scotia Department of Environment and Climate Change
Western Region, Yarmouth Office
55 Starrs Rd. Unit 9

Yarmouth, Nova Scotia B5A 2T2

Phone: (902) 742-8985
Fax: (902) 742-7796

e. Disturbed Area means an area in an unnatural state, affected by human activity associated with the Quarry.

f. Minister means the Minister of Environment and Climate Change and includes any person delegated the authority of the Minister.

g. Overburden means material, including organics, overlying a deposit of aggregate.

h. Site means a place where a designated activity and/or undertaking is occurring or may occur.

i. Surface Watercourse means a watercourse as defined in the Environment Act, excluding groundwater.

j. Undisturbed means in a natural state, unaffected by human activity, or rehabilitated to the satisfaction of the Department.

2. Scope

a. This Approval (the "Approval") relates to the Approval Holder(s) and their application and all documentation submitted to the Department prior to the issuance of this approval for the Quarry situated at or near Seabrook Quarry 11479 Hwy 217 Seabrook.

b. The Approval Holder(s) shall ensure the designated activity is carried out in accordance with this Approval and reference documents, including the application and supporting documentation.

3. General

a. The Approval Holder(s) shall conduct the Designated Activity in accordance with the following provisions:

i. The Act, as amended from time to time;

ii. Any standard adopted by the Department, as amended from time to time, which includes but is not limited to the following:

(a) Nova Scotia Environment and Labour Pit and Quarry Guidelines, 2003, as amended from time to time.

b. Nothing in this Approval relieves the Approval Holder(s) of the responsibility for obtaining and paying for all licenses, permits, approvals or authorizations necessary for carrying out the work authorized to be performed by this Approval which may be required by municipal by-laws, provincial or federal legislation, or other organizations. The Minister does not warrant that such licenses, permits, approvals or other authorizations will be issued.

c. No authority is granted by this Approval to enable the Approval Holder(s) to commence or continue the designated activity on lands which are not in the control or ownership of the Approval Holder(s). It is the responsibility of the Approval Holder(s) to ensure that such a contravention does not occur. The Approval Holder(s) shall provide, to the Department, proof of such control or ownership upon expiry of any relevant lease or agreement. Failure to retain said authorization may result in this Approval being cancelled or suspended.

d. If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.

e. Any request for renewal or amendment of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.

f. The Approval Holder(s) shall not transfer, sell, lease, assign or otherwise dispose of this Approval without the written consent of the Minister. The sale of a controlling interest of a business or a transfer of the approval from a parent company to a subsidiary or an affiliate is deemed to be a transfer requiring consent.

g. If the Minister cancels or suspends this Approval, the Approval Holder(s) remains subject to the penalty provisions of the Act.

h. The Approval Holder(s) shall advise the Department in writing prior to any proposed extensions or modifications to the Activity and/or the Site. An amendment to this Approval may be required before implementing any extension or modification.

i. The Approval Holder(s) shall immediately notify the Department of any incidents of non-compliance with this Approval.

j. The Approval Holder(s) shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

k. Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures that are all deemed acceptable to the Department.

l. Unless written authorization is received otherwise from the Minister, all samples required by this Approval shall be analyzed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.

m. The Approval Holder(s) shall ensure that this Approval, or a copy, is present on Site while personnel are on Site.

n. The Approval Holder(s) shall ensure that personnel directly involved in the designated activity are made fully aware of the terms and conditions of this Approval.

o. Upon any changes to the Registry of Joint Stock Companies information, the Approval Holder(s) shall provide a copy to the Department within five business days.

4. Separation Distances

a. The Approval Holder(s) shall not conduct the designated activity within the following separation distances unless otherwise exempted or varied by conditions of this approval:

i. Public or common highway - 30 m

ii. Watercourse (top of watercourse bank) or Wetland (boundary) - 30 m undisturbed

iii. Property line (of PID) including property lines abutting a public or common highway - 30 m undisturbed

iv. Dug or Drilled well not including site monitoring wells or non-potable process water wells located on the site - 90 m

v. All water supplies and other off-site structure - 800 m

b. The Approval Holder(s) shall not blast within the following separation distances unless the Approval Holder(s) has obtained written letters of permission from the property owner of the structure on or before the date of Approval:

5. Air Quality

a. The Approval Holder(s) shall ensure that air emissions from the designated activity do not contribute to an exceedance of the maximum permissible ground level concentrations of contaminants specified in Schedule A of the Air Quality Regulations.

b. Monitoring of ambient air contaminants shall be conducted at the request of the Department. The number and location of the monitoring station(s) shall be established by a qualified person retained by the Approval Holder(s) and the proposed plan submitted to the Department for acceptance; this may include point(s) beyond the property boundary of the Site.

c. The use of oil as a dust suppressant is prohibited.

d. The Approval Holder(s) shall retain a qualified person to develop a plan to monitor ambient total suspended particulate matter at the request of the Department, in accordance with the EPA standard: EPA/625/R-96/010a, "Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Method IO-2.1 Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler", as amended from time to time.

i. The plan shall be deemed acceptable by the Department and implemented upon request.

6. Noise

a. The Approval Holder(s) shall ensure that noise generated from the designated activity complies with the equivalent sound level criteria identified in the Nova Scotia Environment and Labour "Guidelines for Environmental Noise Measurement and Assessment" dated May 18, 2005, as amended from time to time.

b. The Approval Holder(s) shall monitor noise at the request of the Department. The number and location of the monitoring station(s) for noise measurement shall be established by a qualified person retained by the Approval Holder(s). The proposed plan must be deemed acceptable by the Department.

7. Surface Water

a. The Approval Holder(s) shall ensure the Site is developed and maintained to prevent contaminants from being discharged into a water resource or beyond the property boundary.

b. Monitoring during operations: The Approval Holder(s) shall carry out a program for monitoring surface water discharges from Site and shall include, at a minimum, what is outlined in the Operational Surface Water Monitoring Table found in this Approval.

c. Monitoring during construction: The Approval Holder(s) shall ensure that the following water quality limits are met in the water resource downstream of construction activities:

   i. Total Suspended Solids, Clear Flows (Normal Background Conditions):

      (a) Maximum increase of 25 mg/l from background levels for any short term exposure (24 hour or less);

      (b) Maximum average increase of 5 mg/l from background levels for longer term exposure (inputs lasting between 24 hours and 30 days);

   ii. Total Suspended Solids, High Flow (Spring Freshets and Storm Events)

      (a) Maximum increase of 25 mg/l from background levels at any time when background levels are between 25 mg/l and 250 mg/l ;

      (b) Maximum increase of 10% over background levels when background is >250 mg/l;

d. Additional surface water monitoring may be required at the request of the Department.

e. No authority is granted by this Approval to enable the Approval Holder(s) to discharge surface water onto adjoining lands without the authorization of the affected landowner(s).

f. The Approval Holder(s) shall install and maintain erosion and sediment controls in line with industry best practices (e.g., Nova Scotia Environment Erosion and Sediment Control Handbook for Construction Sites) with the following considerations:

    i. The controls shall be installed prior to the commencement of the construction activities;

    ii. The controls shall remain in place until areas disturbed by construction activities are stabilized so that the risk of release of sediment to a water resource has been mitigated;

    iii. Control features shall be installed as per applicable product specifications or manufacturer's directions; and

    iv. Control materials shall be clean, non-erodible, non-ore-bearing, non-watercourse derived and non-toxic.

g. The Approval Holder(s) shall immediately contact the Department should sulphide bearing material be encountered on the Site.

h. The Approval Holder(s) shall ensure that surface water runoff that may be impacted by petroleum hydrocarbons from the Site is collected and directed for necessary treatment prior to discharge from Site.

i. Erosion and sediment controls shall be inspected yearly, at a minimum, and prior to and after precipitation or flow events of 60mm/24 hours or more. These inspections shall confirm the erosion and sediment controls are working as designed and intended. Records outlining results of these inspections and actions taken to correct any deficiencies shall be kept for the duration of the approval and made available to the Department upon request.

j. Work at the site shall only take place when erosion and sediment controls are functional. Contingency erosion and sediment control materials shall be kept on Site in case of failure.

k. Any silted water pumped from work areas shall be directed to vegetated areas, settling ponds, or other treatment devices that mitigate the risk of release of sediment to a water resource.

l. The Approval Holder(s) shall limit the size of the disturbed area and the removal of riparian vegetation to the area of construction activities as outlined in the supporting documentation.

m. The Approval Holder(s) shall ensure that the following activities take place at a distance of a minimum of 30 metres from a surface watercourse or wetland in an area such that a release will not enter a surface watercourse or wetland:

    i. Fuel storage, refueling, and/or lubrication of equipment;

    ii. Washing of machinery or equipment; and

iii. Storage of equipment, excavated/stockpiled materials, and potential contaminants.

8. Groundwater

a. The Approval Holder(s) shall replace, at their expense, any water supply which has been lost or damaged as a result of the designated activity, as authorized and required by the Department.

b. The Approval Holder shall not excavate within 0.5 metres above the measured maximum annual water table elevation unless an amendment to this Approval is received, or unless otherwise authorized in writing by the Department.

c. Upon request by the Department the Approval Holder(s) shall develop a groundwater monitoring program that meets the requirements of the Department.

9. Operation

a. The Approval Holder(s) shall ensure that legible signage is posted at the entrance to the Site that includes, but is not limited to,

i. information pertaining to the days and hours of operation;

ii. and emergency contact numbers.

b. The Approval Holder(s) shall cease site work and contact the Department immediately if it is determined that an area of historical, archaeological or paleontological importance may exist or is discovered at the site.

c. The boundaries of the Active Area shall be either:

i. Marked with permanent visible markers placed at changes in direction, with no more than 100 metres between the permanent markers; or

ii. mapped on a scale drawing with a list of UTM NAD83 coordinates (with sub-meter accuracy) for each corner of the Site.

10. Blasting

a. The Approval Holder(s) shall have a technical blast design prepared by a qualified person which ensures the ground vibration and air concussion limits in this Approval can be achieved.

b. At the request of the Department, the Approval Holder(s) shall submit a copy of the blast design.

c. At the direction of the Department, the Approval Holder(s) shall modify or cease blasting.

d. The Approval Holder(s)shall conduct a pre-blast survey of all structures within 800 metres of the point of blast including a water quality analysis of any wells serving these structures. The survey shall be conducted in accordance with the Department's "Procedure For Conducting a Pre-Blast Survey" and the results of

this survey sent to the Department prior to blasting on the Site. Additional water quality parameters may be required by the Department staff.

e. No blasting will be performed if thermal inversion conditions are anticipated at the time of the proposed blast.

f. No blasting shall occur on Sunday, on a statutory holiday prescribed by the Province, or on any day between 1800 and 0800 hours.

g. The Approval Holder(s) shall ensure that all blasts are monitored for concussion and ground vibration to ensure that the limits in the Blasting Limits Table are not exceeded.

h. The Approval Holder(s)shall provide the Department with UTM NAD83 coordinates for the blast monitoring stations on each blast monitoring report, or upon request.

i. The monitoring station for blasting shall be as indicated in the Blasting Limits Table. Additional monitoring stations for blasting may be specified as required by the Department.

j. Records of individual blast results shall be maintained by the Approval Holder(s) and made available to the Department upon request.

11. Reporting

a. The Approval Holder(s) shall provide an Annual Report summarizing the following information, as required by the terms and conditions of this Approval, for each calendar year:

   i. all groundwater and surface water monitoring data and reports;

   ii. a description of any complaints received and the follow up actions taken;

   iii. a summary and interpretation of analytical results obtained in accordance with this Approval;

   iv. a summary and interpretation of any instances of non-compliance with this approval and corrective action taken.

   v. hectares disturbed and rehabilitated to date;

   vi. estimates of hectares planned for disturbance or rehabilitation in the upcoming year;

   vii. a summary of any communication with the Mi'kmaq of Nova Scotia;

   viii. any other information requested by the Department.

b. The annual report described herein shall be submitted to the Department on or before January 31 of the following year.

c. All monitoring results shall include interpretation by a qualified person deemed acceptable by the Department.

12. Rehabilitation and Closure

a. The Approval Holder(s) shall review the most recent version of the rehabilitation plan for the designated activity at a minimum of every three years and update the plan accordingly based on current conditions. Updates to the rehabilitation plan must be acceptable to the Department.

b. The Approval Holder(s) shall review the amount of financial security provided to the Department at a minimum of every three years and adjust the amount accordingly based on the estimated costs of rehabilitation provided in the most recent version of the rehabilitation plan.

c. The amount of financial security shall be equal to the cost estimate of the site rehabilitation plan as amended from time to time and shall be no less than $6,250 per hectare of actual and planned disturbed area.

d. The Approval Holder(s)shall maintain for the site a financial security in a form and amount acceptable to the Department.

e. The Approval Holder(s) shall have completed rehabilitation of the designated activity within twelve (12) months of abandonment and in accordance with the final rehabilitation plan unless an alternate time frame has been provided and/or accepted by the Department.

f. The Approval Holder(s) shall submit a final rehabilitation plan to the Department for approval at least sixty (60) days prior to abandonment of the designated activity.

g. The rehabilitation plan shall include but not be limited to the following:

    i. objectives for final land use;

    ii. contouring and drainage patterns;

    iii. soil stabilization methods including but not limited to revegetation and slope grades;

    iv. objectives for existing structures and access roads; and

    v. a detailed cost estimate including unit cost breakdown of labor, equipment, supplies, and services to perform the rehabilitation activities as completed by an outside service provider (third party).

h. The rehabilitation plan shall be implemented by the Approval Holder(s) once deemed acceptable by the Department.

i. Unless otherwise approved by the Department, updated rehabilitation plans shall meet the following criteria :

    i. The site shall be contoured and stabilized:

(a) for long term erosion control;

(b) to mitigate impacts of offsite drainage to adjacent lands, wetlands, and watercourses; and

(c) to blend with natural topography.

ii. Except for engineered features (i.e., wetlands, ponds), all disturbed areas shall be returned to at least one metre above the water table.

iii. If an open pond is to remain on the site, at least 2 exit ramps shall be constructed, on opposite sides of the pond with maximum slope of 5:1 to enable safe exit.

j. The Approval Holders(s) shall provide an updated reclamation plan to the Department by June 1 2024, and every three years there after.

13. Site Specific

a. The Approval Holder(s) shall provide notification to the Department that the reclamation work outlined in the Reference Document is completed before July 30, 2021.

14. Air Emissions

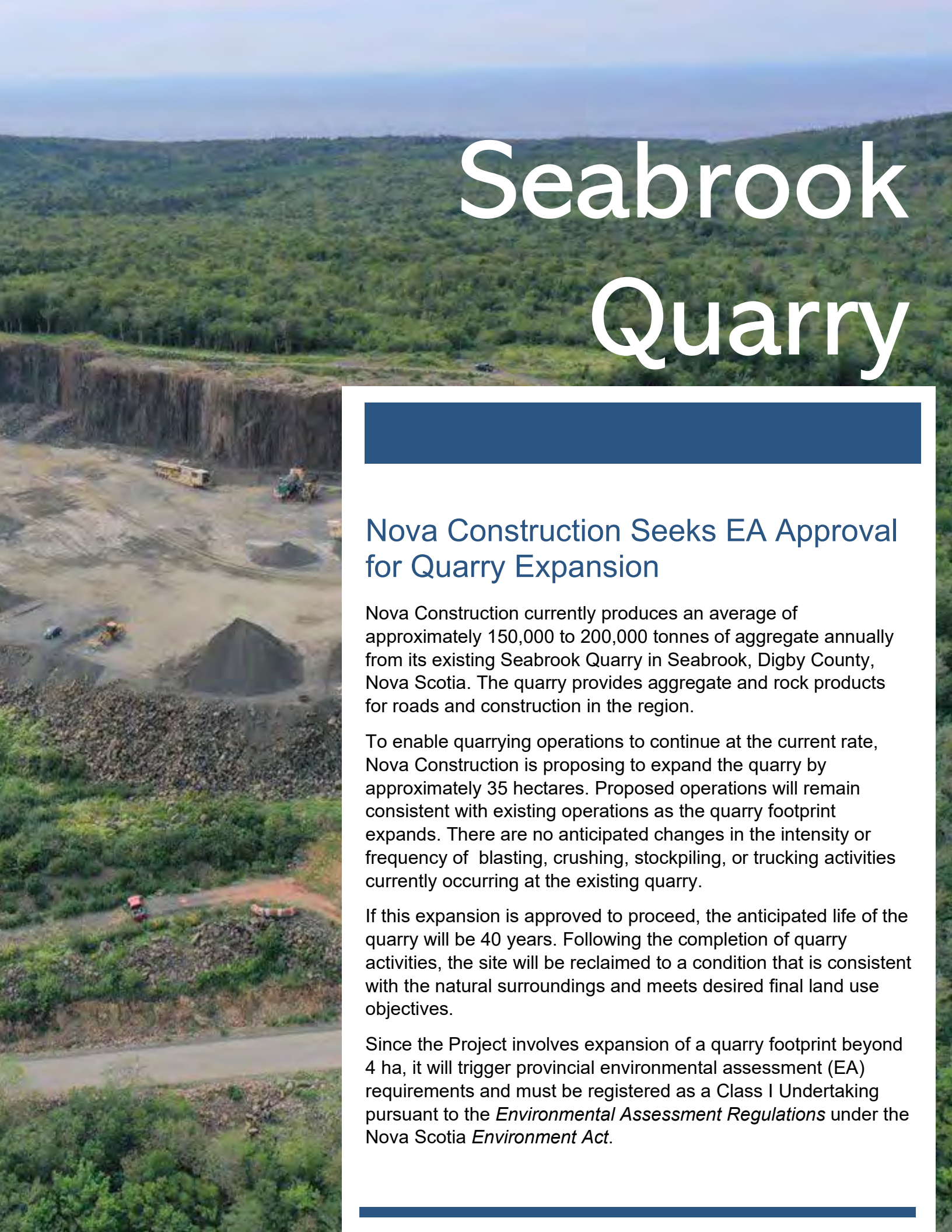
a. When required by the Department, the Approval Holder(s) shall conduct source testing in accordance with a standard deemed acceptable to the Department.

Blasting Limits			
Parameters	**Maximum**	**Monitoring Frequency**	**Monitoring Station**
Concussion (Air Blast)	128 dBL	Every Blast	Within 7 m of the nearest structure not located on the Site
Ground Vibration	0.5 in/sec (12.5 mm/s)	Every Blast	Below grade or less than 1 m above grade in any part of the nearest structure not located on the Site

Operational Activities Surface Water Monitoring Table			
Parameter:	**Criteria:**	**Monitoring Location(s):**	**Monitoring Frequency:**
Total Suspended Solids	25 mg/l	Site Discharge	Quarterly During Operations or At Department Request
pH	6.0-9.0	Site Discharge	Quarterly During Operations or At Department Request

APPENDIX C

Community Newsletter



Seabrook Quarry

Nova Construction Seeks EA Approval for Quarry Expansion

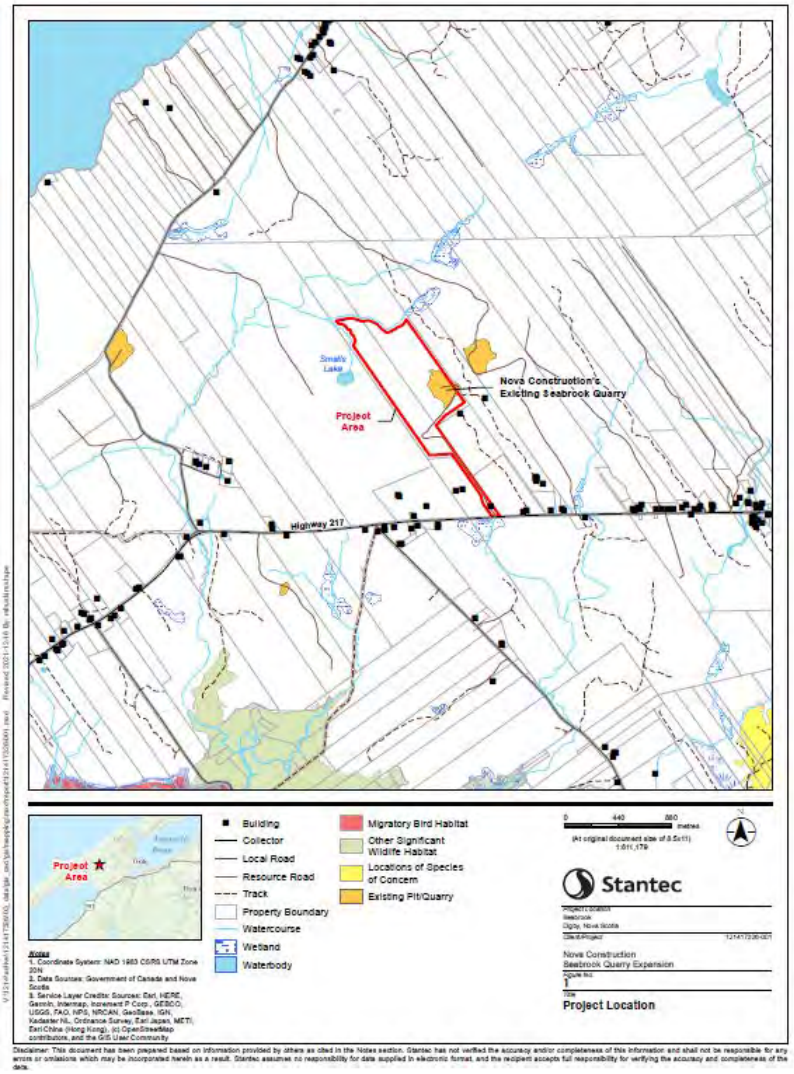
Nova Construction currently produces an average of approximately 150,000 to 200,000 tonnes of aggregate annually from its existing Seabrook Quarry in Seabrook, Digby County, Nova Scotia. The quarry provides aggregate and rock products for roads and construction in the region.

To enable quarrying operations to continue at the current rate, Nova Construction is proposing to expand the quarry by approximately 35 hectares. Proposed operations will remain consistent with existing operations as the quarry footprint expands. There are no anticipated changes in the intensity or frequency of blasting, crushing, stockpiling, or trucking activities currently occurring at the existing quarry.

If this expansion is approved to proceed, the anticipated life of the quarry will be 40 years. Following the completion of quarry activities, the site will be reclaimed to a condition that is consistent with the natural surroundings and meets desired final land use objectives.

Since the Project involves expansion of a quarry footprint beyond 4 ha, it will trigger provincial environmental assessment (EA) requirements and must be registered as a Class I Undertaking pursuant to the *Environmental Assessment Regulations* under the Nova Scotia *Environment Act*.

Quarry Expansion EA



Nova Construction is in the process of completing an EA Registration document which involves the careful planning and consideration for the physical, biological, social and cultural impacts of the quarry expansion. The EA Registration document is anticipated to be filed by the end of 2022 and will be subject to public review.

Progress To Date

Desktop and field programs have been conducted by Stantec Consulting Ltd. for air, noise, vegetation, groundwater, surface water, wetlands, and terrestrial and aquatic wildlife. Membertou Geomatics Solutions is also preparing a Mi'kmaq Ecological Knowledge Study that will be integrated into the EA Registration document. Key findings are presented below.

Terrestrial Wildlife	Several avian species at risk were identified within the proposed quarry expansion area during field investigations. Measures will be taken to reduce adverse effects on terrestrial wildlife and their habitat.
Wetland	No wetlands were found within the proposed quarry expansion area.
Rare Plants	One rare plant species was observed at several locations within the proposed quarry expansion area.
Aquatic Environment	There are two watercourses present to the north of the proposed quarry expansion area and are known to support brook trout.
Land Use	Land use in the proposed quarry expansion area includes local recreational fishing and/or hunting.
Socio-economic	The proposed quarry expansion will allow for continued production of valuable products which support development and infrastructure in the province resulting in a positive effect to the regional economy.

How you can participate: Comments on the environmental assessment, when available, can be provided on the NSECC website at: https://novascotia.ca/nse/ea/projects.asp or comments can be provided to EAFeedback@nova-construction.ca.

APPENDIX D

Hydrogeology Study

Hydrogeology Study, Seabrook Quarry Expansion Project; Digby, Nova Scotia

Final Report

April 2023

Prepared for:

Nova Construction
3098 Post Road,
Antigonish, NS
B2G 2L7

Prepared by:

Stantec Consulting

File: 121417326

HYDROGEOLOGY STUDY, SEABROOK QUARRY EXPANSION PROJECT; DIGBY, NOVA SCOTIA

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Titia Praamsma, PhD, P.Geo.

Hughesman, Megan
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Megan Hughesman, M.Sc., P.Geo.

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1.0 INTRODUCTION

The Seabrook Quarry is owned and operated by Nova Construction Co. Ltd. (Nova Construction) and has been in operation in Seabrook, Digby County, Nova Scotia since its acquisition in 2019 (Figure A-1). Nova Construction currently produces approximately 150,000 to 200,000 tonnes of aggregate annually from its existing quarry under the industrial approval (IA) #2021-2794715-00. To enable quarrying operations to continue at the current rate, Nova Construction is proposing to expand the quarry footprint from 3.99 hectares (ha) to approximately 35 ha, including the associated overburden storage area and aggregate stockpiles and overburden storage areas ("the Project"). The direction of the proposed expansion is primarily to the north and west of the existing quarry footprint.

Stantec Consulting Limited (Stantec) was retained by Nova Construction to conduct a hydrogeological assessment in the vicinity of the proposed expansion. The hydrogeological assessment was conducted to establish existing groundwater conditions for the Project Area. The results of the study will be used in support of the Environmental Assessment (EA) Registration of the Project.

1.1 OBJECTIVE AND SCOPE OF WORK

The objective of the hydrogeological assessment is to characterize the existing hydrogeological conditions in the vicinity of the Project Area. The following scope of work was conducted to meet that objective.

1. Collect and review available supporting information and data from existing sources including:
    a. Historical climate data; and
    b. Publicly available geology, hydrogeology, and topographic mapping
2. Collect data through a field investigation including:
    a. Planning and installation of four groundwater monitoring wells;
    b. Water quality sampling and analysis of groundwater from the new monitoring wells;
    c. Groundwater level monitoring.
3. Prepare a report that presents the results of the baseline conditions within the Project Area.

2.0 PHYSIOGRAPHIC SETTING

2.1 CLIMATE

Climate normals for the 30-year period from 1981 to 2010 for the area were obtained from the Bear River, NS climate station (ECCC 2022a). The Bear River station is located approximately 17 km east of the Project Area. The total annual average precipitation in Bear River is 1,341.9 millimetres (mm), with 198.9 centimetres (cm) falling as snow and 1,143.9 mm falling as rain. Monthly average precipitation ranges from 77.8 mm to 147.4 mm, with the least occurring in August and the most occurring in January.

2.2 TOPOGRAPHY AND DRAINAGE

The topography of the Project Area generally slopes towards the northwest towards the waters of Post Brook which flows southwest and south with an ultimate discharge is into St. Mary's Bay, approximately 3 km southwest of the Project Area. A portion of the Project Area slopes to the southeast, with surface water discharging to Henderson's Brook that also discharges into St. Mary's Bay.

Elevations within the Project Area generally range from 160 metres above sea level (masl) in the vicinity of the current quarry operations to 30 masl at the entrance to the Project property on Highway 217. The topography of the Project Area is shown on Figure A-1 in Appendix A.

2.3 SURFICIAL GEOLOGY

Available surficial geology mapping indicates that the Project Area predominantly consists of a ground moraine and streamlined drift unit type, with the southern part of the Project Area categorized as a silty till plain and a stony till plain to the north (Shea et al., 1992). The surficial geology of the Project Area is shown on Figure A-2 in Appendix A.

2.4 BEDROCK GEOLOGY

Beneath the overburden, the bedrock consists of grey-green basalt (East Ferry Member) of the North Mountain Formation in the Fundy Group overlying sedimentary rocks of the Blomidon Formation (Kontak and Webster 2010). Joints, which are important water-bearing structures (secondary porosity), are well developed in the East Ferry basalt. Blomidon Formation sandstone overlies the North Mountain Formation (Keppie 2000).

The bedrock of the Fundy Group, including the North Mountain Formation and the underlying Blomidon Formation, dips 6 to 12 degrees to the northwest from the shorelines of St. Mary's Bay towards Digby Neck and the Bay of Fundy (Trescott 1969). The regional topography of Digby Neck appears to be controlled by the basalt bedrock structure, forming two northeast-southwest trending ridges with an intervening lower area containing wetlands and lakes (e.g., Lake Midway). The existing quarry footprint is situated on the southern ridge. The bedrock geology is shown on Figure A-3 in Appendix A.

2.5 REGIONAL HYDROGEOLOGY

Fresh groundwater within the Project Area originates from rainfall recharge through the overburden and fractured bedrock in the vicinity of the Project Area. On a regional scale, groundwater flow direction would be expected to follow topography, with flow towards the Bay of Fundy on the north side of the Project Area, with a southward flow component towards Post Brook that flows towards St. Mary's Bay on the isthmus of Digby Neck.

The direction of local groundwater flow within the Project Area is assumed to generally follow local topography. Based on topographic (Figure A-1, Appendix A) and watershed maps, the Project Area is inferred to straddle a groundwater divide, with local groundwater flow in the northwestern portion of the property flowing northwest, and groundwater at the southeastern portion generally flowing southeast. It is expected that the groundwater system in the area will be largely controlled by surface runoff and local recharge.

Shallow groundwater in overburden in the northwesterly portion of the Project Area likely discharges into Post Brook. However, due to the presence of higher topography to the north, deep groundwater in bedrock on the northwestern portion of the property may discharge towards St. Mary's Bay. Current well-density is insufficient to confirm if this is the case. Groundwater at the southeastern portion of the property is expected to discharge into the waters of St. Mary's Bay.

Groundwater recharge and flow directions in the North Mountain basalt units tends to be highly localized and controlled by the presence and orientation of numerous individual sub-horizontal basalt flows and the development of vertical fracturing, including columnar jointing in the basalts. This condition can result in the occurrence of "perched" water tables that result in predominantly downward vertical hydraulic gradients between the horizontal basalt flows.

The Project Area falls within Nova Scotia's volcanic groundwater region (Kennedy and Drage 2008). Based on data from 994 drilled wells in this region, it is characterized by a median drilled well yield of 40.9 L/min and specific capacity (Q/s) of 1.7 cubic metres per day per metre ($m^3/d/m$) (Kennedy and Drage 2009). Constant rate pumping test data from 18 wells in this region (Kennedy and Drage 2009) were processed using the Groundwater Assessments for Subdivision Developments Toolkit (NSE and NSDNR 2011) and showed similar median yield 46.4 L/min and higher specific capacity 7.1 $m^3/d/m$. The difference in specific capacity is attributed to the larger capacity of wells subjected to constant rate testing, compared to predominantly driller's air-lift yield estimates for domestic water supply wells.

Wells located in the sedimentary groundwater regions typically have higher yield, specific capacity, and transmissivity (T) than those in the volcanic (basalt) groundwater region. Based on pumping test data from 387 drilled wells completed in the sedimentary groundwater region, it is characterized by a median yield of 181.8 L/min and specific capacity of 20.4 m^3/d/m (Kennedy and Drage 2009). A lower median yield of 36.3 L/min and a lower specific capacity 2.3 m^3/d/m were found based on well log data from 35,279 wells in this region (Kennedy and Drage 2009).

Mean water quality (general chemistry and metals) data are also available for the volcanic areas (Kennedy and Drage 2009). Naturally occurring trace metals, such as arsenic, iron, manganese, uranium and occasionally fluoride, may be present in all groundwater regions. Acid rock drainage potential has been mapped as low for the Project Area (Trudell and White 2013).

Water wells within 800 m of the Project Area were identified and reviewed using the georeferenced version of the Nova Scotia Well Log Database (NS WLD). Information reviewed included location, construction details, yield and use. The completeness of the inventory of well logs in the NS WLD for the Project Area was confirmed by matching well logs to residences using recent air photography. In rural areas, it can generally be assumed that each residence, agricultural or commercial property has a dug or drilled water supply well. Table 2.1 presents a summary of the available well log information for the four drilled wells identified within 800 m of the Project Area using the NS WLD.

Three of the four wells surrounding the Project Area were completed in the sedimentary rocks of the Blomidon Formation, while one, owned by Municipal Enterprises Limited / Dexter Construction, was completed in the North Mountain Formation. The well in the North Mountain Formation reported a well yield of 1.14 Lpm, while the other three reported yields between 22.7 – 45.4 Lpm.

Table 2.1 Summary of Water Well Records within 800 m of Project Area

Community	Depth (m)	Casing Length (m)	Depth to Bedrock (m)	Yield (Lpm)	Water Use	Drill Date
Roxville	38.06	12.79	11.57	22.7	Domestic	8/27/2001
Roxville	36.54	12.18	6.09	36.32	Domestic	9/30/2003
Seabrook	102.01	12.18	1.22	1.14	Monitoring	10/6/2010
Seabrook	42.63	25.58	–	45.4	Domestic	9/17/1993

3.0 METHODOLOGY

3.1 BOREHOLE/MONITORING WELL INSTALLATION

Four boreholes were drilled and completed with monitoring wells (i.e., MW-01 – MW-04) at the Seabrook Quarry, Digby, Nova Scotia (NS) between August 8 to 11, 2022. Based on available regional hydrogeology and the expansion footprint of the quarry, the monitoring wells were installed near the Project Area boundaries where appropriate. MW-01 is located directly north of the existing quarry on the eastern side of the Project Area. MW-02 is located along the western boundary of the Project Area to the southwest of the existing quarry footprint. MW-03 is located along the northern boundary of the Project Area. MW-04 is located along the western boundary to the northwest of the existing quarry. Monitoring well locations are shown on Figures A-1 to A-3 in Appendix A.

Boreholes/monitoring wells were drilled using a CME45 track-mounted drill rig supplied and operated by Q-Drilling and Remediation Inc. of Fall River, NS. Stantec personnel monitored drilling activities, maintained detailed records of the subsurface and drilling conditions encountered, and obtained representative samples of soil strata encountered. Hollow stem augers were used to advance through the overburden materials and bedrock was cored using H-size (100 mm diameter) casing and diamond coring equipment.

The boreholes/monitoring wells were drilled to depths measuring between 8.08 and 12.19 metres below ground surface (mbgs). Bedrock was encountered at depths measuring between 0.5 and 3.05 mbgs.

Following drilling, monitoring wells were installed in the boreholes. The monitoring wells consisted of 50 mm diameter, flush-threaded, Schedule 40 polyvinyl chloride (PVC) casing and No. 10 slot screen. Silica sand was placed around the screened section to inhibit silt intrusion into the well and facilitate well development. A bentonite seal was placed above the sand pack in each well, followed by backfill sand and gravel to the surface. A standard above ground well cover was installed at each monitoring well location.

Newly constructed monitoring wells were developed using Waterra Groundwater Sampling Pump System with a standard flow foot valve. Approximately three times the well volume of groundwater was removed from each monitoring well during development.

3.2 GROUNDWATER SAMPLING

Groundwater sampling of the four monitoring wells (i.e., MW-01 – MW-04) was conducted on August 12, 2022. Groundwater samples were collected from each well using Waterra Groundwater Sampling Pump System with a standard flow foot valve, after approximately three times the well volume was removed. Groundwater samples were collected into laboratory supplied bottles. The sample bottles were placed into sealed Ziploc bags, which were placed on ice in sample coolers and delivered to BV Laboratories in Bedford, NS.

3.3 HYDRAULIC TESTING

On September 1, 2022, hydraulic (slug) testing was conducted at the four monitoring wells. For each test, the depth to static groundwater level was measured and recorded. A slug designed to fit the 50 mm diameter well was then lowered into the monitoring well. Rising water levels were then measured and recorded at specified intervals (every 15 seconds for 2 minutes, every 30 seconds for the next 3 minutes, and every minute for the next 10 minutes) until the well stabilized. A datalogger set at one-minute intervals was also used to collect water levels for each test. A falling head test was then conducted at each well by removing the slug and measuring water levels at the same intervals until the water levels in the well stabilized.

Analysis of both the rising and falling head hydraulic tests were performed using the Bouwer and Rice method with the aid of the computer program AQTESOLV® Version 4.51 (HydroSOLVE Inc. 2007).

3.4 WATER LEVEL MONITORING

Solinst pressure transducers with datalogging capabilities were installed and an hourly groundwater level survey was completed for the Project Area between September 2 and November 3, 2022. Approximately 1500 groundwater level measurements were collected every hour by Stantec with a Solinst levellogger. The levellogger was re-deployed on November 3, 2022 and will be downloaded at quarterly intervals in 2023. The data collected was processed and compared with local precipitation and barometric measurements from the Greenwood climate station (ECCC 2022b), which is located approximately 80 km northeast of the Project Area. The Greenwood station was used for the water level data because it is the closest station with available daily precipitation data.

4.0 RESULTS

4.1 MONITORING WELL INSTALLATION

During investigations completed between August and November 2022, Stantec completed four monitoring wells for groundwater sampling (i.e., MW-01 – MW-04). A summary of the monitoring well completions is provided in Table 4.1. The location of the monitoring wells within the Project Area are shown on Figure A-1 in Appendix A.

4.2 SUBSURFACE CONDITIONS

Subsurface soil conditions observed within the four newly installed monitoring wells within the Project Area (i.e., MW-01 – MW-04) are described on the borehole logs presented in Appendix B and are summarized below.

4.2.1 Stratigraphy

The stratigraphy observed in monitoring well MW-01 consisted of loose fractured bedrock overlying tightly packed bedrock, MW-02 consisted of mainly brown to red clay, and MW-03 and MW-04 consisted of brown clay overlying bedrock. Bedrock was encountered in the monitoring wells at depths ranging from 0.5 mbgs in MW-04 to 3.05 mbgs in MW-01 and consisted of basalt bedrock.

4.2.2 Groundwater Observations

The groundwater observed in the monitoring wells during installation consisted of gray silty water which, when purged, became clear water with no silt at all monitoring well locations. Groundwater levels were encountered in the monitoring wells at depths ranging from 0.32 mbgs at MW-03 to 6.70 mbgs at MW-02.

4.3 HYDRAULIC TESTING

Results of hydraulic testing in each monitoring well are presented in the following section and time-drawdown plots are presented in Figure 4.2. Hydraulic conductivity analyses at each monitoring well are presented in Appendix C and are summarized in Table 4.1 below. The results of the hydraulic testing analyses indicate the hydraulic conductivity ranged from 4.3 x 10^{-8} m/s to 5.4 x 10^{6} m/s with a mean K value between 1.6 x 10^{-7} m/s to 3.3 x 10^{-6} m/s.

