Appendix M

Surface Water Data

Appendix M1 – Watercourse Fish and Habitat Field Data Sheets (WC#1 & WC#2)
Appendix M2 – Watercourses in the Vicinity of the Project Footprint Area Photo Plate
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Appendix M1

Watercourse Fish and Habitat Field Data Sheets (WC#1 & WC#2)

M1

DILLON CONSULTING

Fish and Fish Habitat Data Sheet

Project Number: 17-6461 **Date:** June 12/18 **Crew:** CK + KR
Weather: Sunny w/ Clouds
UTM Location: Northing _____ **Easting** _____ **Zone** _____
Waypoint: _____
Watercourse Name: WC#1 **Site Length:** ~80 m

Size of Watercourse:	Large Perm.	Small Perm.	(Intermittent)	Ephemeral		
Stage :	High	Mid	(Low)	Dry	Frozen	
Morphology:	(Run)	Flat	Pool	Rifle	Rapid	Cascade	Snye	Oxbow
Channel:	(Class 3: <0.5m)	Class 2: 0.5m-1m	Class 1: > 1m					
Islands:	(None)	Occasional	Irregular	Frequent	Anatomising			
Bars:	(None)	Side	Diagonal	Mid	Span	Braid		
Pattern:	(Straight)	Sinuous	I. Wandering	I. Meandering	R. Meanders	T. Meanders		
Confinement:	None	(Entrenched)	Confined	F. Confined	O. Confined	Unconfined		

Substrate			
% Bedrock	0	% Large Gravel (17-64mm)	10
% Boulder (>256mm)	0	% Small Gravel (2-16mm)	20
% Cobble (65-256mm)	0	% Fines (<2mm)	70

Water Quality	
Temp °C	13.6°C
D.O. (mg/l)	~
pH	6.75
Cond (µs/cm)	0.64
Turbidity (NTU)	~
Salinity	~
TDS	~

Instream Cover (none, trace, moderate, abundant) estimate % if a lot					
Boulder	None	Undercut	mod	SWD	trace
Overhanging Vegetation	abundant	Deep pool	none	Instream Veg.	abundant
LWD	None	LWD = clumped, even; few or abundant			

Channel	T1	T2	T3	T4	T5	Average
Distance from Crossing (m)	WP156					
Channel Width (m)	0.25	→	→	→	→	0.25
Wetted Width (m)	0.12	→	→	→	→	0.12
Water Depth (m)	0.05	→	→	→	→	0.05
Pool Depth (m)	~	→	→	→	→	~ no pools

Riparian						
Crown Closure (%)	0	(1-25)	26-50	51-75	76-100	
Bank Texture	(Fines)	Gravel	Cobble	Boulder	Bedrock	Man Made
Left Bank Shape	Sloped	(Vertical)	(Undercut)	Overhanging		
Right Bank Shape	Sloped	(Vertical)	(Undercut)	Overhanging		
Riparian Vegetation (Give Description)	Dominated by cattails + blueflag iris					
Vegetation Stage	Initial	Shrub	Pole-Sapling	Young Forest	Mature Forest	(N/A)

Velocity					
Water Depth					
Velocity (m/sec)					
Wetted Width		Discharge		Average	

M1

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Fish and Fish Habitat Data Sheet

Habitat Quality	Rating	Species and Rational
Spawning	(P) / M / G	Lack of appropriate substrate, lack of permanent flow
Rearing	(P) / M / G	Lack of permanent water depth + flow
Overwintering	(P) / M / G	Likely to completely freeze through for months during winter
Overall	(P) / M / G	Above reasons

Potential for Fish Presence	Rating				Reason
Open Water	Nil	(Low)	Moderate	High	Very shallow, likely only used @ times of high flow
Winter (frozen conditions)	(Nil)	Low	Moderate	High	Very likely to remain frozen for most winter months

Photo (facing towards flow)	Photo #	Description
Upstream		
Downstream		
Right Bank		
Left Bank		
Substrate		

Notes [e.g. fish barriers, beaver dams and lodges , observed fish, underground sections, waterfall, overhanging culverts, observed spawning areas] Please take measurements when possible and a photo when possible with measuring tape in picture.

M1

DILLON CONSULTING

Fish and Fish Habitat Data Sheet

Project Number: 17-6461 **Date:** June 12th/18 **Crew:** CK + KR
Weather: Sunny w/ clouds
UTM Location: Northing ~ **Easting** ~ **Zone** ~
Waypoint: ~
Watercourse Name: WC#2 **Site Length:** ~135m
Size of Watercourse: Large Perm. (Small Perm.) Intermittent Ephemeral
Stage : High (Mid) Low Dry Frozen
Morphology: (Run) (Flat) Pool Rifle Rapid Cascade Snye Oxbow
Channel: (Class 3: <0.5m) Class 2: 0.5m-1m Class 1: > 1m
Islands: (None) Occasional Irregular Frequent Anatomising
Bars: None (Side) Diagonal Mid Span Braid
Pattern: Straight (Sinuous) I. Wandering I. Meandering R. Meanders T. Meanders
Confinement: None Entrenched (Confined) (F. Confined) O. Confined Unconfined

Substrate			
% Bedrock	0	% Large Gravel (17-64mm)	20
% Boulder (>256mm)	5	% Small Gravel (2-16mm)	25
% Cobble (65-256mm)	10	% Fines (<2mm)	40

Water Quality	
Temp °C	17.5°C
D.O. (mg/l)	~
pH	5.65
Cond (µs/cm)	0.63
Turbidity (NTU)	~
Salinity	~
TDS	~

Instream Cover (none, trace, moderate, abundant) estimate % if a lot					
Boulder	trace	Undercut	mod	SWD	trace
Overhanging Vegetation	mod	Deep pool	trace	Instream Veg.	abundant
LWD	None	LWD = clumped, even; few or abundant			

Channel	T1	T2	T3	T4	T5	Average
Distance from Crossing (m)	WP 149	WP 150	WP 151	WP 152		
Channel Width (m)	0.70m	0.50m	0.55m	1.2m	→	0.74m
Wetted Width (m)	0.50m	0.40m	0.50m	0.8m	→	0.55m
Water Depth (m)	0.10m	0.10m	0.125m	0.10m	→	0.11m
Pool Depth (m)	0.25m	~	0.35m	~	→	0.30m

Riparian						
Crown Closure (%)	0	~~1-25~~	~~26-50~~	51-75	76-100	
Bank Texture	(Fines)	Gravel	Cobble	Boulder	Bedrock	Man Made
Left Bank Shape	(Sloped)	Vertical	(Undercut)	Overhanging		
Right Bank Shape	(Sloped)	Vertical	(Undercut)	Overhanging		
Riparian Vegetation (Give Description)	Primarily herbaceous, dominated by cattails, soft rush					
Vegetation Stage	Initial	Shrub	Pole-Sapling	Young Forest	Mature Forest	(N/A)

Velocity					
Water Depth					
Velocity (m/sec)					
Wetted Width		Discharge		Average	

M1

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Fish and Fish Habitat Data Sheet

Habitat Quality	Rating	Species and Rational
Spawning	(P) / M / G	Insufficient depth, poor spawning substrate quality
Rearing	P / (M) / G	Good instream cover
Overwintering	(P) / M / G	Poor depth + relatively low flow rates
Overall	(P) / M / G	Reasons above

Potential for Fish Presence	Rating				Reason
Open Water	Nil	Low	Moderate	(High)	Minnows were observed Water quality + flow are sufficient
Winter (frozen conditions)	(Nil)	(Low)	Moderate	High	Likely to completely freeze @ times + too shallow

Photo (facing towards flow)	Photo #	Description
Upstream		
Downstream		
Right Bank		
Left Bank		
Substrate		

Notes [e.g. fish barriers, beaver dams and lodges , observed fish, underground sections, waterfall, overhanging culverts, observed spawning areas] Please take measurements when possible and a photo when possible with measuring tape in picture.

Very small minnows were observed along the length of the watercourse ↳ Culvert to Culvert

Appendix M2

Watercourses in the Vicinity of the Project Footprint Area Photo Plate

M2: Watercourses in the Vicinity of the Project Footprint Area Photo Plate

		
2017.	12, 2017.	Oct. 12, 2017.
		
downstream/northeast. Oct. 12, 2017.	facing upstream/south. Oct. 12, 2017.	downstream of WC1 outlet. Oct. 12, 2017.
		
WC2 midstream. Oct. 12, 2017.	WC2 facing east. Oct. 12, 2017.	WC2 facing north. Oct. 12, 2017.

M2

		
WC2 culvert enterance to East River beach. Oct. 12, 2017.	WC2 outlet from East River beach facing south. Oct. 12, 2017.	WC2 outlet and East River beach facing north. June, 12, 2018.
		
Upstream WC3 (Hwy 106 east side ditch). Aug. 2, 2018	Upstream WC3 (Hwy 106 east side ditch). Dec. 12, 2018	Upstream WC3 (Hwy 106 east side ditch). April 12 2017.
		
Downstream section of WC3 facing southwest. Dec. 3, 2018.	Downstream section of WC3 facing southwest. Dec. 3, 2018.	Outlet of WC3 into the Pictou Harbour facing southwest. Dec. 3, 2018.

M2

		
Harvey A. Veniot Pictou Causeway (Hwy 106) and Pictou Harbour (WC4) facing north. Dec. 3, 2018.	Pictou Harbour (WC4) from north side of Abercrombie Point facing north. Dec. 3, 2018.	Pictou Harbour (WC4) from north side of Abercrombie Point facing Hwy 106 Causeway (northwest). Dec. 3, 2018.
		
WC5 upstream and west of Browns Point Road and Jitney Trail intersection. Dec. 3, 2018.	WC5 upstream and west of Browns Point Road and Jitney Trail intersection. Dec. 3, 2018.	Pictou Harbour shore and WC5 outlet, west of Hwy 106. Dec. 3, 2018.
		
WC6 upstream of the Jitney trail. Dec. 3, 2018.	WC6 culvert beneath Jitney trail. Dec. 3, 2018.	WC6 substrate Dec. 3, 2018.

M2

		
WC7 drainage facing west of Hwy 106 roundabout. Dec. 3, 2018.	Google stailite image showing WC7 and WC7A. Image date July 16, 2015.	WC7 within the center of the Hwy 106 Pictou Roundabout. Dec. 3, 2018.
		
From the WC8 Rte. 6 culvert facing upstream/east. Dec. 3, 2018.	WC8 culvert under Rte. 6 facing north. Dec. 3, 2018.	WC8 from Hwy 106 facing downstream/west Dec. 3, 2018.
		
WC9 culvery under Hwy 106. Dec. 3, 2018.	WC9 Dec. 3, 2018.	WC9 Dec. 3, 2018.

M2

		
WC10 west side of Hwy 106. Dec. 3, 2018.	WC10 Dec. 3, 2018.	WC10 east side of Hwy 106. Dec. 3, 2018.
		
WC11 Dec. 3, 2018.	WC11 Dec. 3, 2018.	WC11 Dec. 3, 2018.
		
WC12 facing west. Dec. 3, 2018.	WC12 Dec. 3, 2018.	WC12 from Hwy 106. Dec. 3, 2018.

M2

		
WC13A culvert beneath Hwy 106. Dec. 3, 2018.	WC13A Dec. 3, 2018.	WC13A facing west. Dec. 3, 2018.
		
WC13B Dec. 3, 2018.	WC13B culvert beneath Hwy 106. Dec. 3, 2018.	WC13B Dec. 3, 2018.
		
WC14 Dec. 3, 2018.	WC14 culvert under Hwy 106. Dec. 3, 2018.	WC14 Dec. 3, 2018.

M2

		
WC15 from Hwy 106 facing west. Dec. 3, 2018.	WC15 culvert beneath Hwy 106 and view of the overpass for Three Brooks Road, facing north. Dec. 3, 2018.	Google earth imagery showing WC15. Image date July 16, 2015.
		
WC16 culvert outlet facing downstream/north. Dec. 3, 2018.	From outlet of WC16 facing upstream/South. Dec. 3, 2018.	WC16 outlet facing north. Dec. 3, 2018.

Appendix M3

Summary of General Physical Characteristics of Predicted Watercourse Crossings Along the Pipeline Route (Conducted on December 3, 2018)

M3: Summary of general physical characteristics collected for predicted watercourse crossings along the pipeline route (conducted on December 3, 2018).