Table 4.1 Summary of Hydraulic Conductivities and Well Construction Information

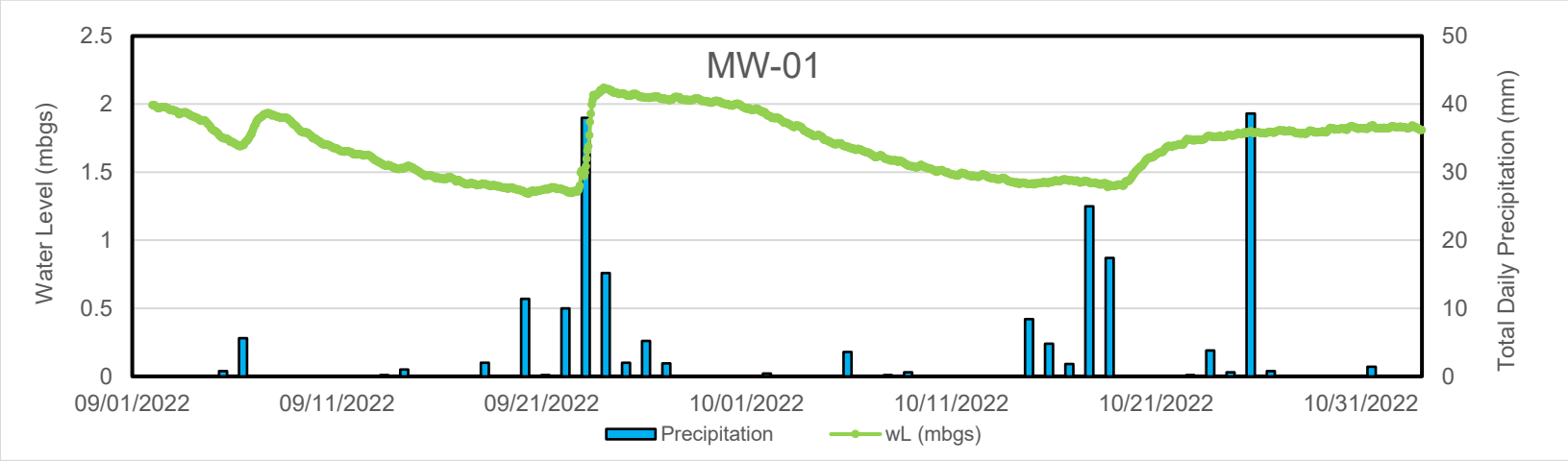
Well ID	Date Drilled	Well Total Depth (m)	Screened Geology	Groundwater Level on September 1, 2022 (m btoc)	Mean Hydraulic Conductivity (K) (m/sec)
MW-01	August 8, 2022	9.45	Basalt bedrock	2.76	$1.1x10^{-7}$
MW-02	August 11, 2022	12.19	Overburden	7.53	$3.3x10^{-6}$
MW-03	August 10, 2022	8.08	Basalt bedrock	1.13	$1.1x10^{-6}$
MW-04	August 9, 2022	9.30	Basalt bedrock	5.07	$1.6x10^{-7}$

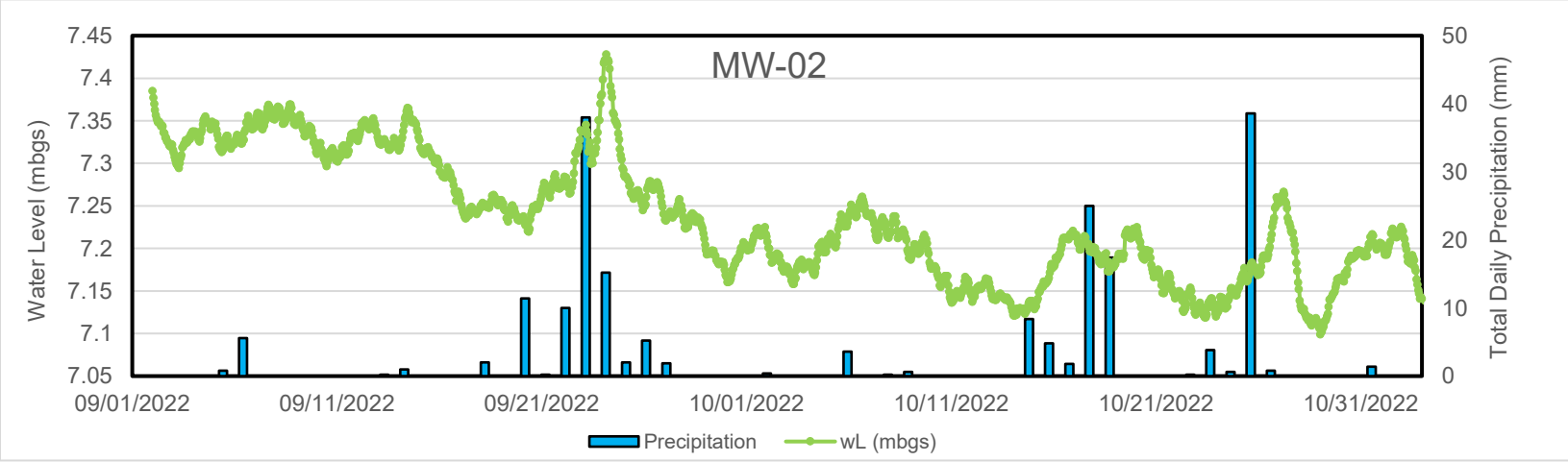
Notes:
m btoc
= metres below top of casing

4.4 WATER LEVEL ANALYSIS

Due to limited rates of recharge in the monitoring wells within the Project Area, water levels were not collected during the well installation event. Groundwater was allowed time to recharge and stabilize and were then measured in all monitoring wells on August 12, 2022 using a Solinst 101 Water Level Meter. As well, a water level logger installed in each well collected water level measurements every hour over a two-month period.

Groundwater levels within the Project Area are expected to vary seasonally and in response to individual precipitation/melting events. Approximately 1500 groundwater level measurements were collected at each monitoring well and were compared with local precipitation and barometric measurements to determine natural variation in each well. The data collected during the water level monitoring event suggests that the groundwater levels spike considerably during precipitation events of 15 mm or more and gradually lower over time. Groundwater levels (mbgs) and total daily precipitation (mm) are shown in Figure 4.1.


MW-01
Water Level (mbgs)
Total Daily Precipitation (mm)
2.5
2
1.5
1
0.5
0
50
40
30
20
10
0
09/01/2022
09/11/2022
09/21/2022
10/01/2022
10/11/2022
10/21/2022
10/31/2022
Precipitation
wL (mbgs)


MW-02
Water Level (mbgs)
Total Daily Precipitation (mm)
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
50
40
30
20
10
0
09/01/2022
09/11/2022
09/21/2022
10/01/2022
10/11/2022
10/21/2022
10/31/2022
Precipitation
wL (mbgs)

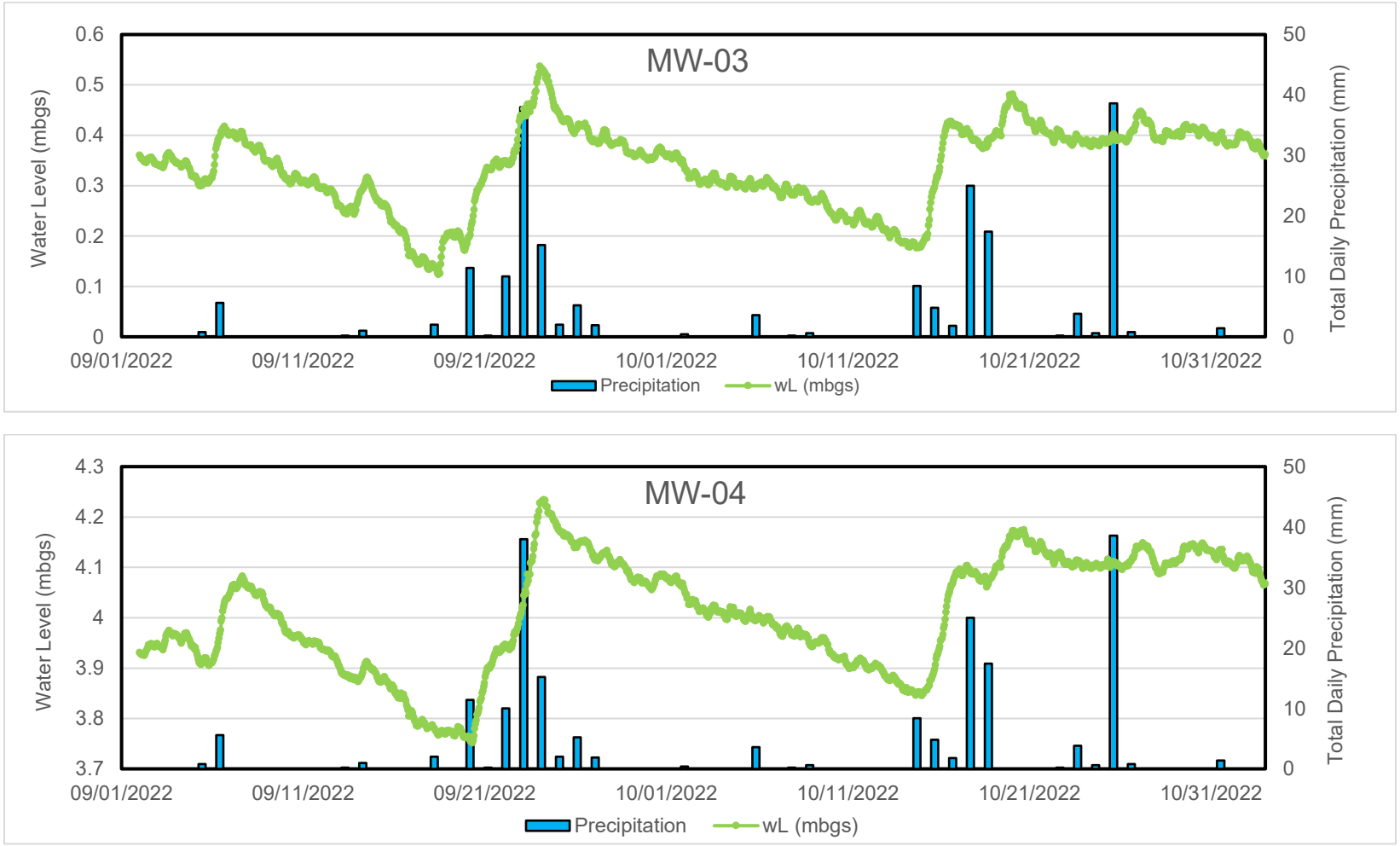


Figure 4.1 Groundwater Level (m) and Precipitation (mm) Data Analysis

Groundwater levels, relative surface elevations and corresponding relative groundwater elevations, as measured during the current investigation of the Project Area are presented in Table 4.2.

Table 4.2 Monitoring Well Elevation Survey

Monitoring Well	Stick-Up Elevation (m)	Groundwater Level September 1, 2022 (m btoc)
MW-01	0.91	2.76
MW-02	0.75	7.53
MW-03	0.8	1.13
MW-04	0.85	5.07

Notes:
m btoc
= metres below top of casing

4.5 ANALYTICAL RESULTS

Results of the laboratory analyses of groundwater quality are presented in Tables D-1 to D-2 in Appendix D. The corresponding Certificates of Analyses from BV Laboratories are provided in Appendix E.

4.5.1 Summary of Exceedances

Groundwater was collected at all four monitoring wells and was analyzed for general chemistry and metals.

Concentrations of all general chemistry parameters in groundwater at all monitoring wells are either below the reportable detection limit (RDL) and or within the applicable guidelines.

Concentrations of metals in groundwater at all monitoring wells, excluding MW-01, are either below the RDL and/or within the applicable guidelines. The concentration of iron at monitoring well MW-01 (2300 µg/L) exceeds the applicable guidelines (300 µg/L). Iron was not detected in MW-02 or MW-03 and was below applicable guidelines at MW-04.

The monitoring wells are non-potable and therefore the Guidelines for Canadian Drinking Water Quality (GCDWQ) drinking water guidelines do not apply. The concentration of iron at the site exceeds the CCME Short-Term guidelines for the protection of aquatic life; however, no surface water is in the immediate area of MW-01. High levels of iron are limited to MW-01 located directly north and downgradient of the existing quarry. Due to the ground disturbance of the quarry, it likely creates the groundwater in the immediate area to be turbid and oxygenated. Any subsurface changes such as these can influence iron concentrations.

4.6 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Chemical analysis was performed by BV Laboratories for general chemistry and metals parameters. BV Laboratories is accredited to the International Organization for Standardization ISO Standard 17025 through the Standards Council of Canada (SCC). BV Laboratories has QA/QC protocols for instrument calibration, lab duplicates, matrix spikes, method blanks, process recovery, and surrogate spikes. The laboratory also follows standard operating procedures including holding time limitations, sample preparation and preservation, data production and reporting. Results of the laboratory analysis of QA/QC water samples (i.e., field blanks, equipment blanks, and trip blanks) are presented in Table D-1 and D-2 in Appendix D.

5.0 DISCUSSION AND RECOMMENDATIONS

Hydrogeological site investigations that were conducted in 2022 included drilling four monitoring wells (MW-01 through MW-04), hydraulic testing (e.g., slug testing) of each well, long term water level monitoring, and one water quality sampling event from each well. Wells were drilled between 8.08 to 12.19 mbgs, with three of the wells completed in the basalt bedrock. The results of the hydraulic testing analysis indicate the hydraulic conductivity ranged from 1.6×10^{-7} m/s to 3.3×10^{-6} m/s. Water level data was collected from September 1 to November 3, 2022 using dataloggers and indicate that recorded water levels are all above the planned quarry depth of 25 mbgs. All four wells responded to precipitation events with rapidly increased water levels, which slowly decreased over a period of days to weeks until the next precipitation event. The water level and hydraulic conductivity data for the three wells completed in bedrock indicate that the basalt recovers to static water levels slowly, suggesting that the aquifer does not transmit significant groundwater flow. These results are in agreement with the available well record for a well completed in the North Mountain basalt, that produced a reported well yield of 1.14 Lpm.

Current quarry operations reportedly operate above the water table, with water levels noted below the quarry floor in a sump. No dewatering is currently conducted beyond occasional surface water removal after a rain event. This lower water table in the current quarry operations may be a result of the existing quarry location at a topographic high. The hydraulic conductivities and slow recovery from precipitation events that were observed in the wells completed in the bedrock aquifer suggest that if the water table was above the current quarry floor, little water was produced through fractures present in the North Mountain Formation and were systematically dewatered during quarrying operations. The predominantly vertical jointing structure of the columnar basalts may also be the reason for the water level responses observed during precipitation events whereby the vertical fractures have a more direct pathway to depth, though without significant jointing in the form of horizontal fractures, aerial connections may not be present.

Water quality samples from the four monitoring wells were collected on August 12, 2022 and were analyzed for general chemistry and metals. Results were compared to both the GCDWQ (Health Canada 2022) and the CCME Freshwater Short-Term and Long-Term Guidelines to provide a baseline understanding of the groundwater quality within the Project Area. Concentrations at all monitoring wells, excluding MW-01, are either below the reportable detection limit and /or within the chosen guidelines. The

concentration of iron at monitoring well MW-01 (2300 µg/L) exceeds the applicable guideline (300 µg/L). The monitoring wells are non-potable and therefore the GCDWQ drinking water guidelines do not apply. The concentration of iron at the site exceeds the CCME Short-Term guidelines for the protection of aquatic life; however, no surface water is present in the immediate area of MW-01. High levels of iron are limited to MW-01 located directly north and downgradient of the existing quarry. Due to the ground disturbance of the quarry, it likely causes the groundwater in the immediate area to be turbid and oxygenated. Any subsurface changes such as these can influence iron concentrations.

Continued groundwater monitoring is recommended at the four monitoring wells that were installed during this program. Monitoring of groundwater levels in the wells using the installed data loggers should continue as the operation proceeds. In addition to water level monitoring, quarterly groundwater quality samples are recommended at each well for general chemistry and metals.

It is also recommended that a survey be conducted for all wells (including monitoring wells) within 400 m of Project blast areas, regardless of well ownership. The survey should include well head inspection; water sampling for general chemistry, metals, and bacteria; and short-term pumping tests (where wells are accessible) to determine the capacity of individual wells and nearby aquifers.

6.0 REFERENCES

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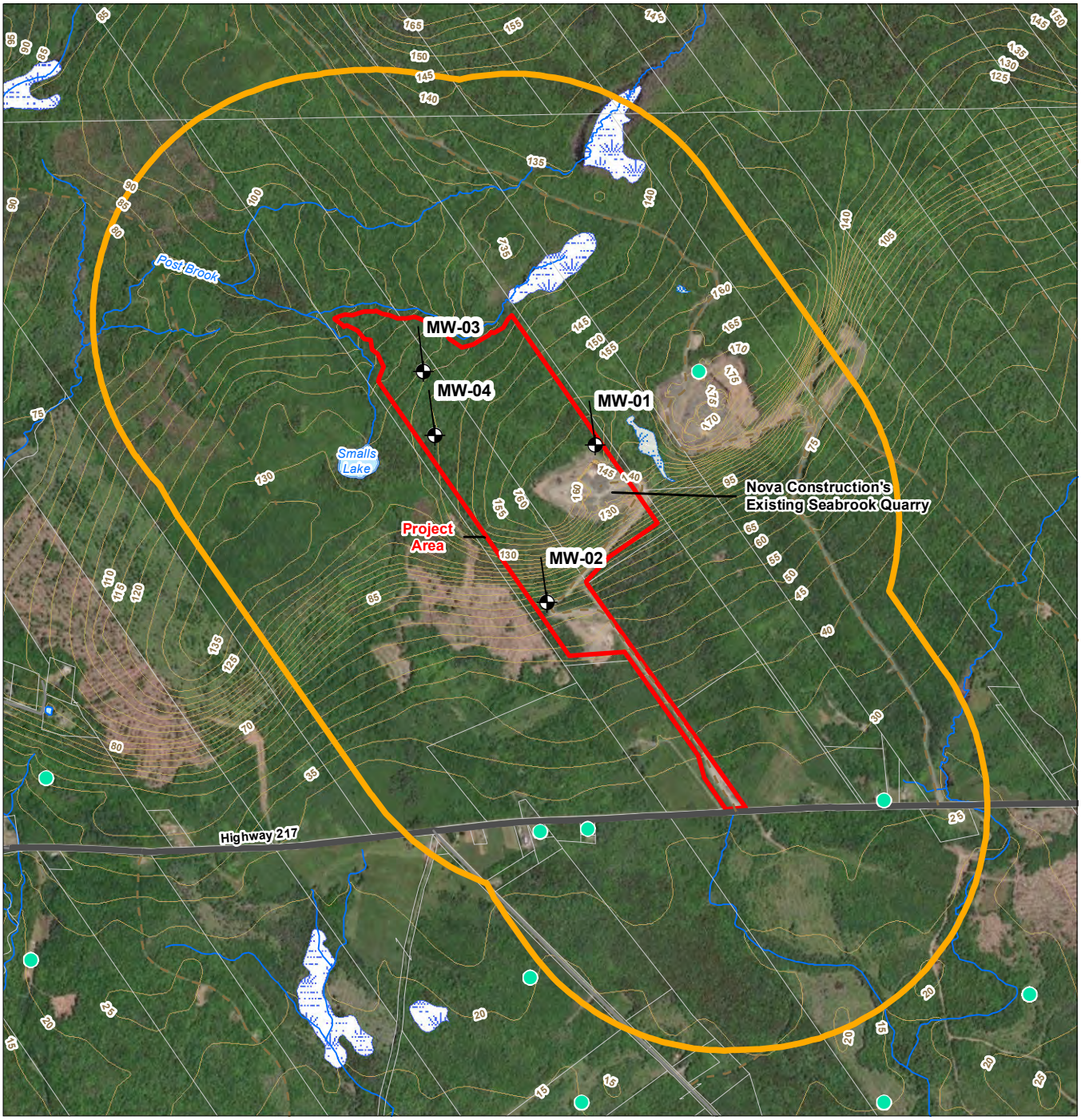
APPENDIX A

Figures



Monitoring Well
Water Wells (NSECC)
Project Area
Local Assessment Area (800 m buffer)

Road / Highway
Local Road
Resource Road
Contour (5m)
Watercourse
Waterbody
Wetlands
Property Boundary

0 250 500 metres

(At original document size of 8.5x11)
1:20,000

N

Stantec

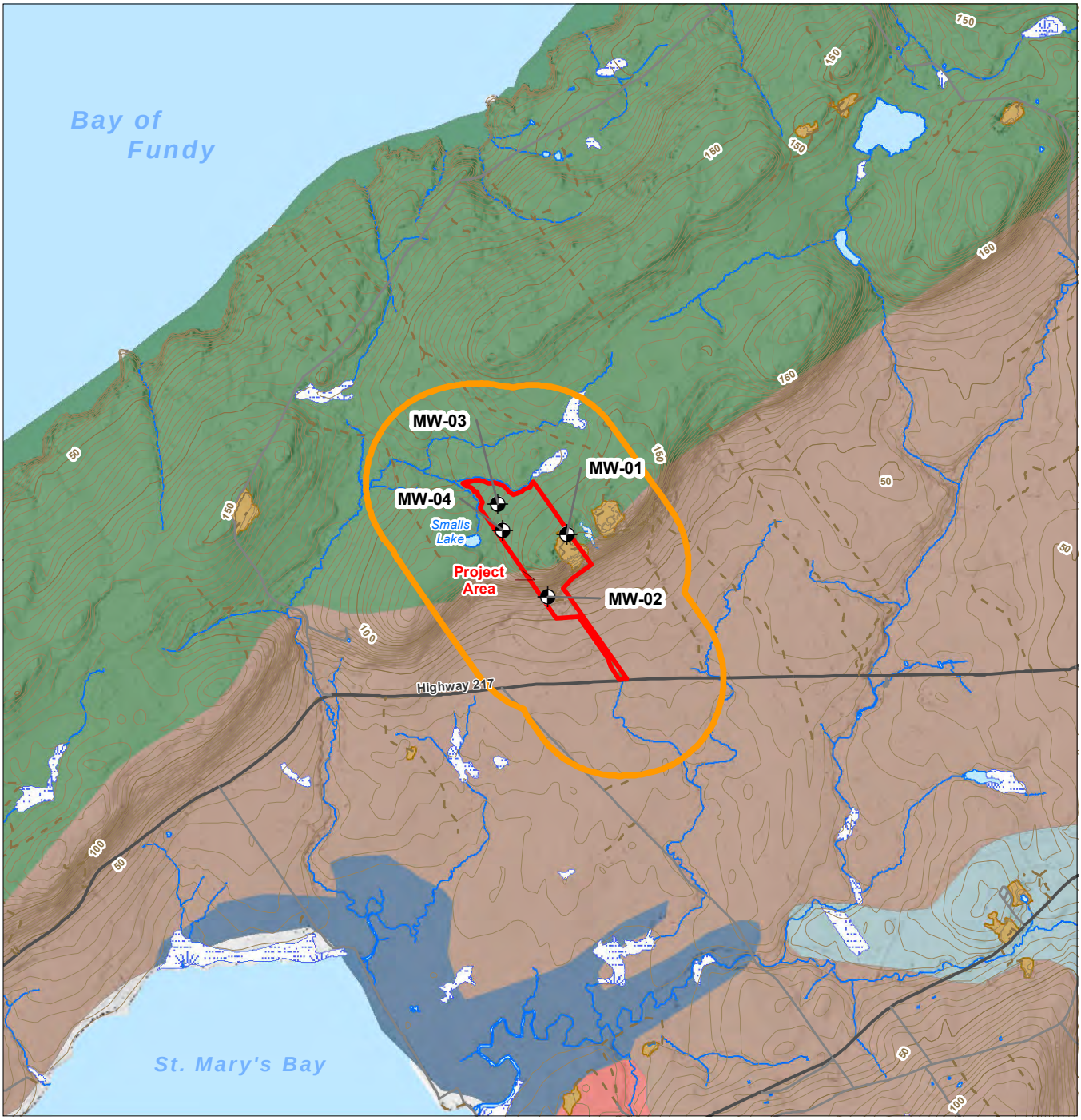
Project Location
Seabrook
Digby, Nova Scotia

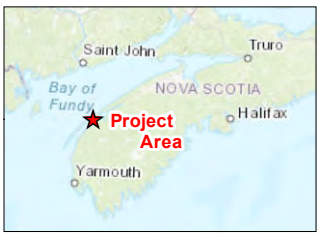
Client/Project 121417326-018
Nova Construction
Seabrook Quarry Expansion

Figure No.
A-1

Title
Groundwater Locations

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Nova Scotia Environment and Climate Change; Nova Scotia Natural Resources and Renewables; Natural Resources Canada CanVec,
3. Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community





Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N

2. Data Sources: Stantec, Nova Construction, Envirosphere, Nova Scotia Dept. of Natural Resources and Renewables, Nova Scotia Dept. of Environment and Climate Change, Government of Canada NRCan CANVEC

3. Service Layer Credits: ESRI 2022

Legend

- Monitoring Well
- Project Area
- Local Assessment Area (800 m buffer)
- Road / Highway
- Local Road
- Resource Road
- Contour (5 m)
- Watercourse
- Waterbody
- Wetlands
- Existing Pit/Quarry

Surficial Geology

- Glaciofluvial Deposits (Kames and Eskers)
- Glaciomarine Deposits
- Marine Deposits
- Silty Till Plain (Ground Moraine)
- Stony Till Plain (Ground Moraine)

0 600 1,200 metres

(At original document size of 8.5x11)
1:50,000

N

Stantec

Project Location
Seabrook
Digby, Nova Scotia

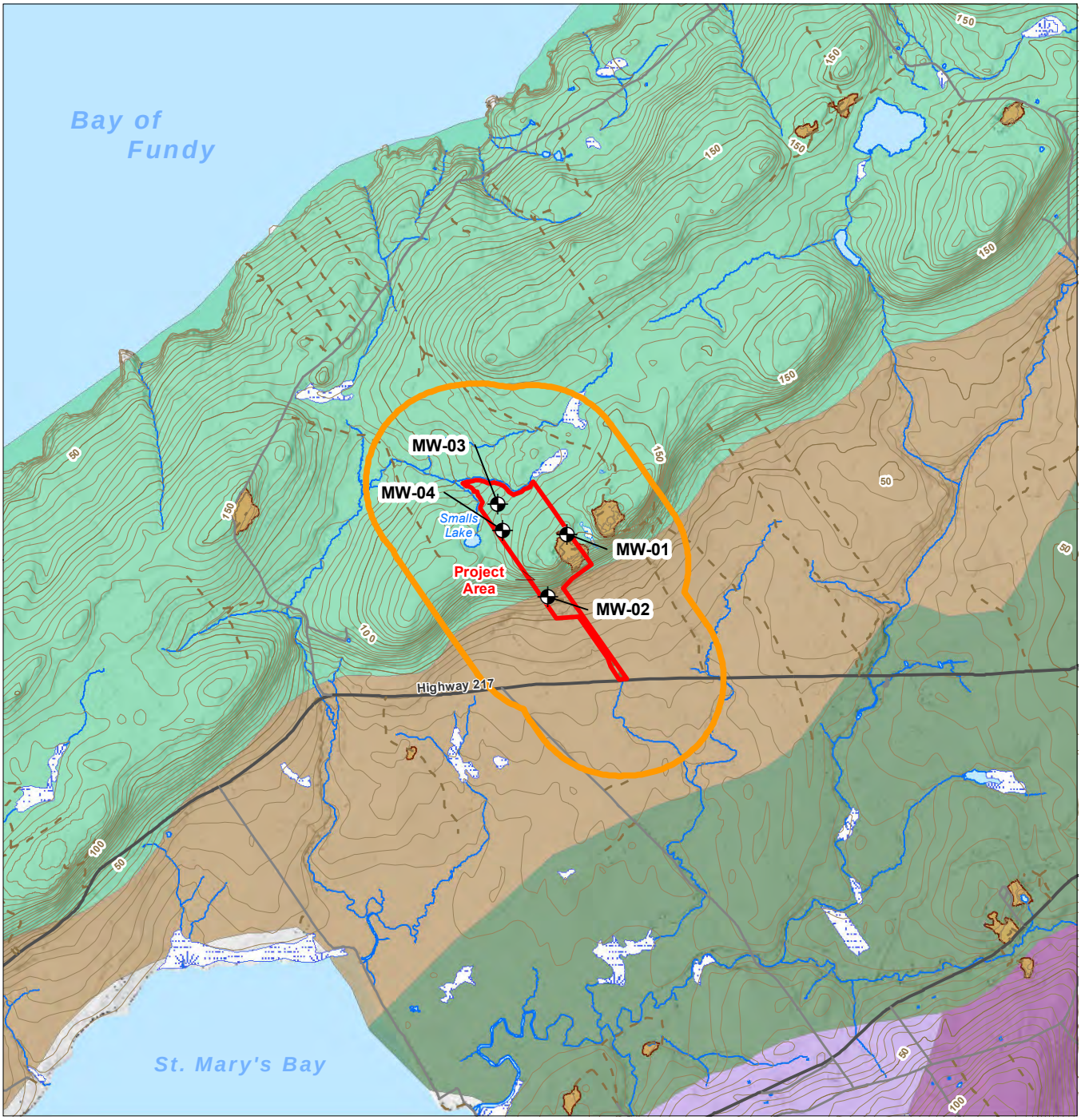
Client/Project 121417326_017

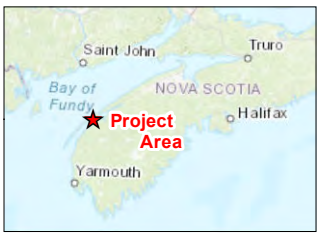
Nova Construction
Seabrook Quarry Expansion

Figure No.
A-2

Title
Surficial Geology

\\Ca0213-ppfss01\work_group\1214\active\121417326\03_data\gis_cad\gis\mappingd\mxd\report\121417326-017a_Surficial Geology.mxd Revised: 2022-12-12 By: NiWhite





Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec, Nova Construction, Envirosphere, Nova Scotia Dept. of Natural Resources and Renewables, Nova Scotia Dept. of Environment and Climate Change, Government of Canada NRCan CANVEC
3. Service Layer Credits: ESRI 2022

Legend

- Monitoring Well
- Project Area
- Local Assessment Area (800 m buffer)
- Road / Highway
- Local Road
- Resource Road
- Contour (5 m)
- Watercourse
- Waterbody
- Wetlands
- Existing Pit/Quarry

Bedrock Geology

- Blomidon Formation: southern mainland
- Goldenville Formation
- Halifax Formation
- North Mountain Formation: southern mainland
- Wolfville Formation: southern mainland

0 640 1,280 metres

(At original document size of 8.5x11)
1:50,000

N

Stantec

Project Location
Seabrook
Digby, Nova Scotia

Client/Project 121417326_016

Nova Construction
Seabrook Quarry Expansion

Figure No.
A-3

Title
Bedrock Geology

\\Ca0213-pp1ss01\work_group\1214\active\121417326\03_data\gis_cad\gis\mapping\mxd\report\121417326-016 Bedrock Geology.mxd Revised: 2022-12-12 By: NiWhite

APPENDIX B

Borehole Logs

MONITORING WELL: MW-01

Project:	DIGBY QUARRY EXPANSION	**Drilling method:**	STANDARD CORE BARREL
Client:	NOVA CONSTRUCTION CO. LTD.	**Date started/completed:**	08-Aug-2022
Location:	SEABROOK QUARRY, DIGBY, NOVA SCOTIA	**Ground surface elevation:**	n/a
Number:	121417326	**Top of casing elevation:**	n/a
Field investigator:	M. AHMAD	**Easting:**	274545
Contractor:	Q DRILLING	**Northing:**	4844675

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft) (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Sample Number	Sample Type	N Value	Diagram	Description
		Ground Surface						ABOVE GROUND WELL PROTECTOR
0 (0)		Loose fractured BEDROCK	0.00					BENTONITE
				1	RC	79.7%		Groundwater Level: 2.34 m BGS 1-Sep-22
10 (3)		BEDROCK	3.05					
				2	RC	80.5%		
				3	RC	83.9%		
				4	RC	81.5%		SLOTTED SCREEN
				5	RC	78.8%		
		End of Borehole	9.45					

Screen Interval: 6.40 - 9.45 m BGS
Sand Pack Interval: 0.00 - 9.45 m BGS
Well Seal Interval: 0.50 - 1.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
RC - rock core
n/a - not available

Stantec

Drawn By/Checked By: D. LANGELAAN

MONITORING WELL: MW-02

Project:	DIGBY QUARRY EXPANSION	**Drilling method:**	STANDARD CORE BARREL
Client:	NOVA CONSTRUCTION CO. LTD.	**Date started/completed:**	11-Aug-2022
Location:	SEABROOK QUARRY, DIGBY, NOVA SCOTIA	**Ground surface elevation:**	n/a
Number:	121417326	**Top of casing elevation:**	n/a
Field investigator:	M. AHMAD	**Easting:**	274385
Contractor:	Q DRILLING	**Northing:**	4944155

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Diagram	Description
-2						
0	0		Ground Surface			ABOVE GROUND WELL PROTECTOR
			Brown to red CLAY - dry to wet	0.00		
2						BENTONITE
4	1					
6	2					
8						
10	3					
12						
14	4					
16	5					
18						
20	6					
22	7					Groundwater Level: 6.70 m BGS 1-Sep-22
24						
26	8					
28						
30	9					
32	10					
34						
36	11					SLOTTED SCREEN
38						
40	12		End of Borehole	12.19		
42	13					

Screen Interval: 9.14 - 12.19 m BGS
Sand Pack Interval: 0.00 - 12.19 m BGS
Well Seal Interval: 0.50 - 1.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Stantec

Drawn By/Checked By: D. LANGELAAN

STANTEC BOREHOLE AND WELL V2 121417326_SEABROOK_QUARRY_OCT2022.GPJ STANTEC - DATA TEMPLATE.GDT 1/16/23 GWHALEN

MONITORING WELL: MW-03

Project:	DIGBY QUARRY EXPANSION	**Drilling method:**	STANDARD CORE BARREL
Client:	NOVA CONSTRUCTION CO. LTD.	**Date started/completed:**	10-Aug-2022
Location:	SEABROOK QUARRY, DIGBY, NOVA SCOTIA	**Ground surface elevation:**	n/a
Number:	121417326	**Top of casing elevation:**	n/a
Field investigator:	M. AHMAD	**Easting:**	273977
Contractor:	Q DRILLING	**Northing:**	494492

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Sample Number	Sample Type	N Value	Diagram / Description
-2								ABOVE GROUND WELL PROTECTOR
0	0		Ground Surface					
2	1		CLAY - wet	0.00				Groundwater Level: 0.32 m BGS 1-Sep-22
4			BEDROCK	1.22				BENTONITE
6	2				1	RC	52.2%	
8					2	RC	45.5%	
10	3							
12	4				3	RC	70.6%	
14								
16	5							
18					4	RC	72.4%	
20	6							
22	7							SLOTTED SCREEN
24					5	RC	86.7%	
26	8		End of Borehole	8.08				
28								
30	9							
32								
34	10							
36	11							
38								
40	12							
42	13							

Screen Interval: 5.03 - 8.08 m BGS
Sand Pack Interval: 0.00 - 8.08 m BGS
Well Seal Interval: 0.50 - 1.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
RC - rock core
n/a - not available

Stantec

Drawn By/Checked By: D. LANGELAAN

MONITORING WELL: MW-04

Project:	DIGBY QUARRY EXPANSION	**Drilling method:**	STANDARD CORE BARREL
Client:	NOVA CONSTRUCTION CO. LTD.	**Date started/completed:**	09-Aug-2022
Location:	SEABROOK QUARRY, DIGBY, NOVA SCOTIA	**Ground surface elevation:**	n/a
Number:	121417326	**Top of casing elevation:**	n/a
Field investigator:	M. AHMAD	**Easting:**	274014
Contractor:	Q DRILLING	**Northing:**	4944709

SUBSURFACE PROFILE				SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	Sample Number	Sample Type	N Value	Diagram / Description
0	0		Ground Surface					ABOVE GROUND WELL PROTECTOR
0	0		Brown CLAY	0.00				
2	1		BEDROCK	0.50				BENTONITE
					1	RC	55.5%	
6	2				2	RC	94.4%	
10	3				3	RC	78.5%	
14	4				4	RC	71.8%	Groundwater Level: 4.63 m BGS 1-Sep-22
18	6				5	RC	79.6%	
24	7				6	RC	99.2%	SLOTTED SCREEN
30	9		End of Borehole	9.30				
32	10							
36	11							
40	12							
42	13							

Screen Interval: 6.25 - 9.30 m BGS
Sand Pack Interval: 0.00 - 9.30 m BGS
Well Seal Interval: 0.50 - 1.00 m BGS