WC No.	WC Name	WL No.	Assessment Location (UTM NAD 83)	WC Features		Direction	
			5055813 N	paths from parking area	moderate flow		forested
	Tributary to Pictou Harbour		5055792 N	project footprint area; within footprint intermittent to tidal connected with Pictou Harbour	intermittent, low to moderate flow, tidally influenced		cobbles
	Pictou Harbour	WL3 WL4	5056680 N		high flow, tidal		
	Tributary to Pictou Harbour		5057441 N	culvert under Highway 106 to wetland drainage	moderate flow		
	Pictou Harbour		5057513 N	drainage and WL4 drainage	flow		cobble
	Haliburton Brook	D)	5058792 N	with roundabout	intermittent low flow	W	
	Tributary to Haliburton Brook	D)	5059083 N	upstream of Highway 106, defined channel downstream of Rte 6	to moderate		cobble
	Haliburton Brook		5060240 N		moderate flow		
	Haliburton Brook		5060520 N	from WL8	moderate flow		
	Haliburton Brook	WL9	5061335 N		Permanent, slow flow		
	Mill Brook	WL11	5061869 N		Permanent, slow flow		organics
	Tributary to Mill Brook	WL13	5062212 N	upstream ponded downstream	moderate flow		organics
	Mill Brook	WL13	5062564 N		moderate flow		organics
	Mill Brook		5063285 N	between wetlands	moderate flow		
	Caribou Harbour		5064206 N		moderate flow		
	Caribou Harbour		5064837 N		flow		cobble

M3

*Flow observations are described as either slow (minimal laminar flow or trickling), moderate or fast (gushing and/or relatively high water levels). Flow descriptions are subjective and based on only one observation; therefore, relative flow descriptions are based on available site observations of typical flow velocity and flow at the time of assessment.

**NA- not assessed, due to the conditions during the assessment (i.e., ice coverage, very high water level, etc.), the substrate was not visible or accessible for observation.

Appendix M4

Maxxam Laboratory Certificates

M4: Laboratory Certificates

Your Project #: 17-6461
Your C.O.C. #: D29810, D29811

Attention: Kelly Regan

Dillon Consulting Limited
137 Chain Lake Dr
Suite 100
Halifax , NS
CANADA B3S 1B3

Report Date: 2018/12/17
Report #: R5528049
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W8094
Received: 2018/12/06, 16:01

Sample Matrix: Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Carbonate, Bicarbonate and Hydroxide	11	N/A	2018/12/11	N/A	SM 23 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	2	N/A	2018/12/12	N/A	SM 23 4500-CO2 D
Alkalinity	13	N/A	2018/12/12	ATL SOP 00013	EPA 310.2 R1974 m
Chloride	11	N/A	2018/12/12	ATL SOP 00014	SM 23 4500-Cl- E m
Chloride	2	N/A	2018/12/13	ATL SOP 00014	SM 23 4500-Cl- E m
Colour	13	N/A	2018/12/12	ATL SOP 00020	SM 23 2120C m
Conductance - water	11	N/A	2018/12/11	ATL SOP 00004	SM 23 2510B m
Conductance - water	2	N/A	2018/12/12	ATL SOP 00004	SM 23 2510B m
Hardness (calculated as CaCO3)	2	N/A	2018/12/11	ATL SOP 00048	Auto Calc
Hardness (calculated as CaCO3)	8	N/A	2018/12/12	ATL SOP 00048	Auto Calc
Hardness (calculated as CaCO3)	3	N/A	2018/12/13	ATL SOP 00048	Auto Calc
Metals Water Total MS	2	2018/12/10	2018/12/11	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS	8	2018/12/10	2018/12/12	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS	3	2018/12/10	2018/12/13	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference)	13	N/A	2018/12/13	N/A	Auto Calc.
Anion and Cation Sum	13	N/A	2018/12/13	N/A	Auto Calc.
Nitrogen Ammonia - water	13	N/A	2018/12/12	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	13	N/A	2018/12/13	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	13	N/A	2018/12/12	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N)	13	N/A	2018/12/13	ATL SOP 00018	ASTM D3867-16
pH (1)	11	N/A	2018/12/11	ATL SOP 00003	SM 23 4500-H+ B m
pH (1)	2	N/A	2018/12/12	ATL SOP 00003	SM 23 4500-H+ B m
Phosphorus - ortho	13	N/A	2018/12/12	ATL SOP 00021	SM 23 4500-P E m
Sat. pH and Langelier Index (@ 20C)	13	N/A	2018/12/13	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	13	N/A	2018/12/13	ATL SOP 00049	Auto Calc.
Reactive Silica	13	N/A	2018/12/12	ATL SOP 00022	EPA 366.0 m
Sulphate	13	N/A	2018/12/12	ATL SOP 00023	ASTM D516-16 m
Total Dissolved Solids (TDS calc)	13	N/A	2018/12/13	N/A	Auto Calc.
Organic carbon - Total (TOC) (2)	3	N/A	2018/12/14	ATL SOP 00203	SM 23 5310B m
Organic carbon - Total (TOC) (2)	1	N/A	2018/12/15	ATL SOP 00203	SM 23 5310B m
Organic carbon - Total (TOC) (2)	9	N/A	2018/12/16	ATL SOP 00203	SM 23 5310B m

Maxxam
A Bureau Veritas Group Company

M4

Your Project #: 17-6461
Your C.O.C. #: D29810, D29811

Attention: Kelly Regan

Dillon Consulting Limited
137 Chain Lake Dr
Suite 100
Halifax , NS
CANADA B3S 1B3

Report Date: 2018/12/17
Report #: R5528049
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W8094
Received: 2018/12/06, 16:01

Sample Matrix: Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Total Suspended Solids	13	2018/12/10	2018/12/13	ATL SOP 00007	SM 23 2540D m
Turbidity	1	N/A	2018/12/11	ATL SOP 00011	EPA 180.1 R2 m
Turbidity	11	N/A	2018/12/12	ATL SOP 00011	EPA 180.1 R2 m
Turbidity	1	N/A	2018/12/13	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam 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.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam 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 Maxxam, unless otherwise agreed in writing. Maxxam 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 Maxxam, 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 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.
(2) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

Encryption Key

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

M4

Your Project #: 17-6461
Your C.O.C. #: D29810, D29811

Attention: Kelly Regan

Dillon Consulting Limited
137 Chain Lake Dr
Suite 100
Halifax , NS
CANADA B3S 1B3

Report Date: 2018/12/17
Report #: R5528049
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W8094
Received: 2018/12/06, 16:01

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Heather Macumber, Senior Project Manager
Email: HMacumber@maxxam.ca
Phone# (902)420-0203 Ext:226
==========

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B8W8094
Report Date: 2018/12/17

Dillon Consulting Limited
Client Project #: 17-6461
Sampler Initials: KSR

M4

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMN595			IMN596			IMN597		
Sampling Date		2018/12/03 09:40			2018/12/03 09:55			2018/12/03 10:25		
COC Number		D29810			D29810			D29810		
	UNITS	WC16	RDL	QC Batch	WC15	RDL	QC Batch	WC14	RDL	QC Batch
Calculated Parameters										
Anion Sum	me/L	2.41	N/A	5877080	1.26	N/A	5877080	3.80	N/A	5877080
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	16	1.0	5877076	<1.0	1.0	5877076	8.8	1.0	5877076
Calculated TDS	mg/L	140	1.0	5877085	79	1.0	5877085	220	1.0	5877085
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5877076	<1.0	1.0	5877076	<1.0	1.0	5877076
Cation Sum	me/L	2.16	N/A	5877080	1.40	N/A	5877080	3.38	N/A	5877080
Hardness (CaCO3)	mg/L	32	1.0	5877077	17	1.0	5877077	25	1.0	5877077
Ion Balance (% Difference)	%	5.47	N/A	5877079	5.26	N/A	5877079	5.85	N/A	5877079
Langelier Index (@ 20C)	N/A	-2.35		5877082	NC		5877082	-3.31		5877082
Langelier Index (@ 4C)	N/A	-2.60		5877083	NC		5877083	-3.56		5877083
Nitrate (N)	mg/L	0.073	0.050	5876806	0.052	0.050	5876806	<0.050	0.050	5876806
Saturation pH (@ 20C)	N/A	9.18		5877082	NC		5877082	9.61		5877082
Saturation pH (@ 4C)	N/A	9.43		5877083	NC		5877083	9.86		5877083
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	16	5.0	5881677	<5.0	5.0	5881677	8.8	5.0	5881677
Dissolved Chloride (Cl-)	mg/L	68	1.0	5881681	45	1.0	5881681	120	1.0	5881681
Colour	TCU	120	25	5881688	160	25	5881688	62	25	5881688
Nitrate + Nitrite (N)	mg/L	0.073	0.050	5881711	0.052	0.050	5881711	<0.050	0.050	5881711
Nitrite (N)	mg/L	<0.010	0.010	5881724	<0.010	0.010	5881724	<0.010	0.010	5881724
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	5881454	<0.050	0.050	5881454	0.057	0.050	5881445
Total Organic Carbon (C)	mg/L	12	0.50	5888741	20	0.50	5888741	8.5	0.50	5886633
Orthophosphate (P)	mg/L	<0.010	0.010	5881702	<0.010	0.010	5881702	<0.010	0.010	5881702
pH	pH	6.82	N/A	5883620	5.40	N/A	5881255	6.29	N/A	5881260
Reactive Silica (SiO2)	mg/L	4.2	0.50	5881684	3.5	0.50	5881684	3.4	0.50	5881684
Total Suspended Solids	mg/L	6.4	2.0	5879412	3.5	2.5	5879412	1.2	1.0	5879412
Dissolved Sulphate (SO4)	mg/L	8.3	2.0	5881682	<2.0	2.0	5881682	9.0	2.0	5881682
Turbidity	NTU	2.2	0.10	5883750	2.9	0.10	5883746	1.7	0.10	5883746
Conductivity	uS/cm	250	1.0	5883621	170	1.0	5881257	420	1.0	5881262

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B8W8094
Report Date: 2018/12/17

Dillon Consulting Limited
Client Project #: 17-6461
Sampler Initials: KSR

M4

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMN598			IMN599			IMN600		
Sampling Date		2018/12/03 10:45			2018/12/03 10:35			2018/12/03 11:05		
COC Number		D29810			D29810			D29810		
	UNITS	**WC13A**	**RDL**	**QC Batch**	**WC13B**	**RDL**	**QC Batch**	**WC12**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	me/L	0.450	N/A	5877080	1.69	N/A	5877080	0.720	N/A	5877080
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5.7	1.0	5877076	11	1.0	5877076	14	1.0	5877076
Calculated TDS	mg/L	31	1.0	5877085	98	1.0	5877085	45	1.0	5877085
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5877076	<1.0	1.0	5877076	<1.0	1.0	5877076
Cation Sum	me/L	0.570	N/A	5877080	1.59	N/A	5877080	0.790	N/A	5877080
Hardness (CaCO3)	mg/L	14	1.0	5877077	18	1.0	5877077	20	1.0	5877077
Ion Balance (% Difference)	%	11.8	N/A	5877079	3.05	N/A	5877079	4.64	N/A	5877079
Langelier Index (@ 20C)	N/A	-4.19		5877082	-2.95		5877082	-2.84		5877082
Langelier Index (@ 4C)	N/A	-4.44		5877083	-3.20		5877083	-3.09		5877083
Nitrate (N)	mg/L	0.054	0.050	5876806	0.052	0.050	5876806	0.066	0.050	5876806
Saturation pH (@ 20C)	N/A	10.0		5877082	9.64		5877082	9.40		5877082
Saturation pH (@ 4C)	N/A	10.3		5877083	9.89		5877083	9.65		5877083
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	5.7	5.0	5881677	11	5.0	5881677	14	5.0	5881677
Dissolved Chloride (Cl-)	mg/L	12	1.0	5881681	49	1.0	5881681	16	1.0	5881681
Colour	TCU	130	25	5881688	42	5.0	5881688	76	25	5881688
Nitrate + Nitrite (N)	mg/L	0.054	0.050	5881711	0.052	0.050	5881711	0.066	0.050	5881711
Nitrite (N)	mg/L	<0.010	0.010	5881724	<0.010	0.010	5881724	<0.010	0.010	5881724
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	5881454	<0.050	0.050	5881454	<0.050	0.050	5881454
Total Organic Carbon (C)	mg/L	15	0.50	5886636	7.7	0.50	5888741	10	0.50	5886636
Orthophosphate (P)	mg/L	<0.010	0.010	5881702	<0.010	0.010	5881702	<0.010	0.010	5881702
pH	pH	5.81	N/A	5881255	6.69	N/A	5881255	6.56	N/A	5881255
Reactive Silica (SiO2)	mg/L	3.4	0.50	5881684	3.1	0.50	5881684	4.5	0.50	5881684
Total Suspended Solids	mg/L	<2.0	2.0	5879412	2.0	2.0	5879412	<1.0	1.0	5879412
Dissolved Sulphate (SO4)	mg/L	<2.0	2.0	5881682	4.0	2.0	5881682	<2.0	2.0	5881682
Turbidity	NTU	3.0	0.10	5883746	5.3	0.10	5883746	0.66	0.10	5883746
Conductivity	uS/cm	60	1.0	5881257	190	1.0	5881257	86	1.0	5881257