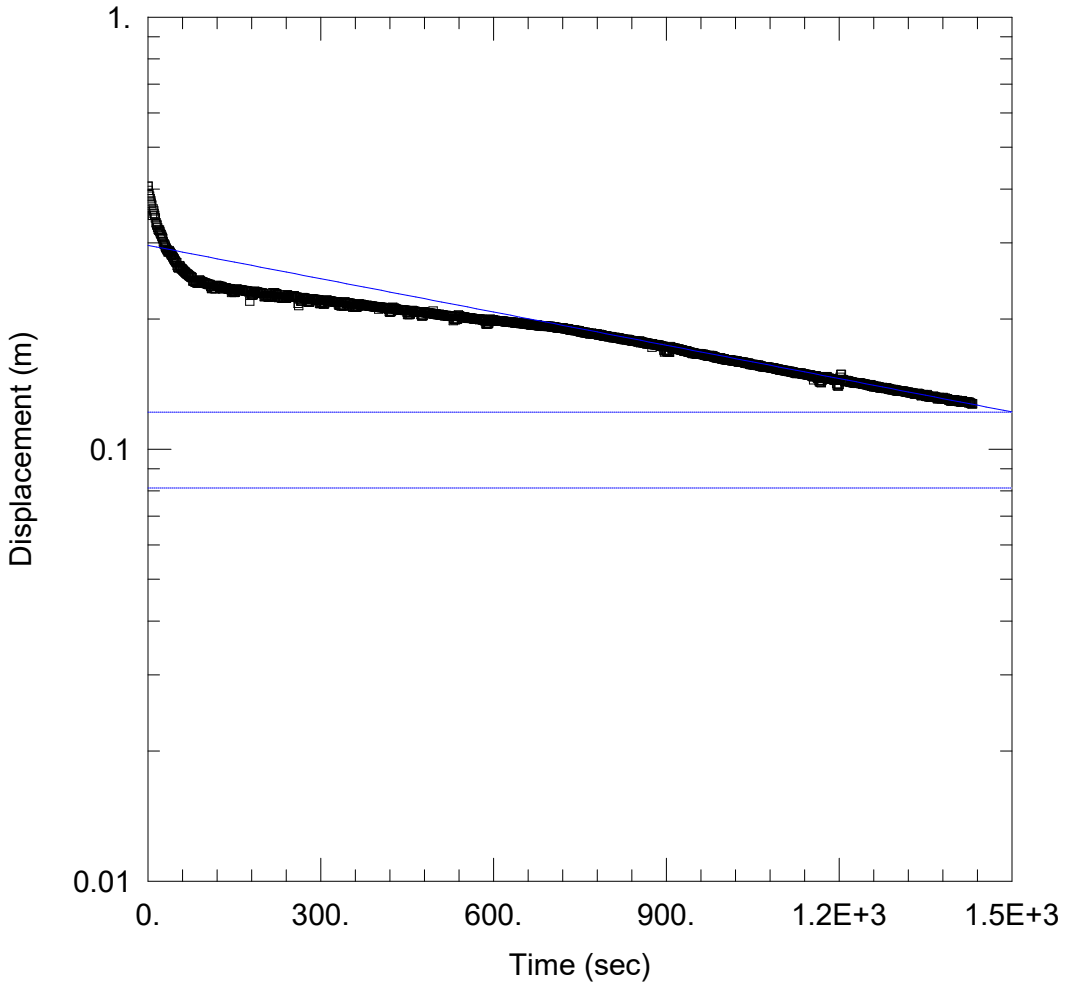
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
RC - rock core
n/a - not available

Stantec

Drawn By/Checked By: D. LANGELAAN

APPENDIX C

Hydraulic Testing



RISING HEAD TEST MW-01

Data Set: \...\MW-01_Rising_head_DL_JK.aqt
Date: 11/30/22 Time: 13:53:45

PROJECT INFORMATION

Company: Stantec Consultant
Client: Nova Construction Co. Ltd.
Project: 121417326
Location: Seabrook Quarry, Digby, NS
Test Well: MW-01
Test Date: September 1, 2022

AQUIFER DATA

Saturated Thickness: 7.16 m Anisotropy Ratio (Kz/Kr): 0.1

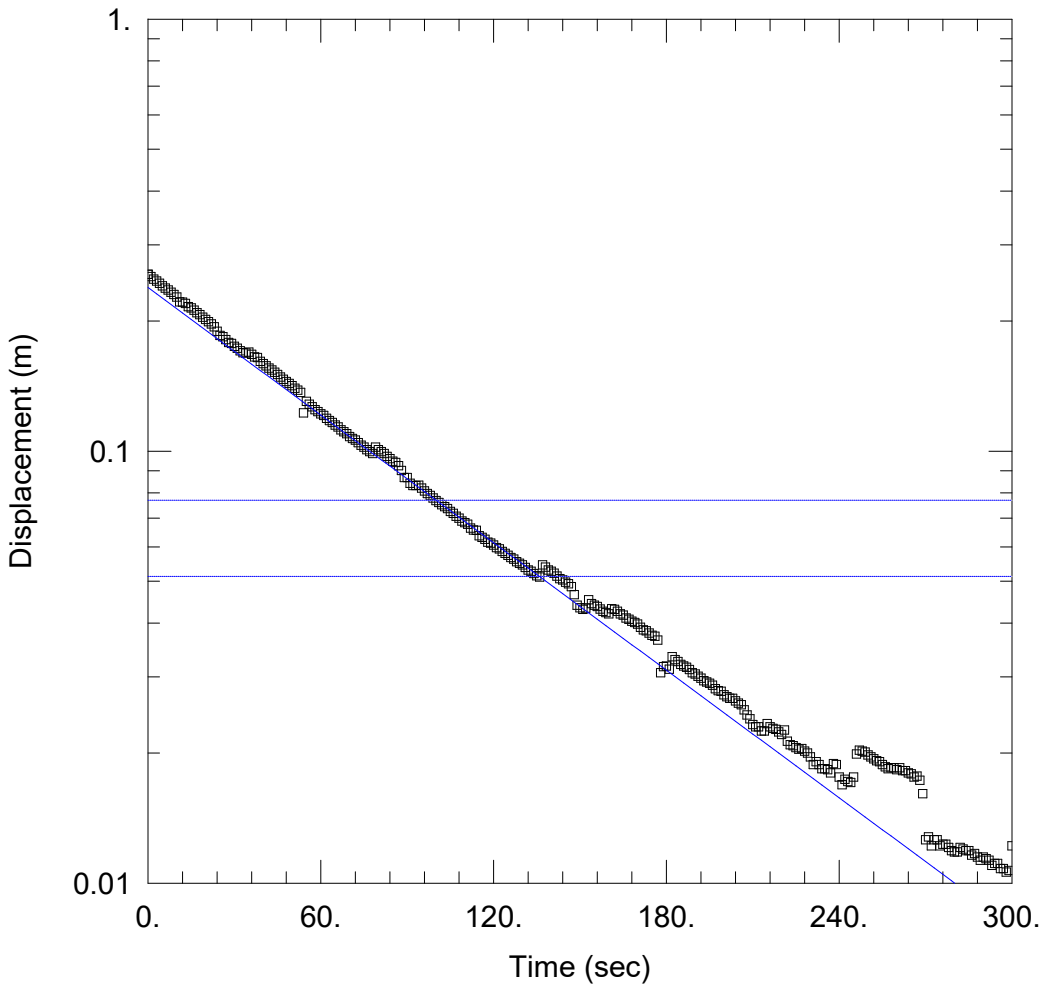
WELL DATA (MW-01)

Initial Displacement: 0.4062 m
Total Well Penetration Depth: 7.16 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.16 m
Screen Length: 3.05 m
Well Radius: 0.048 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 5.2E-7 m/sec y0 = 0.2962 m



RISING HEAD TEST MW-02

Data Set: \...\MW-02_Rising_head_DL_JK.aqt
Date: 11/30/22 Time: 14:54:17

PROJECT INFORMATION

Company: Stantec Consultant
Client: Nova Construction Co. Ltd.
Project: 121417326
Location: Seabrook Quarry, Digby, NS
Test Well: MW-02
Test Date: September 1, 2022

AQUIFER DATA

Saturated Thickness: 5.5 m Anisotropy Ratio (Kz/Kr): 0.1

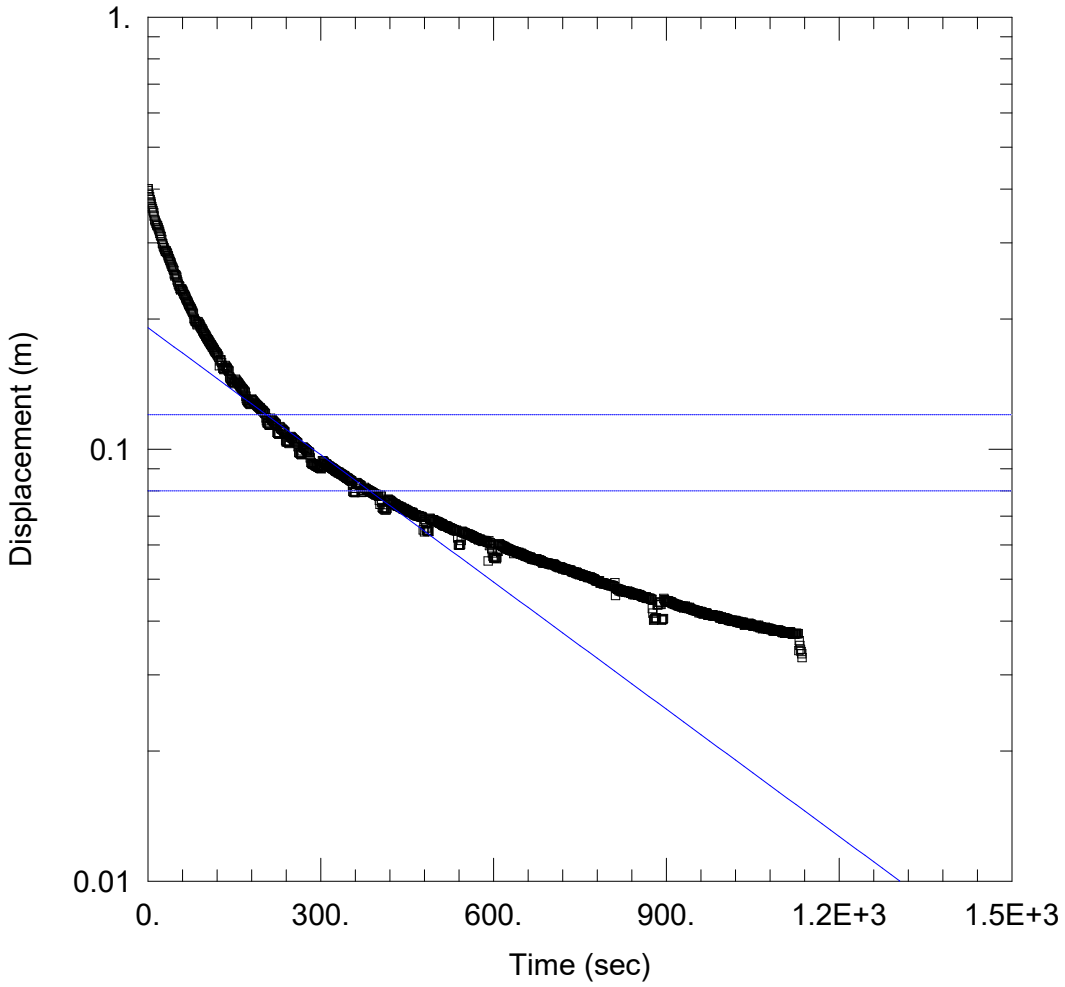
WELL DATA (MW-02)

Initial Displacement: 0.2565 m
Total Well Penetration Depth: 5.5 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.5 m
Screen Length: 3.05 m
Well Radius: 0.048 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 9.6E-6 m/sec y0 = 0.2391 m



RISING HEAD TEST MW-03

Data Set: \...\MW-03_Rising_head_DL_JK.aqt
Date: 11/30/22 Time: 14:58:41

PROJECT INFORMATION

Company: Stantec Consultant
Client: Nova Construction Co. Ltd.
Project: 121417326
Location: Seabrook Quarry, Digby, NS
Test Well: MW-03
Test Date: September 1, 2022

AQUIFER DATA

Saturated Thickness: 7.525 m Anisotropy Ratio (Kz/Kr): 0.1

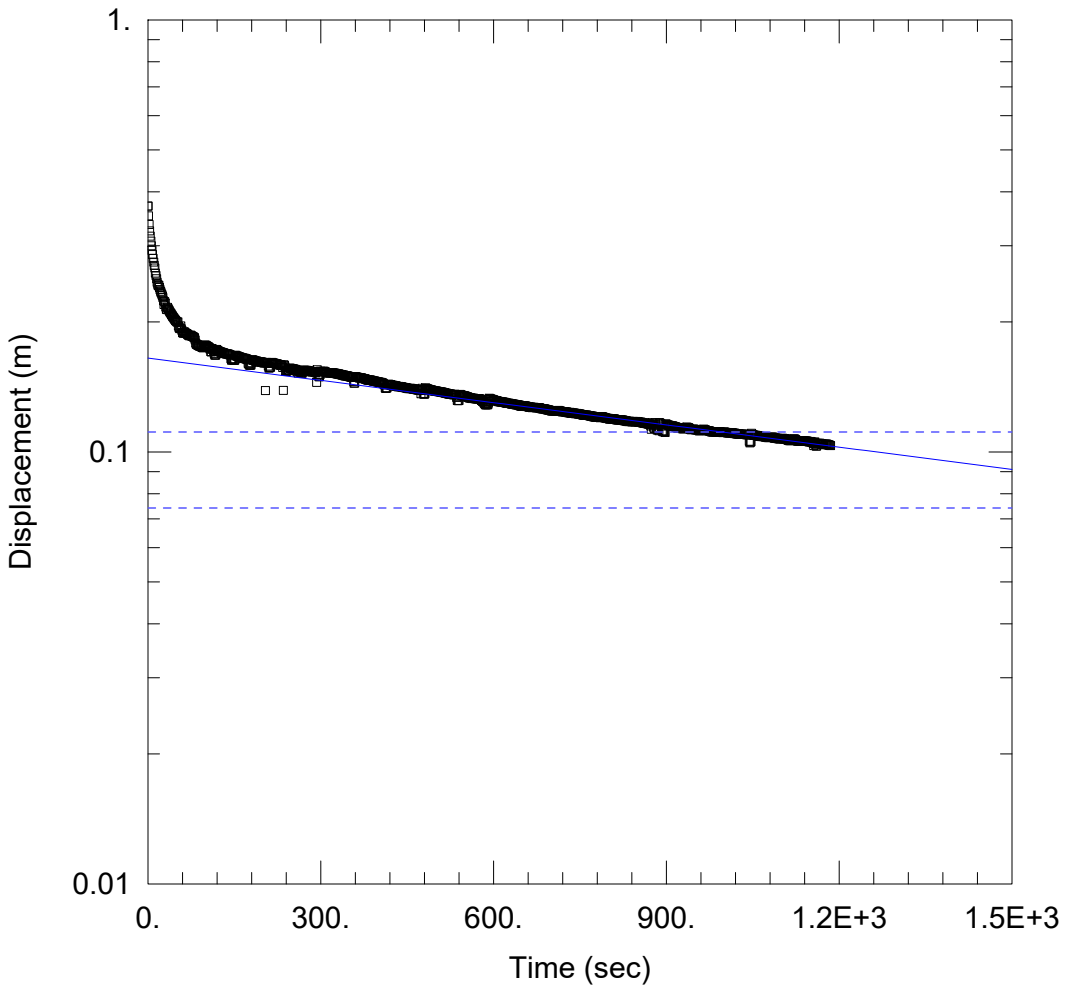
WELL DATA (MW-03)

Initial Displacement: 0.4005 m
Total Well Penetration Depth: 7.53 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.525 m
Screen Length: 3.05 m
Well Radius: 0.048 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.0E-6 m/sec y0 = 0.1911 m



RISING HEAD TEST MW-04

Data Set: \...\MW-04_Rising_head_DL_JK.aqt
Date: 12/19/22 Time: 13:19:57

PROJECT INFORMATION

Company: Stantec Consultant
Client: Nova Construction Co. Ltd.
Project: 121417326
Location: Seabrook Quarry, Digby, NS
Test Well: MW-04
Test Date: September 1, 2022

AQUIFER DATA

Saturated Thickness: 4.97 m
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW-04)

Initial Displacement: 0.3708 m
Total Well Penetration Depth: 4.97 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.97 m
Screen Length: 3.05 m
Well Radius: 0.048 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.3E-7 m/sec
y0 = 0.1648 m

APPENDIX D

Analytical Data

TABLE D-1

GROUNDWATER GENERAL CHEMISTRY
Nova Construction Co. Ltd.
Seabrook Quarry, Digby, Nova Scotia
Stantec Consulting Ltd. Project No. 121417326

Parameter	Units	GCDWQ Guidelines (mg/L)	CCME Freshwater		Sample ID			
			Short Term	Long Term	MW-01	MW-02	MW-03	MW-04
Date Sampled:					**12-Aug-22**	**12-Aug-22**	**12-Aug-22**	**12-Aug-22**
Anion Sum	me/L	-	-	-	4.20	1.69	1.94	2.33
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	-	-	-	180	61	77	55
Calculated TDS	mg/L	≤ 500 (AO)	-	-	240	100	120	150
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	-	-	-	<1.0	1.1	<1.0	2.3
Cation Sum	me/L	-	-	-	4.56	1.64	1.89	2.23
Hardness ($CaCO_3$)	mg/L	-	-	-	170	63	59	40
Ion Balance (% Difference)	%	-	-	-	4.11	1.50	1.31	2.19
Langelier Index (@ 20°C)	N/A	-	-	-	0.0310	-0.0660	-0.141	0.192
Langelier Index (@ 4°C)	N/A	-	-	-	-0.219	-0.317	-0.392	-0.0590
Nitrate (N)	mg/L	45	550	13	<0.050	0.38	0.056	<0.050
Saturation pH (@ 20°C)	N/A	-	-	-	7.46	8.36	8.17	8.45
Saturation pH (@ 4°C)	N/A	-	-	-	7.71	8.61	8.42	8.70
Total Alkalinity (Total as $CaCO_3$)	mg/L	-	-	-	180	62	78	58
Dissolved Chloride (Cl)	mg/L	≤ 250 (AO)	640	120	22	10	8.7	34
Colour	TCU	≤ 15 (AO)	-	-	50	<5.0	<5.0	14
Nitrate + Nitrite	mg/L	-	-	-	<0.050	0.39	0.056	<0.050
Nitrite (N)	mg/L	3	-	0.06	<0.010	0.013	<0.010	0.012
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	VARIES [6]	0.48	<0.050	<0.050	0.054
Total Organic Carbon (C)	mg/L	-	-	-	41	<5.0	1.5	7.7
Orthophosphate (P)	mg/L	-	-	-	<0.010	0.059	0.013	0.015
pH	pH	6.5-8.5	-	6.5-9.0	7.49	8.29	8.03	8.64
Reactive Silica (SiO_2)	mg/L	-	-	-	20	16	23	19
Dissolved Sulphate (SO_4)	mg/L	≤ 500 (AO)	-	-	<2.0	6.0	5.9	11
Turbidity	NTU	≤ 0.3	-	-	320	>1000	230	320
Conductivity	uS/cm	-	-	-	420	160	180	240
Sodium	mg/L	≤ 200 (AO)	-	-	23000	7900	16000	33000

Notes:

1. RDL = laboratory's reportable detection limit
2. <# = parameter not detected above the laboratory RDL
3. ' -' = no guideline available;p NA = not applicable/available
4. CCME Guidelines = Canadian Council of Ministers of the Environment *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME Online 2022); Freshwater aquatic life
5. GCDWQ = Guidelines for Canadian Drinking Water Quality; *Summary Table* (September, 2022)
6. Varies depending on pH and temperature; calculated guideline presented in ( )
   Guideline calculated using field temperature and pH is presented in brackets after the corresponding analytical result;
   When temperature was unknown it was assumed to be 15°C
7. AO = aesthetic objective
8. **Bold & Underlined =** parameter concentration exceeds the referenced guideline

TABLE D-2

GROUNDWATER INORGANIC CHEMISTRY
Nova Construction Co. Ltd.
Seabrook Quarry, Digby, Nova Scotia
Stantec Consulting Ltd. Project No. 121417326

Parameter	GCDWQ Guidelines (µg/L)	CCME Freshwater		Sample ID				
		Long Term	Short Term	MW-01		MW-02	MW-03	MW-04
Date Sampled:				12-Aug-22	Lab-Dup	12-Aug-22	12-Aug-22	12-Aug-22
Aluminum	2,900	-	CCME equation[7]	460	N/A	22	11	63
Antimony	6	-	-	<1.0	N/A	<1.0	<1.0	<1.0
Arsenic	10	-	5	<1.0	N/A	3.9	<1.0	<1.0
Barium	2,000	-	-	29	N/A	58	2.8	6.6
Beryllium	-	-	-	<0.10	N/A	<0.10	<0.10	<0.10
Bismuth		-	-	<2.0	N/A	<2.0	<2.0	<2.0
Boron	5,000	29,000	1,500	<50	N/A	<50	<50	<50
Cadmium	7	CCME equation[7]	CCME equation[7]	0.080	N/A	<0.010	<0.010	<0.010
Calcium		-	-	49000	N/A	16000	20000	15000
Chromium	50	-	-	6.1	N/A	4.9	<1.0	<1.0
Cobalt	-	-	-	16	N/A	<0.40	<0.40	<0.40
Copper	2000	-	CCME equation[7]	91	N/A	<0.50	0.66	14
Iron	≤ 300 (AO)	-	300	**2300**	N/A	<50	<50	63
Lead	5	-	CCME equation[7]	<0.50	N/A	<0.50	<0.50	<0.50
Mangesium	-	-	-	11000	N/A	5500	2300	740
Manganese	12,000	CCME equation[7]	variable	3500	N/A	2.6	7.3	5.8
Mercury	1	-	0.026	0.013	0.013	<0.013	<0.013	<0.013
Molybdenum	-	-	73	5.7	N/A	<2.0	<2.0	6.6
Nickel		-	CCME equation[7]	6.7	N/A	<2.0	<2.0	<2.0
Phosphorus		-	-	<100	N/A	<100	<100	<100
Potassium		-	-	1500	N/A	1600	260	470
Selenium	50	-	1	0.59	N/A	<0.50	<0.50	<0.50
Silver	-	-	0.25	<0.10	N/A	<0.10	<0.10	<0.10
Sodium	≤ 200 (AO)	-	-	23000	N/A	7900	16000	33000
Strontium	7,000	-	-	160	N/A	49	88	100
Thallium	-	-	0.8	<0.10	N/A	<0.10	<0.10	<0.10
Tin	-	-	-	<2.0	N/A	<2.0	<2.0	<2.0
Titanium		-	-	3.6	N/A	<2.0	<2.0	<2.0
Uranium	20	33	15	0.26	N/A	0.97	0.16	0.30
Vanadium	-	-	-	5.1	N/A	5.9	3.4	5.6
Zinc	≤ 5000 (AO)	CCME equation[7]	CCME equation[7]	31	N/A	<5.0	6.7	<5.0

Notes:
1. RDL = laboratory's reportable detection limit
2. <# = parameter not detected above RDL
3. " -" = no guideline available
4. Lab-Dup = laboratory QA/QC duplicate
5. GCDWQ = Guidelines for Canadian Drinking Water Quality; *Summary Table* (September, 2022)
6. AO = aesthetic objective
9. **Bold & Underlined =** parameter concentration exceeds the applicable guideline

APPENDIX E

Laboratory Certificates of Analyses

Your Project #: 121417326
Site Location: DIGBY NS
Your C.O.C. #: N/A

Attention: Janeen McGuigan

Stantec Consulting Ltd
165 Maple Hills Ave
Charlottetown, PE
CANADA C1C 1N9

Report Date: 2022/09/20
Report #: R7303782
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2P6116
Received: 2022/09/02, 16:25

Sample Matrix: Surface Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonate, Bicarbonate and Hydroxide	2	N/A	2022/09/15	N/A	SM 23 4500-CO2 D
Alkalinity	2	N/A	2022/09/14	ATL SOP 00142	SM 23 2320 B
Chloride	2	N/A	2022/09/19	ATL SOP 00014	SM 23 4500-Cl- E m
Colour	2	N/A	2022/09/19	ATL SOP 00020	SM 23 2120C m
Conductance - water	2	N/A	2022/09/14	ATL SOP 00004	SM 23 2510B m
Hardness (calculated as CaCO3)	2	N/A	2022/09/13	ATL SOP 00048	Auto Calc
Metals Water Total MS	2	2022/09/09	2022/09/13	ATL SOP 00058	EPA 6020B R2 m
Ion Balance (% Difference)	2	N/A	2022/09/20	N/A	Auto Calc.
Anion and Cation Sum	2	N/A	2022/09/19	N/A	Auto Calc.
Nitrogen Ammonia - water	2	N/A	2022/09/16	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	2	N/A	2022/09/20	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	2	N/A	2022/09/19	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N)	2	N/A	2022/09/20	ATL SOP 00018	ASTM D3867-16
pH (1)	2	N/A	2022/09/14	ATL SOP 00003	SM 23 4500-H+ B m
Phosphorus - ortho	2	N/A	2022/09/19	ATL SOP 00021	SM 23 4500-P E m
Sat. pH and Langelier Index (@ 20C)	2	N/A	2022/09/20	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	2	N/A	2022/09/20	ATL SOP 00049	Auto Calc.
Reactive Silica	2	N/A	2022/09/19	ATL SOP 00022	EPA 366.0 m
Sulphate	2	N/A	2022/09/19	ATL SOP 00023	ASTM D516-16 m
Total Dissolved Solids (TDS calc)	2	N/A	2022/09/20	N/A	Auto Calc.
Organic carbon - Total (TOC) (2)	2	N/A	2022/09/13	ATL SOP 00203	SM 23 5310B m
Total Suspended Solids	2	2022/09/09	2022/09/12	ATL SOP 00007	SM 23 2540D m
Turbidity	2	N/A	2022/09/16	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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Your Project #: 121417326
Site Location: DIGBY NS
Your C.O.C. #: N/A

Attention: Janeen McGuigan

Stantec Consulting Ltd
165 Maple Hills Ave
Charlottetown, PE
CANADA C1C 1N9

Report Date: 2022/09/20
Report #: R7303782
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2P6116
Received: 2022/09/02, 16:25

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) The APHA Standard Method requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(2) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

Encryption Key

AUTHORIZED REPORT
RAPPORT AUTORISÉ

Bureau Veritas
20 Sep 2022 14:43:11

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Marie Muise, Key Account Specialist
Email: Marie.MUISE@bureauveritas.com
Phone# (902)420-0203 Ext:253

This report has been generated and distributed using a secure automated process.
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For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

ATLANTIC RCAP-MS TOTAL METALS IN WATER (SURFACE WATER)

Bureau Veritas ID		TQU572	TQU572			TQU573		
Sampling Date		2022/09/02 10:00	2022/09/02 10:00			2022/09/02 09:00		
	UNITS	SW-01	SW-01 Lab-Dup	RDL	QC Batch	SW-02	RDL	QC Batch
Calculated Parameters								
Anion Sum	me/L	0.320	N/A	N/A	8212146	0.300	N/A	8212146
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	4.9	N/A	1.0	8212141	4.2	1.0	8212141
Calculated TDS	mg/L	25	N/A	1.0	8212153	25	1.0	8212153
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	N/A	1.0	8212141	<1.0	1.0	8212141
Cation Sum	me/L	0.490	N/A	N/A	8212146	0.450	N/A	8212146
Hardness (CaCO3)	mg/L	9.2	N/A	1.0	8209986	8.4	1.0	8209986
Ion Balance (% Difference)	%	21.0	N/A	N/A	8212145	20.0	N/A	8212145
Langelier Index (@ 20C)	N/A	-4.04	N/A	N/A	8212151	-3.81	N/A	8212151
Langelier Index (@ 4C)	N/A	-4.29	N/A	N/A	8212152	-4.06	N/A	8212152
Nitrate (N)	mg/L	<0.050	N/A	0.050	8212148	0.060	0.050	8210675
Saturation pH (@ 20C)	N/A	10.3	N/A	N/A	8212151	10.4	N/A	8212151
Saturation pH (@ 4C)	N/A	10.6	N/A	N/A	8212152	10.7	N/A	8212152
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	4.9	N/A	2.0	8223399	4.2	2.0	8223392
Dissolved Chloride (Cl-)	mg/L	7.7	N/A	1.0	8232599	7.4	1.0	8232599
Colour	TCU	230	N/A	25	8232596	120	25	8232596
Nitrate + Nitrite (N)	mg/L	<0.050	N/A	0.050	8232592	0.060	0.050	8232592
Nitrite (N)	mg/L	<0.010	N/A	0.010	8231341	<0.010	0.010	8231341
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	N/A	0.050	8229490	<0.050	0.050	8229490
Total Organic Carbon (C)	mg/L	25 (1)	N/A	5.0	8220910	17	0.50	8218837
Orthophosphate (P)	mg/L	<0.010	N/A	0.010	8232595	<0.010	0.010	8232595
pH	pH	6.30	N/A	N/A	8223395	6.60	N/A	8223382
Reactive Silica (SiO2)	mg/L	3.5	N/A	0.50	8232597	5.1	0.50	8232597
Dissolved Sulphate (SO4)	mg/L	<2.0	N/A	2.0	8232598	<2.0	2.0	8232598
Turbidity	NTU	1.5	1.4	0.10	8228846	1.3	0.10	8228846
Conductivity	uS/cm	47	N/A	1.0	8223394	46	1.0	8223377
Metals								
Total Aluminum (Al)	ug/L	200	N/A	5.0	8215603	270	5.0	8215603
Total Antimony (Sb)	ug/L	<1.0	N/A	1.0	8215603	<1.0	1.0	8215603
Total Arsenic (As)	ug/L	<1.0	N/A	1.0	8215603	<1.0	1.0	8215603
Total Barium (Ba)	ug/L	2.3	N/A	1.0	8215603	2.6	1.0	8215603
Total Beryllium (Be)	ug/L	<0.10	N/A	0.10	8215603	<0.10	0.10	8215603

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Elevated reporting limit due to turbidity.

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Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

ATLANTIC RCAP-MS TOTAL METALS IN WATER (SURFACE WATER)

Bureau Veritas ID		TQU572	TQU572			TQU573		
Sampling Date		2022/09/02 10:00	2022/09/02 10:00			2022/09/02 09:00		
	UNITS	**SW-01**	**SW-01 Lab-Dup**	**RDL**	**QC Batch**	**SW-02**	**RDL**	**QC Batch**
Total Bismuth (Bi)	ug/L	<2.0	N/A	2.0	8215603	<2.0	2.0	8215603
Total Boron (B)	ug/L	<50	N/A	50	8215603	<50	50	8215603
Total Cadmium (Cd)	ug/L	0.012	N/A	0.010	8215603	0.014	0.010	8215603
Total Calcium (Ca)	ug/L	1800	N/A	100	8215603	1800	100	8215603
Total Chromium (Cr)	ug/L	1.3	N/A	1.0	8215603	1.0	1.0	8215603
Total Cobalt (Co)	ug/L	<0.40	N/A	0.40	8215603	<0.40	0.40	8215603
Total Copper (Cu)	ug/L	<0.50	N/A	0.50	8215603	0.91	0.50	8215603
Total Iron (Fe)	ug/L	910	N/A	50	8215603	690	50	8215603
Total Lead (Pb)	ug/L	<0.50	N/A	0.50	8215603	<0.50	0.50	8215603
Total Magnesium (Mg)	ug/L	1100	N/A	100	8215603	970	100	8215603
Total Manganese (Mn)	ug/L	47	N/A	2.0	8215603	24	2.0	8215603
Total Molybdenum (Mo)	ug/L	<2.0	N/A	2.0	8215603	<2.0	2.0	8215603
Total Nickel (Ni)	ug/L	<2.0	N/A	2.0	8215603	<2.0	2.0	8215603
Total Phosphorus (P)	ug/L	<100	N/A	100	8215603	<100	100	8215603
Total Potassium (K)	ug/L	560	N/A	100	8215603	870	100	8215603
Total Selenium (Se)	ug/L	<0.50	N/A	0.50	8215603	<0.50	0.50	8215603
Total Silver (Ag)	ug/L	<0.10	N/A	0.10	8215603	<0.10	0.10	8215603
Total Sodium (Na)	ug/L	6000	N/A	100	8215603	5500	100	8215603
Total Strontium (Sr)	ug/L	7.4	N/A	2.0	8215603	9.0	2.0	8215603
Total Thallium (Tl)	ug/L	<0.10	N/A	0.10	8215603	<0.10	0.10	8215603
Total Tin (Sn)	ug/L	<2.0	N/A	2.0	8215603	<2.0	2.0	8215603
Total Titanium (Ti)	ug/L	2.4	N/A	2.0	8215603	3.3	2.0	8215603
Total Uranium (U)	ug/L	<0.10	N/A	0.10	8215603	<0.10	0.10	8215603
Total Vanadium (V)	ug/L	<2.0	N/A	2.0	8215603	<2.0	2.0	8215603
Total Zinc (Zn)	ug/L	<5.0	N/A	5.0	8215603	<5.0	5.0	8215603

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

RESULTS OF ANALYSES OF SURFACE WATER

Bureau Veritas ID		TQU572	TQU573		
Sampling Date		2022/09/02 10:00	2022/09/02 09:00		
	UNITS	**SW-01**	**SW-02**	**RDL**	**QC Batch**
Inorganics					
Total Suspended Solids	mg/L	2.4	2.0	2.0	8214928

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

TEST SUMMARY

Bureau Veritas ID: TQU572
Sample ID: SW-01
Matrix: Surface Water

Collected: 2022/09/02
Shipped:
Received: 2022/09/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	8212141	N/A	2022/09/15	Automated Statchk
Alkalinity	AT	8223399	N/A	2022/09/14	Nachiketa Gohil
Chloride	KONE	8232599	N/A	2022/09/19	Tais Gomes
Colour	KONE	8232596	N/A	2022/09/19	Tais Gomes
Conductance - water	AT	8223394	N/A	2022/09/14	Nachiketa Gohil
Hardness (calculated as CaCO3)		8209986	N/A	2022/09/13	Automated Statchk
Metals Water Total MS	CICP/MS	8215603	2022/09/09	2022/09/13	Jacob Henley
Ion Balance (% Difference)	CALC	8212145	N/A	2022/09/20	Automated Statchk
Anion and Cation Sum	CALC	8212146	N/A	2022/09/19	Automated Statchk
Nitrogen Ammonia - water	KONE	8229490	N/A	2022/09/16	Mary Clancey
Nitrogen - Nitrate + Nitrite	KONE	8232592	N/A	2022/09/20	Tais Gomes
Nitrogen - Nitrite	KONE	8231341	N/A	2022/09/19	Tais Gomes
Nitrogen - Nitrate (as N)	CALC	8212148	N/A	2022/09/20	Automated Statchk
pH	AT	8223395	N/A	2022/09/14	Nachiketa Gohil
Phosphorus - ortho	KONE	8232595	N/A	2022/09/19	Tais Gomes
Sat. pH and Langelier Index (@ 20C)	CALC	8212151	N/A	2022/09/20	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	8212152	N/A	2022/09/20	Automated Statchk
Reactive Silica	KONE	8232597	N/A	2022/09/19	Tais Gomes
Sulphate	KONE	8232598	N/A	2022/09/19	Tais Gomes
Total Dissolved Solids (TDS calc)	CALC	8212153	N/A	2022/09/20	Automated Statchk
Organic carbon - Total (TOC)	TOCV/NDIR	8220910	N/A	2022/09/13	Ronald Steele
Total Suspended Solids	BAL	8214928	2022/09/09	2022/09/12	Michael Nixon
Turbidity	TURB	8228846	N/A	2022/09/16	Nachiketa Gohil

Bureau Veritas ID: TQU572 Dup
Sample ID: SW-01
Matrix: Surface Water

Collected: 2022/09/02
Shipped:
Received: 2022/09/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Turbidity	TURB	8228846	N/A	2022/09/16	Nachiketa Gohil

Bureau Veritas ID: TQU573
Sample ID: SW-02
Matrix: Surface Water

Collected: 2022/09/02
Shipped:
Received: 2022/09/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	8212141	N/A	2022/09/15	Automated Statchk
Alkalinity	AT	8223392	N/A	2022/09/14	Nachiketa Gohil
Chloride	KONE	8232599	N/A	2022/09/19	Tais Gomes
Colour	KONE	8232596	N/A	2022/09/19	Tais Gomes
Conductance - water	AT	8223377	N/A	2022/09/14	Nachiketa Gohil
Hardness (calculated as CaCO3)		8209986	N/A	2022/09/13	Automated Statchk
Metals Water Total MS	CICP/MS	8215603	2022/09/09	2022/09/13	Jacob Henley
Ion Balance (% Difference)	CALC	8212145	N/A	2022/09/20	Automated Statchk
Anion and Cation Sum	CALC	8212146	N/A	2022/09/19	Automated Statchk

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Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

TEST SUMMARY

Bureau Veritas ID: TQU573
Sample ID: SW-02
Matrix: Surface Water

Collected: 2022/09/02
Shipped:
Received: 2022/09/02

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrogen Ammonia - water	KONE	8229490	N/A	2022/09/16	Mary Clancey
Nitrogen - Nitrate + Nitrite	KONE	8232592	N/A	2022/09/20	Tais Gomes
Nitrogen - Nitrite	KONE	8231341	N/A	2022/09/19	Tais Gomes
Nitrogen - Nitrate (as N)	CALC	8210675	N/A	2022/09/20	Automated Statchk
pH	AT	8223382	N/A	2022/09/14	Nachiketa Gohil
Phosphorus - ortho	KONE	8232595	N/A	2022/09/19	Tais Gomes
Sat. pH and Langelier Index (@ 20C)	CALC	8212151	N/A	2022/09/20	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	8212152	N/A	2022/09/20	Automated Statchk
Reactive Silica	KONE	8232597	N/A	2022/09/19	Tais Gomes
Sulphate	KONE	8232598	N/A	2022/09/19	Tais Gomes
Total Dissolved Solids (TDS calc)	CALC	8212153	N/A	2022/09/20	Automated Statchk
Organic carbon - Total (TOC)	TOCV/NDIR	8218837	N/A	2022/09/13	Ronald Steele
Total Suspended Solids	BAL	8214928	2022/09/09	2022/09/12	Michael Nixon
Turbidity	TURB	8228846	N/A	2022/09/16	Nachiketa Gohil

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	23.0°C

Sample TQU572 [SW-01] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample TQU573 [SW-02] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Results relate only to the items tested.