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8W8094
Report Date: 2018/12/17

Dillon Consulting Limited
Client Project #: 17-6461
Sampler Initials: KSR

M4

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMN601		IMN602		IMN603			IMN603		
Sampling Date		2018/12/03 11:20		2018/12/03 11:30		2018/12/03 11:45			2018/12/03 11:45		
COC Number		D29810		D29810		D29810			D29810		
	UNITS	WC11	QC Batch	WC10	QC Batch	WC09	RDL	QC Batch	WC09 Lab-Dup	RDL	QC Batch
Calculated Parameters											
Anion Sum	me/L	0.220	5877080	0.430	5877080	0.550	N/A	5877080			
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	5877076	<1.0	5877076	<1.0	1.0	5877076			
Calculated TDS	mg/L	18	5877085	29	5877085	36	1.0	5877085			
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	5877076	<1.0	5877076	<1.0	1.0	5877076			
Cation Sum	me/L	0.360	5877080	0.510	5877080	0.650	N/A	5877080			
Hardness (CaCO3)	mg/L	8.6	5877077	7.4	5877077	7.7	1.0	5877077			
Ion Balance (% Difference)	%	24.1	5877079	8.51	5877079	8.33	N/A	5877079			
Langelier Index (@ 20C)	N/A	NC	5877082	NC	5877082	NC		5877082			
Langelier Index (@ 4C)	N/A	NC	5877083	NC	5877083	NC		5877083			
Nitrate (N)	mg/L	<0.050	5876806	<0.050	5876806	<0.050	0.050	5876806			
Saturation pH (@ 20C)	N/A	NC	5877082	NC	5877082	NC		5877082			
Saturation pH (@ 4C)	N/A	NC	5877083	NC	5877083	NC		5877083			
Inorganics											
Total Alkalinity (Total as CaCO3)	mg/L	<5.0	5881677	<5.0	5881677	<5.0	5.0	5881677	<5.0	5.0	5881677
Dissolved Chloride (Cl-)	mg/L	7.8	5881681	15	5881681	19	1.0	5881681	19	1.0	5881681
Colour	TCU	190	5881688	150	5881688	140	25	5881688	140	25	5881688
Nitrate + Nitrite (N)	mg/L	<0.050	5881711	<0.050	5881711	<0.050	0.050	5881711	<0.050	0.050	5881711
Nitrite (N)	mg/L	<0.010	5881724	<0.010	5881724	<0.010	0.010	5881724	<0.010	0.010	5881724
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	5881454	<0.050	5881454	<0.050	0.050	5881454			
Total Organic Carbon (C)	mg/L	24	5888741	20	5888741	18	0.50	5888741			
Orthophosphate (P)	mg/L	<0.010	5881702	<0.010	5881702	<0.010	0.010	5881702	<0.010	0.010	5881702
pH	pH	5.14	5881255	4.75	5881255	4.83 (1)	N/A	5881255	4.61	N/A	5881255
Reactive Silica (SiO2)	mg/L	2.8	5881684	3.1	5881684	2.3	0.50	5881684	2.3	0.50	5881684
Total Suspended Solids	mg/L	<1.0	5879412	<1.0	5879412	2.4	1.0	5879412			
Dissolved Sulphate (SO4)	mg/L	<2.0	5881682	<2.0	5881682	<2.0	2.0	5881682	<2.0	2.0	5881682
Turbidity	NTU	0.84	5883746	0.38	5883750	1.1	0.10	5883734			
Conductivity	uS/cm	46	5881257	76	5881257	86	1.0	5881257	86	1.0	5881257

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Poor duplicate recovery, insuficent sample for reanalysis.

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Report Date: 2018/12/17

Dillon Consulting Limited
Client Project #: 17-6461
Sampler Initials: KSR

M4

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMN604			IMN607			IMN608		
Sampling Date		2018/12/03 12:05			2018/12/03 12:55			2018/12/03 13:30		
COC Number		D29810			D29811			D29811		
	UNITS	WC08	RDL	QC Batch	WC06	RDL	QC Batch	WC05	RDL	QC Batch
Calculated Parameters										
Anion Sum	me/L	1.83	N/A	5877080	5.14	N/A	5877080	6.09	N/A	5877080
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	20	1.0	5877076	41	1.0	5877076	110	1.0	5877076
Calculated TDS	mg/L	110	1.0	5877085	290	1.0	5877085	350	1.0	5877085
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5877076	<1.0	1.0	5877076	<1.0	1.0	5877076
Cation Sum	me/L	1.78	N/A	5877080	4.73	N/A	5877080	5.81	N/A	5877080
Hardness (CaCO3)	mg/L	27	1.0	5877077	63	1.0	5877077	170	1.0	5877077
Ion Balance (% Difference)	%	1.39	N/A	5877079	4.15	N/A	5877079	2.35	N/A	5877079
Langelier Index (@ 20C)	N/A	-2.07		5877082	-1.03		5877082	0.00800		5877082
Langelier Index (@ 4C)	N/A	-2.32		5877083	-1.28		5877083	-0.241		5877083
Nitrate (N)	mg/L	0.11	0.050	5876806	0.11	0.050	5876806	0.22	0.050	5876806
Saturation pH (@ 20C)	N/A	9.10		5877082	8.47		5877082	7.62		5877082
Saturation pH (@ 4C)	N/A	9.35		5877083	8.72		5877083	7.87		5877083
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	20	5.0	5881677	41	5.0	5881677	110	25	5881655
Dissolved Chloride (Cl-)	mg/L	46	1.0	5881681	140	1.0	5881681	90	1.0	5881659
Colour	TCU	48	5.0	5881688	24	5.0	5881688	14	5.0	5881662
Nitrate + Nitrite (N)	mg/L	0.11	0.050	5881711	0.11	0.050	5881711	0.22	0.050	5881670
Nitrite (N)	mg/L	<0.010	0.010	5881724	<0.010	0.010	5881724	<0.010	0.010	5881673
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	5881445	<0.050	0.050	5881445	<0.050	0.050	5881445
Total Organic Carbon (C)	mg/L	6.5	0.50	5886644	4.4	0.50	5888773	5.7	0.50	5888741
Orthophosphate (P)	mg/L	0.025	0.010	5881702	<0.010	0.010	5881702	<0.010	0.010	5881668
pH	pH	7.03	N/A	5881255	7.44	N/A	5881255	7.63	N/A	5881255
Reactive Silica (SiO2)	mg/L	4.2	0.50	5881684	4.1	0.50	5881684	3.6	0.50	5881661
Total Suspended Solids	mg/L	3.0	1.0	5879862	4.0	2.0	5879412	6.8	2.0	5879412
Dissolved Sulphate (SO4)	mg/L	5.6	2.0	5881682	18	2.0	5881682	63	2.0	5881660
Turbidity	NTU	3.2	0.10	5883746	4.5	0.10	5886137	9.2	0.10	5881459
Conductivity	uS/cm	200	1.0	5881257	550	1.0	5881257	600	1.0	5881257

RDL = Reportable Detection Limit
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N/A = Not Applicable

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M4

RESULTS OF ANALYSES OF WATER

Maxxam ID		IMN608			IMN609		
Sampling Date		2018/12/03 13:30			2018/12/03 14:30		
COC Number		D29811			D29811		
	UNITS	WC05 Lab-Dup	RDL	QC Batch	WC03	RDL	QC Batch
Calculated Parameters							
Anion Sum	me/L				5.62	N/A	5877080
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				130	1.0	5877076
Calculated TDS	mg/L				320	1.0	5877085
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	1.0	5877076
Cation Sum	me/L				5.73	N/A	5877080
Hardness (CaCO3)	mg/L				140	1.0	5877077
Ion Balance (% Difference)	%				0.970	N/A	5877079
Langelier Index (@ 20C)	N/A				-0.238		5877082
Langelier Index (@ 4C)	N/A				-0.487		5877083
Nitrate (N)	mg/L				0.058	0.050	5876806
Saturation pH (@ 20C)	N/A				7.66		5877082
Saturation pH (@ 4C)	N/A				7.91		5877083
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	110	25	5881655	130	25	5881677
Dissolved Chloride (Cl-)	mg/L	90	1.0	5881659	92	1.0	5881681
Colour	TCU	15	5.0	5881662	210	25	5881688
Nitrate + Nitrite (N)	mg/L	0.22	0.050	5881670	0.058	0.050	5881711
Nitrite (N)	mg/L	<0.010	0.010	5881673	<0.010	0.010	5881724
Nitrogen (Ammonia Nitrogen)	mg/L				<0.050	0.050	5881454
Total Organic Carbon (C)	mg/L				58 (1)	5.0	5888741
Orthophosphate (P)	mg/L	<0.010	0.010	5881668	0.13	0.010	5881702
pH	pH				7.42	N/A	5883620
Reactive Silica (SiO2)	mg/L	3.7	0.50	5881661	4.8	0.50	5881684
Total Suspended Solids	mg/L				120	17	5879412
Dissolved Sulphate (SO4)	mg/L	61	2.0	5881660	17	2.0	5881682
Turbidity	NTU	9.0	0.10	5881459	40	0.10	5883746
Conductivity	uS/cm				540	1.0	5883621

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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M4

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		IMN595	IMN596	IMN597		IMN598	IMN599	IMN600		
Sampling Date		2018/12/03 09:40	2018/12/03 09:55	2018/12/03 10:25		2018/12/03 10:45	2018/12/03 10:35	2018/12/03 11:05		
COC Number		D29810	D29810	D29810		D29810	D29810	D29810		
	UNITS	**WC16**	**WC15**	**WC14**	**QC Batch**	**WC13A**	**WC13B**	**WC12**	**RDL**	**QC Batch**
Metals										
Total Aluminum (Al)	ug/L	250	400	190	5879593	230	280	89	5.0	5879792
Total Antimony (Sb)	ug/L	<1.0	<1.0	<1.0	5879593	<1.0	<1.0	<1.0	1.0	5879792
Total Arsenic (As)	ug/L	<1.0	<1.0	<1.0	5879593	<1.0	<1.0	<1.0	1.0	5879792
Total Barium (Ba)	ug/L	39	31	41	5879593	42	67	54	1.0	5879792
Total Beryllium (Be)	ug/L	<1.0	<1.0	<1.0	5879593	<1.0	<1.0	<1.0	1.0	5879792
Total Bismuth (Bi)	ug/L	<2.0	<2.0	<2.0	5879593	<2.0	<2.0	<2.0	2.0	5879792
Total Boron (B)	ug/L	<50	<50	<50	5879593	<50	<50	<50	50	5879792
Total Cadmium (Cd)	ug/L	0.037	0.056	0.025	5879593	0.018	0.017	<0.010	0.010	5879792
Total Calcium (Ca)	ug/L	9600	4700	7000	5879593	3500	4500	6000	100	5879792
Total Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	5879593	<1.0	<1.0	<1.0	1.0	5879792
Total Cobalt (Co)	ug/L	<0.40	0.45	<0.40	5879593	<0.40	<0.40	<0.40	0.40	5879792
Total Copper (Cu)	ug/L	<2.0	<2.0	<2.0	5879593	<2.0	<2.0	<2.0	2.0	5879792
Total Iron (Fe)	ug/L	360	490	240	5879593	420	280	300	50	5879792
Total Lead (Pb)	ug/L	<0.50	1.6	<0.50	5879593	<0.50	<0.50	<0.50	0.50	5879792
Total Magnesium (Mg)	ug/L	2000	1200	1800	5879593	1200	1500	1200	100	5879792
Total Manganese (Mn)	ug/L	81	140	66	5879593	44	50	64	2.0	5879792
Total Molybdenum (Mo)	ug/L	<2.0	<2.0	<2.0	5879593	<2.0	<2.0	<2.0	2.0	5879792
Total Nickel (Ni)	ug/L	<2.0	<2.0	<2.0	5879593	<2.0	<2.0	<2.0	2.0	5879792
Total Phosphorus (P)	ug/L	<100	<100	<100	5879593	<100	<100	<100	100	5879792
Total Potassium (K)	ug/L	730	410	860	5879593	360	850	550	100	5879792
Total Selenium (Se)	ug/L	<1.0	<1.0	<1.0	5879593	<1.0	<1.0	<1.0	1.0	5879792
Total Silver (Ag)	ug/L	<0.10	<0.10	<0.10	5879593	<0.10	<0.10	<0.10	0.10	5879792
Total Sodium (Na)	ug/L	34000	24000	66000	5879593	6300	28000	8500	100	5879792
Total Strontium (Sr)	ug/L	22	14	18	5879593	10	16	16	2.0	5879792
Total Thallium (Tl)	ug/L	<0.10	<0.10	<0.10	5879593	<0.10	<0.10	<0.10	0.10	5879792
Total Tin (Sn)	ug/L	<2.0	<2.0	<2.0	5879593	<2.0	<2.0	<2.0	2.0	5879792
Total Titanium (Ti)	ug/L	5.2	4.9	2.4	5879593	4.0	7.2	<2.0	2.0	5879792
Total Uranium (U)	ug/L	<0.10	<0.10	<0.10	5879593	<0.10	<0.10	<0.10	0.10	5879792
Total Vanadium (V)	ug/L	<2.0	<2.0	<2.0	5879593	<2.0	<2.0	<2.0	2.0	5879792
Total Zinc (Zn)	ug/L	6.8	8.9	<5.0	5879593	<5.0	<5.0	<5.0	5.0	5879792

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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M4

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		IMN601	IMN602	IMN603	IMN604	IMN607	IMN608	IMN609		
Sampling Date		2018/12/03 11:20	2018/12/03 11:30	2018/12/03 11:45	2018/12/03 12:05	2018/12/03 12:55	2018/12/03 13:30	2018/12/03 14:30		
COC Number		D29810	D29810	D29810	D29810	D29811	D29811	D29811		
	UNITS	WC11	WC10	WC09	WC08	WC06	WC05	WC03	RDL	QC Batch
Metals										
Total Aluminum (Al)	ug/L	180	220	260	220	120	310	5300	5.0	5879792
Total Antimony (Sb)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	5879792
Total Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.6	1.0	5879792
Total Barium (Ba)	ug/L	38	16	21	32	39	71	190	1.0	5879792
Total Beryllium (Be)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	5879792
Total Bismuth (Bi)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5879792
Total Boron (B)	ug/L	<50	<50	<50	<50	<50	<50	<50	50	5879792
Total Cadmium (Cd)	ug/L	0.033	0.019	0.050	0.032	0.041	0.43	0.23	0.010	5879792
Total Calcium (Ca)	ug/L	2300	1900	2100	8600	22000	59000	44000	100	5879792
Total Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7.4	1.0	5879792
Total Cobalt (Co)	ug/L	<0.40	0.41	0.54	<0.40	<0.40	0.63	5.3	0.40	5879792
Total Copper (Cu)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	12	2.0	5879792
Total Iron (Fe)	ug/L	780	380	420	260	150	520	8400	50	5879792
Total Lead (Pb)	ug/L	<0.50	<0.50	0.53	0.53	<0.50	1.2	7.5	0.50	5879792
Total Magnesium (Mg)	ug/L	680	680	610	1300	2100	6700	6600	100	5879792
Total Manganese (Mn)	ug/L	240	100	150	29	15	500	1300	2.0	5879792
Total Molybdenum (Mo)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5879792
Total Nickel (Ni)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.2	11	2.0	5879792
Total Phosphorus (P)	ug/L	<100	<100	<100	<100	<100	<100	500	100	5879792
Total Potassium (K)	ug/L	<100	<100	170	1100	1400	4700	12000	100	5879792
Total Selenium (Se)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	5879792
Total Silver (Ag)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	5879792
Total Sodium (Na)	ug/L	3500	7600	11000	28000	79000	50000	55000	100	5879792
Total Strontium (Sr)	ug/L	11	8.1	9.1	35	66	220	110	2.0	5879792
Total Thallium (Tl)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	5879792
Total Tin (Sn)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5879792
Total Titanium (Ti)	ug/L	2.5	2.3	4.6	6.4	2.3	4.6	64	2.0	5879792
Total Uranium (U)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.28	0.36	0.10	5879792
Total Vanadium (V)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	11	2.0	5879792
Total Zinc (Zn)	ug/L	5.9	<5.0	6.1	8.2	5.3	57	68	5.0	5879792

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

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

Package 1	1.3°C

Sample IMN595 [WC16] : Poor RCAp Ion Balance due to sample matrix.

Sample IMN596 [WC15] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample IMN597 [WC14] : Poor RCAp Ion Balance due to sample matrix.

Sample IMN598 [WC13A] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample IMN601 [WC11] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample IMN602 [WC10] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample IMN603 [WC09] : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Results relate only to the items tested.

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Maxxam Job #: B8W8094
Report Date: 2018/12/17