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Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

QUALITY ASSURANCE REPORT

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8214928	Total Suspended Solids	2022/09/12					<1.0	mg/L	6.7	20	97	80 - 120
8215603	Total Aluminum (Al)	2022/09/12	96	80 - 120	98	80 - 120	<5.0	ug/L	NC	20		
8215603	Total Antimony (Sb)	2022/09/12	104	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
8215603	Total Arsenic (As)	2022/09/12	91	80 - 120	91	80 - 120	<1.0	ug/L	2.1	20		
8215603	Total Barium (Ba)	2022/09/12	97	80 - 120	100	80 - 120	<1.0	ug/L	2.5	20		
8215603	Total Beryllium (Be)	2022/09/12	99	80 - 120	99	80 - 120	<0.10	ug/L	NC	20		
8215603	Total Bismuth (Bi)	2022/09/12	97	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
8215603	Total Boron (B)	2022/09/12	102	80 - 120	99	80 - 120	<50	ug/L	1.9	20		
8215603	Total Cadmium (Cd)	2022/09/12	98	80 - 120	100	80 - 120	<0.010	ug/L	NC	20		
8215603	Total Calcium (Ca)	2022/09/12	99	80 - 120	102	80 - 120	<100	ug/L	0.36	20		
8215603	Total Chromium (Cr)	2022/09/12	96	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
8215603	Total Cobalt (Co)	2022/09/12	95	80 - 120	98	80 - 120	<0.40	ug/L	NC	20		
8215603	Total Copper (Cu)	2022/09/12	94	80 - 120	97	80 - 120	<0.50	ug/L	0.32	20		
8215603	Total Iron (Fe)	2022/09/12	99	80 - 120	105	80 - 120	<50	ug/L	NC	20		
8215603	Total Lead (Pb)	2022/09/12	98	80 - 120	99	80 - 120	<0.50	ug/L	2.6	20		
8215603	Total Magnesium (Mg)	2022/09/12	101	80 - 120	102	80 - 120	<100	ug/L	2.0	20		
8215603	Total Manganese (Mn)	2022/09/12	99	80 - 120	101	80 - 120	<2.0	ug/L	0.075	20		
8215603	Total Molybdenum (Mo)	2022/09/12	105	80 - 120	102	80 - 120	<2.0	ug/L	0.96	20		
8215603	Total Nickel (Ni)	2022/09/12	95	80 - 120	97	80 - 120	<2.0	ug/L	NC	20		
8215603	Total Phosphorus (P)	2022/09/12	101	80 - 120	102	80 - 120	<100	ug/L	NC	20		
8215603	Total Potassium (K)	2022/09/12	101	80 - 120	100	80 - 120	<100	ug/L	2.4	20		
8215603	Total Selenium (Se)	2022/09/12	95	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
8215603	Total Silver (Ag)	2022/09/12	97	80 - 120	99	80 - 120	<0.10	ug/L	NC	20		
8215603	Total Sodium (Na)	2022/09/12	NC	80 - 120	96	80 - 120	<100	ug/L	2.0	20		
8215603	Total Strontium (Sr)	2022/09/12	98	80 - 120	100	80 - 120	<2.0	ug/L	1.2	20		
8215603	Total Thallium (Tl)	2022/09/12	94	80 - 120	94	80 - 120	<0.10	ug/L	NC	20		
8215603	Total Tin (Sn)	2022/09/12	100	80 - 120	103	80 - 120	<2.0	ug/L	NC	20		
8215603	Total Titanium (Ti)	2022/09/12	97	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
8215603	Total Uranium (U)	2022/09/12	104	80 - 120	103	80 - 120	<0.10	ug/L	1.7	20		
8215603	Total Vanadium (V)	2022/09/12	97	80 - 120	97	80 - 120	<2.0	ug/L	NC	20		
8215603	Total Zinc (Zn)	2022/09/12	94	80 - 120	95	80 - 120	<5.0	ug/L	0.89	20		
8218837	Total Organic Carbon (C)	2022/09/13	98 (1)	85 - 115	102	80 - 120	<0.50	mg/L	7.3 (2)	15		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8220910	Total Organic Carbon (C)	2022/09/13	100	85 - 115	100	80 - 120	<0.50	mg/L	NC	15		
8223377	Conductivity	2022/09/14			102	80 - 120	<1.0	uS/cm				
8223382	pH	2022/09/14			100	97 - 103						
8223392	Total Alkalinity (Total as CaCO3)	2022/09/14			103	80 - 120	<2.0	mg/L				
8223394	Conductivity	2022/09/14			101	80 - 120	<1.0	uS/cm	1.3	10		
8223395	pH	2022/09/14			100	97 - 103			0.34	N/A		
8223399	Total Alkalinity (Total as CaCO3)	2022/09/14			103	80 - 120	<2.0	mg/L	0.40	20		
8228846	Turbidity	2022/09/16			99	80 - 120	<0.10	NTU	7.8	20	101	80 - 120
8229490	Nitrogen (Ammonia Nitrogen)	2022/09/16	84	80 - 120	91	80 - 120	<0.050	mg/L	3.1	20		
8231341	Nitrite (N)	2022/09/19	100	80 - 120	106	80 - 120	<0.010	mg/L	NC	20		
8232592	Nitrate + Nitrite (N)	2022/09/20	101	80 - 120	101	80 - 120	<0.050	mg/L	NC	20		
8232595	Orthophosphate (P)	2022/09/19	99	80 - 120	100	80 - 120	<0.010	mg/L	NC	20		
8232596	Colour	2022/09/19			97	80 - 120	<5.0	TCU	NC	20		
8232597	Reactive Silica (SiO2)	2022/09/19	95	80 - 120	98	80 - 120	<0.50	mg/L	0.066	20		
8232598	Dissolved Sulphate (SO4)	2022/09/19	95	80 - 120	95	80 - 120	<2.0	mg/L	NC	20		
8232599	Dissolved Chloride (Cl-)	2022/09/19	99	80 - 120	101	80 - 120	<1.0	mg/L	NC	20		

N/A = Not Applicable

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Elevated reporting limit due to sample matrix.

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Bureau Veritas Job #: C2P6116
Report Date: 2022/09/20

Stantec Consulting Ltd
Client Project #: 121417326
Site Location: DIGBY NS
Sampler Initials: SW

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Bureau Veritas Proprietary Software
Logiciel Propriétaire de Bureau Veritas

Automated Statchk

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Your Project #: 121417326.500.100

Attention: Joanne Whalen-Gayton

Stantec Consulting Ltd
40 Highfield Park Drive
Suite 102
Dartmouth, NS
CANADA B3A 0A3

Report Date: 2022/08/24
Report #: R7267209
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2M9772
Received: 2022/08/15, 09:40

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonate, Bicarbonate and Hydroxide (1)	3	N/A	2022/08/19	N/A	SM 23 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide (1)	1	N/A	2022/08/23	N/A	SM 23 4500-CO2 D
Alkalinity (1)	3	N/A	2022/08/18	ATL SOP 00142	SM 23 2320 B
Alkalinity (1)	1	N/A	2022/08/22	ATL SOP 00142	SM 23 2320 B
Chloride (1)	4	N/A	2022/08/22	ATL SOP 00014	SM 23 4500-Cl- E m
Colour (1)	4	N/A	2022/08/22	ATL SOP 00020	SM 23 2120C m
Conductance - water (1)	3	N/A	2022/08/18	ATL SOP 00004	SM 23 2510B m
Conductance - water (1)	1	N/A	2022/08/22	ATL SOP 00004	SM 23 2510B m
Hardness (calculated as CaCO3) (1)	4	N/A	2022/08/24	ATL SOP 00048	Auto Calc
Mercury - Dissolved (CVAA,LL) (1)	4	2022/08/22	2022/08/22	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Diss. MS (as rec'd) (1)	4	N/A	2022/08/23	ATL SOP 00058	EPA 6020B R2 m
Ion Balance (% Difference) (1)	4	N/A	2022/08/24	N/A	Auto Calc.
Anion and Cation Sum (1)	4	N/A	2022/08/24	N/A	Auto Calc.
Nitrogen Ammonia - water (1)	4	N/A	2022/08/18	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite (1)	4	N/A	2022/08/22	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite (1)	4	N/A	2022/08/22	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N) (1)	4	N/A	2022/08/23	ATL SOP 00018	ASTM D3867-16
pH (1, 2)	3	N/A	2022/08/18	ATL SOP 00003	SM 23 4500-H+ B m
pH (1, 2)	1	N/A	2022/08/22	ATL SOP 00003	SM 23 4500-H+ B m
Phosphorus - ortho (1)	4	N/A	2022/08/22	ATL SOP 00021	SM 23 4500-P E m
Sat. pH and Langelier Index (@ 20C) (1)	4	N/A	2022/08/24	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C) (1)	4	N/A	2022/08/24	ATL SOP 00049	Auto Calc.
Reactive Silica (1)	4	N/A	2022/08/22	ATL SOP 00022	EPA 366.0 m
Sulphate (1)	4	N/A	2022/08/22	ATL SOP 00023	ASTM D516-16 m
Total Dissolved Solids (TDS calc) (1)	4	N/A	2022/08/24	N/A	Auto Calc.
Organic carbon - Total (TOC) (1, 3)	1	N/A	2022/08/18	ATL SOP 00203	SM 23 5310B m
Organic carbon - Total (TOC) (1, 3)	3	N/A	2022/08/22	ATL SOP 00203	SM 23 5310B m
Turbidity (1)	4	N/A	2022/08/19	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau

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Your Project #: 121417326.500.100

Attention: Joanne Whalen-Gayton

Stantec Consulting Ltd
40 Highfield Park Drive
Suite 102
Dartmouth, NS
CANADA B3A 0A3

Report Date: 2022/08/24
Report #: R7267209
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2M9772
Received: 2022/08/15, 09:40

Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Bedford, 200 Bluewater Rd Suite 105, Bedford, NS, B4B 1G9
(2) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(3) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC

Encryption Key

Chen Zhang
Project Manager Assistant
24 Aug 2022 15:57:23

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Natalie MacAskill, Key Account Specialist
Email: Natalie.MacAskill@bureauveritas.com
Phone# (902)567-1255 Ext:17

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AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Bureau Veritas ID		TLD374			TLD377			TLD378		
Sampling Date		2022/08/12 13:45			2022/08/12 15:00			2022/08/12 10:40		
	UNITS	**MW-01**	**RDL**	**QC Batch**	**MW-02**	**RDL**	**QC Batch**	**MW-03**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	me/L	4.20	N/A	8165608	1.69	N/A	8165608	1.94	N/A	8165608
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	1.0	8165603	61	1.0	8165603	77	1.0	8165603
Calculated TDS	mg/L	240	1.0	8165613	100	1.0	8165613	120	1.0	8165613
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	8165603	1.1	1.0	8165603	<1.0	1.0	8165603
Cation Sum	me/L	4.56	N/A	8165608	1.64	N/A	8165608	1.89	N/A	8165608
Hardness (CaCO3)	mg/L	170	1.0	8165606	63	1.0	8165606	59	1.0	8165606
Ion Balance (% Difference)	%	4.11	N/A	8165607	1.50	N/A	8165607	1.31	N/A	8165607
Langelier Index (@ 20C)	N/A	0.0310	N/A	8165611	-0.0660	N/A	8165611	-0.141	N/A	8165611
Langelier Index (@ 4C)	N/A	-0.219	N/A	8165612	-0.317	N/A	8165612	-0.392	N/A	8165612
Nitrate (N)	mg/L	<0.050	0.050	8165609	0.38	0.050	8165609	0.056	0.050	8165609
Saturation pH (@ 20C)	N/A	7.46	N/A	8165611	8.36	N/A	8165611	8.17	N/A	8165611
Saturation pH (@ 4C)	N/A	7.71	N/A	8165612	8.61	N/A	8165612	8.42	N/A	8165612
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	180	2.0	8173973	62	2.0	8179256	78	2.0	8173973
Dissolved Chloride (Cl^-)	mg/L	22	1.0	8176763	10	1.0	8176763	8.7	1.0	8176763
Colour	TCU	50 (1)	25	8176777	<5.0	5.0	8176777	<5.0	5.0	8176777
Nitrate + Nitrite (N)	mg/L	<0.050	0.050	8176780	0.39	0.050	8176780	0.056	0.050	8176780
Nitrite (N)	mg/L	<0.010	0.010	8176782	0.013	0.010	8176782	<0.010	0.010	8176782
Nitrogen (Ammonia Nitrogen)	mg/L	0.48	0.050	8172977	<0.050	0.050	8173114	<0.050	0.050	8173114
Total Organic Carbon (C)	mg/L	41 (2)	5.0	8176263	<5.0 (2)	5.0	8179654	1.5	0.50	8173959
Orthophosphate (P)	mg/L	<0.010	0.010	8176778	0.059	0.010	8176778	0.013	0.010	8176778
pH	pH	7.49	N/A	8173966	8.29	N/A	8179255	8.03	N/A	8173966
Reactive Silica (SiO_2)	mg/L	20 (1)	1.0	8176776	16	0.50	8176776	23	1.0	8176776
Dissolved Sulphate (SO_4)	mg/L	<2.0	2.0	8176770	6.0	2.0	8176770	5.9	2.0	8176770
Turbidity	NTU	320	1.0	8175638	>1000	1.0	8175638	230	1.0	8175638
Conductivity	uS/cm	420	1.0	8173961	160	1.0	8179247	180	1.0	8173961
Metals										
Dissolved Aluminum (Al)	ug/L	460	5.0	8179274	22	5.0	8179274	11	5.0	8179274
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	8179274	<1.0	1.0	8179274	<1.0	1.0	8179274
Dissolved Arsenic (As)	ug/L	<1.0	1.0	8179274	3.9	1.0	8179274	<1.0	1.0	8179274
Dissolved Barium (Ba)	ug/L	29	1.0	8179274	58	1.0	8179274	2.8	1.0	8179274
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	8179274	<0.10	0.10	8179274	<0.10	0.10	8179274
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	8179274	<2.0	2.0	8179274	<2.0	2.0	8179274

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Elevated reporting limit due to sample matrix.
(2) Elevated reporting limit due to turbidity.

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Bureau Veritas Job #: C2M9772
Report Date: 2022/08/24

Stantec Consulting Ltd
Client Project #: 121417326.500.100
Sampler Initials: MA

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Bureau Veritas ID		TLD374			TLD377			TLD378		
Sampling Date		2022/08/12 13:45			2022/08/12 15:00			2022/08/12 10:40		
	UNITS	MW-01	RDL	QC Batch	MW-02	RDL	QC Batch	MW-03	RDL	QC Batch
Dissolved Boron (B)	ug/L	<50	50	8179274	<50	50	8179274	<50	50	8179274
Dissolved Cadmium (Cd)	ug/L	0.080	0.010	8179274	<0.010	0.010	8179274	<0.010	0.010	8179274
Dissolved Calcium (Ca)	ug/L	49000	100	8179274	16000	100	8179274	20000	100	8179274
Dissolved Chromium (Cr)	ug/L	6.1	1.0	8179274	4.9	1.0	8179274	<1.0	1.0	8179274
Dissolved Cobalt (Co)	ug/L	16	0.40	8179274	<0.40	0.40	8179274	<0.40	0.40	8179274
Dissolved Copper (Cu)	ug/L	91	0.50	8179274	<0.50	0.50	8179274	0.66	0.50	8179274
Dissolved Iron (Fe)	ug/L	2300	50	8179274	<50	50	8179274	<50	50	8179274
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8179274	<0.50	0.50	8179274	<0.50	0.50	8179274
Dissolved Magnesium (Mg)	ug/L	11000	100	8179274	5500	100	8179274	2300	100	8179274
Dissolved Manganese (Mn)	ug/L	3500	2.0	8179274	2.6	2.0	8179274	7.3	2.0	8179274
Dissolved Molybdenum (Mo)	ug/L	5.7	2.0	8179274	<2.0	2.0	8179274	<2.0	2.0	8179274
Dissolved Nickel (Ni)	ug/L	6.7	2.0	8179274	<2.0	2.0	8179274	<2.0	2.0	8179274
Dissolved Phosphorus (P)	ug/L	<100	100	8179274	<100	100	8179274	<100	100	8179274
Dissolved Potassium (K)	ug/L	1500	100	8179274	1600	100	8179274	260	100	8179274
Dissolved Selenium (Se)	ug/L	0.59	0.50	8179274	<0.50	0.50	8179274	<0.50	0.50	8179274
Dissolved Silver (Ag)	ug/L	<0.10	0.10	8179274	<0.10	0.10	8179274	<0.10	0.10	8179274
Dissolved Sodium (Na)	ug/L	23000	100	8179274	7900	100	8179274	16000	100	8179274
Dissolved Strontium (Sr)	ug/L	160	2.0	8179274	49	2.0	8179274	88	2.0	8179274
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	8179274	<0.10	0.10	8179274	<0.10	0.10	8179274
Dissolved Tin (Sn)	ug/L	<2.0	2.0	8179274	<2.0	2.0	8179274	<2.0	2.0	8179274
Dissolved Titanium (Ti)	ug/L	3.6	2.0	8179274	<2.0	2.0	8179274	<2.0	2.0	8179274
Dissolved Uranium (U)	ug/L	0.26	0.10	8179274	0.97	0.10	8179274	0.16	0.10	8179274
Dissolved Vanadium (V)	ug/L	5.1	2.0	8179274	5.9	2.0	8179274	3.4	2.0	8179274
Dissolved Zinc (Zn)	ug/L	31	5.0	8179274	<5.0	5.0	8179274	6.7	5.0	8179274

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Bureau Veritas ID		TLD379		
Sampling Date		2022/08/12 11:20		
	UNITS	**MW-04**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	2.33	N/A	8165608
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	55	1.0	8165603
Calculated TDS	mg/L	150	1.0	8165613
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.3	1.0	8165603
Cation Sum	me/L	2.23	N/A	8165608
Hardness (CaCO3)	mg/L	40	1.0	8165606
Ion Balance (% Difference)	%	2.19	N/A	8165607
Langelier Index (@ 20C)	N/A	0.192	N/A	8165611
Langelier Index (@ 4C)	N/A	-0.0590	N/A	8165612
Nitrate (N)	mg/L	<0.050	0.050	8165609
Saturation pH (@ 20C)	N/A	8.45	N/A	8165611
Saturation pH (@ 4C)	N/A	8.70	N/A	8165612
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L	58	2.0	8173973
Dissolved Chloride (Cl-)	mg/L	34	1.0	8176763
Colour	TCU	14	5.0	8176777
Nitrate + Nitrite (N)	mg/L	<0.050	0.050	8176780
Nitrite (N)	mg/L	0.012	0.010	8176782
Nitrogen (Ammonia Nitrogen)	mg/L	0.054	0.050	8173114
Total Organic Carbon (C)	mg/L	7.7 (1)	5.0	8176263
Orthophosphate (P)	mg/L	0.015	0.010	8176778
pH	pH	8.64	N/A	8173966
Reactive Silica (SiO2)	mg/L	19	0.50	8176776
Dissolved Sulphate (SO4)	mg/L	11	2.0	8176770
Turbidity	NTU	320	1.0	8175638
Conductivity	uS/cm	240	1.0	8173961
Metals				
Dissolved Aluminum (Al)	ug/L	63	5.0	8179274
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	8179274
Dissolved Arsenic (As)	ug/L	<1.0	1.0	8179274
Dissolved Barium (Ba)	ug/L	6.6	1.0	8179274
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	8179274
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	8179274
Dissolved Boron (B)	ug/L	<50	50	8179274

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Elevated reporting limit due to turbidity.

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AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Bureau Veritas ID		TLD379		
Sampling Date		2022/08/12 11:20		
	UNITS	**MW-04**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	ug/L	<0.010	0.010	8179274
Dissolved Calcium (Ca)	ug/L	15000	100	8179274
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	8179274
Dissolved Cobalt (Co)	ug/L	<0.40	0.40	8179274
Dissolved Copper (Cu)	ug/L	14	0.50	8179274
Dissolved Iron (Fe)	ug/L	63	50	8179274
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8179274
Dissolved Magnesium (Mg)	ug/L	740	100	8179274
Dissolved Manganese (Mn)	ug/L	5.8	2.0	8179274
Dissolved Molybdenum (Mo)	ug/L	6.6	2.0	8179274
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	8179274
Dissolved Phosphorus (P)	ug/L	<100	100	8179274
Dissolved Potassium (K)	ug/L	470	100	8179274
Dissolved Selenium (Se)	ug/L	<0.50	0.50	8179274
Dissolved Silver (Ag)	ug/L	<0.10	0.10	8179274
Dissolved Sodium (Na)	ug/L	33000	100	8179274
Dissolved Strontium (Sr)	ug/L	100	2.0	8179274
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	8179274
Dissolved Tin (Sn)	ug/L	<2.0	2.0	8179274
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	8179274
Dissolved Uranium (U)	ug/L	0.30	0.10	8179274
Dissolved Vanadium (V)	ug/L	5.6	2.0	8179274
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	8179274
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				

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MERCURY BY COLD VAPOUR AA (WATER)

Bureau Veritas ID		TLD374	TLD374	TLD377	TLD378	TLD379		
Sampling Date		2022/08/12 13:45	2022/08/12 13:45	2022/08/12 15:00	2022/08/12 10:40	2022/08/12 11:20		
	UNITS	**MW-01**	**MW-01 Lab-Dup**	**MW-02**	**MW-03**	**MW-04**	**RDL**	**QC Batch**
Metals								
Dissolved Mercury (Hg)	ug/L	0.013	0.013	<0.013	<0.013	<0.013	0.013	8175869

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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TEST SUMMARY

Bureau Veritas ID: TLD374
Sample ID: MW-01
Matrix: Water

Collected: 2022/08/12
Shipped:
Received: 2022/08/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	8165603	N/A	2022/08/19	Automated Statchk
Alkalinity	AT	8173973	N/A	2022/08/18	Nachiketa Gohil
Chloride	KONE	8176763	N/A	2022/08/22	Tais Gomes
Colour	KONE	8176777	N/A	2022/08/22	Tais Gomes
Conductance - water	AT	8173961	N/A	2022/08/18	Nachiketa Gohil
Hardness (calculated as CaCO3)		8165606	N/A	2022/08/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	8175869	2022/08/22	2022/08/22	Faheema Joga
Metals Water Diss. MS (as rec'd)	CICP/MS	8179274	N/A	2022/08/23	Jacob Henley
Ion Balance (% Difference)	CALC	8165607	N/A	2022/08/24	Automated Statchk
Anion and Cation Sum	CALC	8165608	N/A	2022/08/24	Automated Statchk
Nitrogen Ammonia - water	KONE	8172977	N/A	2022/08/18	Tais Gomes
Nitrogen - Nitrate + Nitrite	KONE	8176780	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrite	KONE	8176782	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrate (as N)	CALC	8165609	N/A	2022/08/23	Automated Statchk
pH	AT	8173966	N/A	2022/08/18	Nachiketa Gohil
Phosphorus - ortho	KONE	8176778	N/A	2022/08/22	Tais Gomes
Sat. pH and Langelier Index (@ 20C)	CALC	8165611	N/A	2022/08/24	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	8165612	N/A	2022/08/24	Automated Statchk
Reactive Silica	KONE	8176776	N/A	2022/08/22	Tais Gomes
Sulphate	KONE	8176770	N/A	2022/08/22	Tais Gomes
Total Dissolved Solids (TDS calc)	CALC	8165613	N/A	2022/08/24	Automated Statchk
Organic carbon - Total (TOC)	TOCV/NDIR	8176263	N/A	2022/08/22	Janvi Shah
Turbidity	TURB	8175638	N/A	2022/08/19	Nachiketa Gohil

Bureau Veritas ID: TLD374 Dup
Sample ID: MW-01
Matrix: Water

Collected: 2022/08/12
Shipped:
Received: 2022/08/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury - Dissolved (CVAA,LL)	CV/AA	8175869	2022/08/22	2022/08/22	Faheema Joga

Bureau Veritas ID: TLD377
Sample ID: MW-02
Matrix: Water

Collected: 2022/08/12
Shipped:
Received: 2022/08/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	8165603	N/A	2022/08/23	Automated Statchk
Alkalinity	AT	8179256	N/A	2022/08/22	Nachiketa Gohil
Chloride	KONE	8176763	N/A	2022/08/22	Tais Gomes
Colour	KONE	8176777	N/A	2022/08/22	Tais Gomes
Conductance - water	AT	8179247	N/A	2022/08/22	Nachiketa Gohil
Hardness (calculated as CaCO3)		8165606	N/A	2022/08/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	8175869	2022/08/22	2022/08/22	Faheema Joga
Metals Water Diss. MS (as rec'd)	CICP/MS	8179274	N/A	2022/08/23	Jacob Henley
Ion Balance (% Difference)	CALC	8165607	N/A	2022/08/24	Automated Statchk
Anion and Cation Sum	CALC	8165608	N/A	2022/08/24	Automated Statchk

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Bureau Veritas Job #: C2M9772
Report Date: 2022/08/24

Stantec Consulting Ltd
Client Project #: 121417326.500.100
Sampler Initials: MA

TEST SUMMARY

Bureau Veritas ID: TLD377
Sample ID: MW-02
Matrix: Water

Collected: 2022/08/12
Shipped:
Received: 2022/08/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrogen Ammonia - water	KONE	8173114	N/A	2022/08/18	Tais Gomes
Nitrogen - Nitrate + Nitrite	KONE	8176780	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrite	KONE	8176782	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrate (as N)	CALC	8165609	N/A	2022/08/23	Automated Statchk
pH	AT	8179255	N/A	2022/08/22	Nachiketa Gohil
Phosphorus - ortho	KONE	8176778	N/A	2022/08/22	Tais Gomes
Sat. pH and Langelier Index (@ 20C)	CALC	8165611	N/A	2022/08/24	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	8165612	N/A	2022/08/24	Automated Statchk
Reactive Silica	KONE	8176776	N/A	2022/08/22	Tais Gomes
Sulphate	KONE	8176770	N/A	2022/08/22	Tais Gomes
Total Dissolved Solids (TDS calc)	CALC	8165613	N/A	2022/08/24	Automated Statchk
Organic carbon - Total (TOC)	TOCV/NDIR	8179654	N/A	2022/08/22	Janvi Shah
Turbidity	TURB	8175638	N/A	2022/08/19	Nachiketa Gohil

Bureau Veritas ID: TLD378
Sample ID: MW-03
Matrix: Water

Collected: 2022/08/12
Shipped:
Received: 2022/08/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	8165603	N/A	2022/08/19	Automated Statchk
Alkalinity	AT	8173973	N/A	2022/08/18	Nachiketa Gohil
Chloride	KONE	8176763	N/A	2022/08/22	Tais Gomes
Colour	KONE	8176777	N/A	2022/08/22	Tais Gomes
Conductance - water	AT	8173961	N/A	2022/08/18	Nachiketa Gohil
Hardness (calculated as CaCO3)		8165606	N/A	2022/08/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	8175869	2022/08/22	2022/08/22	Faheema Joga
Metals Water Diss. MS (as rec'd)	CICP/MS	8179274	N/A	2022/08/23	Jacob Henley
Ion Balance (% Difference)	CALC	8165607	N/A	2022/08/24	Automated Statchk
Anion and Cation Sum	CALC	8165608	N/A	2022/08/24	Automated Statchk
Nitrogen Ammonia - water	KONE	8173114	N/A	2022/08/18	Tais Gomes
Nitrogen - Nitrate + Nitrite	KONE	8176780	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrite	KONE	8176782	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrate (as N)	CALC	8165609	N/A	2022/08/23	Automated Statchk
pH	AT	8173966	N/A	2022/08/18	Nachiketa Gohil
Phosphorus - ortho	KONE	8176778	N/A	2022/08/22	Tais Gomes
Sat. pH and Langelier Index (@ 20C)	CALC	8165611	N/A	2022/08/24	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	8165612	N/A	2022/08/24	Automated Statchk
Reactive Silica	KONE	8176776	N/A	2022/08/22	Tais Gomes
Sulphate	KONE	8176770	N/A	2022/08/22	Tais Gomes
Total Dissolved Solids (TDS calc)	CALC	8165613	N/A	2022/08/24	Automated Statchk
Organic carbon - Total (TOC)	TOCV/NDIR	8173959	N/A	2022/08/18	Janvi Shah
Turbidity	TURB	8175638	N/A	2022/08/19	Nachiketa Gohil

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Bureau Veritas Job #: C2M9772
Report Date: 2022/08/24

Stantec Consulting Ltd
Client Project #: 121417326.500.100
Sampler Initials: MA

TEST SUMMARY

Bureau Veritas ID: TLD379
Sample ID: MW-04
Matrix: Water

Collected: 2022/08/12
Shipped:
Received: 2022/08/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	8165603	N/A	2022/08/19	Automated Statchk
Alkalinity	AT	8173973	N/A	2022/08/18	Nachiketa Gohil
Chloride	KONE	8176763	N/A	2022/08/22	Tais Gomes
Colour	KONE	8176777	N/A	2022/08/22	Tais Gomes
Conductance - water	AT	8173961	N/A	2022/08/18	Nachiketa Gohil
Hardness (calculated as CaCO3)		8165606	N/A	2022/08/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	8175869	2022/08/22	2022/08/22	Faheema Joga
Metals Water Diss. MS (as rec'd)	CICP/MS	8179274	N/A	2022/08/23	Jacob Henley
Ion Balance (% Difference)	CALC	8165607	N/A	2022/08/24	Automated Statchk
Anion and Cation Sum	CALC	8165608	N/A	2022/08/24	Automated Statchk
Nitrogen Ammonia - water	KONE	8173114	N/A	2022/08/18	Tais Gomes
Nitrogen - Nitrate + Nitrite	KONE	8176780	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrite	KONE	8176782	N/A	2022/08/22	Tais Gomes
Nitrogen - Nitrate (as N)	CALC	8165609	N/A	2022/08/23	Automated Statchk
pH	AT	8173966	N/A	2022/08/18	Nachiketa Gohil
Phosphorus - ortho	KONE	8176778	N/A	2022/08/22	Tais Gomes
Sat. pH and Langelier Index (@ 20C)	CALC	8165611	N/A	2022/08/24	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	8165612	N/A	2022/08/24	Automated Statchk
Reactive Silica	KONE	8176776	N/A	2022/08/22	Tais Gomes
Sulphate	KONE	8176770	N/A	2022/08/22	Tais Gomes
Total Dissolved Solids (TDS calc)	CALC	8165613	N/A	2022/08/24	Automated Statchk
Organic carbon - Total (TOC)	TOCV/NDIR	8176263	N/A	2022/08/22	Janvi Shah
Turbidity	TURB	8175638	N/A	2022/08/19	Nachiketa Gohil

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GENERAL COMMENTS

Sample TLD377 [MW-02] : ortho-Phosphate > Phosphorus: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample TLD378 [MW-03] : ortho-Phosphate > Phosphorus: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample TLD379 [MW-04] : NOX < NO2 : Both values fall within the method uncertainty for duplicates and are likely equivalent. ortho-Phosphate > Phosphorus: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Bureau Veritas Job #: C2M9772
Report Date: 2022/08/24

QUALITY ASSURANCE REPORT

Stantec Consulting Ltd
Client Project #: 121417326.500.100
Sampler Initials: MA

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8172977	Nitrogen (Ammonia Nitrogen)	2022/08/18	NC	80 - 120	102	80 - 120	<0.050	mg/L	0.38	20		
8173114	Nitrogen (Ammonia Nitrogen)	2022/08/18	NC	80 - 120	95	80 - 120	<0.050	mg/L	3.7	20		
8173959	Total Organic Carbon (C)	2022/08/18	95	85 - 115	103	80 - 120	<0.50	mg/L	0.87	15		
8173961	Conductivity	2022/08/18			100	80 - 120	1.1	uS/cm	0.30	10		
8173966	pH	2022/08/18			100	97 - 103			0.32	N/A		
8173973	Total Alkalinity (Total as CaCO3)	2022/08/18			99	80 - 120	<2.0	mg/L	5.0	20		
8175638	Turbidity	2022/08/19			101	80 - 120	<0.10	NTU	2.3	20	111	80 - 120
8175869	Dissolved Mercury (Hg)	2022/08/22	102	80 - 120	102	80 - 120	<0.013	ug/L	0	20		
8176263	Total Organic Carbon (C)	2022/08/22	95	85 - 115	99	80 - 120	<0.50	mg/L				
8176763	Dissolved Chloride (Cl-)	2022/08/22	96	80 - 120	95	80 - 120	<1.0	mg/L	1.8	20		
8176770	Dissolved Sulphate (SO4)	2022/08/22	105	80 - 120	103	80 - 120	<2.0	mg/L	4.4	20		
8176776	Reactive Silica (SiO2)	2022/08/22	88	80 - 120	94	80 - 120	<0.50	mg/L	0.90	20		
8176777	Colour	2022/08/22			99	80 - 120	<5.0	TCU	NC	20		
8176778	Orthophosphate (P)	2022/08/22	103	80 - 120	102	80 - 120	<0.010	mg/L	3.1	20		
8176780	Nitrate + Nitrite (N)	2022/08/22	98	80 - 120	102	80 - 120	<0.050	mg/L	NC	20		
8176782	Nitrite (N)	2022/08/22	96	80 - 120	99	80 - 120	<0.010	mg/L	NC	20		
8179247	Conductivity	2022/08/22			101	80 - 120	<1.0	uS/cm	0	10		
8179255	pH	2022/08/22			100	97 - 103			0.34	N/A		
8179256	Total Alkalinity (Total as CaCO3)	2022/08/22			100	80 - 120	<2.0	mg/L	NC	20		
8179274	Dissolved Aluminum (Al)	2022/08/23	103	80 - 120	107	80 - 120	<5.0	ug/L	0.79	20		
8179274	Dissolved Antimony (Sb)	2022/08/23	101	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
8179274	Dissolved Arsenic (As)	2022/08/23	98	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
8179274	Dissolved Barium (Ba)	2022/08/23	99	80 - 120	100	80 - 120	<1.0	ug/L	0.027	20		
8179274	Dissolved Beryllium (Be)	2022/08/23	105	80 - 120	102	80 - 120	<0.10	ug/L	NC	20		
8179274	Dissolved Bismuth (Bi)	2022/08/23	95	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
8179274	Dissolved Boron (B)	2022/08/23	104	80 - 120	101	80 - 120	<50	ug/L	NC	20		
8179274	Dissolved Cadmium (Cd)	2022/08/23	90	80 - 120	102	80 - 120	<0.010	ug/L	NC (1)	20		
8179274	Dissolved Calcium (Ca)	2022/08/23	NC	80 - 120	104	80 - 120	<100	ug/L	2.3	20		
8179274	Dissolved Chromium (Cr)	2022/08/23	97	80 - 120	104	80 - 120	<1.0	ug/L	0.71	20		
8179274	Dissolved Cobalt (Co)	2022/08/23	96	80 - 120	101	80 - 120	<0.40	ug/L	NC	20		
8179274	Dissolved Copper (Cu)	2022/08/23	94	80 - 120	103	80 - 120	<0.50	ug/L	2.7	20		
8179274	Dissolved Iron (Fe)	2022/08/23	101	80 - 120	107	80 - 120	<50	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8179274	Dissolved Lead (Pb)	2022/08/23	98	80 - 120	103	80 - 120	<0.50	ug/L	NC	20		
8179274	Dissolved Magnesium (Mg)	2022/08/23	100	80 - 120	111	80 - 120	<100	ug/L	2.7	20		
8179274	Dissolved Manganese (Mn)	2022/08/23	100	80 - 120	105	80 - 120	<2.0	ug/L	NC	20		
8179274	Dissolved Molybdenum (Mo)	2022/08/23	NC	80 - 120	101	80 - 120	<2.0	ug/L	0.39	20		
8179274	Dissolved Nickel (Ni)	2022/08/23	96	80 - 120	104	80 - 120	<2.0	ug/L	NC	20		
8179274	Dissolved Phosphorus (P)	2022/08/23	106	80 - 120	111	80 - 120	<100	ug/L	NC	20		
8179274	Dissolved Potassium (K)	2022/08/23	NC	80 - 120	105	80 - 120	<100	ug/L	0.23	20		
8179274	Dissolved Selenium (Se)	2022/08/23	99	80 - 120	106	80 - 120	<0.50	ug/L	0.11	20		
8179274	Dissolved Silver (Ag)	2022/08/23	96	80 - 120	103	80 - 120	<0.10	ug/L	NC	20		
8179274	Dissolved Sodium (Na)	2022/08/23	NC	80 - 120	107	80 - 120	<100	ug/L	1.4	20		
8179274	Dissolved Strontium (Sr)	2022/08/23	NC	80 - 120	100	80 - 120	<2.0	ug/L	0.49	20		
8179274	Dissolved Thallium (Tl)	2022/08/23	97	80 - 120	99	80 - 120	<0.10	ug/L	NC	20		
8179274	Dissolved Tin (Sn)	2022/08/23	103	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
8179274	Dissolved Titanium (Ti)	2022/08/23	103	80 - 120	107	80 - 120	<2.0	ug/L	NC	20		
8179274	Dissolved Uranium (U)	2022/08/23	104	80 - 120	108	80 - 120	<0.10	ug/L	NC	20		
8179274	Dissolved Vanadium (V)	2022/08/23	99	80 - 120	103	80 - 120	<2.0	ug/L	0.88	20		
8179274	Dissolved Zinc (Zn)	2022/08/23	99	80 - 120	105	80 - 120	<5.0	ug/L	NC	20		
8179654	Total Organic Carbon (C)	2022/08/22	95	85 - 115	98	80 - 120	<0.50	mg/L	3.2	15		

N/A = Not Applicable

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Elevated reporting limit due to sample matrix.

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Janah Rhyno, Metals Supervisor-Bedford

Bureau Veritas Proprietary Software
Logiciel Propriétaire de Bureau Veritas

Automated Statchk

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APPENDIX E

Pre- and Post-Development Water Balance

Surface Water Technical Report, Seabrook Quarry Expansion Project; Digby, Nova Scotia

Final Report

April 2023

Prepared for:

Nova Construction
3098 Post Road,
Antigonish, NS
B2G 2L7

Prepared by:

Stantec Consulting

File: 121417326

The conclusions in the Report titled Water Balance Report, Surface Water Technical Report for Seabrook Quarry Expansion are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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Digitally signed by Nicole Bell
Date: 2023.04.12 13:32:34 -03'00'

Prepared by _____
(signature)

Nicole Bell, M.A.Sc., E.I.T

Digitally signed by McGuigan, Janeen
Date: 2023.04.13 10:35:59 -03'00'

Reviewed by _____
(signature)

Janeen McGuigan, M.A.Sc., P.Eng.

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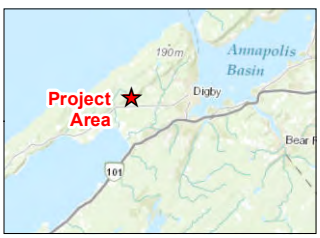
LIST OF APPENDICES

1.0 INTRODUCTION

The Seabrook Quarry is owned and operated by Nova Construction Co. Ltd. (Nova Construction) and has been in operation in Seabrook, Digby County, Nova Scotia since acquisition in 2019 (Figure 1). Nova Construction currently produces an average of approximately 150,000 to 200,000 tonnes of aggregate annually from its existing quarry under the industrial approval (IA) #2021-2794715-00. To enable quarrying operations to continue at the current rate, Nova Construction is proposing to expand the quarry footprint from 3.99 hectares (ha) to approximately 35 ha, including the associated overburden storage area and aggregate stockpiles and overburden storage areas ("the Project"). The direction of the proposed expansion is primarily to the north and west of the existing quarry footprint.

This report describes the proposed water balance for the expanded quarry footprint in a climate normal year for operations. The objective of the water balance is to understand the overall water management at Seabrook Quarry under pre- and post-development conditions. The water balance was prepared as an appended document in support of the Environmental Assessment (EA) for the Seabrook Quarry expansion.



Project Area
Pre-Development Watershed
Post-Development Watershed

Road / Highway
Local Road
Resource Road
Watercourse
Waterbody
Wetlands
Property Boundary

0 0.5 1 Kilometres
(At original document size of 8.5x11)
1:50,000

N

Stantec

Project Location
Seabrook
Digby, Nova Scotia

Client/Project 121417326-019
Nova Construction
Seabrook Quarry Expansion

Figure No.
1

Title
Project Location and Drainage Areas

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Stantec; Nova Scotia Environment and Climate Change; Nova Scotia Natural Resources and Renewables; Natural Resources Canada CanVec.
3. Base Map and Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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1.1 EXISTING CONDITIONS

The Seabrook Quarry is located in Digby County, Nova Scotia. The existing quarry (3.99 ha) is located within a watershed with an area of 1,150 ha (WS-1) and is comprised of agricultural land (32.6 ha), roads and buildings (3.94 ha), the existing quarry and nearby quarries (10.59 ha), and forest (1,103 ha). There is a topographic watershed divide immediately northwest of the existing quarry footprint. Pre-development land use is summarized in Table 1.1. WS-1 drains to drains to Henderson's Brook, into St. Mary's Bay and south to the Atlantic Ocean. As shown in Table 1.1, the Project is not expected to impact WS-1.

Table 1.1 Land Use for Pre-Development Watershed

Land Use	WS-1	
	Pre-Development	Post-Development
Total Watershed Area (ha)	1,150	1,150
Forested (ha)	1,103	1,103
Agriculture (ha)	32.6	32.6
Roads / Buildings (ha)	3.94	3.94
Gravel Pit / Quarry (ha)	10.59	10.59

1.2 PROPOSED DEVELOPMENT

The proposed expansion area for the Seabrook Quarry is 31.1 ha in addition to the existing 3.99 ha for a total project area of 35 ha. As the existing quarry is located on the edge of a watershed divide, the expansion of the quarry will extend fully into WS-2. The post-development land use of WS-2 includes agricultural land (13.2 ha), roads and buildings (3.8 ha), forest (1,172 ha), and gravel/quarry (33.4 ha). The gravel/quarry land in the proposed-development watershed includes existing nearby quarries, and the proposed expansion area. The land use for the proposed development watershed is summarized in Table 1.2. The expansion alters approximately 31.0 ha of forested land use within the WS-2 watershed. WS-2 drains through Post Brook, into St. Mary's Bay, and south to the Atlantic Ocean.

Table 1.2 Land Use for Post-Development Watershed

Land Use	WS-2	
	Pre-Development	Post-Development
Total Watershed Area (ha)	1,191	1,191
Forested (ha)	1,172	1,140
Agriculture (ha)	13.3	13.3
Roads / Buildings (ha)	3.8	3.8
Gravel Pit / Quarry (ha)	2.4	33.4

As the quarry expansion solely affects WS-2 (i.e., no land disturbance or land use change in WS-1), a water balance was completed for WS-2 only, as the pre- and post-development water balance conditions for WS-1 do not change from current conditions.

2.0 WATER BALANCE METHODOLOGY

A spreadsheet-based monthly water balance model for pre- and post-development conditions based on the Thornthwaite and Mather method was developed to estimate evapotranspiration, surface runoff, infiltration, and streamflow (Mather, 1969, 1978 and 1979).

The amount of water flowing past a given point on a stream during a specified period can be described by the following, the water balance equation (NRCS 2009):

$$Q = P - ET - G - DS - D + I$$

Where,

Q = streamflow
P = precipitation
ET = evapotranspiration
G = net groundwater export, assumed to be 0
DS = change in storage
D = watershed diversions, assumed to be 0
I = watershed import, assumed to be 0

Although groundwater recharge and groundwater discharge may not balance within the temporal confines of a climate year, in the long-term for the Project Study Area case, all groundwater is assumed to flow in relatively localized groundwater watersheds which are correlated to the surface watersheds, and all baseflow returns to the local watershed into which its source infiltration occurred. As a result of this convention, the water balance can be further simplified into ET, surface runoff and change in storage which includes all infiltration-based mechanisms: soil moisture storage, interflow and groundwater recharge. It was assumed that runoff, and evapotranspiration are negligible in months with average monthly temperatures below 0°C and infiltration is reduced by 50%. In the context of a quarry development, diversions or import may result from pumping activities that occur in one watershed being discharged to an adjacent watershed; however, there are no identified imports or diversions in WS-2.

2.1 CLIMATE

Project Area climatic and hydrologic conditions are required for the water balance analysis. Baseline climate and hydrology conditions at the Seabrook Quarry and relevant data required for water balance analysis are presented in this section.

Environment Canada's Bear River climate station (Station ID 8200500) and Annapolis Royal climate station (Station ID 8200100) were used to characterize the precipitation and temperature climatic conditions, respectively, within the Project Area. The Bear River station is located approximately 17 km east of the Project Area, and reports precipitation data. The Annapolis Royal climate station is located approximately 30 km northeast of the Project Area, and reports temperature data. As presented in Table 2.1, the climate normal precipitation from the Bear River Climate Station is approximately 1341.9 mm and the average snowfall of 198.9 cm, reported within the climate normal data period of 1981 to 2010 (climate normal, Environment Canada 2022a, b). Climate normal temperatures typically drop below zero between the months of December through March each year at the Annapolis Royal Climate Station.

Table 2.1 Representative Climate Values for Seabrook Quarry

Climate Normals (1981- 2010) at Bear River Climate Station													
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Rainfall (mm)	83.7	66.2	95.6	98.5	99.0	88.9	79.6	77.8	114.8	111.3	129.3	99.2	1143.9
Snowfall (cm)	63.7	42.1	32.7	9.1	0.3	0.0	0.0	0.0	0.0	0.0	7.7	43.3	198.9
Precipitation (mm)	147.4	108.3	128.3	107.1	99.4	88.9	79.6	77.8	114.8	111.3	137.0	142.1	1341.9
Extreme Snow Depth (cm)	48	70	49	26	3	0	0	0	0	1	24	50	70
Climate Normals (1981 - 2010) at Annapolis Royal Climate Station													
Temperature (°C)	-4.3	-3.8	-0.3	5.1	11.1	15.5	18.5	18.6	14.9	9.6	4.9	-1.1	7.4

2.2 EVAPOTRANSPIRATION

Monthly potential evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from vegetation-covered area assuming there is available water to satisfy full evaporation potential (Thornthwaite 1948; Mather 1978). The Thornthwaite PET is calculated using the following equation:

$$PET\ (unadjusted) = 16\left(\frac{10T}{I}\right)^{a}$$

Where, T represents monthly temperature, I is the heat index per month, and a is calculated using the heat index (I) in the following formula:

$$a = 6.75\ \times 10^{-7} I^3 - 7.71 \times 10^{-5} I^2 + 1.792 \times 10^{-2} I + 0.49239$$

PET is then adjusted for changes in available daylight hours associated with the local climate using an adjustment factor. Actual evapotranspiration (AET) is used in the water balance equation to represent the actual losses due to evapotranspiration as it assumes a limit on available water and an associated reduction in evapotranspiration. AET accounts for losses and withdrawals from soil moisture storage, assuming AET only occurs after the required soil moisture storage capacity is satisfied and a surplus of water is available for withdrawal and evapotranspiration. This soil-moisture storage withdrawal (STW) is quantified in the following formula:

$$STW = ST_{i-1} - \left[abs(P_{total} - PET)x\left(\frac{ST_{i-1}}{STC}\right)\right]$$

Where, ST_{i-1} represents soil moisture storage from the previous month and STC represents the soil moisture capacity.

2.3 INFILTRATION AND RUNOFF

Precipitation that falls on site is simplistically fractioned into two primary flow paths: infiltration and surface runoff. Infiltration and surface runoff are directly related to surface cover, topography and underlying soil type and are inversely related to each other, meaning an increase infiltration results in a proportional decrease in surface runoff. Infiltrated water recharges aquifers and routes via interflow and discharge to waterbodies and watercourses (baseflow). Surface water flows overland to watercourses and waterbodies, increasing stream flow and lake/pond volume during precipitation events. Runoff coefficients, typically used in the rational runoff surface flow calculation method, are used to describe the fraction of precipitation that generates surface flow and are selected for a specific land use type and land slope (ODOT 2014).

Infiltration factors described by the Ontario Ministry of the Environment (OMOE 2003) are used to determine the fraction of water surplus (excess of precipitation over evapotranspiration, PET) that infiltrates into the ground and the fraction that runs off to nearby streams. Infiltration factors include topography, soil and vegetative cover types.

A weighted runoff coefficient is developed considering land use type and area for both the pre- and post-development scenarios to quantify the fraction of precipitation that generates surface runoff. Infiltration factors have been used as a verification of surface runoff coefficients selected for each land use.

The runoff coefficients were calculated based on land use for pre- and post-development conditions. The runoff coefficients for each land use type were chosen using the “hilly” slope condition and the rational method runoff coefficients (ODOT 2014). Runoff coefficients for pre- and post-construction are shown in Table 2.2.

Table 2.2 Weighted Runoff Coefficients and Infiltration Factors for Pre- and Post-Development Water Balance

Land Use Type	Runoff Coefficient[1]	Pre-Development Area (ha)	Post-Development Area (ha)
Forested	0.40	1,171.6	1,140.6
Agricultural	0.55	13.3	13.3
Impervious / Roads	0.90	3.8	3.8
Gravel Pit / Quarry	0.85	2.4	33.4
Weighted Runoff Coefficient		0.40	0.42
Infiltration Factor		0.60	0.58
[1] Runoff Coefficients from ODOT 2014			

2.4 CHANGE IN STORAGE

For the purpose of the water balance, change in storage refers to infiltration-based water quantities which can be quantified in soil moisture storage and groundwater. Soil moisture storage was estimated using the values of water holding capacity of the soil types identified in the Project Area and the Stormwater Management Planning and Design Manual (OMOE 2003). Based on the methodology outlined by OMOE (2003), the annual change in soil moisture storage is 0; however, soil moisture is used on a monthly timestep to quantify AET. The pre-development soil moisture storage capacity for the study area is assumed as 400 mm (conservatively assumed to be 300 mm post-development) based on the surficial geology in the surrounding watershed, which included fluvial sandstone and conglomerate, with minor deltaic-lacustrine deposits (OMOE 2003).

Groundwater is fractioned into a quantity of water that is temporarily retained in the ground, eventually flowing to a surface discharge point in the form of baseflow, and a quantity that percolates deeper into the aquifer as groundwater recharge. Baseflow quantification is assumed to be approximately 16% of the total available rainfall precipitation (Geological Survey of Canada 2012). The remaining volume of infiltrated water is assumed to be largely attributed to groundwater recharge. A change in groundwater quantity may result from changes to land cover or groundwater dewatering (pumping) activities.

3.0 WATER BALANCE RESULTS

The environmental water balance was modeled on a monthly basis using a spreadsheet-based water balance model. The water balance model requires input of monthly precipitation, average monthly temperature, soil-moisture storage capacity, and runoff or infiltration factors. Infiltration is adjusted for winter climate conditions assuming a reduction of 50% during cold months and an increase in infiltration during spring freshet (April).

Balances have been completed for both the pre-construction and post-construction scenario, primarily modeling the effect of the change in land use from forested to quarry. The post-construction balance considers the full impact of quarry development, at a 33.4 ha expansion limit. The surface flow regime during operations is anticipated to shift from a surface runoff (minimal excavation) to a pumped flow scenario (full quarry excavation) as the quarry is developed. Through this flow regime shift, the contribution to stream flow is not anticipated to change. The primary source of supply to stream flow is anticipated to be gravity discharge from on-site sediment ponds, with ponds being supplied flow via runoff or pumped discharge depending on the phase of operations.

3.1 PRE-DEVELOPMENT WATER BALANCE RESULTS

Using the climate normal scenario from the Bear River climate station, the calculated annual Actual Evapotranspiration (AET) is 561 mm. Accounting for additional storage losses, there is a remaining 192 mm of surplus water available for infiltration.

The monthly AET, infiltration, and pre-construction surface runoff can be found in Table 3.1 below. Detailed calculations are presented in Appendix A.

Table 3.1 Pre-Development Water Balance Results for WS-2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AET (mm)	0	0	0	28	71	97	118	111	75	43	18	0	561
Infiltration (mm)	19.1	9.6	8.6	58.0	37.4	18.7	9.3	4.7	2.3	1.2	15.5	7.8	192
Infiltration (corrected for winter) (mm)	9.6	4.8	4.3	80.5	37.4	18.7	9.3	4.7	2.3	1.2	15.5	3.9	192
Pre-Development Infiltration (m^3)	113,797	56,899	51,212	959,068	445,326	222,663	111,331	55,666	27,833	13,916	185,180	46,295	2,289,186
Pre-Development Surface Runoff (m^3)	154,388	77,194	69,479	468,647	302,085	151,043	75,521	37,761	18,880	9,440	125,616	62,808	1,552,862

3.2 POST-DEVELOPMENT WATER BALANCE RESULTS

In the post-development scenario, the quarry footprint is proposed to expand to include an additional watershed (WS-2), as described in Table 3.2. Accounting for additional storage losses and changes site land cover, there is a remaining 188 mm of surplus water available for infiltration.

The monthly distribution of AET, infiltration, and post-development surface runoff are provided in Table 3.2. Detailed calculations are presented in Appendix A.

Table 3.2 Post-Development Water Balance Results for WS-2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AET (mm)	0.0	0.0	0.0	27.9	71.2	97.1	116.8	109.1	74.7	43.0	18.4	0.0	558
Infiltration (mm)	18.7	9.4	8.4	56.9	36.7	18.3	9.2	4.6	2.3	1.1	15.2	7.6	188
Infiltration (corrected for winter) (mm)	9	5	4	79	37	18	9	5	2	1	15	4	188
Post-Development Infiltration (m^3)	111,560	55,780	50,205	940,216	436,572	218,286	109,143	54,571	27,286	13,643	181,540	45,385	2,244,187
Post-Development Surface Runoff (m^3)	158,862	79,431	71,492	482,228	310,839	155,420	77,710	38,855	19,427	9,714	129,257	64,628	1,597,862

3.3 ESTIMATION OF GROUNDWATER BASEFLOW AND RECHARGE

A fraction of the monthly precipitation is infiltrated into the subsurface and becomes a baseflow source to adjacent watercourses or percolates deeper into the aquifer as recharge. The infiltration component of the water balance was fractioned into an estimate of baseflow and groundwater recharge, as a high-level quantification of potential changes resulting from development. The recharge component may range from approximately 6% to 16% of total available precipitation (Shawinigan Engineering Ltd. .1980; Rivard et al. 2014; Geological Survey of Canada 2012) within areas of Nova Scotia. A value of 6% was used for estimation purposes as higher estimates of recharge are typically associated with higher infiltration quantities than what is currently estimated for this site. Per Rivard et al., the baseflow component is then estimated using the relationship of recharge (W) = I - R_{sub}, where I = infiltration and R_{sub} = baseflow. An increase in site imperviousness as a result of quarry development reduces the post-development infiltration volume and shifts a fraction of the baseflow to surface runoff.

Table 3.3 Pre-and Post-Development Groundwater Recharge and Baseflow Estimates

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Recharge (m^3) (assume 6%)	105,337	77,395	91,688	76,538	71,035	63,531	56,885	55,599	82,040	79,539	97,905	101,550	959,042
Recharge (mm)	8.8	6.5	7.7	6.4	6.0	5.3	4.8	4.7	6.9	6.7	8.2	8.5	81
Pre-Devel. Baseflow (m^3)	8,460	0	0	882,531	374,291	159,132	54,446	67	0	0	87,275	0	1,566,201
Pre-Devel. Baseflow (mm)	0.7	0.0	0.0	74.1	31.4	13.4	4.6	0.0	0.0	0.0	7.3	0.0	131.50
Post-Devel. Baseflow (m^3)	6,223	0	0	863,678	365,537	154,755	52,258	0	0	0	83,635	0	1,526,085
Post-Devel. Baseflow (mm)	0.5	0.0	0.0	72.5	30.7	13.0	4.4	0.0	0.0	0.0	7.0	0.0	128.1

Groundwater dewatering is anticipated as a result of the Project although quantities are expected to be limited. Monitoring at the onsite monitoring wells suggests that the average water table is approximately 4 m below surface. Excavation in the Project Area will require collection of groundwater seepage with discharge to an approved surface water body. As the size of the quarry increases, there is potential to increase groundwater gradients towards the open face of the bedrock, resulting in a water table depression surrounding the quarry. Dewatering is anticipated to remove a fraction of recharge from the infiltration-component of the water balance.

3.4 PRE-DEVELOPMENT TO POST-DEVELOPMENT CHANGES

The overall land use change resulting from the quarry expansion removes approximately 31 ha of forested area from the WS-2 watershed and increases the surface runoff from the site. From the water balance analysis, the pre- and post-development land use changes result in the alteration of 2% of the available forested land to a semi-impermeable land use. To quantify the effect, AET, infiltration, runoff, and baseflow values for the proposed Project were compared. Based on the results of the analysis, the proposed development will produce a minor increase in runoff and a reduction in infiltration within the WS-2 watershed. The reduction in infiltration is attributed to the decrease in forested land use and increase in imperviousness within WS-2. The overall reduction in infiltration of approximately 45,000 m^3/year or an average of 3,750 m^3/month. This is largely attributed to baseflow removal through future site dewatering activities.

4.0 CONCLUSION

To enable quarrying operations to continue at the current rate, Nova Construction is proposing to expand the quarry footprint from 3.99 hectares (ha) to approximately 35 ha, including the associated overburden storage area and aggregate stockpiles and overburden storage areas. The results of the water balance for the expanded quarry footprint in a climate normal year for operations have indicated the proposed expansion will produce a minor increase in surface runoff and a reduction in infiltration. The results of the water balance are attributed to the decrease in forested land use area in the post-development scenario, as approximately 31 ha of forested land use will be converted to quarry, or a conversion of approximately 2% of the watershed forested area.

Considering the groundwater dewatering at the site that is anticipated as a result of the Project, the loss of baseflow will be supplemented with an increase in surface water discharge to the stream using dewatering flow. It is anticipated this flow will be collected and diverted from a sedimentation pond on site after undergoing settling of suspended solids.

5.0 CLOSURE

This report has been prepared for the sole benefit of Nova Construction and the Nova Scotia Department of Environment and Climate Change. This report may not be used by any other person or entity without the express written consent of Stantec Consulting Ltd. and Nova Construction/NSECC.

Any use that a third party makes of this report, or any reliance on decisions made based on it, are the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions taken, based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Conclusions and recommendations presented in this report should not be construed as legal advice.

The conclusions presented in this report consist of Stantec's professional opinion based on the data obtained from the work. If any conditions become apparent that differ from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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APPENDIX A

Water Balance Calculations

PRE-DEVELOPMENT

400

	T (degC)	i	L	N	a	PET adj Factor	PET adj mm/ month	P	P-PET	APWL	SMC	Soil Moisture Storage	Delta SMS	SMW	AET (SUM)	Water Surplus	SMRO	RO	Total RO
Jan	-4.3	0.0	8.0	31.0	0.5	0.7	0.0	147.4	147.4	0.0	400	547.4	0.0	342.3	0.0	0.0	25.7	6.4	32.1
Feb	-3.8	0.0	10.0	28.0	0.5	0.8	0.0	108.3	108.3	0.0	400	508.3	0.0	399.2	0.0	0.0	12.8	3.2	16.0
Mar	-0.3	0.0	11.5	31.0	0.5	1.0	0.0	128.3	128.3	0.0	400	528.3	0.0	345.3	0.0	0.0	12.8	1.6	14.4
Apr	5.1	1.0	13.5	30.0	0.5	1.1	27.9	107.1	79.2	0.0	400	400.0	0.0	423.7	27.9	79.2	57.7	39.6	97.4
May	11.1	3.3	15.0	31.0	0.6	1.3	71.2	99.4	28.2	0.0	400	400.0	0.0	371.8	71.2	28.2	28.9	33.9	62.8
Jun	15.5	5.5	15.0	30.0	0.6	1.3	97.2	88.9	-8.3	-8.3	400	391.8	-8.2	391.7	97.1	0.0	14.4	16.9	31.4
Jul	18.5	7.2	15.0	31.0	0.6	1.3	120.5	79.6	-40.9	-49.3	400	353.6	-38.1	351.7	117.7	0.0	7.2	8.5	15.7
Aug	18.6	7.3	14.5	31.0	0.6	1.2	117.2	77.8	-39.4	-88.6	400	320.5	-33.2	318.8	111.0	0.0	3.6	4.2	7.8
Sep	14.9	5.2	12.0	30.0	0.6	1.0	74.7	114.8	40.1	-48.5	400	354.3	33.8	288.3	74.7	0.0	1.8	2.1	3.9
Oct	9.6	2.7	10.5	31.0	0.5	0.9	43.0	111.3	68.3	0.0	400	422.6	0.0	293.8	43.0	0.0	0.9	1.1	2.0
Nov	4.9	1.0	9.0	31.0	0.5	0.8	18.4	137.0	118.6	0.0	400	400.0	0.0	297.4	18.4	50.2	0.5	25.6	26.1
Dec	-1.1	0.0	8.0	31.0	0.5	0.7	0.0	142.1	142.1	0.0	400	542.1	0.0	257.9	0.0	0.0	0.2	12.8	13.0
	sum i=	**33.3555**					**570.1**	**1342.0**	**771.9**						**561.0**	**157.6**	**166.6**	**156.0**	**322.6**

POST-DEVELOPMENT

300

	T (degC)	i	L	N	a	PET adj Factor	PET adj mm/ month	P	P-PET	APWL	SMC	Soil Moisture Storage	Delta SMS	SMW	AET (SUM)	Water Surplus	SMRO	RO	Total RO
Jan	-4.3	0.0	8.0	31.0	0.5	0.7	0.0	147.4	147.4	0.0	300	447.4	0.0	224.9	0.0	0.0	25.7	6.4	32.1
Feb	-3.8	0.0	10.0	28.0	0.5	0.8	0.0	108.3	108.3	0.0	300	408.3	0.0	285.9	0.0	0.0	12.8	3.2	16.0
Mar	-0.3	0.0	11.5	31.0	0.5	1.0	0.0	128.3	128.3	0.0	300	428.3	0.0	233.7	0.0	0.0	12.8	1.6	14.4
Apr	5.1	1.0	13.5	30.0	0.5	1.1	27.9	107.1	79.2	0.0	300	300.0	0.0	315.2	27.9	79.2	57.7	39.6	97.4
May	11.1	3.3	15.0	31.0	0.6	1.3	71.2	99.4	28.2	0.0	300	300.0	0.0	271.8	71.2	28.2	28.9	33.9	62.8
Jun	15.5	5.5	15.0	30.0	0.6	1.3	97.2	88.9	-8.3	-8.3	300	291.8	-8.2	291.7	97.1	0.0	14.4	16.9	31.4
Jul	18.5	7.2	15.0	31.0	0.6	1.3	120.5	79.6	-40.9	-49.3	300	254.6	-37.2	252.0	116.8	0.0	7.2	8.5	15.7
Aug	18.6	7.3	14.5	31.0	0.6	1.2	117.2	77.8	-39.4	-88.6	300	223.3	-31.3	221.2	109.1	0.0	3.6	4.2	7.8
Sep	14.9	5.2	12.0	30.0	0.6	1.0	74.7	114.8	40.1	-48.5	300	255.2	31.9	193.4	74.7	0.0	1.8	2.1	3.9
Oct	9.6	2.7	10.5	31.0	0.5	0.9	43.0	111.3	68.3	0.0	300	366.5	0.0	197.0	43.0	0.0	0.9	1.1	2.0
Nov	4.9	1.0	9.0	31.0	0.5	0.8	18.4	137.0	118.6	0.0	300	300.0	0.0	221.6	18.4	50.2	0.5	25.6	26.1
Dec	-1.1	0.0	8.0	31.0	0.5	0.7	0.0	142.1	142.1	0.0	300	442.1	0.0	157.9	0.0	0.0	0.2	12.8	13.0
							570.1	**1342.0**	**771.9**						**558.2**	**157.6**	**166.6**	**156.0**	**322.6**

PET is potential evapotranspiration, assumes available water to satisfy full evaporation potential
AET is actual evapotranspiration, assumes limited water and reduced ET

APWL Accumulated Potential Water Loss (accumulated sum of negative P-PET Values)
SMC Soil Moisture Capacity
SMS Soil Moisture Storage
Delta SMS Change in Soil Moisture Capacity
SMW Soil Moisture Storage Withdrawal

Pre-Development			**RC**
Total Watershed Area	1191.06	ha	
Forested	1171.6	ha	0.4
Agricultural	13.25	ha	0.55
Roads	3.83	ha	0.9
Gravel Pit/Quarry	2.38		0.85
sum check	1191.06		**0.404** Weighted RC
			0.596 Infiltration Factor

Post-Development			**RC**
Total Watershed .	1191.06	ha	
Forested	1140.6	ha	0.4
Agricultural	13.25	ha	0.55
Roads	3.83	ha	0.9
Quarry Pit	33.38	ha	0.85
sum check	1191.06		**0.416** Weighted RC
			0.584 Infiltration Factor

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Total Available Water (mm)	1,755,622	1,289,918	1,528,130	1,275,625	1,183,914	1,058,852	948,084	926,645	1,367,337	1,325,650	1,631,752	1,692,496	15,984,025
Total Surplus Runoff (mm)	32.1	16.0	14.4	97.4	62.8	31.4	15.7	7.8	3.9	2.0	26.1	13.0	322.6
Total Water Surplus (m3)	381,982	190,991	171,902	1,159,513	747,411	373,705	186,853	93,426	46,713	23,357	310,797	155,398	3,842,048

Pre-Development	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AET (m3)	0	0	0	331,916	848,605	1,157,046	1,402,055	1,321,498	889,562	511,563	219,428	0	6,681,674
AET (mm)	0	0	0	28	71	97	118	111	75	43	18	0	561
Infiltration (mm)	19.1	9.6	8.6	58.0	37.4	18.7	9.3	4.7	2.3	1.2	15.5	7.8	192
Infiltration (corrected for winter) (mm)	9.6	4.8	4.3	80.5	37.4	18.7	9.3	4.7	2.3	1.2	15.5	3.9	192
Pre-Development Infiltration (m3)	113,797	56,899	51,212	959,068	445,326	222,663	111,331	55,666	27,833	13,916	185,180	46,295	2,289,186
Net Precipitation as Runoff (mm)	13.0	6.5	5.8	39.3	25.4	12.7	6.3	3.2	1.6	0.8	10.5	5.3	130
Pre-Development Surface Runoff (m3)	154,388	77,194	69,479	468,647	302,085	151,043	75,521	37,761	18,880	9,440	125,616	62,808	1,552,862
Flow (m3/s)	0.0596	0.0298	0.0268	0.1808	0.1165	0.0583	0.0291	0.0146	0.0073	0.0036	0.0485	0.0242	

Post-Development	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AET (m3)	0	0	0	331,916	848,605	1,156,707	1,391,439	1,299,564	889,562	511,563	219,428	0	6,648,785
AET (mm)	0	0	0	28	71	97	117	109	75	43	18	0	558
Infiltration (mm)	18.7	9.4	8.4	56.9	36.7	18.3	9.2	4.6	2.3	1.1	15.2	7.6	188
Infiltration (corrected for winter) (mm)	9.4	4.7	4.2	78.9	36.7	18.3	9.2	4.6	2.3	1.1	15.2	3.8	188
Post-Development Infiltration (m3)	111,560	55,780	50,205	940,216	436,572	218,286	109,143	54,571	27,286	13,643	181,540	45,385	2,244,187
Net Precipitation as Runoff (mm)	13.3	6.7	6.0	40.5	26.1	13.0	6.5	3.3	1.6	0.8	10.9	5.4	134
Post-Development Surface Runoff (m3)	158,862	79,431	71,492	482,228	310,839	155,420	77,710	38,855	19,427	9,714	129,257	64,628	1,597,862
Flow (m3/s)	0.0613	0.0306	0.0276	0.1860	0.1199	0.0600	0.0300	0.0150	0.0075	0.0037	0.0499	0.0249	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Surface Runoff Difference	4,473.9	2,236.9	2,013.4	13,580.5	8,753.9	4,376.9	2,188.5	1,094.2	547.1	273.6	3,640.1	1,820.1	44,999
Infiltration Difference	-2,237	-1,118	-1,007	-18,853	-8,754	-4,377	-2,188	-1,094	-547	-274	-3,640	-910	-44,999

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Recharge (m3) (assume 6%)	105,337	77,395	91,688	76,538	71,035	63,531	56,885	55,599	82,040	79,539	97,905	101,550	959,042
Recharge (mm)	8.8	6.5	7.7	6.4	6.0	5.3	4.8	4.7	6.9	6.7	8.2	8.5	81
Pre-Development Baseflow (m3)	8,460	0	0	882,531	374,291	159,132	54,446	67	0	0	87,275	0	1,566,201
Pre-Development Baseflow (mm)	0.7	0.0	0.0	74.1	31.4	13.4	4.6	0.0	0.0	0.0	7.3	0.0	131.50
Post-Development Baseflow (m3)	6,223	0	0	863,678	365,537	154,755	52,258	0	0	0	83,635	0	1,526,085
Post-Development Baseflow (mm)	0.5	0.0	0.0	72.5	30.7	13.0	4.4	0.0	0.0	0.0	7.0	0.0	128.1

APPENDIX F

Analytical Surface Water Quality Results

TABLE F-1

SURFACE WATER GENERAL CHEMISTRY
Nova Construction Co. Ltd.
Seabrook Quarry, Digby, Nova Scotia
Stantec Consulting Ltd. Project No. 121417326

Parameter	Units	CCME Freshwater		Sample ID						
		Short Term	Long Term	SW-01				SW-02		
Date Sampled:				29-Jun-22	27-Jul-22	2-Sep-22	Lab-Dup	29-Jun-22	27-Jul-22	2-Sep-22
Anion Sum	me/L	-	-	0.400	0.360	0.320	N/A	0.290	0.390	0.300
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	-	-	4.7	5.1	4.9	N/A	3.4	7.5	4.2
Calculated TDS	mg/L	-	-	25	29	25	N/A	23	31	25
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	-	-	<1.0	<1.0	<1.0	N/A	<1.0	<1.0	<1.0
Cation Sum	me/L	-	-	0.430	0.540	0.490	N/A	0.400	0.520	0.450
Hardness ($CaCO_3$)	mg/L	-	-	7.6	11	9.2	N/A	6.9	11	8.4
Ion Balance (% Difference)	%	-	-	3.61	20.0	21.0	N/A	15.9	14.3	20.0
Langelier Index (@ 20°C)	N/A	-	-	-3.90	-3.77	-4.04	N/A	-4.15	-3.12	-3.81
Langelier Index (@ 4°C)	N/A	-	-	-4.16	-4.02	-4.29	N/A	-4.41	-3.37	-4.06
Nitrate (N)	mg/L	550	13	<0.050	0.086	<0.050	N/A	<0.050	0.16	0.060
Saturation pH (@ 20°C)	N/A	-	-	10.4	10.2	10.3	N/A	10.6	10.1	10.4
Saturation pH (@ 4°C)	N/A	-	-	10.7	10.5	10.6	N/A	10.9	10.3	10.7
Total Suspended Solids	mg/L	-	-	5	5	2.4	N/A	2	< 2.2	2.0
Total Alkalinity (Total as $CaCO_3$)	mg/L	-	-	4.7	5.1	4.9	N/A	3.4	7.5	4.2
Dissolved Chloride (Cl)	mg/L	640	120	8.8	9.1	7.7	N/A	7.8	8.3	7.4
Colour	TCU	-	-	190	310	230	N/A	120	160	120
Nitrate + Nitrite	mg/L	-	-	<0.050	0.086	<0.050	N/A	<0.050	0.16	0.060
Nitrite (N)	mg/L	-	0.06	<0.010	<0.010	<0.010	N/A	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	-	VARIES [6]	<0.050	0.13	<0.050	N/A	<0.050	0.088	<0.050
Total Organic Carbon (C)	mg/L	-	-	18	30	25	N/A	13	17	17
Orthophosphate (P)	mg/L	-	-	<0.010	<0.010	<0.010	N/A	<0.010	<0.010	<0.010
pH	pH	-	6.5-9.0	6.52	**6.47**	**6.30**	N/A	**6.45**	6.95	6.60
Reactive Silica (SiO_2)	mg/L	-	-	0.98	4.5	3.5	N/A	4.3	6.1	5.1
Dissolved Sulphate (SO_4)	mg/L	-	-	3.0	<2.0	<2.0	N/A	<2.0	<2.0	<2.0
Turbidity	NTU	-	-	1.2	2.5	1.5	1.4	0.84	0.88	1.3
Conductivity	uS/cm	-	-	53	52	47	N/A	43	54	46
Sodium	mg/L	-	-	5.9	6.0	6000	N/A	5.6	5.5	5500

Notes:

1. RDL = laboratory's reportable detection limit
2. <# = parameter not detected above RDL
3. ' -' = no guideline available
4. Lab-Dup = laboratory QA/QC duplicate
5. CCME Guidelines = Canadian Council of Ministers of the Environment *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME Online 2022); Freshwater aquatic life
6. Varies depending on pH and temperature; calculated guideline presented in ( )
   Guideline calculated using field temperature and pH is presented in brackets after the corresponding analytical result;
   When temperature was unknown it was assumed to be 15°C
7. AO = aesthetic objective
8. **Bold & Underlined =** parameter concentration exceeds the referenced guideline
9. In situ water quality measurements were collected with a YSI Multi-Meter (Model Pro2030, Ohio, USA) and a Hanna Instruments pH meter (Model HI98127, Quebec, Canada).

TABLE F-2

SURFACE WATER INORGANIC CHEMISTRY
Nova Construction Co. Ltd.
Seabrook Quarry, Digby, Nova Scotia
Stantec Consulting Ltd. Project No. 121417326

Parameter	Units	CCME Freshwater		Sample ID					
		Short Term	Long Term	SW-01			SW-02		
Date Sampled:				**29-Jun-22**	**27-Jul-22**	**2-Sep-22**	**29-Jun-22**	**27-Jul-22**	**2-Sep-22**
Aluminum	µg/L	-	CCME equation[7]	**170** (100)	**280** (5)	**200** (5)	**350** (5)	**340** (100)	**270** (100)
Antimony	µg/L	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	µg/L	-	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	µg/L	-	-	1.8	2.8	2.3	2.3	2.8	2.6
Beryllium	µg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Bismuth	µg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	µg/L	29,000	1,500	<50	<50	<50	<50	<50	<50
Cadmium	µg/L	CCME equation[7]	CCME equation[7]	0.020 (0.04)	0.024 (0.04)	0.012 (0.04)	0.022 (0.04)	0.018 (0.04)	0.014 (0.041)
Calcium	µg/L	-	-	1600	2200	1800	1400	2200	1800
Chromium	µg/L	-	-	<1.0	1.8	1.3	1.3	1.2	1
Cobalt	µg/L	-	-	<0.40	1.0	<0.40	<0.40	<0.40	<0.40
Copper	µg/L	-	CCME equation[7]	0.68 (2.0)	<0.50	<0.50	1.1 (2.0)	0.69 (2.0)	0.91 (2.00
Iron	µg/L	-	300	**440**	**1300**	**910**	**350**	**1100**	**690**
Lead	µg/L	-	CCME equation[7]	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mangesium	µg/L	-	-	900	1200	1100	830	1300	970
Manganese	µg/L	CCME equation[7]	variable	36	120	47	14	35	24
Molybdenum	µg/L	-	73	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	µg/L	-	CCME equation[7]	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus	µg/L	-	-	<100	<100	<100	<100	<100	<100
Potassium	µg/L	-	-	230	460	560	300	790	870
Selenium	µg/L	-	1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Silver	µg/L	-	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	µg/L	-	-	5900	6000	6000	5600	5500	5500
Strontium	µg/L	-	-	6.8	9.4	7.4	7.6	12	9
Thallium	µg/L	-	0.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	µg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	µg/L	-	-	2.3	4.4	2.4	3.0	4.6	3.3
Uranium	µg/L	33	15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium	µg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc	µg/L	CCME equation[7]	CCME equation[7]	<5.0	5.4 (1000)	<5.0	<5.0	<5.0	<5.0

Notes:

1. RDL = laboratory's reportable detection limit
2. <# = parameter not detected above RDL
3.' -' = no guideline available
5. AO = aesthetic objective
4. CCME Guidelines = Canadian Council of Ministers of the Environment *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME Online 2022); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness)
   Copper guideline = $0.2 * e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness)
6. **Bold & Underlined =** parameter concentration exceeds the referenced guideline
7. In situ water quality measurements were collected with a YSI Multi-Meter (Model Pro2030, Ohio, USA) and a Hanna Instruments pH meter (Model HI98127, Quebec, Canada).