Dillon Consulting Limited
Client Project #: 17-6461
Sampler Initials: KSR

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5879412	AM6	QC Standard	Total Suspended Solids	2018/12/13		99	%	80 - 120
5879412	AM6	Method Blank	Total Suspended Solids	2018/12/13	<1.0		mg/L	
5879412	AM6	RPD	Total Suspended Solids	2018/12/13	18		%	20
5879593	AWL	Matrix Spike	Total Aluminum (Al)	2018/12/11		97	%	80 - 120
			Total Antimony (Sb)	2018/12/11		103	%	80 - 120
			Total Arsenic (As)	2018/12/11		96	%	80 - 120
			Total Barium (Ba)	2018/12/11		97	%	80 - 120
			Total Beryllium (Be)	2018/12/11		95	%	80 - 120
			Total Bismuth (Bi)	2018/12/11		100	%	80 - 120
			Total Boron (B)	2018/12/11		99	%	80 - 120
			Total Cadmium (Cd)	2018/12/11		100	%	80 - 120
			Total Calcium (Ca)	2018/12/11		101	%	80 - 120
			Total Chromium (Cr)	2018/12/11		94	%	80 - 120
			Total Cobalt (Co)	2018/12/11		95	%	80 - 120
			Total Copper (Cu)	2018/12/11		NC	%	80 - 120
			Total Iron (Fe)	2018/12/11		98	%	80 - 120
			Total Lead (Pb)	2018/12/11		95	%	80 - 120
			Total Magnesium (Mg)	2018/12/11		102	%	80 - 120
			Total Manganese (Mn)	2018/12/11		94	%	80 - 120
			Total Molybdenum (Mo)	2018/12/11		102	%	80 - 120
			Total Nickel (Ni)	2018/12/11		96	%	80 - 120
			Total Phosphorus (P)	2018/12/11		104	%	80 - 120
			Total Potassium (K)	2018/12/11		101	%	80 - 120
			Total Selenium (Se)	2018/12/11		96	%	80 - 120
			Total Silver (Ag)	2018/12/11		100	%	80 - 120
			Total Sodium (Na)	2018/12/11		98	%	80 - 120
			Total Strontium (Sr)	2018/12/11		98	%	80 - 120
			Total Thallium (Tl)	2018/12/11		101	%	80 - 120
			Total Tin (Sn)	2018/12/11		104	%	80 - 120
			Total Titanium (Ti)	2018/12/11		98	%	80 - 120
			Total Uranium (U)	2018/12/11		102	%	80 - 120
			Total Vanadium (V)	2018/12/11		98	%	80 - 120
			Total Zinc (Zn)	2018/12/11		95	%	80 - 120
5879593	AWL	Spiked Blank	Total Aluminum (Al)	2018/12/11		97	%	80 - 120
			Total Antimony (Sb)	2018/12/11		103	%	80 - 120
			Total Arsenic (As)	2018/12/11		93	%	80 - 120
			Total Barium (Ba)	2018/12/11		94	%	80 - 120
			Total Beryllium (Be)	2018/12/11		97	%	80 - 120
			Total Bismuth (Bi)	2018/12/11		100	%	80 - 120
			Total Boron (B)	2018/12/11		100	%	80 - 120
			Total Cadmium (Cd)	2018/12/11		99	%	80 - 120
			Total Calcium (Ca)	2018/12/11		101	%	80 - 120
			Total Chromium (Cr)	2018/12/11		92	%	80 - 120
			Total Cobalt (Co)	2018/12/11		95	%	80 - 120
			Total Copper (Cu)	2018/12/11		93	%	80 - 120
			Total Iron (Fe)	2018/12/11		98	%	80 - 120
			Total Lead (Pb)	2018/12/11		94	%	80 - 120
			Total Magnesium (Mg)	2018/12/11		100	%	80 - 120
			Total Manganese (Mn)	2018/12/11		94	%	80 - 120
			Total Molybdenum (Mo)	2018/12/11		102	%	80 - 120
			Total Nickel (Ni)	2018/12/11		94	%	80 - 120
			Total Phosphorus (P)	2018/12/11		101	%	80 - 120
			Total Potassium (K)	2018/12/11		100	%	80 - 120
			Total Selenium (Se)	2018/12/11		95	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Silver (Ag)	2018/12/11		97	%	80 - 120
			Total Sodium (Na)	2018/12/11		97	%	80 - 120
			Total Strontium (Sr)	2018/12/11		93	%	80 - 120
			Total Thallium (Tl)	2018/12/11		100	%	80 - 120
			Total Tin (Sn)	2018/12/11		102	%	80 - 120
			Total Titanium (Ti)	2018/12/11		98	%	80 - 120
			Total Uranium (U)	2018/12/11		99	%	80 - 120
			Total Vanadium (V)	2018/12/11		96	%	80 - 120
			Total Zinc (Zn)	2018/12/11		96	%	80 - 120
5879593	AWL	Method Blank	Total Aluminum (Al)	2018/12/11	<5.0		ug/L	
			Total Antimony (Sb)	2018/12/11	<1.0		ug/L	
			Total Arsenic (As)	2018/12/11	<1.0		ug/L	
			Total Barium (Ba)	2018/12/11	<1.0		ug/L	
			Total Beryllium (Be)	2018/12/11	<1.0		ug/L	
			Total Bismuth (Bi)	2018/12/11	<2.0		ug/L	
			Total Boron (B)	2018/12/11	<50		ug/L	
			Total Cadmium (Cd)	2018/12/11	<0.010		ug/L	
			Total Calcium (Ca)	2018/12/11	<100		ug/L	
			Total Chromium (Cr)	2018/12/11	<1.0		ug/L	
			Total Cobalt (Co)	2018/12/11	<0.40		ug/L	
			Total Copper (Cu)	2018/12/11	<2.0		ug/L	
			Total Iron (Fe)	2018/12/11	<50		ug/L	
			Total Lead (Pb)	2018/12/11	<0.50		ug/L	
			Total Magnesium (Mg)	2018/12/11	<100		ug/L	
			Total Manganese (Mn)	2018/12/11	<2.0		ug/L	
			Total Molybdenum (Mo)	2018/12/11	<2.0		ug/L	
			Total Nickel (Ni)	2018/12/11	<2.0		ug/L	
			Total Phosphorus (P)	2018/12/11	<100		ug/L	
			Total Potassium (K)	2018/12/11	<100		ug/L	
			Total Selenium (Se)	2018/12/11	<1.0		ug/L	
			Total Silver (Ag)	2018/12/11	<0.10		ug/L	
			Total Sodium (Na)	2018/12/11	<100		ug/L	
			Total Strontium (Sr)	2018/12/11	<2.0		ug/L	
			Total Thallium (Tl)	2018/12/11	<0.10		ug/L	
			Total Tin (Sn)	2018/12/11	<2.0		ug/L	
			Total Titanium (Ti)	2018/12/11	<2.0		ug/L	
			Total Uranium (U)	2018/12/11	<0.10		ug/L	
			Total Vanadium (V)	2018/12/11	<2.0		ug/L	
			Total Zinc (Zn)	2018/12/11	<5.0		ug/L	
5879593	AWL	RPD	Total Copper (Cu)	2018/12/11	1.7		%	20
			Total Iron (Fe)	2018/12/11	2.3		%	20
			Total Lead (Pb)	2018/12/11	4.1		%	20
			Total Manganese (Mn)	2018/12/11	0.10		%	20
5879792	MLB	Matrix Spike	Total Aluminum (Al)	2018/12/12		101	%	80 - 120
			Total Antimony (Sb)	2018/12/12		109	%	80 - 120
			Total Arsenic (As)	2018/12/12		99	%	80 - 120
			Total Barium (Ba)	2018/12/12		95	%	80 - 120
			Total Beryllium (Be)	2018/12/12		95	%	80 - 120
			Total Bismuth (Bi)	2018/12/12		101	%	80 - 120
			Total Boron (B)	2018/12/12		94	%	80 - 120
			Total Cadmium (Cd)	2018/12/12		99	%	80 - 120
			Total Calcium (Ca)	2018/12/12		NC	%	80 - 120
			Total Chromium (Cr)	2018/12/12		95	%	80 - 120
			Total Cobalt (Co)	2018/12/12		95	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Copper (Cu)	2018/12/12		92	%	80 - 120
			Total Iron (Fe)	2018/12/12		102	%	80 - 120
			Total Lead (Pb)	2018/12/12		95	%	80 - 120
			Total Magnesium (Mg)	2018/12/12		102	%	80 - 120
			Total Manganese (Mn)	2018/12/12		97	%	80 - 120
			Total Molybdenum (Mo)	2018/12/12		106	%	80 - 120
			Total Nickel (Ni)	2018/12/12		95	%	80 - 120
			Total Phosphorus (P)	2018/12/12		109	%	80 - 120
			Total Potassium (K)	2018/12/12		102	%	80 - 120
			Total Selenium (Se)	2018/12/12		100	%	80 - 120
			Total Silver (Ag)	2018/12/12		100	%	80 - 120
			Total Sodium (Na)	2018/12/12		NC	%	80 - 120
			Total Strontium (Sr)	2018/12/12		NC	%	80 - 120
			Total Thallium (Tl)	2018/12/12		102	%	80 - 120
			Total Tin (Sn)	2018/12/12		110	%	80 - 120
			Total Titanium (Ti)	2018/12/12		98	%	80 - 120
			Total Uranium (U)	2018/12/12		107	%	80 - 120
			Total Vanadium (V)	2018/12/12		98	%	80 - 120
			Total Zinc (Zn)	2018/12/12		96	%	80 - 120
5879792	MLB	Spiked Blank	Total Aluminum (Al)	2018/12/12		103	%	80 - 120
			Total Antimony (Sb)	2018/12/12		108	%	80 - 120
			Total Arsenic (As)	2018/12/12		98	%	80 - 120
			Total Barium (Ba)	2018/12/12		97	%	80 - 120
			Total Beryllium (Be)	2018/12/12		95	%	80 - 120
			Total Bismuth (Bi)	2018/12/12		105	%	80 - 120
			Total Boron (B)	2018/12/12		93	%	80 - 120
			Total Cadmium (Cd)	2018/12/12		100	%	80 - 120
			Total Calcium (Ca)	2018/12/12		105	%	80 - 120
			Total Chromium (Cr)	2018/12/12		97	%	80 - 120
			Total Cobalt (Co)	2018/12/12		98	%	80 - 120
			Total Copper (Cu)	2018/12/12		96	%	80 - 120
			Total Iron (Fe)	2018/12/12		105	%	80 - 120
			Total Lead (Pb)	2018/12/12		98	%	80 - 120
			Total Magnesium (Mg)	2018/12/12		105	%	80 - 120
			Total Manganese (Mn)	2018/12/12		101	%	80 - 120
			Total Molybdenum (Mo)	2018/12/12		105	%	80 - 120
			Total Nickel (Ni)	2018/12/12		99	%	80 - 120
			Total Phosphorus (P)	2018/12/12		108	%	80 - 120
			Total Potassium (K)	2018/12/12		104	%	80 - 120
			Total Selenium (Se)	2018/12/12		100	%	80 - 120
			Total Silver (Ag)	2018/12/12		102	%	80 - 120
			Total Sodium (Na)	2018/12/12		100	%	80 - 120
			Total Strontium (Sr)	2018/12/12		104	%	80 - 120
			Total Thallium (Tl)	2018/12/12		103	%	80 - 120
			Total Tin (Sn)	2018/12/12		108	%	80 - 120
			Total Titanium (Ti)	2018/12/12		98	%	80 - 120
			Total Uranium (U)	2018/12/12		106	%	80 - 120
			Total Vanadium (V)	2018/12/12		99	%	80 - 120
			Total Zinc (Zn)	2018/12/12		99	%	80 - 120
5879792	MLB	Method Blank	Total Aluminum (Al)	2018/12/12	<5.0		ug/L	
			Total Antimony (Sb)	2018/12/12	<1.0		ug/L	
			Total Arsenic (As)	2018/12/12	<1.0		ug/L	
			Total Barium (Ba)	2018/12/12	<1.0		ug/L	
			Total Beryllium (Be)	2018/12/12	<1.0		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Bismuth (Bi)	2018/12/12	<2.0		ug/L	
			Total Boron (B)	2018/12/12	<50		ug/L	
			Total Cadmium (Cd)	2018/12/12	<0.010		ug/L	
			Total Calcium (Ca)	2018/12/12	<100		ug/L	
			Total Chromium (Cr)	2018/12/12	<1.0		ug/L	
			Total Cobalt (Co)	2018/12/12	<0.40		ug/L	
			Total Copper (Cu)	2018/12/12	<2.0		ug/L	
			Total Iron (Fe)	2018/12/12	<50		ug/L	
			Total Lead (Pb)	2018/12/12	<0.50		ug/L	
			Total Magnesium (Mg)	2018/12/12	<100		ug/L	
			Total Manganese (Mn)	2018/12/12	<2.0		ug/L	
			Total Molybdenum (Mo)	2018/12/12	<2.0		ug/L	
			Total Nickel (Ni)	2018/12/12	<2.0		ug/L	
			Total Phosphorus (P)	2018/12/12	<100		ug/L	
			Total Potassium (K)	2018/12/12	<100		ug/L	
			Total Selenium (Se)	2018/12/12	<1.0		ug/L	
			Total Silver (Ag)	2018/12/12	<0.10		ug/L	
			Total Sodium (Na)	2018/12/12	<100		ug/L	
			Total Strontium (Sr)	2018/12/12	<2.0		ug/L	
			Total Thallium (Tl)	2018/12/12	<0.10		ug/L	
			Total Tin (Sn)	2018/12/12	<2.0		ug/L	
			Total Titanium (Ti)	2018/12/12	<2.0		ug/L	
			Total Uranium (U)	2018/12/12	<0.10		ug/L	
			Total Vanadium (V)	2018/12/12	<2.0		ug/L	
			Total Zinc (Zn)	2018/12/12	<5.0		ug/L	
5879792	MLB	RPD	Total Arsenic (As)	2018/12/12	NC		%	20
5879862	AM6	QC Standard	Total Suspended Solids	2018/12/13		101	%	80 - 120
5879862	AM6	Method Blank	Total Suspended Solids	2018/12/13	<1.0		mg/L	
5879862	AM6	RPD	Total Suspended Solids	2018/12/13	8.7		%	20
5881255	NHU	QC Standard	pH	2018/12/11		100	%	97 - 103
5881255	NHU	RPD [IMN603-02]	pH	2018/12/11	4.7		%	N/A
5881257	NHU	Spiked Blank	Conductivity	2018/12/11		101	%	80 - 120
5881257	NHU	Method Blank	Conductivity	2018/12/11	1.9, RDL=1.0		uS/cm	
5881257	NHU	RPD [IMN603-02]	Conductivity	2018/12/11	0.34		%	25
5881260	NHU	QC Standard	pH	2018/12/11		100	%	97 - 103
5881260	NHU	RPD	pH	2018/12/11	0.49		%	N/A
5881262	NHU	Spiked Blank	Conductivity	2018/12/11		101	%	80 - 120
5881262	NHU	Method Blank	Conductivity	2018/12/11	100, RDL=1.0		uS/cm	
5881262	NHU	RPD	Conductivity	2018/12/11	0.39		%	25
5881445	SRM	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2018/12/12		87	%	80 - 120
5881445	SRM	Spiked Blank	Nitrogen (Ammonia Nitrogen)	2018/12/12		93	%	80 - 120
5881445	SRM	Method Blank	Nitrogen (Ammonia Nitrogen)	2018/12/12	<0.050		mg/L	
5881445	SRM	RPD	Nitrogen (Ammonia Nitrogen)	2018/12/12	NC		%	20
5881454	SRM	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2018/12/12		NC	%	80 - 120
5881454	SRM	Spiked Blank	Nitrogen (Ammonia Nitrogen)	2018/12/12		94	%	80 - 120
5881454	SRM	Method Blank	Nitrogen (Ammonia Nitrogen)	2018/12/12	<0.050		mg/L	
5881454	SRM	RPD	Nitrogen (Ammonia Nitrogen)	2018/12/12	0.45		%	20
5881459	NHU	QC Standard	Turbidity	2018/12/11		97	%	80 - 120
5881459	NHU	Spiked Blank	Turbidity	2018/12/11		100	%	80 - 120
5881459	NHU	Method Blank	Turbidity	2018/12/11	<0.10		NTU	
5881459	NHU	RPD [IMN608-02]	Turbidity	2018/12/11	2.1		%	20
5881655	MCN	Matrix Spike [IMN608-02]	Total Alkalinity (Total as CaCO3)	2018/12/12		NC	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5881655	MCN	Spiked Blank	Total Alkalinity (Total as CaCO3)	2018/12/12		105	%	80 - 120
5881655	MCN	Method Blank	Total Alkalinity (Total as CaCO3)	2018/12/12	<5.0		mg/L	
5881655	MCN	RPD [IMN608-02]	Total Alkalinity (Total as CaCO3)	2018/12/12	2.3		%	25
5881659	MCN	Matrix Spike [IMN608-02]	Dissolved Chloride (Cl-)	2018/12/12		95	%	80 - 120
5881659	MCN	QC Standard	Dissolved Chloride (Cl-)	2018/12/12		104	%	80 - 120
5881659	MCN	Spiked Blank	Dissolved Chloride (Cl-)	2018/12/12		97	%	80 - 120
5881659	MCN	Method Blank	Dissolved Chloride (Cl-)	2018/12/12	<1.0		mg/L	
5881659	MCN	RPD [IMN608-02]	Dissolved Chloride (Cl-)	2018/12/12	0.055		%	25
5881660	MCN	Matrix Spike [IMN608-02]	Dissolved Sulphate (SO4)	2018/12/12		NC	%	80 - 120
5881660	MCN	Spiked Blank	Dissolved Sulphate (SO4)	2018/12/12		100	%	80 - 120
5881660	MCN	Method Blank	Dissolved Sulphate (SO4)	2018/12/12	<2.0		mg/L	
5881660	MCN	RPD [IMN608-02]	Dissolved Sulphate (SO4)	2018/12/12	1.9		%	25
5881661	MCN	Matrix Spike [IMN608-02]	Reactive Silica (SiO2)	2018/12/12		94	%	80 - 120
5881661	MCN	Spiked Blank	Reactive Silica (SiO2)	2018/12/12		97	%	80 - 120
5881661	MCN	Method Blank	Reactive Silica (SiO2)	2018/12/12	<0.50		mg/L	
5881661	MCN	RPD [IMN608-02]	Reactive Silica (SiO2)	2018/12/12	1.5		%	25
5881662	MCN	Spiked Blank	Colour	2018/12/12		102	%	80 - 120
5881662	MCN	Method Blank	Colour	2018/12/12	<5.0		TCU	
5881662	MCN	RPD [IMN608-02]	Colour	2018/12/12	4.4		%	20
5881668	MCN	Matrix Spike [IMN608-02]	Orthophosphate (P)	2018/12/12		90	%	80 - 120
5881668	MCN	Spiked Blank	Orthophosphate (P)	2018/12/12		96	%	80 - 120
5881668	MCN	Method Blank	Orthophosphate (P)	2018/12/12	<0.010		mg/L	
5881668	MCN	RPD [IMN608-02]	Orthophosphate (P)	2018/12/12	NC		%	25
5881670	MCN	Matrix Spike [IMN608-02]	Nitrate + Nitrite (N)	2018/12/13		93	%	80 - 120
5881670	MCN	Spiked Blank	Nitrate + Nitrite (N)	2018/12/13		99	%	80 - 120
5881670	MCN	Method Blank	Nitrate + Nitrite (N)	2018/12/13	<0.050		mg/L	
5881670	MCN	RPD [IMN608-02]	Nitrate + Nitrite (N)	2018/12/13	2.3		%	25
5881673	MCN	Matrix Spike [IMN608-02]	Nitrite (N)	2018/12/12		107	%	80 - 120
5881673	MCN	Spiked Blank	Nitrite (N)	2018/12/12		100	%	80 - 120
5881673	MCN	Method Blank	Nitrite (N)	2018/12/12	<0.010		mg/L	
5881673	MCN	RPD [IMN608-02]	Nitrite (N)	2018/12/12	NC		%	20
5881677	MCN	Matrix Spike [IMN603-02]	Total Alkalinity (Total as CaCO3)	2018/12/12		101	%	80 - 120
5881677	MCN	Spiked Blank	Total Alkalinity (Total as CaCO3)	2018/12/12		107	%	80 - 120
5881677	MCN	Method Blank	Total Alkalinity (Total as CaCO3)	2018/12/12	<5.0		mg/L	
5881677	MCN	RPD [IMN603-02]	Total Alkalinity (Total as CaCO3)	2018/12/12	NC		%	25
5881681	MCN	Matrix Spike [IMN603-02]	Dissolved Chloride (Cl-)	2018/12/12		94	%	80 - 120
5881681	MCN	QC Standard	Dissolved Chloride (Cl-)	2018/12/12		106	%	80 - 120
5881681	MCN	Spiked Blank	Dissolved Chloride (Cl-)	2018/12/12		97	%	80 - 120
5881681	MCN	Method Blank	Dissolved Chloride (Cl-)	2018/12/12	<1.0		mg/L	
5881681	MCN	RPD [IMN603-02]	Dissolved Chloride (Cl-)	2018/12/12	2.6		%	25
5881682	MCN	Matrix Spike [IMN603-02]	Dissolved Sulphate (SO4)	2018/12/12		114	%	80 - 120
5881682	MCN	Spiked Blank	Dissolved Sulphate (SO4)	2018/12/12		99	%	80 - 120
5881682	MCN	Method Blank	Dissolved Sulphate (SO4)	2018/12/12	<2.0		mg/L	
5881682	MCN	RPD [IMN603-02]	Dissolved Sulphate (SO4)	2018/12/12	NC		%	25
5881684	MCN	Matrix Spike [IMN603-02]	Reactive Silica (SiO2)	2018/12/12		97	%	80 - 120
5881684	MCN	Spiked Blank	Reactive Silica (SiO2)	2018/12/12		96	%	80 - 120
5881684	MCN	Method Blank	Reactive Silica (SiO2)	2018/12/12	<0.50		mg/L	
5881684	MCN	RPD [IMN603-02]	Reactive Silica (SiO2)	2018/12/12	0.69		%	25
5881688	MCN	Spiked Blank	Colour	2018/12/12		103	%	80 - 120
5881688	MCN	Method Blank	Colour	2018/12/12	<5.0		TCU	
5881688	MCN	RPD [IMN603-02]	Colour	2018/12/12	1.4		%	20
5881702	MCN	Matrix Spike [IMN603-02]	Orthophosphate (P)	2018/12/12		88	%	80 - 120
5881702	MCN	Spiked Blank	Orthophosphate (P)	2018/12/12		96	%	80 - 120
5881702	MCN	Method Blank	Orthophosphate (P)	2018/12/12	<0.010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5881702	MCN	RPD [IMN603-02]	Orthophosphate (P)	2018/12/12	NC		%	25
5881711	MCN	Matrix Spike [IMN603-02]	Nitrate + Nitrite (N)	2018/12/13		93	%	80 - 120
5881711	MCN	Spiked Blank	Nitrate + Nitrite (N)	2018/12/13		94	%	80 - 120
5881711	MCN	Method Blank	Nitrate + Nitrite (N)	2018/12/13	<0.050		mg/L	
5881711	MCN	RPD [IMN603-02]	Nitrate + Nitrite (N)	2018/12/13	NC		%	25
5881724	MCN	Matrix Spike [IMN603-02]	Nitrite (N)	2018/12/12		90	%	80 - 120
5881724	MCN	Spiked Blank	Nitrite (N)	2018/12/12		105	%	80 - 120
5881724	MCN	Method Blank	Nitrite (N)	2018/12/12	<0.010		mg/L	
5881724	MCN	RPD [IMN603-02]	Nitrite (N)	2018/12/12	NC		%	20
5883620	NHU	QC Standard	pH	2018/12/12		100	%	97 - 103
5883620	NHU	RPD	pH	2018/12/12	1.8		%	N/A
5883621	NHU	Spiked Blank	Conductivity	2018/12/12		101	%	80 - 120
5883621	NHU	Method Blank	Conductivity	2018/12/12	1.4, RDL=1.0		uS/cm	
5883621	NHU	RPD	Conductivity	2018/12/12	1.7		%	25
5883734	NHU	QC Standard	Turbidity	2018/12/12		97	%	80 - 120
5883734	NHU	Spiked Blank	Turbidity	2018/12/12		99	%	80 - 120
5883734	NHU	Method Blank	Turbidity	2018/12/12	<0.10		NTU	
5883734	NHU	RPD	Turbidity	2018/12/12	2.5		%	20
5883746	NHU	QC Standard	Turbidity	2018/12/12		98	%	80 - 120
5883746	NHU	Spiked Blank	Turbidity	2018/12/12		98	%	80 - 120
5883746	NHU	Method Blank	Turbidity	2018/12/12	<0.10		NTU	
5883746	NHU	RPD	Turbidity	2018/12/12	NC		%	20
5883750	NHU	QC Standard	Turbidity	2018/12/12		97	%	80 - 120
5883750	NHU	Spiked Blank	Turbidity	2018/12/12		99	%	80 - 120
5883750	NHU	Method Blank	Turbidity	2018/12/12	<0.10		NTU	
5883750	NHU	RPD	Turbidity	2018/12/12	NC		%	20
5886137	NHU	QC Standard	Turbidity	2018/12/13		95	%	80 - 120
5886137	NHU	Spiked Blank	Turbidity	2018/12/13		98	%	80 - 120
5886137	NHU	Method Blank	Turbidity	2018/12/13	<0.10		NTU	
5886137	NHU	RPD	Turbidity	2018/12/13	2.6		%	20
5886633	HM2	Matrix Spike	Total Organic Carbon (C)	2018/12/14		107	%	85 - 115
5886633	HM2	Spiked Blank	Total Organic Carbon (C)	2018/12/14		101	%	80 - 120
5886633	HM2	Method Blank	Total Organic Carbon (C)	2018/12/14	<0.50		mg/L	
5886633	HM2	RPD	Total Organic Carbon (C)	2018/12/14	0.35		%	15
5886636	HM2	Matrix Spike	Total Organic Carbon (C)	2018/12/14		109	%	85 - 115
5886636	HM2	Spiked Blank	Total Organic Carbon (C)	2018/12/14		105	%	80 - 120
5886636	HM2	Method Blank	Total Organic Carbon (C)	2018/12/14	<0.50		mg/L	
5886636	HM2	RPD	Total Organic Carbon (C)	2018/12/14	NC		%	15
5886644	HM2	Matrix Spike	Total Organic Carbon (C)	2018/12/15		106	%	85 - 115
5886644	HM2	Spiked Blank	Total Organic Carbon (C)	2018/12/15		101	%	80 - 120
5886644	HM2	Method Blank	Total Organic Carbon (C)	2018/12/15	<0.50		mg/L	
5886644	HM2	RPD	Total Organic Carbon (C)	2018/12/15	1.4		%	15
5888741	KMC	Matrix Spike	Total Organic Carbon (C)	2018/12/16		101	%	85 - 115
5888741	KMC	Spiked Blank	Total Organic Carbon (C)	2018/12/15		102	%	80 - 120
5888741	KMC	Method Blank	Total Organic Carbon (C)	2018/12/15	<0.50		mg/L	
5888741	KMC	RPD	Total Organic Carbon (C)	2018/12/15	4.0 (1)		%	15
5888773	KMC	Matrix Spike	Total Organic Carbon (C)	2018/12/16		105	%	85 - 115
5888773	KMC	Spiked Blank	Total Organic Carbon (C)	2018/12/16		101	%	80 - 120
5888773	KMC	Method Blank	Total Organic Carbon (C)	2018/12/16	<0.50		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5888773	KMC	RPD	Total Organic Carbon (C)	2018/12/16	1.4		%	15