APPENDIX G

Fish Habitat Data and Photographic Log for Watercourse 2 and Watercourse 3

Table G-1 Fish Habitat Data for Transects in Watercourse 2 (WC2) and Watercourse 3 (WC3)

Watercourse and Transect Number	Watercourse Name	Coordinates	Habitat Type	Wetted Width (m)	Channel Width (m)	Substrate (%)									Aquatic Vegetation (% Cover)	Cover on Banks (%)				
						O	F	S	SG	G	C	B	LB	BR		B	G	S	C	D
WC2-1	Post Brook	44.624284, -65.856905	Run	1.30	2.36	10	0	0	5	5	55	10	10	5	20	20	30	10	10	30
WC2-2	Post Brook	44.623847, -65.854863	Pool	4.00	4.20	10	0	0	5	5	55	10	10	5	20	20	30	10	10	30
WC2-3	Post Brook	44.623829, -65.854855	Cascade	0.30	2.60	10	0	0	5	5	55	10	10	5	0	20	30	10	10	30
WC2-4	Tributary to Post Brook	44.624181, -65.852773	Run	1.32	1.76	10	0	0	5	5	55	10	10	5	20	20	30	10	10	30
WC2-5	Tributary to Post Brook	44.623174, -65.847732	Run	2.10	2.41	50	40	0	0	0	0	10	0	0	0	10	60	0	30	0
WC2-6	Tributary to Post Brook	44.623354, -65.847083	Run	2.61	2.83	5	0	0	5	10	55	10	10	5	20	10	35	20	10	25
WC-3-1	Post Brook	44.620325, -65.851334	Intermittent Pool	4.50	5.50	95	0	0	0	0	0	5	0	0	0	30	10	20	20	0
WC-3-2	Post Brook	44.620445, -65.851295	Intermittent Pool	0.56	1.56	40	0	0	0	0	5	20	25	0	30	10	20	20	50	0
WC-3-3	Post Brook	44.622433, -65.851497	Intermittent Pool	2.00	2.50	35	0	0	0	0	5	20	25	0	15	0	30	20	50	0
WC-3-4	Post Brook	44.623144, -65.852802	Run	1.40	2.80	30	0	20	5	20	10	20	25	0	30	5	35	10	50	0
WC-3-5	Post Brook	44.623624, -65.854175	Run	1.42	1.60	30	0	0	5	5	15	25	45	5	20	5	35	10	50	0

Note: Averages are based on lengths of habitat units and are not a simple average of all measurements
Substrate - O: Organics, F: Fines, S: Sand, SG: Small Gravel, G: Gravel, C: Cobble, B: Boulder, LB: Large Boulder, BR: Bedrock
Cover on banks – B: Bare, G: Grass, S: Shrub. C: Coniferous, D: Deciduous

Stantec

Photographic Log

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 1

Photo Location:
WC2

Survey Date:
7/27/2022

Comments:
Wetland habitat near the origin of WC2

Photograph ID: 2

Photo Location:
WC2

Survey Date:
7/27/2022

Comments:
Cascade located along WC2

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 3 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Cascade located along WC2	

Photograph ID: 4 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Debris dam located along WC2	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 5 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Representative run habitat upstream of the confluence with WC3	
Photograph ID: 6 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Representative run habitat downstream of the confluence with WC3	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 7 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Representative run habitat downstream of the confluence with WC3	
Photograph ID: 8 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Beaver activity directly downstream of Smalls Lake	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 9 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Impounded water (likely due to beaver activity) downstream of Smalls Lake	
Photograph ID: 10 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Habitat present downstream of Smalls Lake	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 11 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Intermittent pools and debris jams are present at low flow conditions, downstream of Smalls Lake and upstream of the confluence with Post Brook	
Photograph ID: 12 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Intermittent pools and debris jams are present at low flow conditions, downstream of Smalls Lake and upstream of the confluence with Post Brook	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 13 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Sub-surface and ephemeral section of watercourse	
Photograph ID: 14 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Watercourse is braided, has intermittent flow and debris jams upstream of the confluence with WC2	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 15

Photo Location:
WC3

Survey Date:
7/27/2022

Comments:
Representative run habitat upstream of the confluence with WC2

Stantec

Photographic Log

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 1

Photo Location:
WC2

Survey Date:
7/27/2022

Comments:
Wetland habitat near the origin of WC2

Photograph ID: 2

Photo Location:
WC2

Survey Date:
7/27/2022

Comments:
Cascade located along WC2

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 3 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Cascade located along WC2	

Photograph ID: 4 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Debris dam located along WC2	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 5 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Representative run habitat upstream of the confluence with WC3	
Photograph ID: 6 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Representative run habitat downstream of the confluence with WC3	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 7 **Photo Location:** WC2 **Survey Date:** 7/27/2022 **Comments:** Representative run habitat downstream of the confluence with WC3	
Photograph ID: 8 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Beaver activity directly downstream of Smalls Lake	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 9 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Impounded water (likely due to beaver activity) downstream of Smalls Lake	
Photograph ID: 10 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Habitat present downstream of Smalls Lake	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 11 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Intermittent pools and debris jams are present at low flow conditions, downstream of Smalls Lake and upstream of the confluence with Post Brook	
Photograph ID: 12 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Intermittent pools and debris jams are present at low flow conditions, downstream of Smalls Lake and upstream of the confluence with Post Brook	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 13 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Sub-surface and ephemeral section of watercourse	
Photograph ID: 14 **Photo Location:** WC3 **Survey Date:** 7/27/2022 **Comments:** Watercourse is braided, has intermittent flow and debris jams upstream of the confluence with WC2	

Client:	**Nova Construction**	**Project:**	**Seabrook Quarry Expansion Project**
Site Name:	**Seabrook Quarry**	**Site Location:**	**Watercourses 2 and 3**

Photograph ID: 15

Photo Location:
WC3

Survey Date:
7/27/2022

Comments:
Representative run habitat upstream of the confluence with WC2

APPENDIX H

Data Report from the Atlantic Canada Conservation Data Centre

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada atlantique

DATA REPORT 7244: Seabrook, NS

Prepared 19 April 2022
by J. Churchill, Data Manager

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; 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	Contents
SeabrookNS_7244ob.xls	Rare or legally-protected Flora and Fauna in your study area
SeabrookNS_7244ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
SeabrookNS_7244msa.xls	Managed and Biologically Significant Areas in your study area
SeabrookNS_7244mm.xls	Rare and common Marine Mammals in your study area

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
(506) 364-2658
sean.blaney@accdc.ca

Animals (Fauna)
John Klymko
Zoologist
(506) 364-2660
john.klymko@accdc.ca

Data Management, GIS
James Churchill
Conservation Data Analyst / Field Biologist
(902) 679-6146
james.churchill@accdc.ca

Billing
Jean Breau
Financial Manager / Executive Assistant
(506) 364-2657
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

Western: Sarah Spencer
(902) 541-0081
Sarah.Spencer@novascotia.ca

Central: Shavonne Meyer
(902) 893-0816
Shavonne.Meyer@novascotia.ca

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(902) 890-1046
Kimberly.George@novascotia.ca

Eastern: Harrison Moore
(902) 497-4119
Harrison.Moore@novascotia.ca

Eastern: Maureen Cameron-MacMillan
(902) 295-2554
Maureen.Cameron-MacMillan@novascotia.ca

Eastern: Elizabeth Walsh
(902) 563-3370
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

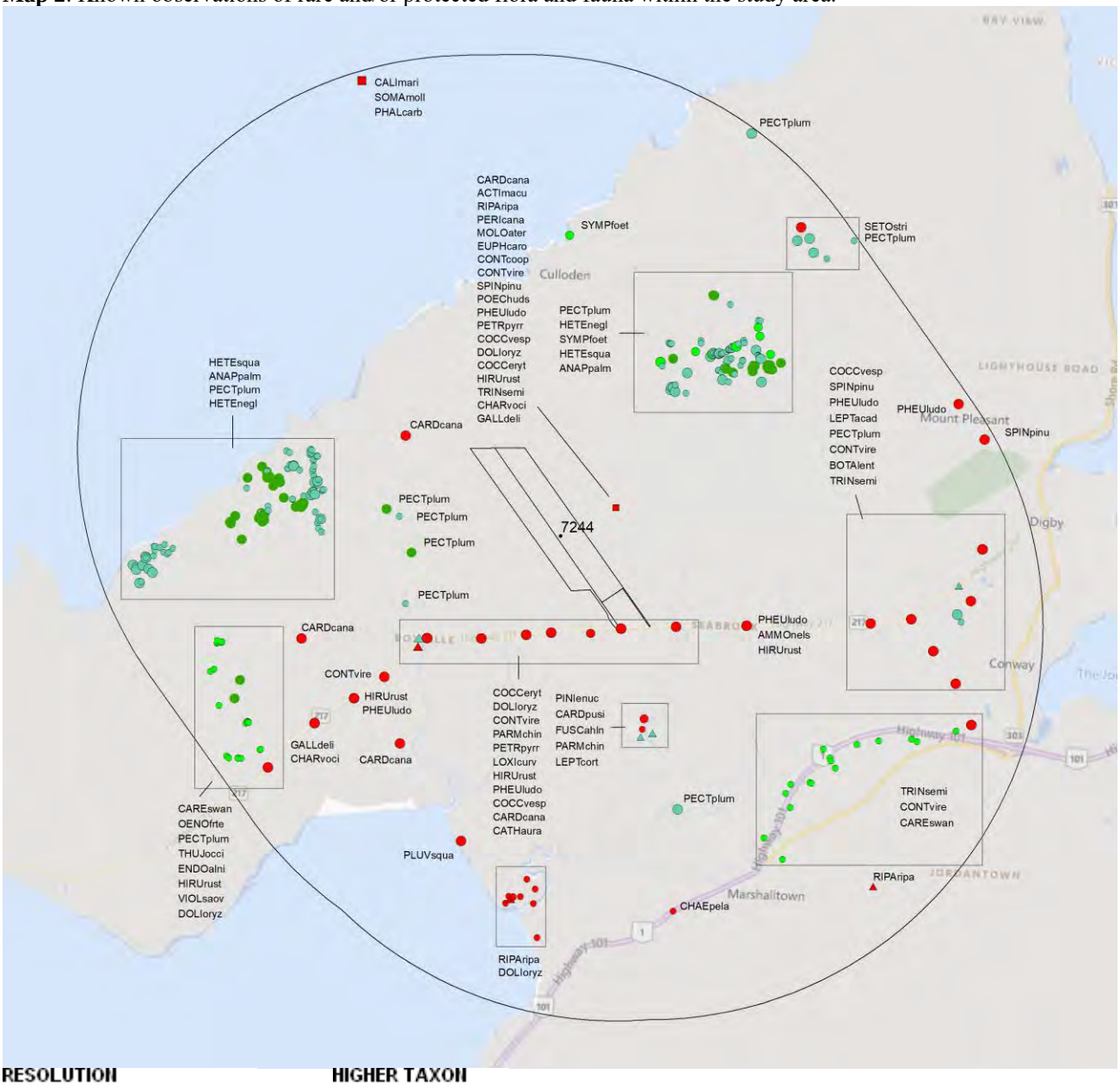
2.1 FLORA

The study area contains 45 records of 6 vascular, 265 records of 8 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 130 records of 31 vertebrate, no records of 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 13 managed areas in the vicinity of the study area (Map 3 and attached file: *msa.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified 2 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 (± 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	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	244	1.9 ± 0.0
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	1	2.8 ± 0.0
N	*Heterodermia squamulosa*	Scaly Fringe Lichen				S3	6	2.3 ± 0.0
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4	1	5.1 ± 0.0
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3S4	1	2.8 ± 0.0
N	*Parmotrema perlatum*	Powdered Ruffle Lichen				S3S4	2	2.2 ± 2.0
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	7	2.3 ± 0.0
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	3	2.4 ± 0.0
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S2S3	1	4.9 ± 0.0
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2S3	8	4.5 ± 0.0
P	*Carex swanii*	Swan's Sedge				S3	24	4.3 ± 0.0
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3S4	1	4.7 ± 0.0
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	3	4.7 ± 0.0
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S3S4	8	2.5 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2B	6	0.8 ± 7.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	1	5.0 ± 0.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3B	21	0.8 ± 7.0
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	1	0.8 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Endangered	S3B	20	0.8 ± 7.0
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Endangered	S3B	9	0.8 ± 7.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B	1	0.8 ± 7.0
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M	4	0.8 ± 7.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	8	0.8 ± 7.0
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	1	2.6 ± 0.0
A	*Molothrus ater*	Brown-headed Cowbird				S2B	1	0.8 ± 7.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	3	0.8 ± 7.0
A	*Phalacrocorax carbo*	Great Cormorant				S2S3B,S2S3N	1	6.3 ± 10.0
A	*Cathartes aura*	Turkey Vulture				S2S3B,S4S5M	1	2.3 ± 0.0
A	*Perisoreus canadensis*	Canada Jay				S3	1	0.8 ± 7.0
A	*Poecile hudsonicus*	Boreal Chickadee				S3	1	0.8 ± 7.0
A	*Spinus pinus*	Pine Siskin				S3	4	0.8 ± 7.0
A	*Charadrius vociferus*	Killdeer				S3B	3	0.8 ± 7.0
A	*Tringa semipalmata*	Willet				S3B	6	0.8 ± 7.0
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	4	0.8 ± 7.0
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	18	0.8 ± 7.0
A	*Somateria mollissima*	Common Eider				S3B,S3M,S3N	4	6.3 ± 10.0
A	*Gallinago delicata*	Wilson's Snipe				S3B,S5M	2	0.8 ± 7.0
A	*Setophaga striata*	Blackpoll Warbler				S3B,S5M	1	5.0 ± 0.0
A	*Cardellina pusilla*	Wilson's Warbler				S3B,S5M	2	2.6 ± 0.0
A	*Pinicola enucleator*	Pine Grosbeak				S3B,S5N,S5M	1	2.6 ± 0.0
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	1	4.1 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Loxia curvirostra*	Red Crossbill				S3S4	1	1.4 ± 0.0
A	*Botaurus lentiginosus*	American Bittern				S3S4B,S4S5M	1	4.6 ± 0.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	1	0.8 ± 7.0
A	*Calidris maritima*	Purple Sandpiper				S3S4N	1	6.3 ± 10.0

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".

Nova Scotia

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Fraxinus nigra	**Black Ash**		**Threatened**	**YES**
Emydoidea blandingii	*Blanding's Turtle - Nova Scotia pop.*	Endangered	Vulnerable	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Vulnerable	No
Bat hibernaculum or bat species occurrence		**[Endangered][1]**	**[Endangered][1]**	**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 NS Endangered Species 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.

# recs	CITATION
166	Riley, J. 2020. Digby County lichen observations. Pers. comm. to J.L. Churchill.
62	iNaturalist. 2020. iNaturalist Data Export 2020. iNaturalist.org and iNaturalist.ca, Web site: 128728 recs.
43	Pardieck, K.L., Ziolkowski Jr., D.J., Lutmerding, M., Aponte, V.I., and Hudson, M-A.R. 2020. North American Breeding Bird Survey Dataset 1966 - 2019: U.S. Geological Survey data release, https://doi.org/10.5066/P9J6QUF6
36	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
34	Riley, J. 2019. Digby County lichen observations. Pers. comm. to J.L. Churchill, 50 recs.
20	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
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16	LaPaix, R.W.; Crowell, M.J.; MacDonald, M.; Neily, T.D.; Quinn, G. 2017. Stantec Nova Scotia rare plant records, 2012-2016. Stantec Consulting.
15	McLean, K. 2020. Species occurrence records from Clean Annapolis River Project fieldwork in 2020. Clean Annapolis River Project, 206 records.
10	Canadian Wildlife Service. 2019. Canadian Protected and Conserved Areas Database (CPCAD). December 2019. ECCC.https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html.
6	Belliveau, A.G. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre, 10695 recs.
6	Hicks, Andrew. 2009. Coastal Waterfowl Surveys Database, 2000-08. Canadian Wildlife Service, Sackville, 46488 recs (11149 non-zero).
5	Brazner, J. 2016. Nova Scotia Forested Wetland Bird Surveys. Nova Scotia Department of Lands and Forestry.
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2	Benjamin, L.K. (compiler). 2012. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 4965 recs.
2	Ducks Unlimited Canada (DUC). 2020. DUC owned properties in Atlantic Canada (v. DUC_Lands_Sept2020). DUC.
2	Kenney, R.D. 2001. Marine Mammal Observation Records in Bay of Fundy. North Atlantic Right Whale Consortium, Boston MA, 35,532 recs.
1	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
1	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
1	Nova Scotia Dept Natural Resources, Forestry Branch. 2007. Restricted & Limited Use Land Database (RLUL). , http://www.gov.ns.ca/natr/FORESTRY/rlul/downloadrlul.htm.
1	Wong, Sarah. 2020. Two Chimney Swift observation made by Sarah Wong. pers. comm. to Sean Blaney.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 55597 records of 148 vertebrate and 763 records of 64 invertebrate fauna; 21887 records of 305 vascular, 3555 records of 165 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 (± 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	*Coregonus huntsmani*	Atlantic Whitefish	Endangered	Endangered	Endangered	S1	6	82.8 ± 1.0	NS
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	636	3.2 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Myotis	Endangered	Endangered	Endangered	S1	102	19.7 ± 0.0	NS
A	*Perimyotis subflavus*	Tricolored Bat	Endangered	Endangered	Endangered	S1	190	19.7 ± 0.0	NS
A	*Emydoidea blandingii*	Blanding's Turtle	Endangered	Endangered	Endangered	S1	10048	27.8 ± 0.0	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy population	Endangered	Endangered		S1	16	8.8 ± 1.0	NS
A	*Salmo salar pop. 6*	Atlantic Salmon - Nova Scotia Southern Upland population	Endangered			S1	15	44.8 ± 1.0	NS
A	*Eubalaena glacialis*	North Atlantic Right Whale	Endangered	Endangered		S1	8	12.0 ± 50.0	NS
A	*Charadrius melodus melodus*	Piping Plover melodus subspecies	Endangered	Endangered	Endangered	S1B	30	68.8 ± 0.0	NB
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	20	42.3 ± 0.0	NB
A	*Dermochelys coriacea pop. 2*	Leatherback Sea Turtle - Atlantic population	Endangered	Endangered		S1S2N	5	6.8 ± 0.0	NS
A	*Morone saxatilis pop. 2*	Striped Bass - Bay of Fundy population	Endangered			S2S3B,S2S3N	3	15.3 ± 1.0	NS
A	*Rangifer tarandus pop. 2*	Caribou - Atlantic-Gasp ├⌐sie population	Endangered	Endangered	Extirpated	SX	3	75.0 ± 1.0	NB
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	17	50.5 ± 7.0	NS
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Threatened	Endangered	S1B	22	14.9 ± 7.0	NS
A	*Asio flammeus*	Short-eared Owl	Threatened	Special Concern		S1B	4	73.1 ± 0.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	580	33.8 ± 5.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2B	1165	0.8 ± 7.0	NS
A	*Thamnophis saurita*	Eastern Ribbonsnake	Threatened	Threatened	Threatened	S2S3	2118	43.1 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	533	5.0 ± 0.0	NS
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S2S3M	101	67.7 ± 0.0	NB
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2S3N	1	98.5 ± 0.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3B	1117	0.8 ± 7.0	NS
A	*Hydrobates leucorhous*	Leach's Storm-Petrel	Threatened			S3B	138	37.1 ± 32.0	NB
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S3M	825	39.0 ± 0.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S3N	292	20.7 ± 1.0	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	7	20.7 ± 7.0	NS
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened		SUB	14	71.6 ± 5.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	70	19.4 ± 7.0	NS
A	*Bucephala islandica*	Barrow's Goldeneye	Special Concern	Special Concern		S1N,SUM	31	21.3 ± 0.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	211	0.8 ± 7.0	NS
A	*Balaenoptera physalus*	Fin Whale	Special Concern	Special Concern		S2S3	16	46.0 ± 50.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S2S3M	227	43.0 ± 0.0	NB
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern population	Special Concern	Special Concern	Endangered	S2S3N,SUM	172	23.0 ± 15.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	344	14.3 ± 0.0	NS
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Endangered	S3B	1401	0.8 ± 7.0	NS
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Endangered	S3B	653	0.8 ± 7.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S3B	406	9.0 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B	728	0.8 ± 7.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M	563	0.8 ± 7.0	NS
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern		S3N,SUM	259	55.4 ± 15.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	1063	0.8 ± 7.0	NS
A	*Phocoena phocoena*	Harbour Porpoise	Special Concern			S4	227	9.0 ± 1.0	NS
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern	Special Concern		S4	557	10.9 ± 0.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B,SUN,SUM	10	55.0 ± 0.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	9	29.8 ± 0.0	NS
A	*Chlidonias niger*	Black Tern	Not At Risk			S1B	1	73.8 ± 4.0	NB
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Vulnerable	S1B,SUM	620	6.7 ± 0.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B,SUM	5	71.2 ± 7.0	NB
A	*Lynx canadensis*	Canada Lynx	Not At Risk		Endangered	S2S3	1	81.2 ± 1.0	NB
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3	3	71.4 ± 1.0	NB
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	17	48.8 ± 0.0	NS
A	*Megaptera novaeangliae*	Humpback Whale	Not At Risk			S3	41	26.3 ± 0.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	302	24.2 ± 0.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	126	6.3 ± 0.0	NS
A	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	3	67.6 ± 0.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	54	28.5 ± 7.0	NS
A	*Glaucomys volans*	Southern Flying Squirrel	Not At Risk			S3S4	9	51.7 ± 10.0	NS
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4	3	57.9 ± 0.0	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	316	2.6 ± 0.0	NS
A	*Calidris canutus rufa*	Red Knot rufa subspecies - Tierra del Fuego / Patagonia wintering population	E,SC	Endangered	Endangered	S2M	424	59.5 ± 0.0	NS
A	*Morone saxatilis*	Striped Bass	E,SC			S2S3B,S2S3N	6	17.0 ± 0.0	NS
A	*Odobenus rosmarus pop. 5*	Atlantic Walrus - Nova Scotia - Newfoundland - Gulf of St Lawrence population	X			SX	1	29.8 ± 5.0	NS
A	*Alces alces americana*	Moose			Endangered	S1	121	30.9 ± 0.0	NS
A	*Uria aalge*	Common Murre				S1?B	145	37.1 ± 32.0	NB
A	*Passerina cyanea*	Indigo Bunting				S1?B,SUM	46	18.4 ± 0.0	NS
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	63	66.0 ± 7.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	46	30.0 ± 0.0	NS
A	*Gallinula galeata*	Common Gallinule				S1B	23	32.4 ± 7.0	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S1B	53	29.6 ± 7.0	NS
A	*Cistothorus palustris*	Marsh Wren				S1B	212	32.4 ± 7.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	103	9.2 ± 0.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	54	54.6 ± 7.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S4M	2107	6.4 ± 0.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S4M	1591	29.9 ± 0.0	NS
A	*Anas acuta*	Northern Pintail				S1B,SUM	20	30.1 ± 0.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B,SUM	31	40.4 ± 0.0	NS
A	*Vespertilionidae sp.*	bat species				S1S2	286	3.2 ± 0.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S1S2B,SUM	46	67.1 ± 1.0	NB
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B,SUM	53	35.7 ± 0.0	NS
A	*Alca torda*	Razorbill				S2B	181	37.1 ± 32.0	NB
A	*Fratercula arctica*	Atlantic Puffin				S2B	176	37.1 ± 32.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S2B	70	19.7 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	193	0.8 ± 7.0	NS
A	*Spatula clypeata*	Northern Shoveler				S2B,SUM	79	29.9 ± 0.0	NS
A	*Mareca strepera*	Gadwall				S2B,SUM	151	29.4 ± 0.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B,SUM	48	20.7 ± 7.0	NS
A	*Calidris alba*	Sanderling				S2N,S3M	1100	7.1 ± 0.0	NS
A	*Martes americana*	American Marten			Endangered	S2S3	27	25.4 ± 0.0	NS
A	*Asio otus*	Long-eared Owl				S2S3	19	60.8 ± 7.0	NS
A	*Rallus limicola*	Virginia Rail				S2S3B	113	14.9 ± 7.0	NS

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A	*Rissa tridactyla*	Black-legged Kittiwake				S2S3B	64	55.5 ± 6.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	315	0.8 ± 7.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3B,S2S3N	337	6.3 ± 10.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B,S4S5M	178	2.3 ± 0.0	NS
A	*Setophaga pinus*	Pine Warbler				S2S3B,S4S5M	43	44.5 ± 0.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2S3B,S5N,S5M	166	6.5 ± 5.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B,SUM	90	10.8 ± 0.0	NS
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	314	53.9 ± 0.0	NS
A	*Numenius phaeopus hudsonicus*	Whimbrel				S2S3M	510	53.9 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	130	37.1 ± 32.0	NB
A	*Perisoreus canadensis*	Canada Jay				S3	280	0.8 ± 7.0	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	275	0.8 ± 7.0	NS
A	*Spinus pinus*	Pine Siskin				S3	281	0.8 ± 7.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	54	38.5 ± 0.0	NS
A	*Salvelinus namaycush*	Lake Trout				S3	1	84.0 ± 0.0	NB
A	*Sorex maritimensis*	Maritime Shrew				S3	1	40.4 ± 0.0	NS
A	*Pekania pennanti*	Fisher				S3	7	42.8 ± 0.0	NS
A	*Calcarius lapponicus*	Lapland Longspur				S3?N,SUM	37	68.1 ± 0.0	NB
A	*Spatula discors*	Blue-winged Teal				S3B	119	32.4 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	879	0.8 ± 7.0	NS
A	*Tringa semipalmata*	Willet				S3B	577	0.8 ± 7.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	147	36.2 ± 7.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	84	0.8 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	299	19.3 ± 6.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	390	0.8 ± 7.0	NS
A	*Alosa pseudoharengus*	Alewife				S3B	15	34.9 ± 1.0	NS
A	*Somateria mollissima*	Common Eider				S3B,S3M,S3N	2066	6.3 ± 10.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S4M	1740	30.3 ± 0.0	NS
A	*Falco sparverius*	American Kestrel				S3B,S4S5M	160	19.7 ± 7.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B,S5M	358	0.8 ± 7.0	NS
A	*Setophaga striata*	Blackpoll Warbler				S3B,S5M	103	5.0 ± 0.0	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B,S5M	130	2.6 ± 0.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S3B,S5N,S5M	61	2.6 ± 0.0	NS
A	*Setophaga tigrina*	Cape May Warbler				S3B,SUM	68	20.7 ± 7.0	NS
A	*Branta bernicla*	Brant				S3M	542	54.3 ± 4.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	1500	4.1 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	861	7.1 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3094	6.4 ± 1.0	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S3M	387	53.9 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	1086	53.9 ± 0.0	NS
A	*Chroicocephalus ridibundus*	Black-headed Gull				S3N	39	69.8 ± 1.0	NB
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	50	22.8 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	194	1.4 ± 0.0	NS
A	*Sorex palustris*	American Water Shrew				S3S4	4	90.5 ± 1.0	NB
A	*Botaurus lentiginosus*	American Bittern				S3S4B,S4S5M	372	4.6 ± 0.0	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B,S4S5M	301	12.9 ± 6.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	1024	0.8 ± 7.0	NS
A	*Leiothlypis peregrina*	Tennessee Warbler				S3S4B,S5M	182	9.7 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B,S5M	16	32.0 ± 0.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5M,S5N	381	17.1 ± 0.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3S4N	250	6.3 ± 10.0	NS
A	*Lanius borealis*	Northern Shrike				S3S4N	1	74.2 ± 0.0	NB
A	*Morus bassanus*	Northern Gannet				SHB	850	8.2 ± 0.0	NS
A	*Aythya americana*	Redhead				SHB	7	69.2 ± 7.0	NB
A	*Leucophaeus atricilla*	Laughing Gull				SHB	84	50.3 ± 24.0	NB
A	*Progne subis*	Purple Martin				SHB	14	60.7 ± 7.0	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N,S5M	27	59.7 ± 0.0	NS

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I	*Bombus bohemicus*	Ashton Cuckoo Bumble Bee	Endangered	Endangered	Endangered	S1	9	23.9 ± 5.0	NS
I	*Epeoloides pilosulus*	Macropis Cuckoo Bee	Endangered	Endangered	Endangered	S1	2	71.7 ± 5.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2?B,S3M	247	6.4 ± 0.0	NS
I	*Danaus plexippus plexippus*	Monarch	Endangered	Special Concern		S2?B,S3M	1	96.5 ± 0.0	NS
I	*Bombus suckleyi*	Suckley's Cuckoo Bumble Bee	Threatened			SH	1	68.1 ± 5.0	NB
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern	Vulnerable	S3	44	6.2 ± 5.0	NS
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle	Special Concern		Endangered	SH	3	71.2 ± 2.0	NS
I	*Erora laeta*	Early Hairstreak				S1	2	7.1 ± 2.0	NS
I	*Ophiogomphus anomalus*	Extra-Striped Snaketail				S1	5	91.1 ± 0.0	NS
I	*Pachydiplax longipennis*	Blue Dasher				S1	1	79.8 ± 0.0	NB
I	*Atlanticoncha ochracea*	Tidewater Mucket				S1	4	37.5 ± 0.0	NS
I	*Polygonia comma*	Eastern Comma				S1?	3	7.0 ± 2.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	6	7.0 ± 2.0	NS
I	*Euphyes bimacula*	Two-spotted Skipper				S1S2	3	73.4 ± 0.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S2	2	72.8 ± 5.0	NB
I	*Coenagrion resolutum*	Taiga Bluet				S2	5	67.1 ± 1.0	NB
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	13	21.4 ± 1.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	10	67.1 ± 1.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S2S3	24	6.2 ± 20.0	NS
I	*Aglais milberti*	Milbert's Tortoiseshell				S2S3	6	29.8 ± 2.0	NS
I	*Aglais milberti milberti*	Milbert's Tortoise Shell				S2S3	1	71.9 ± 0.0	NB
I	*Somatochlora kennedyi*	Kennedy's Emerald				S2S3	2	88.7 ± 0.0	NB
I	*Somatochlora williamsoni*	Williamson's Emerald				S2S3	1	70.6 ± 0.0	NB
I	*Williamsonia fletcheri*	Ebony Boghaunter				S2S3	1	83.2 ± 0.0	NS
I	*Enallagma geminatum*	Skimming Bluet				S2S3	10	57.7 ± 0.0	NS
I	*Stylurus scudderi*	Zebra Clubtail				S2S3	3	70.8 ± 0.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	3	88.9 ± 0.0	NB
I	*Carabus maeander*	Meander Ground Beetle				S3	1	76.5 ± 0.0	NB
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	4	72.4 ± 0.0	NS
I	*Naemia seriata*	Seaside Lady Beetle				S3	8	29.3 ± 1.0	NS
I	*Chilocorus stigma*	Twice-stabbed Lady Beetle				S3	5	54.0 ± 0.0	NS
I	*Myzia pullata*	Streaked Lady Beetle				S3	1	88.9 ± 0.0	NS
I	*Monochamus marmorator*	Balsam Fir Sawyer				S3	1	72.7 ± 1.0	NB
I	*Dicerca tenebrosa*	Dark Jewel Beetle				S3	1	38.8 ± 0.0	NS
I	*Astylopsis sexguttata*	Six-speckled Long-horned Beetle				S3	1	94.2 ± 0.0	NS
I	*Satyrium calanus*	Banded Hairstreak				S3	5	29.3 ± 2.0	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	2	98.5 ± 1.0	NB
I	*Strymon melinus*	Gray Hairstreak				S3	9	7.0 ± 2.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S3	3	20.3 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S3	15	75.3 ± 0.0	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S3	9	54.6 ± 1.0	NS
I	*Epitheca princeps*	Prince Baskettail				S3	5	56.0 ± 1.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S3	2	35.6 ± 1.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	56	7.0 ± 2.0	NS
I	*Lepturopsis biforis*	Two-spotted Long-horned Beetle				S3S4	1	72.7 ± 1.0	NB
I	*Cecropterus pylades*	Northern Cloudywing				S3S4	9	72.8 ± 5.0	NB
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S3S4	5	69.1 ± 0.0	NB
I	*Cupido comyntas*	Eastern Tailed Blue				S3S4	17	65.9 ± 0.0	NB
I	*Argynnis aphrodite*	Aphrodite Fritillary				S3S4	14	7.1 ± 2.0	NS
I	*Polygonia faunus*	Green Comma				S3S4	20	6.2 ± 20.0	NS
I	*Oeneis jutta*	Jutta Arctic				S3S4	5	72.1 ± 1.0	NB
I	*Aeshna clepsydra*	Mottled Darner				S3S4	31	35.8 ± 0.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3S4	16	29.6 ± 1.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3S4	18	38.8 ± 0.0	NS

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I	*Gomphaeschna furcillata*	Harlequin Darner				S3S4	18	33.8 ± 1.0	NS
I	*Somatochlora franklini*	Delicate Emerald				S3S4	2	35.6 ± 1.0	NS
I	*Erythrodiplax berenice*	Seaside Dragonlet				S3S4	16	64.0 ± 0.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3S4	12	29.6 ± 1.0	NS
I	*Sympetrum danae*	Black Meadowhawk				S3S4	8	46.8 ± 0.0	NS
I	*Enallagma vesperum*	Vesper Bluet				S3S4	20	24.8 ± 0.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3S4	1	96.2 ± 0.0	NB
I	*Icaricia saepiolus*	Greenish Blue				SH	1	7.0 ± 2.0	NS
I	*Chlosyne nycteis*	Silvery Checkerspot				SH	8	35.8 ± 2.0	NS
I	*Polygonia gracilis*	Hoary Comma				SH	1	64.6 ± 7.0	NB
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1	132	55.5 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	8	81.5 ± 0.0	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened	Threatened	S2S3	74	7.4 ± 0.0	NS
N	*Pannaria lurida ssp. russellii*	Wrinkled Shingle Lichen	Threatened	Threatened		S2S3	1	58.6 ± 0.0	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened	Threatened	S3	181	14.4 ± 2.0	NS
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S3	307	38.6 ± 3.0	NS
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	660	1.9 ± 0.0	NS
N	*Sclerophora peronella (Atlantic pop.)*	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern		S3S4	58	10.7 ± 0.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	22	10.8 ± 0.0	NS
N	*Fissidens exilis*	Pygmy Pocket Moss	Not At Risk			S3	2	45.2 ± 3.0	NS
N	*Frullania selwyniana*	Selwyn's Scalewort				S1	8	61.9 ± 0.0	NS
N	*Harpalejeunea molleri ssp. integra*	a liverwort				S1	3	61.9 ± 0.0	NS
N	*Homalotheciella subcapillata*	Few-haired Moss				S1	1	56.0 ± 0.0	NS
N	*Orthotrichum pallens*	Pale Bristle Moss				S1	1	57.5 ± 0.0	NS
N	*Seligeria calcarea*	Chalk Brittle Moss				S1	1	88.2 ± 1.0	NB
N	*Seligeria diversifolia*	a Moss				S1	1	92.2 ± 0.0	NB
N	*Sematophyllum demissum*	a Moss				S1	1	89.1 ± 1.0	NS
N	*Sphagnum carolinianum*	Carolina Peat Moss				S1	1	57.6 ± 0.0	NS
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				S1	1	56.1 ± 0.0	NS
N	*Heterodermia leucomela*	Elegant Fringe Lichen				S1	4	36.4 ± 0.0	NS
N	*Scytinium dactylinum*	Brown-buttoned Jellyskin Lichen				S1	1	74.6 ± 0.0	NS
N	*Ephebe hispidula*	Dryside Rockshag Lichen				S1	1	61.8 ± 0.0	NS
N	*Ephebe perspinulosa*	Thread Lichen				S1	1	68.9 ± 0.0	NS
N	*Parmotrema perforatum*	Perforated Ruffle Lichen				S1	4	55.0 ± 0.0	NS
N	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen				S1	2	60.5 ± 0.0	NS
N	*Spilonema revertens*	Rock Hairball Lichen				S1	4	53.5 ± 0.0	NS
N	*Sticta limbata*	Powdered Moon Lichen				S1	5	49.2 ± 0.0	NS
N	*Leptogium hibernicum*	Hibernia Jellyskin Lichen				S1	62	12.3 ± 0.0	NS
N	*Hypotrachyna horrescens*	Hairy-spined Shield Lichen				S1	4	14.6 ± 0.0	NS
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S1	1	83.3 ± 0.0	NS
N	*Hypogymnia hultenii*	Powdered Honeycomb Lichen				S1	3	58.4 ± 0.0	NS
N	*Brachythecium erythrorrhizon*	Taiga Ragged Moss				S1?	1	78.4 ± 0.0	NB
N	*Imbribryum muehlenbeckii*	Muehlenbeck's Bryum Moss				S1?	1	83.3 ± 1.0	NB
N	*Tortula obtusifolia*	a Moss				S1?	1	85.9 ± 0.0	NB
N	*Grimmia anodon*	Toothless Grimmia Moss				S1?	4	52.7 ± 3.0	NS
N	*Homomallium adnatum*	Adnate Hairy-gray Moss				S1?	2	54.7 ± 5.0	NS
N	*Meesia triquetra*	Three-ranked Cold Moss				S1?	1	22.1 ± 0.0	NS
N	*Physcomitrium immersum*	a Moss				S1?	1	99.7 ± 1.0	NB
N	*Sphagnum molle*	Blushing Peat Moss				S1?	2	65.7 ± 0.0	NS
N	*Plagiomnium ellipticum*	Marsh Leafy Moss				S1?	1	80.3 ± 0.0	NS