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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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Maxxam Job #: B8W8094
Report Date: 2018/12/17

Dillon Consulting Limited
Client Project #: 17-6461
Sampler Initials: KSR

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Mike MacGillivray, Scientific Specialist (Inorganics)

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Appendix M5

Middle River of Pictou Water Availability – Final Report

Middle River of Pictou Water Availability

Final Report

December 17, 2015

Prepared for:

R.V. Anderson Associates Limited
engineering · environment · infrastructure

CANADA'S BEST MANAGED COMPANIES Platinum member

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R.V. Anderson Associates Limited
engineering · environment · infrastructure

445 Urquhart Crescent Fredericton
New Brunswick E3B 8K4 Canada
Tel 506 455 2888 Fax 506 455 0193
www.rvanderson.com

Middle River of Pictou Water Availability

Final Report

Province of Nova Scotia

NOVA SCOTIA
CANADA

RVA 153094

December 17, 2015

MIDDLE RIVER OF PICTOU WATER AVAILABILITY

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EXECUTIVE SUMMARY

R.V. Anderson Associates Limited (RVA) was retained by the Province of Nova Scotia to determine the surface water availability for the Middle River of Pictou at Granton and estimate a sustainable water withdrawal rate from the Middle River Reservoir. The scope of work for this hydrologic study included the review and summary of existing information, a description of the hydrology of the Middle River and hydrologic analyses of the Middle River stream flow and reservoir.

The sustainable water withdrawal rate for the Granton water intake was determined to be 1.10 m^3/s (95,040 m^3/day), which considered the anticipated effects of climate change.

1.0 INTRODUCTION

R.V. Anderson Associates Limited (RVA) was retained by the Province of Nova Scotia to determine the surface water availability for the Middle River of Pictou at Granton. The intent of this hydrologic review is to determine stream flow rates throughout the year to estimate allowable and sustainable water withdrawal rates.

There is an existing water intake located at Pump House Road in Granton (N45°37'53.2", W062°44'22.3"), approximately 500 m upstream of the dam that forms the Middle River Reservoir (circled on the figure below).

Figure 1.1 – Water withdrawal location.

1.1 Scope of Work

The scope of work for this hydrologic study included the following:

- Gathering, review and summary of existing information, including previous hydrologic studies, hydrometric data, climatic data, and mapping.
- Descriptive hydrology to define stream flow rates for the Middle River.
    - tabulation of average annual, monthly, and daily flows (flow rates and volumes) and observed extreme low flows (flow rates) for the Environment Canada Middle River hydrometric station,
    - proration of selected flows to the study location, and
    - identification of hydrometric records that are typical of average and low flow years.
- Hydrologic analyses of the Middle River stream flow.
    - annual, monthly and seasonal flow duration analyses,
    - low flow frequency analysis, and
    - plotting and analysis of mass curves to determine the probability of surface water availability.

1.2 Approach

The surface water availability for extraction is referred to as the “safe yield” of a watershed. It is a measure of the probability that sufficient quantities of water are available to satisfy a withdrawal demand (either from direct stream flow or reservoir storage) while maintaining an environmental flow or aquatic protection flow, for both current and future conditions. In the context of this report, the term safe yield is intended as a water withdrawal rate with a given probability of being satisfied. Even though this probability may be small, it is not zero, and there is a chance that the demand for water withdrawal may not be met.

The determination of safe yield, or the probability of sufficient surface water availability, consists of the following components:

- an evaluation of the water available directly from the Middle River as stream flow,
- a evaluation of the water available from the Middle River Reservoir storage,
- an evaluation of the Middle River stream flow required for environmental or aquatic habitat protection, and
- an evaluation of the potential for changes in the hydrologic regime (urbanization and climate change) that could affect the availability of water in the foreseeable future.

Flow estimates for Middle River at the water intake were prorated from the hydrometric records of the upstream gauged station maintained by Environment Canada at Rocklin.

2.0 WATERSHED DESCRIPTION

The Middle River, East River and West River of Pictou converge in Pictou Harbour and discharge to the Northumberland Straight. The Middle River flow regime was altered with the construction of the causeway at Abercrombie Point (1967) and the dam and spillway at Granton which impounds flow at the mouth of the Middle River.

The Middle River watershed has a drainage area of 239 km^2 at the water intake location in Granton. The reservoir upstream of the dam in Granton has a surface area of 5.2 km^2 and provides storage for water withdrawal during periods of low stream flow. The water surface area of the reservoir was delineated using Google Earth Pro imagery and confirmed using imagery from the ESRI site (showed the water surface area to be approximately 5.4 km^2). As no detailed bathymetric information was available for the reservoir, the size of the reservoir water surface was checked during different times of the year (October 05, 2003, June 09, 2004, July 03, 2007, June 18, 2012 and August 16, 2013) using historic imagery from Google Earth Pro and was found to be highly invariable with little change in the location of the shoreline on the above images. This indicates relatively steep shorelines which would be consistent with flooding of valley walls (artificial reservoir) rather than the flatter shorelines of natural reservoirs.

The water surface elevation in Google Earth Pro is shown at 10 ft but does not change for the different images, indicating this elevation is associated with the latest August 2013 data (please note the elevation resolution is plus or minus 1 foot). For the purposes of this water availability study, the water surface area of the reservoir was assumed to be constant at 5.2 km^2 (more conservative than the 5.4 km^2 area measured from the ESRI data) for the range of water surface elevations analyzed.

There is a hydrometric station on the Middle River at Rocklin (01DP001, drainage area 92.2 km^2), approximately 17 km upstream of the water intake at Granton. This station is expected to provide representative unit flow rates for the Middle River as development within the watershed is sparse in both the upper and lower regions.

2.1 Hydrometric Data

Flow data for the Middle River of Pictou hydrometric station at Rocklin was acquired from the Environment Canada HYDAT database. This data spanned from 1965 to 2012 and included a record of all daily flows, mean monthly flows, and flow extremes (maximum and minimum). This data was prorated based on drainage area from the Rocklin hydrometric station (92.2 km^2) to the water intake location at Granton (239 km^2).

Table 2.1 – Flows Prorated from Middle River at Rocklin to the Granton Water Intake

	Flows (m^3/s)			Extreme Daily flows (m^3/s)	
	Average	**Min**	**Max**	**Min**	**Max**
January	6.80	0.91	18.3	0.18	93.3
February	5.79	0.39	16.1	0.16	116.9
March	10.1	0.77	22.0	0.20	129.6
April	14.0	4.92	27.5	1.14	109.6
May	8.20	2.22	26.4	0.90	88.1
June	3.88	0.76	22.8	0.17	131.4
July	1.96	0.19	7.70	0.02	80.4
August	2.25	0.04	12.9	0.01	121.8
September	2.85	0.24	19.3	0.01	70.8
October	5.99	0.45	18.2	0.14	96.7
November	10.2	1.55	21.3	0.29	130.1
December	10.1	2.06	19.3	0.99	130.4
Full Year	6.87	4.22	10.0	0.01	131.4
Winter	7.56	--	--	--	--
Spring	8.69	--	--	--	--
Summer	2.35	--	--	--	--
Fall	8.76	--	--	--	--

2.2 Middle River Reservoir Fish Ladder

The fish ladder at the Middle River Reservoir spillway is operated by Nova Scotia Department of Internal Services. This ladder was designed by DFO and is intended to protect and maintain fish passage between the Middle River and Pictou Harbour. An as-built survey of the fish ladder dated December 09, 2015 was used as the basis to calculate the minimum reservoir water level elevation and is attached in Appendix B. It should be noted that all elevations and water levels noted on the drawing as well as the tidal levels and reservoir operating levels discussed in the following paragraphs are referenced to geodetic datum. These elevations are presented in Imperial units throughout the report to be consistent with the survey drawing and fish ladder operations.

The minimum water level in the reservoir is governed by Baffle 9 in the fish ladder, which has a concrete crest elevation of 6.0 ft. This elevation is above the higher high water elevation for a large tide (2.8 ft) and is sufficient to prevent the backflow of brackish water into the reservoir.

The Middle River fish ladder was originally designed to convey 0.21 m^3/s with an increase to 0.42 m^3/s between April 21 and May 21 to improve downstream smolt migration. Subsequent modifications, including the installation of metal chutes, reduced the minimum flow requirement for fish passage upstream through the fish ladder to

0.14 m^3/s with an increase to 0.42 m^3/s between April 21 and May 21 (DFO personal correspondence).

The proper functioning of the fish ladder during periods of low flow at 0.14 m^3/s would require a 1.0 ft flow depth over Baffle 9 (flow control) or a water level at the obvert of the orifice in Baffle 9, i.e. 1.25 ft flow depth (fish passage). This converts to reservoir water level elevations of 7.0 ft and 7.25 ft, respectively, with the second more conservative scenario governing the design (minimum reservoir water level elevation required to ensure fish passage is 7.25 ft geodetic datum).

3.0 HYDROLOGIC ANALYSIS

The hydrologic information presented in this section forms the basis of determining water availability from both direct stream flow and reservoir storage. The availability of water in the context of environmental flows, climate change and safe yield is presented later in Section 6.

3.1 Flow Duration Analysis

Flow duration analyses were used to determine the percent of time specified daily discharges were equaled or exceeded during a given period. If the period used for flow duration analyses represents the long-term flow of a stream, the results can be used to predict the distribution of future flows for water extraction.

Flow duration analyses were completed for the entire year, for each month and for each season.

Table 3.1 summarizes the prorated 50%, 75%, 90%, and 95% exceedance flows (i.e. the daily flows that are exceeded 50%, 75%, 90% and 95% of the time) at the water intake. The 50% exceedance flow represents the median flow for each period, while the 75%, 90%, and 95% exceedance flows are commonly used as hydrologic indices to describe low flows.

Table 3.1 – Prorated Exceedance Flows (m^3/s) for Middle River at Granton Water Intake

Exceedance Probability	50%	75%	90%	95%
January	3.94	2.13	1.12	0.58
February	3.08	1.61	0.73	0.39
March	5.47	2.72	1.17	0.64
April	9.69	6.48	4.20	1.92
May	5.44	3.01	1.86	1.46
June	1.94	1.17	0.72	0.53
July	0.90	0.44	0.21	0.11
August	0.67	0.24	0.12	0.04
September	0.90	0.43	0.20	0.10
October	2.59	1.07	0.45	0.27
November	6.71	3.19	1.78	1.21
December	6.22	3.89	2.05	1.45
Full Year	3.37	1.22	0.41	0.20
Winter	4.15	2.20	1.12	0.72
Spring	6.32	3.08	1.68	1.30
Summer	0.86	0.39	0.17	0.08
Fall	4.72	1.84	0.73	0.42

3.2 Low Flow Frequency Analysis

Low flow frequency analyses detail the probability and magnitude of extreme flows (in this case droughts). Extreme flows are often specified as having a return period (or exceedance probability). For example, 1.01-year, 10-year, and 20-year return periods based on annual series low flow analyses are equivalent to probabilities of occurrence in any year of 99%, 10%, and 5%, respectively.

Lower flow events would occur less frequently and thus have a greater return period or lower probability of occurrence. Usually, for low flows, the duration of an extreme event is also specified. The duration of the event is the time the flow condition would continue, with longer durations generally resulting in greater ecological consequences. The average of low flows over a longer duration, as determined by statistical analyses, should be greater than the extreme low flow experienced during a shorter period. Where a one-year, one-day duration low flow is an indicator of an annual extreme daily low flow, flows of seven days in duration are more indicative of average flows during drought conditions.

The drought durations chosen for analysis were one-day, seven-day, and 14-day, which are commonly used in this type of low flow investigation. The low flow estimates for the Middle River water intake are presented in Table 3.2.

Table 3.2 – Low Flow Estimates (m^3/s) for the Middle River at the Granton Water Intake

Low Flow Events (1965-2012)	1 Day Duration	7 Day Duration	14 Day Duration
Lowest on Record (2001)	0.004	0.005	0.006
Annual Average	0.119	0.334	0.418
Highest on Record (1977)	0.496	1.478	1.970
10 Year Return Period	0.080	0.104	0.130

3.3 Reservoir Storage

The Middle River Reservoir serves as a source of water during periods of low flows that could mitigate drought conditions. Therefore, the controlling factor affecting of water availability during low flow periods may not be the stream flow but rather the reservoir storage volume.

The Middle River Reservoir has a surface area of approximately 5.2 km^2. A 0.1 m drawdown in water level represents an extraction rate of 0.86 m^3/s over 7 days, 0.43 m^3/s over 14 days or 0.20 m^3/s over 30 days during drought conditions. These values do not account for stream flow recharge to the reservoir, which was shown in 2001 to be extremely low during severe drought conditions.

4.0 WATER AVAILABILITY

4.1 Environmental Protection Requirements

In order to ensure that water extraction does not deplete the remaining flow in the Middle River to a level that causes damage to the aquatic habitat, environmental protection flows or maintenance flows (minimum flows that are to remain in watercourses) are typically specified by regulatory and permitting agencies. The primary agencies that regulate water withdrawal are Nova Scotia Environment (NSE, provincial) and the Department of Fisheries and Oceans (DFO, federal).

The situation at the Granton water intake is not typical of water extraction from a free-flowing watercourse. The Middle River Reservoir discharges directly to the tidal estuary upstream of the Pictou Causeway. This does not include a connecting section of natural watercourse that would have low flow concerns. As such, an environmental protection flow is not needed for the watercourse at or downstream of the Granton water intake. Fish migration between the Middle River and Pictou Harbour, therefore, becomes the primary concern in determining an aquatic protection flow.

The sustainable water withdrawal rate for the Granton intake was determined based on the following three (3) criteria:

1. Minimum fish ladder design flows are maintained at all times prior to water withdrawal.
    a. April 21 to May 21: 0.42 m^3/s
    b. Rest of the year: 0.14 m^3/s
2. Maximum allowable operational reservoir water level drawdown is to be 6.75 ft. This accounts for drawdown from a full reservoir operating level of 15.0 ft in the spring to 8.25 ft in the summer/fall.

    The full reservoir water level elevation at the end of the spring freshet was selected at 15.0 ft as this is the maximum water level elevation fully contained on property owned by the Province of Nova Scotia and is the maximum normal operating water level of the reservoir.

    The minimum reservoir water level elevation was selected at 8.25 ft based on a minimum reservoir water level elevation of 7.25 ft needed for proper functioning of the fish ladder (see Section 2.3) plus a 1.0 ft allowance for evaporative losses from the reservoir. This 1.0 ft allowance was deemed to be needed to correct for the higher percentage of lakes and swamps and resulting evaporative losses for the entire watershed compared to the gauged upper portion of the watershed. These drawdown calculations also include steam flow recharge as noted below.

3. Stream flow into the reservoir equals monthly flows with an 85% exceedance probability. These are the flows that historically would be exceeded on 85% of the days during each month, represent a reasonably conservative estimate of inflow into the reservoir (based on a comparison to other environmental protection flows), and are presented in Table 4.1.

Table 4.1 – Middle River Monthly 85% Exceedance Probability Flows

	% Exceedence Prob Flow (m^3/s)		85 % Exceedence Prob Flow (m^3/s)
January	1.53	July	0.26
February	0.99	August	0.17
March	1.70	September	0.27
April	5.24	October	0.65
May	2.36	November	2.08
June	0.88	December	2.83

4.2 Sustainable Water Withdrawal Rate

A maximum sustainable withdrawal rate of 1.10 m^3/s satisfies all three of the environmental requirements described in the previous paragraphs. Table 4.2 presents the monthly flow summary and estimated reservoir water levels associated with a sustainable withdrawal rate of 1.10 m^3/s during a year with monthly flows that are exceeded 85% of the time.

Table 4.2 – Middle River Water Availability during a Typical Year

	Sustainable Yield (m^3/s)	Fish Ladder Design Flow (m^3/s)	Total Flow Requirement (m^3/s)	85 % Exceed Prob Flow (%)	Reservoir Withdrawal (m^3/s)	Reservoir Gauge Ht (ft)
Jan	1.10	0.14	1.24	1.53	--	12.9
Feb	1.10	0.14	1.24	0.99	0.25	12.5
Mar	1.10	0.14	1.24	1.70	--	13.3
Apr	1.10	0.42	1.52	5.24	--	15.0
May	1.10	0.42	1.52	2.36	--	15.0
Jun	1.10	0.14	1.24	0.88	0.36	14.4
Jul	1.10	0.14	1.24	0.26	0.98	12.7
Aug	1.10	0.14	1.24	0.17	1.07	10.9
Sept	1.10	0.14	1.24	0.27	0.97	9.3
Oct	1.10	0.14	1.24	0.65	0.59	8.3
Nov	1.10	0.14	1.24	2.08	--	9.7
Dec	1.10	0.14	1.24	2.83	--	12.4

The data presented in Table 4.2 indicate that withdrawal from the reservoir storage would typically be required from June until October, with water levels rebounding above 12 ft by the start of the year.