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N	*Enchylium limosum*	Lime-loving Tarpaper Lichen				S1?	1	65.8 ± 0.0	NS
N	*Euopsis granatina*	Lesser Rockbud Lichen				S1?	1	60.5 ± 1.0	NS
N	*Scytinium intermedium*	Forty-five Jellyskin Lichen				S1?	1	65.1 ± 1.0	NS
N	*Peltigera malacea*	Veinless Pelt Lichen				S1?	1	25.0 ± 0.0	NS
N	*Metzgeria crassipilis*	Hairy Veilwort				S1S2	2	89.8 ± 0.0	NS
N	*Porella pinnata*	Pinnate Scalewort				S1S2	2	86.3 ± 0.0	NS
N	*Arrhenopterum heterostichum*	One-sided Groove Moss				S1S2	1	86.5 ± 5.0	NS
N	*Didymodon rigidulus*	Rigid Screw Moss				S1S2	4	54.0 ± 0.0	NS
N	*Didymodon ferrugineus*	Rusty Beard Moss				S1S2	1	90.5 ± 1.0	NB
N	*Hypnum pratense*	Meadow Plait Moss				S1S2	1	76.3 ± 0.0	NB
N	*Plagiothecium latebricola*	Alder Silk Moss				S1S2	1	68.8 ± 0.0	NB
N	*Sematophyllum marylandicum*	a Moss				S1S2	1	54.1 ± 0.0	NS
N	*Sphagnum trinitense*	a peatmoss				S1S2	3	63.6 ± 0.0	NS
N	*Tortula mucronifolia*	Mucronate Screw Moss				S1S2	2	52.7 ± 3.0	NS
N	*Pseudotaxiphyllum distichaceum*	a Moss				S1S2	6	49.7 ± 4.0	NS
N	*Hamatocaulis vernicosus*	a Moss				S1S2	3	21.9 ± 0.0	NS
N	*Haplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2	1	44.4 ± 3.0	NS
N	*Pilophorus cereolus*	Powdered Matchstick Lichen				S1S2	2	20.9 ± 3.0	NS
N	*Parmotrema reticulatum*	Netted Ruffle Lichen				S1S2	11	17.7 ± 0.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1S2	1	49.2 ± 0.0	NS
N	*Lecanora polytropa*	a lichen				S1S3	1	96.6 ± 1.0	NS
N	*Usnea fragilescens*	Inflationary Beard Lichen				S1S3	1	75.1 ± 40.0	NS
N	*Stereocaulon intermedium*	Pacific Brain Foam Lichen				S1S3	2	68.2 ± 0.0	NS
N	*Anacamptodon splachnoides*	a Moss				S2	1	54.8 ± 0.0	NS
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2	4	76.8 ± 0.0	NB
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S2	2	65.2 ± 0.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2	5	58.2 ± 0.0	NS
N	*Cystocoleus ebeneus*	Rockgossamer Lichen				S2	1	60.5 ± 0.0	NS
N	*Hypotrachyna catawbiensis*	Powder-tipped Antler Lichen				S2	30	7.2 ± 0.0	NS
N	*Nephroma resupinatum*	a lichen				S2	2	34.9 ± 0.0	NS
N	*Placynthium flabellosum*	Scaly Ink Lichen				S2	1	74.0 ± 0.0	NS
N	*Riccardia multifida*	Delicate Germanderwort				S2?	1	79.0 ± 0.0	NB
N	*Anomodon viticulosus*	a Moss				S2?	6	72.5 ± 1.0	NB
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	7	12.7 ± 3.0	NS
N	*Ptychostomum pendulum*	Drooping Bryum				S2?	2	56.8 ± 0.0	NS
N	*Drepanocladus polygamus*	Polygamous Hook Moss				S2?	1	55.7 ± 0.0	NS
N	*Pseudocampylium radicale*	Long-stalked Fine Wet Moss				S2?	2	55.7 ± 0.0	NS
N	*Climacium americanum*	American Tree Moss				S2?	9	54.0 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	3	37.9 ± 0.0	NS
N	*Ditrichum rhynchostegium*	a Moss				S2?	5	54.7 ± 5.0	NS
N	*Fissidens bushii*	Bush's Pocket Moss				S2?	8	12.7 ± 3.0	NS
N	*Fontinalis hypnoides*	a moss				S2?	1	55.7 ± 0.0	NS
N	*Fontinalis sullivantii*	Sullivant's Water Moss				S2?	4	57.3 ± 0.0	NS
N	*Grimmia olneyi*	a Moss				S2?	10	53.7 ± 15.0	NS
N	*Hygrohypnum bestii*	Best's Brook Moss				S2?	1	75.7 ± 0.0	NS
N	*Orthotrichum anomalum*	Anomalous Bristle Moss				S2?	1	57.5 ± 0.0	NS
N	*Philonotis marchica*	a Moss				S2?	1	54.0 ± 0.0	NS
N	*Physcomitrium collenchymatum*	a Moss				S2?	6	42.8 ± 6.0	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	1	78.2 ± 0.0	NB
N	*Anomobryum julaceum*	Slender Silver Moss				S2?	1	92.2 ± 0.0	NB
N	*Rauiella scita*	Smaller Fern Moss				S2?	16	53.6 ± 0.0	NS
N	*Platylomella lescurii*	a Moss				S2?	5	57.5 ± 0.0	NS

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N	*Phylliscum demangeonii*	Black Rock-wafer Lichen				S2?	2	60.5 ± 0.0	NS
N	*Oxyrrhynchium hians*	Light Beaked Moss				S2S3	3	35.5 ± 0.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3	54.0 ± 0.0	NS
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2S3	4	45.2 ± 3.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S2S3	64	59.8 ± 0.0	NS
N	*Moelleropsis nebulosa ssp. frullaniae*	Blue-gray Moss Shingle Lichen				S2S3	3	58.1 ± 0.0	NS
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S2S3	1	75.4 ± 2.0	NS
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2S3	9	51.3 ± 32.0	NS
N	*Usnea rubicunda*	Red Beard Lichen				S2S3	4	41.5 ± 0.0	NS
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S2S3	13	40.2 ± 0.0	NS
N	*Usnocetraria oakesiana*	Yellow Band Lichen				S2S3	5	29.9 ± 0.0	NS
N	*Cladonia incrassata*	Powder-foot British Soldiers Lichen				S2S3	3	73.3 ± 3.0	NS
N	*Cladonia mateocyatha*	Mixed-up Pixie-cup				S2S3	1	82.2 ± 0.0	NS
N	*Parmelia fertilis*	Fertile Shield Lichen				S2S3	1	82.7 ± 0.0	NS
N	*Hypotrachyna minarum*	Hairless-spined Shield Lichen				S2S3	4	49.4 ± 0.0	NS
N	*Usnea cavernosa*	Pitted Beard Lichen				S2S3	1	17.7 ± 0.0	NS
N	*Fuscopannaria sorediata*	a Lichen				S2S3	15	28.0 ± 0.0	NS
N	*Stereocaulon condensatum*	Granular Soil Foam Lichen				S2S3	2	81.2 ± 0.0	NS
N	*Hypotrachyna revoluta*	Granulating Loop Lichen				S2S3	18	14.6 ± 0.0	NS
N	*Cetraria arenaria*	Sand-loving Icelandmoss Lichen				S2S3	17	70.1 ± 1.0	NS
N	*Cladonia coccifera*	Eastern Boreal Pixie-cup Lichen				S2S3	2	56.0 ± 0.0	NS
N	*Cladonia phyllophora*	Felt Lichen				S2S3	1	41.6 ± 0.0	NS
N	*Hypotrachyna afrorevoluta*	Pustulate Revolute Loop Lichen				S2S3	4	32.3 ± 2.0	NS
N	*Usnea flammea*	Coastal Bushy Beard Lichen				S2S3	1	7.2 ± 0.0	NS
N	*Microlejeunea ulicina*	a pouncewort				S3	6	61.9 ± 0.0	NS
N	*Anomodon tristis*	a Moss				S3	6	54.8 ± 0.0	NS
N	*Sphagnum contortum*	Twisted Peat Moss				S3	2	72.9 ± 0.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S3	5	37.3 ± 0.0	NS
N	*Tetraplodon mnioides*	Entire-leaved Nitrogen Moss				S3	3	77.3 ± 1.0	NB
N	*Rostania occultata*	Crusted Tarpaper Lichen				S3	3	54.6 ± 2.0	NS
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	51	40.9 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	52	2.8 ± 0.0	NS
N	*Heterodermia squamulosa*	Scaly Fringe Lichen				S3	40	2.3 ± 0.0	NS
N	*Scytinium lichenoides*	Tattered Jellyskin Lichen				S3	7	78.8 ± 0.0	NS
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S3	36	12.6 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	5	73.8 ± 9.0	NS
N	*Punctelia appalachensis*	Appalachian Speckleback Lichen				S3	45	7.5 ± 0.0	NS
N	*Viridothelium virens*					S3	8	36.2 ± 2.0	NS
N	*Ephebe lanata*	Waterside Rockshag Lichen				S3	1	52.2 ± 0.0	NS
N	*Phaeophyscia adiastola*	Powder-tipped Shadow Lichen				S3	17	96.0 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S3	4	11.2 ± 0.0	NS
N	*Metzgeria conjugata*	Rock Veilwort				S3?	1	43.0 ± 0.0	NS
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3?	1	74.4 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S3?	1	72.6 ± 0.0	NS
N	*Drummondia prorepens*	a Moss				S3?	3	32.7 ± 0.0	NS
N	*Elodium blandowii*	Blandow's Bog Moss				S3?	2	80.3 ± 0.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3?	8	66.5 ± 1.0	NB

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N	*Cladonia stygia*	Black-footed Reindeer Lichen				S3?	2	69.9 ± 0.0	NB
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	9	12.7 ± 3.0	NS
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S3S4	6	54.8 ± 0.0	NS
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	1	88.2 ± 1.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	2	53.5 ± 0.0	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	2	50.4 ± 0.0	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	3	77.2 ± 0.0	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	2	82.8 ± 0.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	3	54.8 ± 0.0	NS
N	*Enchylium tenax*	Soil Tarpaper Lichen				S3S4	1	96.5 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3S4	110	44.0 ± 0.0	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	2	58.7 ± 0.0	NS
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	8	43.8 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4	18	5.1 ± 0.0	NS
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3S4	9	55.2 ± 0.0	NS
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	1	74.1 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3S4	43	10.7 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3S4	237	2.8 ± 0.0	NS
N	*Melanohalea olivacea*	Spotted Camouflage Lichen				S3S4	1	40.0 ± 0.0	NS
N	*Parmotrema perlatum*	Powdered Ruffle Lichen				S3S4	55	2.2 ± 2.0	NS
N	*Sphaerophorus fragilis*	Fragile Coral Lichen				S3S4	2	90.6 ± 0.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	546	10.6 ± 0.0	NS
N	*Physcia caesia*	Blue-gray Rosette Lichen				S3S4	1	47.3 ± 20.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	121	2.3 ± 0.0	NS
N	*Evernia prunastri*	Valley Oakmoss Lichen				S3S4	5	12.4 ± 0.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	121	2.4 ± 0.0	NS
P	*Geum peckii*	Eastern Mountain Avens	Endangered	Endangered	Endangered	S1	3199	36.7 ± 0.0	NS
P	*Rhynchospora macrostachya*	Tall Beakrush	Endangered	Endangered	Endangered	S1	57	71.5 ± 0.0	NS
P	*Lyonia ligustrina*	Maleberry	Endangered			S1	11	78.7 ± 0.0	NS
P	*Coreopsis rosea*	Pink Coreopsis	Endangered	Endangered	Endangered	S2	468	69.6 ± 0.0	NS
P	*Clethra alnifolia*	Coast Pepper-Bush	Endangered	Threatened	Vulnerable	S2	299	34.1 ± 0.0	NS
P	*Sabatia kennedyana*	Plymouth Gentian	Endangered	Endangered	Endangered	S2S3	1266	32.9 ± 0.0	NS
P	*Fraxinus nigra*	Black Ash	Threatened		Threatened	S1S2	99	1.3 ± 1.0	NS
P	*Baccharis halimifolia*	Eastern Baccharis	Threatened	Threatened	Threatened	S2	173	86.1 ± 6.0	NS
P	*Hydrocotyle umbellata*	Water Pennywort	Special Concern	Special Concern	Endangered	S2	205	51.5 ± 0.0	NS
P	*Eleocharis tuberculosa*	Tubercled Spike-rush	Special Concern	Special Concern	Vulnerable	S2	352	70.9 ± 0.0	NS
P	*Lachnanthes caroliniana*	Redroot	Special Concern	Special Concern	Vulnerable	S2	1468	76.8 ± 0.0	NS
P	*Lophiola aurea*	Goldencrest	Special Concern	Special Concern	Vulnerable	S2	823	24.9 ± 1.0	NS
P	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S3	33	83.1 ± 0.0	NS
P	*Scirpus longii*	Long's Bulrush	Special Concern		Vulnerable	S3	478	50.1 ± 0.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S3	6	14.4 ± 0.0	NS
P	*Acer saccharinum*	Silver Maple				S1	10	72.7 ± 10.0	NB
P	*Toxicodendron vernix*	Poison Sumac				S1	41	71.0 ± 0.0	NS
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S1	29	8.1 ± 0.0	NS
P	*Turritis glabra*	Tower Mustard				S1	2	78.5 ± 0.0	NB
P	*Barbarea orthoceras*	American Yellow Rocket				S1	2	76.2 ± 1.0	NB
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	1	63.9 ± 50.0	NS
P	*Silene antirrhina*	Sleepy Catchfly				S1	5	82.4 ± 0.0	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	4	78.5 ± 0.0	NB
P	*Elatine americana*	American Waterwort				S1	2	86.9 ± 1.0	NB
P	*Gentianella amarella ssp. acuta*	Northern Gentian				S1	3	72.2 ± 0.0	NB
P	*Ribes americanum*	Wild Black Currant				S1	4	73.7 ± 1.0	NB
P	*Trichostema dichotomum*	Forked Bluecurls				S1	6	85.1 ± 0.0	NS
P	*Fraxinus pennsylvanica*	Red Ash				S1	26	72.2 ± 0.0	NB
P	*Polygonum achoreum*	Leathery Knotweed				S1	5	45.5 ± 10.0	NS

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P	*Persicaria careyi*	Carey's Smartweed				S1	1	98.8 ± 5.0	NB
P	*Podostemum ceratophyllum*	Horn-leaved Riverweed				S1	4	82.3 ± 0.0	NS
P	*Montia fontana*	Water Blinks				S1	4	54.2 ± 0.0	NS
P	*Lysimachia minima*	Chaffweed				S1	1	54.8 ± 0.0	NS
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	7	74.4 ± 1.0	NB
P	*Clematis occidentalis*	Purple Clematis				S1	5	74.3 ± 0.0	NB
P	*Ranunculus pensylvanicus*	Pennsylvania Buttercup				S1	2	75.8 ± 1.0	NB
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	3	78.7 ± 5.0	NB
P	*Veronica catenata*	Pink Water-Speedwell				S1	1	33.1 ± 0.0	NS
P	*Carex digitalis*	Slender Wood Sedge				S1	4	53.0 ± 0.0	NS
P	*Carex garberi*	Garber's Sedge				S1	1	90.9 ± 0.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S1	1	84.2 ± 0.0	NB
P	*Carex laxiflora*	Loose-Flowered Sedge				S1	5	32.8 ± 5.0	NS
P	*Carex ormostachya*	Necklace Spike Sedge				S1	4	34.0 ± 0.0	NS
P	*Carex prairea*	Prairie Sedge				S1	1	15.9 ± 5.0	NS
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S1	4	73.3 ± 1.0	NB
P	*Carex tincta*	Tinged Sedge				S1	8	70.2 ± 1.0	NB
P	*Carex viridula var. saxilittoralis*	Greenish Sedge				S1	2	55.8 ± 5.0	NS
P	*Carex saxatilis*	Russet Sedge				S1	14	75.9 ± 10.0	NB
P	*Cyperus diandrus*	Low Flatsedge				S1	7	71.0 ± 0.0	NS
P	*Eleocharis erythropoda*	Red-stemmed Spikerush				S1	12	72.5 ± 1.0	NB
P	*Fimbristylis autumnalis*	Slender Fimbry				S1	3	62.0 ± 0.0	NS
P	*Rhynchospora capillacea*	Slender Beakrush				S1	1	78.9 ± 0.0	NS
P	*Blysmopsis rufa*	Red Bulrush				S1	5	71.8 ± 1.0	NB
P	*Schoenoplectus torreyi*	Torrey's Bulrush				S1	19	72.2 ± 0.0	NS
P	*Sisyrinchium fuscatum*	Coastal Plain Blue-eyed-grass				S1	9	7.8 ± 0.0	NS
P	*Juncus secundus*	Secund Rush				S1	2	52.4 ± 3.0	NS
P	*Juncus vaseyi*	Vasey Rush				S1	1	92.9 ± 0.0	NB
P	*Triantha glutinosa*	Sticky False-Asphodel				S1	4	78.5 ± 0.0	NB
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	3	76.6 ± 10.0	NB
P	*Spiranthes casei var. casei*	Case's Ladies'-Tresses				S1	2	22.7 ± 0.0	NS
P	*Torreyochloa pallida var. pallida*	Pale False Manna Grass				S1	2	49.6 ± 0.0	NS
P	*Graphephorum melicoides*	Purple False Oats				S1	3	78.5 ± 0.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	6	76.6 ± 0.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S1	1	80.6 ± 0.0	NB
P	*Selaginella rupestris*	Rock Spikemoss				S1	29	6.7 ± 0.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	5	24.4 ± 0.0	NS
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S1?	1	78.9 ± 0.0	NB
P	*Bolboschoenus robustus*	Sturdy Bulrush				S1?	2	34.3 ± 5.0	NS
P	*Juncus anthelatus*	Greater Poverty Rush				S1?	1	68.5 ± 0.0	NS
P	*Allium schoenoprasum*	Wild Chives				S1?	7	54.2 ± 1.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S1?	7	24.5 ± 1.0	NS
P	*Panicum dichotomiflorum ssp. puritanorum*	Spreading Panicgrass				S1?	18	34.2 ± 0.0	NS
P	*Huperzia selago*	Northern Firmoss				S1?	4	55.8 ± 5.0	NS
P	*Crocanthemum canadense*	Long-branched Frostweed			Endangered	S1S2	133	79.6 ± 0.0	NS
P	*Ageratina altissima*	White Snakeroot				S1S2	3	75.8 ± 1.0	NB
P	*Draba glabella*	Rock Whitlow-Grass				S1S2	8	80.7 ± 1.0	NB
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1S2	2	69.4 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1S2	14	74.4 ± 0.0	NB
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	1	72.7 ± 0.0	NS

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P	*Woodsia alpina*	Alpine Cliff Fern				S1S2	6	87.6 ± 0.0	NB
P	*Selaginella selaginoides*	Low Spikemoss				S1S2	6	58.3 ± 2.0	NS
P	*Euphrasia farlowii*	Farlow's Eyebright				S1S3	1	94.0 ± 1.0	NB
P	*Carex vacillans*	Estuarine Sedge				S1S3	2	68.6 ± 0.0	NB
P	*Zizia aurea*	Golden Alexanders				S2	19	68.9 ± 10.0	NB
P	*Antennaria parlinii ssp. fallax*	Parlin's Pussytoes				S2	7	70.4 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S2	3	36.8 ± 7.0	NS
P	*Rudbeckia laciniata var. laciniata*	Cut-Leaved Coneflower				S2	2	99.6 ± 2.0	NS
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S2	5	72.7 ± 5.0	NB
P	*Cardamine maxima*	Large Toothwort				S2	21	73.7 ± 4.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	74	58.7 ± 0.0	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S2	13	53.3 ± 0.0	NS
P	*Hylodesmum glutinosum*	Large Tick-trefoil				S2	18	52.1 ± 1.0	NS
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	1	87.0 ± 50.0	NB
P	*Conopholis americana*	American Cancer-root				S2	44	51.2 ± 5.0	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	18	73.4 ± 0.0	NS
P	*Hepatica americana*	Round-lobed Hepatica				S2	7	10.1 ± 0.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S2	3	70.8 ± 0.0	NB
P	*Galium boreale*	Northern Bedstraw				S2	6	33.9 ± 0.0	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	1	78.5 ± 0.0	NB
P	*Agalinis maritima*	Saltmarsh Agalinis				S2	51	86.1 ± 6.0	NS
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S2	6	68.8 ± 0.0	NB
P	*Carex pellita*	Woolly Sedge				S2	2	74.9 ± 1.0	NB
P	*Carex livida*	Livid Sedge				S2	2	72.7 ± 2.0	NB
P	*Juncus greenei*	Greene's Rush				S2	1	85.6 ± 0.0	NB
P	*Juncus alpinoarticulatus ssp. americanus*	Northern Green Rush				S2	6	61.5 ± 0.0	NS
P	*Allium tricoccum*	Wild Leek				S2	45	7.0 ± 0.0	NS
P	*Lilium canadense*	Canada Lily				S2	4	78.5 ± 0.0	NB
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	4	18.4 ± 1.0	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	3	72.7 ± 2.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	6	76.5 ± 0.0	NB
P	*Platanthera flava var. flava*	Southern Rein Orchid				S2	413	59.4 ± 0.0	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S2	19	67.9 ± 1.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3	43.9 ± 0.0	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S2	25	90.0 ± 0.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S2	1	72.7 ± 0.0	NB
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	8	80.9 ± 10.0	NS
P	*Cryptogramma stelleri*	Steller's Rockbrake				S2	3	78.5 ± 0.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5	72.2 ± 1.0	NB
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	3	59.1 ± 0.0	NS
P	*Crataegus submollis*	Quebec Hawthorn				S2?	3	71.1 ± 1.0	NB
P	*Carex peckii*	White-Tinged Sedge				S2?	1	78.5 ± 0.0	NB
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S2S3	490	4.9 ± 0.0	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S2S3	1	78.5 ± 0.0	NB
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2S3	12	60.3 ± 1.0	NS
P	*Eutrochium dubium*	Coastal Plain Joe Pye Weed				S2S3	184	59.2 ± 1.0	NS
P	*Lactuca hirsuta*	Hairy Lettuce				S2S3	6	54.7 ± 1.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2S3	5	96.5 ± 0.0	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2S3	10	72.4 ± 0.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2S3	8	73.8 ± 1.0	NB
P	*Draba arabisans*	Rock Whitlow-Grass				S2S3	14	87.2 ± 0.0	NB
P	*Stellaria humifusa*	Saltmarsh Starwort				S2S3	5	69.3 ± 1.0	NB

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P	*Oxybasis rubra*	Red Goosefoot				S2S3	4	73.1 ± 1.0	NB
P	*Hypericum majus*	Large St John's-wort				S2S3	9	66.4 ± 1.0	NS
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	12	31.8 ± 0.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	10	59.6 ± 0.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2S3	12	24.1 ± 0.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	54	6.7 ± 0.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2S3	22	4.5 ± 0.0	NS
P	*Polygala polygama*	Racemed Milkwort				S2S3	26	6.0 ± 0.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	19	50.8 ± 7.0	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	1	57.7 ± 5.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2S3	13	71.3 ± 0.0	NB
P	*Primula mistassinica*	Mistassini Primrose				S2S3	10	76.6 ± 1.0	NB
P	*Anemone quinquefolia*	Wood Anemone				S2S3	38	51.7 ± 1.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2S3	4	72.6 ± 0.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	9	54.1 ± 0.0	NS
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2S3	25	57.6 ± 0.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	14	78.5 ± 0.0	NB
P	*Tiarella cordifolia*	Heart-leaved Foamflower				S2S3	5	76.8 ± 1.0	NB
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S2S3	3	90.5 ± 1.0	NB
P	*Boehmeria cylindrica*	Small-spike False-nettle				S2S3	23	81.2 ± 0.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3	56.8 ± 7.0	NS
P	*Carex capillaris*	Hairlike Sedge				S2S3	6	72.7 ± 2.0	NB
P	*Carex comosa*	Bearded Sedge				S2S3	8	21.7 ± 0.0	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	11	52.4 ± 3.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2S3	6	75.8 ± 1.0	NB
P	*Carex longii*	Long's Sedge				S2S3	12	54.9 ± 5.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2S3	9	24.0 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2S3	10	25.1 ± 5.0	NS
P	*Vallisneria americana*	Wild Celery				S2S3	30	70.0 ± 0.0	NB
P	*Juncus ranarius*	Seaside Rush				S2S3	1	78.5 ± 0.0	NB
P	*Najas gracillima*	Thread-Like Naiad				S2S3	20	58.7 ± 1.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2S3	78	30.2 ± 0.0	NS
P	*Spiranthes casei*	Case's Ladies'-Tresses				S2S3	2	50.4 ± 7.0	NS
P	*Spiranthes casei var. novaescotiae*	Case's Ladies'-Tresses				S2S3	7	55.8 ± 10.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2S3	7	57.6 ± 1.0	NS
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S2S3	3	78.5 ± 0.0	NB
P	*Potamogeton friesii*	Fries' Pondweed				S2S3	4	83.6 ± 5.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S2S3	1	77.1 ± 1.0	NB
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	7	64.8 ± 1.0	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3	69.5 ± 1.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	10	36.8 ± 7.0	NS
P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S3	44	28.6 ± 0.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	3	70.2 ± 1.0	NB
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S3	30	6.4 ± 5.0	NS
P	*Iva frutescens*	Big-leaved Marsh-elder				S3	50	89.0 ± 0.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S3	22	71.3 ± 1.0	NB
P	*Symphyotrichum boreale*	Boreal Aster				S3	22	18.0 ± 0.0	NS
P	*Symphyotrichum undulatum*	Wavy-leaved Aster				S3	75	50.4 ± 7.0	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S3	12	9.5 ± 0.0	NS
P	*Alnus serrulata*	Smooth Alder				S3	810	50.6 ± 0.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S3	52	55.8 ± 5.0	NS
P	*Betula pumila*	Bog Birch				S3	9	68.3 ± 1.0	NB

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P	*Cardamine parviflora*	Small-flowered Bittercress				S3	16	57.7 ± 5.0	NS
P	*Palustricodon aparinoides*	Marsh Bellflower				S3	15	78.5 ± 0.0	NB
P	*Lobelia kalmii*	Brook Lobelia				S3	7	73.7 ± 1.0	NB
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	69	28.5 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S3	37	6.8 ± 0.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S3	2	6.4 ± 5.0	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S3	4	74.5 ± 10.0	NB
P	*Ceratophyllum echinatum*	Prickly Hornwort				S3	6	74.7 ± 1.0	NB
P	*Viburnum edule*	Squashberry				S3	1	78.5 ± 0.0	NB
P	*Crassula aquatica*	Water Pygmyweed				S3	9	69.5 ± 1.0	NB
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3	56.6 ± 0.0	NS
P	*Halenia deflexa*	Spurred Gentian				S3	13	67.4 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	16	58.8 ± 0.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S3	6	71.9 ± 1.0	NB
P	*Utricularia resupinata*	Inverted Bladderwort				S3	51	18.6 ± 0.0	NS
P	*Epilobium strictum*	Downy Willowherb				S3	12	66.7 ± 1.0	NB
P	*Polygala sanguinea*	Blood Milkwort				S3	7	71.8 ± 0.0	NS
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S3	7	63.1 ± 0.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	7	57.6 ± 1.0	NS
P	*Primula laurentiana*	Laurentian Primrose				S3	42	9.1 ± 1.0	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	20	83.1 ± 0.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3	6.5 ± 1.0	NS
P	*Anemone virginiana*	Virginia Anemone				S3	1	78.5 ± 0.0	NB
P	*Cephalanthus occidentalis*	Common Buttonbush				S3	1916	42.7 ± 7.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S3	1	78.7 ± 1.0	NB
P	*Salix pedicellaris*	Bog Willow				S3	92	18.0 ± 0.0	NS
P	*Salix sericea*	Silky Willow				S3	116	55.8 ± 5.0	NS
P	*Saxifraga paniculata ssp. laestadii*	Laestadius' Saxifrage				S3	8	87.6 ± 10.0	NB
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	8	58.6 ± 2.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3	78.5 ± 0.0	NB
P	*Pilea pumila*	Dwarf Clearweed				S3	1	49.9 ± 0.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S3	5	76.1 ± 0.0	NB
P	*Carex bebbii*	Bebb's Sedge				S3	5	76.1 ± 0.0	NB
P	*Carex castanea*	Chestnut Sedge				S3	2	78.5 ± 0.0	NB
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	29	63.0 ± 3.0	NS
P	*Carex lupulina*	Hop Sedge				S3	26	56.6 ± 0.0	NS
P	*Carex rosea*	Rosy Sedge				S3	15	7.3 ± 0.0	NS
P	*Carex swanii*	Swan's Sedge				S3	90	4.3 ± 0.0	NS
P	*Carex tenera*	Tender Sedge				S3	3	69.5 ± 0.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	13	58.8 ± 0.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	1	78.5 ± 0.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3	2	72.7 ± 0.0	NB
P	*Eleocharis nitida*	Quill Spikerush				S3	8	22.4 ± 7.0	NS
P	*Eleocharis flavescens var. olivacea*	Bright-green Spikerush				S3	18	33.7 ± 1.0	NS
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3	8	24.3 ± 0.0	NS
P	*Eleocharis rostellata*	Beaked Spikerush				S3	63	85.6 ± 0.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S3	7	18.0 ± 0.0	NS
P	*Schoenoplectus americanus*	Olney's Bulrush				S3	92	84.6 ± 5.0	NS
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S3	2	96.7 ± 5.0	NB
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S3	5	75.8 ± 2.0	NB
P	*Neottia bifolia*	Southern Twayblade				S3	86	31.6 ± 0.0	NS
P	*Platanthera flava*	Southern Rein-Orchid				S3	39	60.2 ± 0.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	31	8.8 ± 1.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	13	50.8 ± 0.0	NS
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S3	13	50.6 ± 5.0	NS

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P	*Piptatheropsis canadensis*	Canada Ricegrass				S3	17	38.1 ± 0.0	NS
P	*Poa glauca*	Glaucous Blue Grass				S3	9	72.7 ± 2.0	NB
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S3	7	30.7 ± 7.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	10	72.7 ± 1.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3	1	72.7 ± 1.0	NB
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	9	72.7 ± 0.0	NB
P	*Asplenium viride*	Green Spleenwort				S3	16	64.1 ± 0.0	NB
P	*Dryopteris fragrans*	Fragrant Wood Fern				S3	3	78.5 ± 0.0	NB
P	*Sceptridium dissectum*	Dissected Moonwort				S3	15	45.1 ± 1.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	15	48.3 ± 0.0	NS
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S3?	34	61.7 ± 1.0	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3?	39	54.6 ± 0.0	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	6	52.6 ± 2.0	NS
P	*Bidens vulgata*	Tall Beggarticks				S3S4	3	62.1 ± 0.0	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3S4	5	78.5 ± 0.0	NB
P	*Hieracium paniculatum*	Panicled Hawkweed				S3S4	30	7.4 ± 0.0	NS
P	*Bidens beckii*	Water Beggarticks				S3S4	38	30.6 ± 0.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3S4	15	77.2 ± 1.0	NB
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	4	83.8 ± 1.0	NB
P	*Vaccinium boreale*	Northern Blueberry				S3S4	1	90.1 ± 0.0	NB
P	*Vaccinium cespitosum*	Dwarf Bilberry				S3S4	34	67.8 ± 0.0	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	748	6.6 ± 1.0	NS
P	*Fagus grandifolia*	American Beech				S3S4	297	7.7 ± 0.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3S4	59	43.8 ± 0.0	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3S4	102	29.6 ± 1.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3S4	298	37.1 ± 1.0	NS
P	*Nuphar microphylla*	Small Yellow Pond-lily				S3S4	7	40.2 ± 0.0	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3S4	14	32.4 ± 7.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	12	27.5 ± 7.0	NS
P	*Rumex pallidus*	Seabeach Dock				S3S4	15	69.0 ± 0.0	NB
P	*Pyrola asarifolia*	Pink Pyrola				S3S4	6	14.4 ± 7.0	NS
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3S4	25	4.7 ± 0.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3S4	49	16.9 ± 3.0	NS
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	8	78.2 ± 0.0	NB
P	*Fragaria vesca*	Woodland Strawberry				S3S4	2	78.5 ± 0.0	NB
P	*Galium aparine*	Common Bedstraw				S3S4	7	63.7 ± 0.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3S4	14	66.1 ± 0.0	NB
P	*Limosella australis*	Southern Mudwort				S3S4	15	68.5 ± 0.0	NB
P	*Ulmus americana*	White Elm				S3S4	24	29.6 ± 0.0	NS
P	*Verbena hastata*	Blue Vervain				S3S4	8	51.5 ± 1.0	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	57	4.7 ± 0.0	NS
P	*Viola selkirkii*	Great-Spurred Violet				S3S4	3	78.5 ± 0.0	NB
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S3S4	533	2.5 ± 0.0	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	23	15.8 ± 5.0	NS
P	*Sisyrinchium atlanticum*	Eastern Blue-Eyed-Grass				S3S4	393	29.8 ± 2.0	NS
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	24	31.4 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	19	58.4 ± 0.0	NS
P	*Juncus subcaudatus*	Woods-Rush				S3S4	26	28.2 ± 0.0	NS
P	*Luzula parviflora ssp. melanocarpa*	Black-fruited Woodrush				S3S4	3	74.9 ± 2.0	NB
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3S4	21	49.7 ± 0.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	19	18.4 ± 1.0	NS
P	*Platanthera obtusata*	Blunt-leaved Orchid				S3S4	32	37.4 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3S4	48	28.5 ± 7.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3S4	4	78.5 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3S4	103	7.4 ± 0.0	NS
P	*Coleataenia longifolia*	Long-leaved Panicgrass				S3S4	2348	47.4 ± 0.0	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	29	42.3 ± 0.0	NS
P	*Koeleria spicata*	Narrow False Oats				S3S4	12	77.2 ± 2.0	NB
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3S4	10	16.0 ± 0.0	NS
P	*Lorinseria areolata*	Netted Chain Fern				S3S4	298	47.0 ± 0.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3S4	5	72.3 ± 0.0	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	10	48.8 ± 1.0	NS
P	*Huperzia appressa*	Mountain Firmoss				S3S4	5	66.5 ± 5.0	NB
P	*Sceptridium multifidum*	Leathery Moonwort				S3S4	9	56.8 ± 0.0	NS
P	*Botrychium matricariifolium*	Daisy-leaved Moonwort				S3S4	3	75.4 ± 2.0	NB
P	*Bidens discoidea*	Swamp Beggarticks				SH	1	42.9 ± 0.0	NS
P	*Dichanthelium meridionale*	Matting Witchgrass				SH	3	10.7 ± 10.0	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

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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21	Benjamin, L.K. (compiler). 2010. Baccharis halimifolia observation records. NS Dept of Natural Resources, 40.
21	McLean, K. 2019. Species At Risk observations. Clean Annapolis River Project.
21	McNeil, J.A. 2019. Snapping Turtle records, 2017. Mersey Tobeatic Research Institute.
20	Benjamin, L.K. 2011. NSDNR fieldwork & consultant reports 1997, 2009-10. Nova Scotia Dept Natural Resources, 85 recs.
20	Blaney, C.S. & Mazerolle, D.M. 2011. Field data from NCC properties at Musquash Harbour NB & Goose Lake NS. Atlantic Canada Conservation Data Centre, 1739 recs.
20	Chapman, C.J. 2018. Atlantic Canada Conservation Data Centre botanical fieldwork 2018. Atlantic Canada Conservation Data Centre, 11171 recs.
20	Klymko, J.J.D.; Robinson, S.L. 2014. 2013 field data. Atlantic Canada Conservation Data Centre.
20	O'Grady, Sally. 2010. Water Pennywort in Kejimkujik National Park, 2010. Parks Canada, 20 shapefiles.
19	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
19	Newell, R.E. 2000. Eleocharis tuberculosa records in NS, 1994-99. Acadia University, Wolfville NS, Pers. comm. to S.H. Gerriets, Feb. 11. 32 recs.
19	Sollows, M.C. 2008. NBM Science Collections databases: herpetiles. New Brunswick Museum, Saint John NB, download Jan. 2008, 8636 recs.
18	Basquill, S.; Sam, D. 2019. Crocanthemum canadense observations near Greenwood, NS, 2015-2019. pers. commun. from Nova Scotia Department of Lands and Forestry to AC CDC, 18 recs.
17	Blaney, C.S. 2020. Sean Blaney 2020 field data. Atlantic Canada Conservation Data Centre, 4407 records.
17	MacKinnon, D.S. 2000. Fieldwork 2000. Dept of Environment and Labour, Protected Areas Branch, 17 recs.
17	McKendry, Karen. 2016. Rare species observations, 2016. Nova Scotia Nature Trust, 19 recs.
17	Thomas, A.W. 1996. A preliminary atlas of the butterflies of New Brunswick. New Brunswick Museum.
17	Tingley, S. (compiler). 2001. Butterflies of New Brunswick. , Web site: www.geocities.com/Yosemite/8425/buttrfly. 142 recs.
16	Hunsinger, J. 2021. Species at Risk records from Medway Community Forest Cooperative monitoring plots and baited game cameras, 2019-2020. Medway Community Forest Cooperative, 16 records.
16	LaPaix, R.W.; Crowell, M.J.; MacDonald, M. 2011. Stantec rare plant records, 2010-11. Stantec Consulting, 334 recs.
16	LaPaix, R.W.; Crowell, M.J.; MacDonald, M.; Neily, T.D.; Quinn, G. 2017. Stantec Nova Scotia rare plant records, 2012-2016. Stantec Consulting.
16	Neily, T.H. Hectanooga, Nova Scotia Liverwort records. T.H. Neily. 2017.
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15	Pike, E., Tingley, S. & Christie, D.S. 2000. Nature NB Listserve. University of New Brunswick, listserv.unb.ca/archives/naturenb. 68 recs.
15	Sollows, M.C,. 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
14	Basquill, S.P., Porter, C. 2019. Bryophyte and lichen specimens submitted to the E.C. Smith Herbarium. NS Department of Lands and Forestry.
14	Clayden, S.R. 2005. Confidential supplement to Status Report on Ghost Antler Lichen (Pseudevernia cladonia). Committee on the Status of Endangered Wildlife in Canada, 27 recs.
14	Toms, Brad. 2011. Species at Risk data from 2011 field surveys. Mersey Tobeatic Research Institute, 17 recs.
13	G.Proulx, R. Newell, A. Mills, D. Bayne. 2018. Selaginella rupestris records, Digby Co. Nova Scotia Lands and Forestry, 1387601 recs.
13	MacKinnon, D.S. 1998. Ponhook Lake survey map & notes. Dept of Environment and Labour, Protected Areas Branch, 13 recs.
13	Patrick, A.; Horne, D.; Noseworthy, J. et. al. 2017. Field data for Nova Scotia and New Brunswick, 2015 and 2017. Nature Conservancy of Canada.
12	Cameron, R.P. 2017. 2017 rare species field data. Nova Scotia Environment, 64 recs.
12	Goltz, J.P. 2012. Field Notes, 1989-2005. , 1091 recs.
12	Parks Canada. 2010. Specimens in or near National Parks in Atlantic Canada. Canadian National Museum, 3925 recs.
11	Bryson, I. 2020. Nova Scotia and Newfoundland rare species observations, 2018-2020. Nova Scotia Environment.
11	Cameron, R.P. 2018. Degelia plumbea records. Nova Scotia Environment.
11	Manthorne, A. 2019. Incidental aerial insectivore observations. Birds Canada.

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10	Benedict, B. Connell Herbarium Specimen Database Download 2004. Connell Memorial Herbarium, University of New Brunswick. 2004.
10	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
10	Cameron, R.P. 2011. Lichen observations, 2011. Nova Scotia Environment & Labour, 731 recs.
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10	Ferguson, D.C. 1954. The Lepidoptera of Nova Scotia. Part I, macrolepidoptera. Proceedings of the Nova Scotian Institute of Science, 23(3), 161-375.
10	Kennedy, Joseph. 2010. New Brunswick Peregrine records, 2010. New Brunswick Dept Natural Resources, 16 recs (11 active).
10	Parker, M.S.R. 2011. Hampton Wind Farm 2010: significant floral/faunal observations. , 13 recs.
10	Robinson, S.L. 2014. 2013 Field Data. Atlantic Canada Conservation Data Centre.
9	deGooyer, K. 2019. Snapping Turtle and Eastern White Cedar observations. Nova Scotia Environment.
9	Hinds, H.R. 1999. Connell Herbarium Database. University New Brunswick, Fredericton, 131 recs.
9	Klymko, J. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre.
9	Klymko, J.J.D. 2012. Odonata specimens & observations, 2010. Atlantic Canada Conservation Data Centre, 425 recs.
9	MacKinnon, D.S. & Maass, O.C. 1996. Fieldwork 1996. Dept Natural Resources, Parks Division, 9 recs.
9	McAlpine, D.F. 1998. NBM Science Collections: Wood Turtle records. New Brunswick Museum, Saint John NB, 329 recs.
9	McNeil, J.A. 2018. Snapping Turtle records, 2018. Mersey Tobeatic Research Institute.
9	Smith, T.W. 2009. Eleocharis tuberculosa records in Yarmouth, Shelburne Count. COSEWIC. Pers. comm. to D.M. Mazerolle, 10 recs.
9	Sollows, M.C,. 2009. NBM Science Collections databases: Coccinellid & Cerambycid Beetles. New Brunswick Museum, Saint John NB, download Feb. 2009, 569 recs.
8	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
8	Belliveau, A. 2013. email to Sean Blaney regarding Listera australis observations in SW Nova Scotia. Mersey Tobeatic Research Institute, 8.
8	Catling, P.M. 1981. Taxonomy of autumn-flowering Spiranthes species of southern Nova Scotia in Can. J. Bot. , 59:1250-1273. 30 recs.
8	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
8	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
8	Neily, T.H. Tom Neily NS Sphagnum records (2009-2014). T.H. Neily, Atlantic Canada Conservation Data Centre. 2019.
8	Pepper, C. 2021. Rare bird, plant and mammal observations in Nova Scotia, 2017-2021.
8	Wood, E.W. 2011. Sabatia kennedyana locations in Nova Scotia. Pers. comm. to C.S. Blaney. Gray Herbarium, Harvard University, 8 recs.
7	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
7	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
7	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
7	Kennedy, B.; Cron, C. 2019. observations of Poison Sumac andButtonbush, Nova Scotia. pers. commun to AC CDC.
7	Maddox, G.D., Cannell, P.F. 1982. The Butterflies Of Kent Island, Grand Manan, New Brunswick. Journal of the Lepidopterists' Society, 36(4): 264-268.
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6	Basquill, S.P. 2009. 2009 field observations. Nova Scotia Dept of Natural Resources.
6	Blaney, C.S. 1999. Fieldwork 1999. Atlantic Canada Conservation Data Centre. Sackville NB, 292 recs.
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6	McAlpine, D.F. 1983. Status & Conservation of Solution Caves in New Brunswick. New Brunswick Museum, Publications in Natural Science, no. 1, 28pp.
6	McMullin, Troy. 2021. Anzia colpodes observations near Kejimkujik National Park. Canadian Museum of Nature.
6	NS DNR. 2017. Black Ash records from NS DNR Permanent Sample Plots (PSPs), 1965-2016. NS Dept of Natural Resources.
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5	Boyne, A.W. 2000. Harlequin Duck Surveys. Canadian Wildlife Service, Sackville, unpublished data. 5 recs.
5	Chapman-Lam, C.J. 2021. Atlantic Canada Conservation Data Centre 2020 botanical fieldwork. Atlantic Canada Conservation Data Centre, 17309 recs.
5	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
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5	Honeyman, K. 2019. Unique Areas Database, 2018. J.D. Irving Ltd.
5	Keddy, C. 1986. Status report on the eastern mountain avens, Geum peckii, in Canada Ottawa, Ontario, Canada: Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
5	Majka, C.G. & McCorquodale, D.B. 2006. The Coccinellidae (Coleoptera) of the Maritime Provinces of Canada: new records, biogeographic notes, and conservation concerns. Zootaxa. Zootaxa, 1154: 49–68. 7 recs.
5	Newell, R.E. 2002. A Botanical Survey of the Sand Pond National Wildlife Area. , 12 recs.
5	Shortt, R. UNB specimen data for various tracked species formerly considered secure. Connell Memorial Herbarium, UNB, Fredericton NB. 2019.
4	Belliveau, A.G. 2019. Maleberry (Lyonia ligustrina) count at Long Lake, Yarmouth Co., NS. E.C Smith Herbarium, Acadia University, Wolfville NS, 4 records.
4	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
4	Hicklin, P.W. 1999. The Maritime Shorebird Survey Newsletter. Calidris, No. 7. 6 recs.
4	Marx, M. & Kenney, R.D. 2001. North Atlantic Right Whale Database. University of Rhode Island, 4 recs.
4	Misc. rare species records gathered by NSDNR staff or communicated to NSDNR and forwared to ACCDC
4	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
4	NatureServe Canada. 2018. iNaturalist Butterfly Data Export . iNaturalist.org and iNaturalist.ca.
4	Newell, R.E. 2006. Rare plant observations in Digby Neck. Pers. comm. to S. Blaney, 6 recs.
4	Phinney, Lori; Toms, Brad; et. al. 2016. Bank Swallows (Riparia riparia) in Nova Scotia: inventory and assessment of colonies. Merset Tobeiatc Research Institute, 25 recs.

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4	Speers, L. 2001. Butterflies of Canada database. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 190 recs.
4	Toms, B. 2015. Lophiola aurea (Goldencrest) records from Molega Lake. Mersey Tobeatic Research Institute, 4 records.
4	Toms, B. 2016. Email list of four GPS locations of Golden Crest (Lophiola aurea) from the previously documented site on Molega Lake, NS. Mersey Tobeatic Research Institute, 4 records.
3	Anon. Dataset of butterfly records for the Maritime provinces. Museum of Comparative Zoology, Harvard University. 2017.
3	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
3	Churchill, J.L. 2020. Atlantic Canada Conservation Data Centre Fieldwork 2020. Atlantic Canada Conservation Data Centre, 1083 recs.
3	Clayden, S.R. 2003. NS lichen ranks, locations. Pers. comm to C.S. Blaney. 1p, 5 recs, 5 recs.
3	Cowie, F. 2007. Electrofishing Population Estimates 1979-98. Canadian Rivers Institute, 2698 recs.
3	deGooyer, K. 2019. Eastern White Cedar observations, Norwood, Nova Scotia. Nova Scotia Environment.
3	Hill, N.M., Myra, M. 2017. Email to Sean Blaney regarding rich intervale flora on Nictaux River. Fern Hill Institute, 3 records.
3	Holder, M.L.; Kingsley, A.L. 2000. Kinglsey and Holder observations from 2000 field work.
3	Hope, P. 2002. Field survey of Goodyera pubescens population at Kejimkujik National Park. Kejimkujik National Park, 3 recs.
3	Klymko, J.J.D. 2016. 2014 field data. Atlantic Canada Conservation Data Centre.
3	Klymko, J.J.D. 2016. 2015 field data. Atlantic Canada Conservation Data Centre.
3	Layberry, R.A. 2012. Lepidopteran records for the Maritimes, 1974-2008. Layberry Collection, 1060 recs.
3	Mills, Pamela. 2008. Clethra alnifolia at Mudflat Lake. Nova Scotia Dept of Natural Resources, Wildlife Div. Pers. comm. to D.M. Mazerolle, 4 recs.
3	Nash, Vicky. 2018. Hammond River Angling Association Wood Turtle observations. Hammond River Angling Association, 3 recs.
3	Neily, T.H. 2013. Email communication to Sean Blaney regarding Listera australis observations made from 2007 to 2011 in Nova Scotia. , 50.
3	Olsen, Ervin. 2018. Nova Scotia Atlantic Coastal Plain Flora observations. Halifax Field Naturalists Nova Scotia Nature Archive Facebook Page.
3	Riley, J. 2020. Digby County Pannaria lurida observations. Pers. comm. to J.L. Churchill.
3	Robinson, S.L. 2015. 2014 field data.
3	Rothrock, P. 2002. Carex longii in NS. Taylor University, Pers. com. to L. Benjamin, forwarded to S. Blaney. 5 recs.
3	Spicer, C.D. 2001. Powerline Corridor Botanical Surveys, Charlotte & Saint John Counties. A M E C International, 1269 recs.
3	Staicer, C. 2013. Personal communication concerning Hirundo rustica nesting in and around Kejimkujik NP, NS. Pers. comm.
3	White, S. 2019. Notable species sightings, 2018. East Coast Aquatics.
3	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
3	WIlliams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
2	Amirault, D.L. & Stewart, J. 2007. Piping Plover Database 1894-2006. Canadian Wildlife Service, Sackville, 3344 recs, 1228 new.
2	Amirault, D.L. 1997-2000. Unpublished files. Canadian Wildlife Service, Sackville, 470 recs.
2	Anon. 2017. Export of Maritimes Butterfly records. Global Biodiversity Information Facility (GBIF).
2	Bayne, D.M. 2014. 2014 insect field observations.
2	Benjamin, L.K. 2002. Rare plant observations by P. MacDonald, P. Mills, S. Eaton, H. MacKinnon, B. Colpitts at Sloans Lake, NS. Pers. comm. to L.K. Benjamin, NSDNR, with P. MacDonald, 3 recs.
2	Bishop, G. 2012. Field data from September 2012 Anticosti Aster collection trip. , 135 rec.
2	Brunelle, P.-M. 2009. NS Power odonata records for Mersey, Tusket & Sissiboo systems. Nova Scotia Power, 218 recs.
2	Bryson, I.C. 2020. Nova Scotia flora and lichen observations 2020. Nova Scotia Environment, 139 recs.
2	Cameron, R.P. 2014. 2013-14 rare species field data. Nova Scotia Department of Environment, 35 recs.
2	Catling, P.M. 2001. Bog Elfin records in NB, 1939-95. Eastern Cereal & Oilseed Research Centre, Ottawa, Pers. comm. to K.A. Bredin. 11 recs.
2	Clayden, S.R. 2020. Email to Sean Blaney regarding Pilophorus cereus and P. fibula at Fidele Lake area, Charlotte County, NB. pers. comm., 2 records.
2	e-Butterfly. 2019. Export of Maritimes records and photos. McFarland, K. (ed.) e-butterfly.org.
2	Edge, Thomas A. 1984. Status report on the Atlantic Whitefish (Coregonus huntsmani). Committee on the Status of Endangered Wildlife in Canada.
2	Elderkin M.F. 2007. Selaginella rupestris, Iris prismatica & Lophiola aurea records in NS. NS Dept of Natural Resources, Wildlife Div. Pers. comm. to C.S. Blaney, 3 recs.
2	Goltz, J. 2017. Harlequin Duck observations. New Brunswick Department of Agriculture, Aquaculture and Fisheries.
2	Hill, N.M. 2019. Observation of Crocanthemum canadense near Auburn, Annapolis Co. NS on May 29, 2019. Fern Hill Institute, 2 recs.
2	Hinds, H.R. 1999. A Vascular Plant Survey of the Musquash Estuary in New Brunswick. , 12pp.
2	Kennedy, B. & Cron, C.; Patriquin, D. 2018. Email to Sean Blaney on observations of Trichostema dichotomum at Shingle Lake, Nova Scotia. , 2 records.
2	Lovit, M. 2015. Rare Passamaquoddy Flora of Grand Manan. New Brunswick Museum, Florence M. Christie Grant in Botany, 32 pp.
2	McIntosh, W. 1899. The Butterflies of New Brunswick. Bulletin of the Natural History Society of New Brunswick, 18: 223-225.
2	Mills, P. 2016. Email communication to S. Blaney, re: Scirpus longii at Upper Great Brook, Queens Co. NS. NS DNR, 2 recs.
2	Neily, T.H. & Pepper, C.; Toms, B. 2018. Nova Scotia lichen database Update. Mersey Tobeatic Research Institute, 14 recs.
2	Ogden, K. Nova Scotia Museum butterfly specimen database. Nova Scotia Museum. 2017.
2	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
2	Perrin, J., Russel, J. 1912. Catalogue of Butterflies and Moths, Mostly Collected in the Neighborhood of Halifax and Digby, Nova Scotia. Proceedings and Transactions of the Nova Scotian Institute of Science, 12(3), 258-290.
2	Proulx, V.D. 2002. Selaginella rupestris sight record at Centreville, Nova Scotia. Virginia D. Proulx collection, 2 recs.
2	Sabine, M. 2016. Black Ash records from the NB DNR Forest Development Survey. New Brunswick Department of Natural Resources.
2	Sheffield, C.S. 2004. The Rare Cleptoparasitic Bee Epeoloides pilosula (Hymenoptera: Apoidea: Apidae) Discovered in Nova Scotia, Canada, with Distributional Notes
2	Smith, T.W. 2009. Assessment and update status report on the Tubercled Spike-rush (Eleocharis tuberculosa) in Canada. Committee on the Status of Endangered Wildlife in Canada, 3 recs.
2	Wong, Sarah. 2020. Two Chimney Swift observation made by Sarah Wong. pers. comm. to Sean Blaney.

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2	Wong, Sarah. 2021. Chimney Swift observations, Beverly Lake, NS. pers. comm.
1	Allan Smith. 2011. Cedar stand location at South Williamston. Abitibi Bowater, 1 Rec.
1	Amiro, Peter G. 1998. Atlantic Salmon: Inner Bay of Fundy SFA 22 & part of SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-12. 4 recs.
1	Amiro, Peter G. 1998. Atlantic Salmon: Southern Nova Scotia SFA 21. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-11. 1 rec.
1	Arsenault, R. 2009. Goodyera pubescens record in Kejimkujik National Park. Pers. comm. to C.S. Blaney, 1 rec.
1	Bagnell, B.A. 2003. Update to New Brunswick Rare Bryophyte Occurrences. B&B Botanical, Sussex, 5 recs.
1	Basquill, S.P. 2018. Various specimens, NS DNR field work. NS Department of Natural Resources, 10.
1	Basquill, S.P.; Neily, T. 2015. Database of Sphagnum records for Nova Scotia. NS Department of Natural Resources, 4 recs.
1	Bateman, M.C. 2000. Waterfowl Brood Surveys Database, 1990-2000 . Canadian Wildlife Service, Sackville, unpublished data. 149 recs.
1	Belliveau, A. & Toms, B. 2012. Email regarding Lophiola aurea (Goldencrest) location on Molega Lake, NS. Mersey Tobeatic Research Institute, 3 records.
1	Belliveau, A.G. 2020. Email to Colin Chapman on new NS locations for Allium tricoccum. Chapman, C.J. (ed.) Acadia University.
1	Belliveau, A.G. E.C. Smith Herbarium Specimen Database 2019. E.C. Smith Herbarium, Acadia University. 2019.
1	Berg, L. 2020. Canada Warbler observations, Birch Lake, NS. pers. comm. to J. Churchill.
1	Bernard, Laurel. 2013. Email to Sean Blaney regarding Listera australis at Lake Rossignol. Nature Conservancy of Canada, 1.
1	Bishop, G., Bagnell, B.A. 2004. Site Assessment of Musquash Harbour, Nature Conservancy of Canada Property - Preliminary Botanical Survey. B&B Botanical, 12pp.
1	Blaney, C.S. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 1042 recs.
1	Bradford, R. 2004. Coregonus huntsmani locations. Dept of Fisheries & Oceans, Atlantic Region, Pers. comm. to K. Bredin. 4 recs.
1	Bredin, K.A. 2001. WTF Project: Freshwater Mussel Fieldwork in Freshwater Species data. Atlantic Canada Conservation Data Centere, 101 recs.
1	Bredin, K.A. 2002. NS Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centere, 30 recs.
1	Butt, Brad. 2020. Email from Brad Butt to Sean Blaney regarding a Blue Felt Lichen (Pectenia plumbea) from near Deception Lake, Shelburne Co., NS. pers. comm., 1 record.
1	Clayden, S.R. 2006. Pseudevernia cladonia records. NB Museum. Pers. comm. to S. Blaney, Dec, 4 recs.
1	Clayden, S.R. 2020. Email regarding Blue Felt Lichen (Pectenia plumbea) occurrences in New Brunswick, from Stephen Clayden to Sean Blaney. pers. comm., 2 records.
1	Cook, K. 2016. Wood Turtle record. Pers comm. to Nova Scotia Department of Lands and Forestry.
1	Cronin, P. & Ayer, C.; Dubee, B.; Hooper, W.C.; LeBlanc, E.; Madden, A.; Pettigrew, T.; Seymour, P. 1998. Fish Species Management Plans (draft). NB DNRE Internal Report. Fredericton, 164pp.
1	Crowell, M.J. Plant specimens from Nictaux, NS sent to Sean Blaney for identification. Jacques Whitford Limited. 2005.
1	Daury, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (Bucephala islandica) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
1	deGooyer, K. 2018. Chelydra serpentina observation record. Nova Scotia Environment.
1	deGooyer, K. 2020. Eastern White Cedar observations, Norwood, Nova Scotia. Nova Scotia Environment.
1	Dept of Fisheries & Oceans. 1999. Status of Wild Striped Bass, & Interaction between Wild & Cultured Striped Bass in the Maritime Provinces. , Science Stock Status Report D3-22. 13 recs.
1	e-Butterfly. 2018. Selected Maritimes butterfly records from 2016 and 2017. Maxim Larrivee, Sambo Zhang (ed.) e-butterfly.org.
1	Fernald, M.L. 1921. Expedition to Nova Scotia. Rhodora 13: 136-273.
1	Gobeil, R.E. 1865. Butterflies On Kent Island, New Brunswick. Journal of the Lepidopterists' Society. , 19(3): 181-183.
1	Goltz, J.P. 2001. Botany Ramblings April 29-June 30, 2001. N.B. Naturalist, 28 (2): 51-2. 8 recs.
1	Hall, Duane. 2018. Martes americana record by Duane Sabine, emailed to J. Klymko on 13 12 2018. pers. comm.
1	Hicklin, P.W. 1990. Shorebird Concentration Sites (unpubl. data). Canadian Wildlife Service, Sackville, 296 sites, 30 spp.
1	Hill, N. 2014. 2014 Monarch email report, Bridgetown, NS. Fern Hill Institute for Plant Conservation.
1	Hill, N.M. 2016. Email communications to Sean Blaney and Alain Belliveau regarding the discovery of Fimbristylis autumnalis on the shores of Loon Lake, Kejimkujik National Park. Pers. comm., 1 rec.
1	Hope, P. 2007. Water-pennywort (Hydrocotyle umbellata) on Ell Island. Parks Canada, Kejimkujik NP, 1 record.
1	Johnstone, D.; Churchill J. 2014. 2014 Chimney Swift observation, Kejimkujik NP, NS. Atlantic Canada Conservation Data Centre.
1	Kennedy, B. 2019. observations of Crocanthemum canadense at Bangs Falls, Nova Scotia. iNaturalist.ca.
1	Klymko, J. Dataset of butterfly records at the New Brunswick Museum not yet accessioned by the museum. Atlantic Canada Conservation Data Centre. 2016.
1	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
1	Klymko, J.J.D.; Robinson, S.L. 2012. 2012 field data. Atlantic Canada Conservation Data Centre, 447 recs.
1	LaPaix, R.W. 2014. Trans-Canada Energy East Pipeline Environmental Assessment, Records from 2013-14. Stantec Consulting, 5 recs.
1	Maass, W.S.G. & Yetman, D. 2002. Assessment and status report on the boreal felt lichen (Erioderma pedicellatum) in Canada. Committee on the Status of Endangered Wildlife in Canada, 1 rec.
1	MacFarlane, Wayne. 2018. Skunk Cabbage observation on Long Island, Kings Co. NB. Pers. comm., 1 records.
1	MacKinnon, D.S. 2002. Fieldwork 2002. Dept of Environment & Labour, Protected Areas Branch, 1 rec.
1	MacKinnon, D.S. 2012. Goodyera pubescens observation, photo. Pers. comm. to S. Blaney, Sep 18, 1 rec.
1	MacKinnon, D.S. 2013. Email report of Peregrine Falcon nest E of St. Martins NB. NS Department of Environment and Labour, 1 record.
1	Marshall, L. 1998. Atlantic Salmon: Southwest New Brunswick outer-Fundy SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-13. 6 recs.
1	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
1	McCarthy, C. 2003. Ecological Inventory of Melanson Property, Annapolis County, Nova Scotia. Kejimkujik National Park.
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APPENDIX I

Plant Species Recorded in the Project Area During Field Surveys

Seabrook Quarry Expansion Project - Appendix I

Table I.1 Plant Species Recorded in the Project Area During Field Surveys Conducted in 2022

Scientific Name	Common Name	AC CDC Rank[1]
Abies balsamea	Balsam Fir	S5
Acer pensylvanicum	Striped Maple	S5
Acer rubrum	Red Maple	S5
Acer saccharum	Sugar Maple	S4S5
Acer spicatum	Mountain Maple	S5
Actaea pachypoda	White Baneberry	S4
Agrostis scabra	Rough Bent Grass	S5
Alnus alnobetula	Green Alder	S5
Amelanchier sp.	A Serviceberry	—
Anaphalis margaritacea	Pearly Everlasting	S5
Anthoxanthum odoratum	Large Sweet Vernal Grass	SNA
Aralia nudicaulis	Wild Sarsaparilla	S5
Athyrium filix-femina var. cyclosorum	Northwestern Lady Fern	SNA
Betula alleghaniensis	Yellow Birch	S5
Betula papyrifera	Paper Birch	S5
Betula populifolia	Gray Birch	S5
Brachyelytrum erectum	Bearded Shorthusk	SNA
Carex swanii	**Swan's Sedge**	**S3**
Carex communis	Fibrous-Root Sedge	S5
Carex debilis	White-edged Sedge	S5
Carex echinata	Star Sedge	S5
Carex folliculata	Northern Long Sedge	S5
Carex gracillima	Graceful Sedge	S5
Carex gynandra	Nodding Sedge	S5
Carex intumescens	Bladder Sedge	S5
Carex leptalea	Bristly-stalked Sedge	S5
Carex leptonervia	Finely-Nerved Sedge	S5
Carex novae-angliae	New England Sedge	S5
Carex pallescens	Pale Sedge	S5
Carex scabrata	Rough Sedge	S5
Carex crawfordii	Crawford's Sedge	S5
Chelone glabra	White Turtlehead	S5
Cinna latifolia	Drooping Wood Reed Grass	S5
Circaea alpina ssp. alpina	Small Enchanter's Nightshade	S5
Clematis virginiana	Virginia Clematis	S5
Clintonia borealis	Yellow Bluebead Lily	S5
Coptis trifolia	Goldthread	S5

Table I.1 Plant Species Recorded in the Project Area During Field Surveys Conducted in 2022

Scientific Name	Common Name	AC CDC Rank[1]
Corallorhiza maculata	Spotted Coralroot	S4
Corallorhiza trifida	Early Coralroot	S4
Cornus alternifolia	Alternate-leaved Dogwood	S5
Cornus canadensis	Bunchberry	S5
Cypripedium acaule	Pink Lady's-Slipper	S5
Danthonia spicata	Poverty Oat Grass	S5
Dendrolycopodium obscurum	Flat-branched Tree-clubmoss	S4
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	S5
Dichanthelium acuminatum	Woolly Panic Grass	SNA
Diervilla lonicera	Northern Bush Honeysuckle	S5
Doellingeria umbellata	Hairy Flat-top White Aster	S5
Dryopteris campyloptera	Mountain Wood Fern	S5
Dryopteris carthusiana	Spinulose Wood Fern	S5
Dryopteris cristata	Crested Wood Fern	S5
Dryopteris intermedia	Evergreen Wood Fern	S5
Dryopteris marginalis	Marginal Wood Fern	S5
Epifagus virginiana	Beechdrops	S4
Epipactis helleborine	Helleborine	SNA
Equisetum arvense	Field Horsetail	S5
Eurybia macrophylla	Large-leaved Aster	S5
Euthamia graminifolia	Grass-leaved Goldenrod	S5
Fagus grandifolia	American Beech	S3S4
Fragaria virginiana	Wild Strawberry	S5
Frangula alnus	Glossy Buckthorn	SNA
Fraxinus americana	White Ash	S4
Galeopsis tetrahit	Common Hemp-nettle	SNA
Galium tinctorium	Dyer's Bedstraw	S5
Glyceria grandis	Common Tall Manna Grass	S5
Glyceria striata	Fowl Manna Grass	S5
Gymnocarpium dryopteris	Common Oak Fern	S5
Hamamelis virginiana	American Witch-Hazel	S5
Hieracium lachenalii	Common Hawkweed	SNA
Hieracium scabrum	Rough Hawkweed	S5
Holcus lanatus	Common Velvet Grass	SNA
Hypericum perforatum	Common St. John's-wort	SNA
Hypopitys monotropa	Pinesap	S4
Ilex verticillata	Common Winterberry	S5
Linnaea borealis	Twinflower	S5

Table I.1 Plant Species Recorded in the Project Area During Field Surveys Conducted in 2022

Scientific Name	Common Name	AC CDC Rank[1]
Lonicera canadensis	Canada Fly Honeysuckle	S5
Luzula multiflora	Common Woodrush	S5
Lycopus uniflorus	Northern Water Horehound	S5
Lysimachia borealis	Northern Starflower	S5
Maianthemum canadense	Wild Lily-of-The-Valley	S5
Malus pumila	Common Apple	SNA
Medeola virginiana	Cucumber Root	S5
Mitchella repens	Partridgeberry	S5
Nabalus altissimus	Tall Rattlesnakeroot	S5
Nabalus trifoliolatus	Three-leaved Rattlesnakeroot	S5
Oclemena acuminata	Whorled Wood Aster	S5
Onoclea sensibilis	Sensitive Fern	S5
Claytosmunda claytoniana	Interrupted Fern	S5
Osmundastrum cinnamomeum	Cinnamon Fern	S5
Ostrya virginiana	Ironwood	S4S5
Oxalis montana	Common Wood Sorrel	S5
Phegopteris connectilis	Northern Beech Fern	S5
Picea glauca	White Spruce	S5
Picea mariana	Black Spruce	S5
Picea rubens	Red Spruce	S5
Pilosella caespitosa	Meadow Hawkweed	SNA
Platanthera clavellata	Club Spur Orchid	S5
Platanthera hyperborea	Leafy Northern Green Orchis	SNA
Platanthera orbiculata	Small Round-leaved Orchid	S3S4
Poa nemoralis	Wood Blue Grass	SNA
Poa pratensis	Kentucky Blue Grass	S5
Polystichum acrostichoides	Christmas Fern	S5
Populus grandidentata	Large-toothed Aspen	S5
Potentilla simplex	Old Field Cinquefoil	S5
Prunella vulgaris	Common Self-heal	S5
Prunus pensylvanica	Pin Cherry	S5
Pteridium aquilinum	Bracken Fern	S5
Ranunculus repens	Creeping Buttercup	SNA
Ribes glandulosum	Skunk Currant	S5
Rosa multiflora	Multiflora Rose	SNA
Rosa virginiana	Virginia Rose	S5
Rubus allegheniensis	Alleghaney Blackberry	S5
Rubus canadensis	Smooth Blackberry	S5

Table I.1 Plant Species Recorded in the Project Area During Field Surveys Conducted in 2022

Scientific Name	Common Name	AC CDC Rank[1]
Rubus hispidus	Bristly Dewberry	S5
Rubus idaeus	Red Raspberry	S5
Rubus pubescens	Dwarf Red Raspberry	S5
Sambucus racemosa	Red Elderberry	S5
Scirpus hattorianus	Mosquito Bulrush	S5
Solidago canadensis	Canada Goldenrod	S4S5
Solidago flexicaulis	Zigzag Goldenrod	S5
Solidago macrophylla	Large-leaved Goldenrod	S4S5
Solidago rugosa var. rugosa	Rough-stemmed Goldenrod	S5
Sonchus arvensis	Field Sow Thistle	SNA
Sorbus americana	American Mountain Ash	S5
Spiraea alba	White Meadowsweet	S5
Streptopus amplexifolius	Clasping-leaved Twisted-stalk	S4S5
Symphyotrichum cordifolium	Heart-leaved Aster	S4S5
Symphyotrichum lateriflorum	Calico Aster	S5
Symphyotrichum novi-belgii	New York Aster	S5
Taraxacum officinale	Common Dandelion	SNA
Thalictrum pubescens	Tall Meadow-Rue	S5
Parathelypteris noveboracensis	New York Fern	S5
Trillium erectum	Red Trillium	S4
Tussilago farfara	Coltsfoot	SNA
Vaccinium angustifolium	Late Lowbush Blueberry	S5
Vaccinium myrtilloides	Velvet-leaved Blueberry	S5
Veronica officinalis	Common Speedwell	SNA
Viburnum lantanoides	Hobblebush	S4
Viburnum cassinoides	Northern Wild Raisin	S5
Viola cucullate	Marsh Blue Violet	S5
Viola macloskeyi	Small White Violet	S5

[1] S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, SNA = Not Applicable (AC CDC 2022a)

— = No AC CDC Rank

APPENDIX J

Bird Species Recorded in the Project Area During Field Surveys

Table J.1 Bird Species Recorded in the Project Area During Field Surveys Conducted in 2022

Common Name	Scientific Name	Count	Habitat	Breeding
American Crow	*Corvus brachyrhynchos*	7	• Mature Mixedwood (6 Individuals) • Flew Over (1 Individual)	No indication of breeding (7 Individuals)
American Goldfinch	*Spinus tristis*	7	• Flew Over (3 Individuals) • Immature Hardwood (1 Individual) • Tall Shrub Thicket (3 Individuals)	• No indication of breeding (3 Individuals) • Habitat (2 Individuals) • Pair in suitable nest (2 Individuals)
American Redstart	*Setophaga ruticilla*	18	• Mature Hardwood (6 Individuals) • Immature Hardwood (5 Individuals) • Mature Mixedwood (5 Individuals) • Tall Shrub Thicket (2 Individuals)	• Singing male present (13 Individuals) • Adult carrying food (2 Individuals) • Habitat (2 Individuals) • Agitated (1 Individual)
American Robin	*Turdus migratorius*	8	• Mature Hardwood (6 Individuals) • Mature Mixedwood (1 Individual) • Immature Mixedwood (1 Individual)	• Singing male present (4 Individuals) • Habitat (3 Individuals) • Agitated (1 Individual)
American Woodcock	*Scolopax minor*	1	• Immature Mixedwood	• Habitat
Black-and-White Warbler	*Mniotilta varia*	10	• Immature Hardwood (4 Individuals) • Immature Mixedwood (4 Individuals) • Mature Hardwood (1 Individual) • Mature Mixedwood (1 Individual)	• Singing male present (6 Individuals) • Agitated (2 Individuals) • Adult carrying food (1 Individual) • Habitat (1 Individual)
Blackburnian Warbler	*Setophaga fusca*	1	• Mature Hardwood	• Singing male present
Black-throated Blue Warbler	*Setophaga caerulescens*	1	• Mature Hardwood	• Singing male present
Black-throated Green Warbler	*Setophaga virens*	13	• Immature Hardwood (4 Individuals) • Mature Mixedwood (5 Individuals) • Mature Hardwood (3 Individuals) • Immature Mixedwood (1 Individual)	• Singing male present (10 Individuals) • Adult carrying food (1 Individual) • Pair in suitable nest (2 Individuals)
Blue-headed Vireo	*Vireo solitarius*	4	• Mature Hardwood (3 Individuals)	• Singing male present (4 Individuals)

Table J.1 Bird Species Recorded in the Project Area During Field Surveys Conducted in 2022

Common Name	Scientific Name	Count	Habitat	Breeding
			• Mature Mixedwood (1 Individual)	
Brown Creeper	*Certhia americana*	1	• Mature Mixedwood	• Singing male present
Canada Warbler	*Cardellina canadensis*	4	• Mature Mixedwood (2 Individuals) • Coniferous Treed Swamp (1 Individual) • Habitat Unclassified (1 Individual)	• Pair in suitable nest (2 Individuals) • Singing male present (2 Individuals)
Cedar Waxwing	*Bombycilla cedrorum*	7	• Immature Hardwood (2 Individuals) • Tall Shrub Thicket (2 Individuals) • Mature Mixedwood (3 Individuals)	• Habitat (7 Individuals)
Chestnut-sided Warbler	*Setophaga pensylvanica*	1	• Tall Shrub Thicket	• Singing male present
Common Grackle	*Quiscalus quiscula*	1	• Flew Over	• No indication of breeding
Common Yellowthroat	*Geothlypis trichas*	4	• Immature Mixedwood (2 Individuals) • Immature Hardwood (1 Individual) • Tall Shrub Thicket (1 Individual)	• Singing male present (4 Individuals)
Dark-eyed Junco	*Junco hyemalis*	1	• Mature Hardwood	• Singing male present
Eastern Wood-Pewee	*Contopus virens*	1	• Mature Hardwood	• Singing male present
European Starling	*Sturnus vulgaris*	1	• Flew Over	• No indiciation of breeding
Golden-crowned Kinglet	*Regulus satrapa*	4	• Mature Hardwood (3 Individuals) Mature Mixedwood (1 Individual)	• No indication of breeding (3 Individuals) Habitat (1 Individual)
Gray Catbird	*Dumetella carolinensis*	3	• Tall Shrub Thicket (2 Individuals) • Flew Over (1 Individual)	• Singing male present (1 Individual) • Pair in suitable nest (1 Individual) • No indication of breeding (1 Individual)
Hairy Woodpecker	*Dryobates villosus*	1	• Mature Hardwood	• Singing male present

Table J.1 Bird Species Recorded in the Project Area During Field Surveys Conducted in 2022

Common Name	Scientific Name	Count	Habitat	Breeding
Hermit Thrush	*Catharus guttatus*	9	• Immature Hardwood (3 Individuals) • Mature Mixedwood (3 Individuals) • Mature Hardwood (2 Individuals) • Habitat Unclassified (1 Individual)	• Singing male present (5 Individuals) • Habitat (2 Individuals) • Agitated (1 Individual) • Nest with eggs (1 Individual)
Herring Gull	*Larus argentatus*	1	• Flew Over	• No indication of breeding
Least Flycatcher	*Empidonax minimus*	4	• Mature Hardwood (4 Individuals)	• Singing male present (4 Individuals)
Magnolia Warbler	*Setophaga magnolia*	5	• Immature Mixedwood (3 Individuals) • Mature Hardwood (1 Individual) • Mature Mixedwood (1 Individual)	• Singing male present (3 Individuals) • Pair in suitable nest (2 Individuals)
Mourning Dove	*Zenaida macroura*	1	• Habitat Unclassified	• Singing male present
Northern Cardinal	*Cardinalis cardinalis*	1	• Tall Shrub Thicket	• Singing male present
Northern Flicker	*Colaptes auratus*	1	• Mature Hardwood	• Habitat
Northern Parula	*Setophaga americana*	2	• Mature Hardwood (2 Individuals)	• Singing male present (2 Individuals)
Ovenbird	*Seiurus aurocapilla*	42	• Mature Mixedwood (17 Individuals) • Mature Hardwood (12 Individuals) • Immature Hardwood (9 Individuals) • Immature Mixedwood (5 Individuals)	• Singing male present (32 Individuals) • Adult carrying food (3 Individuals) • Pair in suitable nest (4 Individuals) • Agitated (2 Individuals) • Habitat (1 Individual) • No indication of breeding (1 Individual)
Purple Finch	*Haemorhous purpureus*	2	• Mature Mixedwood (2 Individuals)	• Singing male present (2 Individuals)
Red Crossbill	*Loxia curvirostra*	2	• Flew Over (2 Individuals)	• No indication of breeding (2 Individuals)
Red-eyed Vireo	*Vireo olivaceus*	17	• Mature Hardwood (6 Individuals) • Mature Mixedwood (7 Individuals) • Immature Hardwood (2 Individuals) • Immature Mixedwood (2 Individuals)	• Singing male present (14 Individuals) • Pair in suitable nest (2 Individuals) • Habitat (1 Individual)

Table J.1 Bird Species Recorded in the Project Area During Field Surveys Conducted in 2022

Common Name	Scientific Name	Count	Habitat	Breeding
Red-tailed Hawk	*Buteo jamaicensis*	1	• Habitat Unclassified	• Agitated
Rose-Breasted Grosbeak	*Pheucticus ludovicianus*	1	• Mature Hardwood	• Habitat
Ruby-throated Hummingbird	*Archilochus colubris*	2	• Immature Hardwood (1 Individual) • Tall Shub Thicket (1 Individual)	• Habitat (1 Individual) • No indication of breeding (1 Individual)
Song Sparrow	*Melospiza melodia*	5	• Tall Shrub Thicket (4 Individuals) • Disturbed Area (1 Individual)	• Singing male present (3 Individuals) • Habitat (2 Individuals)
Swainson's Thrush	*Catharus ustulatus*	10	• Immature Mixedwood (5 Individuals) • Mature Hardwood (3 Individuals) • Mature Mixedwood (2 Individuals)	• Singing male present (8 Individuals) • Agitated (1 Individual) Habitat (1 Individual)
Turkey Vulture	*Cathartes aura*	3	• Flew Over (2 Individuals)	• No indication of breeding (2 Individuals)
Veery	*Catharus fuscescens*	1	• Tall Shrub Thicket	• Singing male present
White-throated Sparrow	*Zonotrichia albicollis*	2	• Immature Mixedwood (1 Individual) • Immature Hardwood (1 Individual)	• Singing male present (2 Individuals)
Yellow Warbler	*Setophaga petechia*	1	• Tall Shrub Thicket	• Singing male present
Yellow-bellied Flycatcher	*Empidonax flaviventris*	1	• Habitat Unclassified	• Singing male present
Yellow-bellied Sapsucker	*Sphyrapicus varius*	1	• Mature Hardwood	• Agitated
Yellow-rumped Warbler	*Setophaga coronata*	2	• Mature Hardwood (1 Individual) • Mature Mixedwood (1 Individual)	• Singing male present (1 Individual) • Habitat (1 Individual)