Withdrawal rates higher than the sustainable rate of 1.10 m^3/s could be safely accommodated during April and May as long as the reservoir levels are maintained at gauge height of 15.0 ft. The water withdrawal rates could also be increased partway through the summer if the reservoir levels exceed those presented in Table 4.2.

5.0 HYDROLOGIC CHANGES

The low population density and low population growth within the Middle River basin indicates that increased urbanization within the developed areas is not likely to significantly increase the volume of runoff from the watershed as a whole. As such, the effects of future land-use changes on hydrology were assumed to be minimal.

Climate change is expected to have a greater impact on the Middle River hydrology. Although uncertainties as to the magnitude of the effects of climate change on low flows makes quantification of these impacts difficult, a general evaluation of the potential effects of climate change was performed and the results are presented below.

An increasing body of observations indicates changes in climate, the most noticeable observations being a gradual warming and an increase in precipitation of 0.5% to 1% per decade in the 20th century over most mid- and high latitudes of the Northern Hemisphere (IPCC, 2001a). Evidence exists that most of the warming observed over the last 50 years is attributable to human activities. Furthermore, emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect the climate for many centuries (IPCC, 2001a).

Predictions of the future effects of climate change are primarily based on a number of Global or General Circulation Models (GCMs) that predict increases in the global average temperature and sea level under all scenarios modelled by the Intergovernmental Panel on Climate Change (IPCC). The globally averaged surface temperature is projected to increase between 1.4°C and 5.8°C over the period 1990 to 2100, with nearly all land areas warming more rapidly than this global average. In addition, precipitation is projected to increase during the 21st century, especially during the second half of the 21st century over northern mid- to high latitudes (IPCC, 2001a).

Climate change will affect hydrological systems, as precipitation is the main driver of variability in the water balance over both space and time (IPCC, 2001b). The frequency of low flows is affected primarily by changes in the seasonal distribution of precipitation, its year-to-year variability, and the occurrence of prolonged droughts (IPCC, 2001b). Increased temperatures, in effect, reduce the snow pack storing water during winter. Furthermore, if a smaller proportion of precipitation during winter falls as snow, there is proportionately more runoff in winter and, as there is less snow to melt, less runoff during spring.

5.1.1 Climate Projections

The Province of Nova Scotia and Environment Canada commissioned a study entitled Adapting to a Changing Climate in Nova Scotia: Vulnerability Assessment and Adaptation Options (published September 2005, DeRomilly and deRomilly Limited, Dillon Consulting Limited, Allan Bell Environmental Management Services, Cameron Consulting, and Environment Canada). This report identified key issues related to climate change, the impacts associated with changes and a recommended framework for adapting to the potential climate changes. The following points were among the key findings associated with surface water availability.

- Potential for increased variability in the quality and quantity of regional water resources.

- Projected climate change likely to alter snow and rainfall patterns, resulting in less frequent, but heavier precipitation earlier than present (April rather than May).
- It is anticipated that less water is likely to be available for consumption, agriculture and recreation with more conflicts over use.
- Longer and warmer summers likely to result in more droughts.

The Climate Change Nova Scotia website (https://climatechange.novascotia.ca/climate-data) provides climate change projections for the various regions of the province. The relevant parameters for the Middle River watershed are presented in the table below.

Table 5.1 – Climate Change Projections for Pictou, NS

Parameter		Historical 1980s	Projected 2020s	Projected 2050s	Projected 2080s
Temperature (deg. C)	Annual	5.7	6.8	8.0	9.2
	Winter	-5.4	-4.3	-3.0	-1.7
	Spring	3.5	4.4	5.5	6.6
	Summer	16.8	17.8	19.0	20.1
	Fall	8.1	9.2	10.3	11.5
Hot Days (T_{max} > 30 deg. C)		3.1	6.3	11.6	18.6
Precipitation (mm)	Annual	1,383	1,416	1,424	1,462
	Winter	364	378	385	404
	Spring	324	334	340	352
	Summer	292	297	294	295
	Fall	404	407	404	411
Days With Rain		108.2	120.7	124.2	127.1
Days With Snow		35.0	51.7	45.2	38.8

The above projections indicate warmer temperatures and an increase in annual precipitation. This is no increase in summer precipitation and it is likely that changing precipitation patterns could make stream flow conditions more variable in the future. Storage within the reservoir is likely to help offset changing flow patterns.

An overall increase in runoff volume should help the Middle River Reservoir to satisfy demands at the Granton water intake. The slightly increasing precipitation predictions also indicate that we can continue to rely on historic data as a predictor of runoff volume to the Middle River Reservoir.

6.0 CONCLUSIONS

Based on the information presented in the previous sections of this report, the following conclusions were drawn.

1. The Middle River Reservoir discharges to the tidal estuary upstream of the Pictou Causeway. There is no section of free-flowing natural watercourse downstream of the Granton water intake that would have low flow concerns. As such, the fish ladder at the reservoir outlet is the only location where an aquatic protection flow is recommended.
2. The fish ladder at the Middle River Reservoir has a design flow of 0.42 m^3/s for the period of April 21 to May 21 and 0.14 m^3/s for the rest of the year. These design flows were used in all analyses as the minimum flows to be maintained at the reservoir outlet.
3. The minimum water level in the Middle River Reservoir to sustain fish passage through the fish ladder is 7.25 ft, geodetic. This represents the obvert elevation of the orifice in the fifth most upstream baffle (#9).
4. Climate change is likely to make the Middle River stream flow patterns more variable, however runoff volumes are not expected to decrease. Storage within the reservoir is likely to offset the changing flow patterns. As such the effects of climate changes are not expected to significantly impact the ability of the Middle River Reservoir to satisfy withdrawal demands.
5. Withdrawal rates higher than the recommended sustainable rate could be safely accommodated during April and May as long as the reservoir levels are maintained at gauge height of 15.0 ft. Water withdrawal rates could also be increased partway through the summer if the reservoir levels exceed those presented in Table 4.2.
6. The maximum sustainable withdrawal rate for the Granton intake is 1.10 m^3/s (95,040 m^3/day).

APPENDIX A

Sustainable Withdrawal Rate Calculation Spreadsheet

M5

Middle River Water Availability

November 10, 2015

Monthly Exceedence Prob Flows for Stn 01DP004 - Middle River at Rocklin (Drainage Area = 92.2 km2)
Prorated to Middle River Reservoir (Drainage Area = 239 km2)

Table 1. Exceedance Probability Flows (m^3/s)

Exc Prob %	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0	41.73	43.29	54.44	62.21	43.81	32.14	16.75	27.48	27.22	50.29	54.95	53.92
5	19.44	17.89	30.85	35.51	23.49	11.28	6.12	8.22	8.48	20.06	28.77	27.48
10	13.09	11.38	22.11	26.70	16.28	7.34	3.68	4.28	5.21	13.19	20.06	20.22
15	10.37	8.55	17.16	22.01	12.86	5.68	2.72	2.64	3.34	10.06	16.64	15.97
20	8.68	6.79	14.36	18.72	10.94	4.59	2.15	1.93	2.54	7.85	13.71	12.94
25	7.41	5.70	11.92	16.49	9.33	3.91	1.77	1.53	2.06	6.38	11.79	10.99
30	6.48	4.95	10.14	14.62	8.17	3.27	1.56	1.32	1.72	5.39	10.29	9.54
35	5.70	4.41	8.66	12.86	7.23	2.83	1.36	1.09	1.38	4.59	9.25	8.45
40	5.05	3.89	7.31	11.82	6.45	2.48	1.21	0.91	1.20	3.86	8.40	7.70
45	4.41	3.50	6.25	10.58	5.86	2.21	1.05	0.77	1.03	3.16	7.49	6.97
50	3.94	3.08	5.47	9.69	5.44	1.94	0.90	0.67	0.90	2.59	6.71	6.22
55	3.60	2.72	4.85	9.02	4.90	1.74	0.79	0.58	0.79	2.14	5.96	5.73
60	3.19	2.45	4.17	8.27	4.43	1.58	0.69	0.48	0.69	1.84	5.18	5.31
65	2.85	2.20	3.76	7.65	3.86	1.45	0.60	0.39	0.62	1.55	4.54	4.87
70	2.49	1.94	3.32	7.02	3.42	1.31	0.54	0.30	0.53	1.27	3.81	4.33
75	2.13	1.61	2.72	6.48	3.01	1.17	0.44	0.24	0.43	1.07	3.19	3.89
80	1.83	1.27	2.19	5.96	2.67	1.03	0.34	0.20	0.34	0.85	2.55	3.37
85	1.53	0.99	1.70	5.24	2.36	0.88	0.26	0.17	0.27	0.65	2.08	2.83
90	1.12	0.73	1.17	4.20	1.86	0.72	0.21	0.12	0.20	0.45	1.78	2.05
95	0.58	0.39	0.64	1.92	1.46	0.53	0.11	0.04	0.10	0.27	1.21	1.45
100	0	0	0	0	0	0	0	0	0	0	0	0

Table 2. Subtract Fish Ladder Design Flows April/May 0.42 m^3/s Other 0.14 m^3/s

Exc Prob %	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0	41.59	43.15	54.30	61.79	43.39	32.00	16.61	27.34	27.08	50.15	54.81	53.78
5	19.30	17.75	30.71	35.09	23.07	11.14	5.98	8.08	8.34	19.92	28.63	27.34
10	12.95	11.24	21.97	26.28	15.86	7.20	3.54	4.14	5.07	13.05	19.92	20.08
15	10.23	8.41	17.02	21.59	12.44	5.54	2.58	2.50	3.20	9.92	16.50	15.83
20	8.54	6.65	14.22	18.30	10.52	4.45	2.01	1.79	2.40	7.71	13.57	12.80
25	7.27	5.56	11.78	16.07	8.91	3.77	1.63	1.39	1.92	6.24	11.65	10.85
30	6.34	4.81	10.00	14.20	7.75	3.13	1.42	1.18	1.58	5.25	10.15	9.40
35	5.56	4.27	8.52	12.44	6.81	2.69	1.22	0.95	1.24	4.45	9.11	8.31
40	4.91	3.75	7.17	11.40	6.03	2.34	1.07	0.77	1.06	3.72	8.26	7.56
45	4.27	3.36	6.11	10.16	5.44	2.07	0.91	0.63	0.89	3.02	7.35	6.83
50	3.80	2.94	5.33	9.27	5.02	1.80	0.76	0.53	0.76	2.45	6.57	6.08
55	3.46	2.58	4.71	8.60	4.48	1.60	0.65	0.44	0.65	2.00	5.82	5.59
60	3.05	2.31	4.03	7.85	4.01	1.44	0.55	0.34	0.55	1.70	5.04	5.17
65	2.71	2.06	3.62	7.23	3.44	1.31	0.46	0.25	0.48	1.41	4.40	4.73
70	2.35	1.80	3.18	6.60	3.00	1.17	0.40	0.16	0.39	1.13	3.67	4.19
75	1.99	1.47	2.58	6.06	2.59	1.03	0.30	0.10	0.29	0.93	3.05	3.75
80	1.69	1.13	2.05	5.54	2.25	0.89	0.20	0.06	0.20	0.71	2.41	3.23
85	1.39	0.85	1.56	4.82	1.94	0.74	0.12	0.03	0.13	0.51	1.94	2.69
90	0.98	0.59	1.03	3.78	1.44	0.58	0.07	-0.02	0.06	0.31	1.64	1.91
95	0.44	0.25	0.50	1.50	1.04	0.39	-0.03	-0.10	-0.04	0.13	1.07	1.31
100		0	0	0	0	0	0	0	0	0	0	0

Table 3. Subtract Sustainable Withdrawal Flow 1.10 m3/s

Exc Prob %	Jan	Feb	Mar	Apr	May	Jun	1.15	Aug	Sept	Oct	Nov	Dec
0	40.49	42.05	53.20	60.69	42.29	30.90	15.51	26.24	25.98	49.05	53.71	52.68
5	18.20	16.65	29.61	33.99	21.97	10.04	4.88	6.98	7.24	18.82	27.53	26.24
10	11.85	10.14	20.87	25.18	14.76	6.10	2.44	3.04	3.97	11.95	18.82	18.98
15	9.13	7.31	15.92	20.49	11.34	4.44	1.48	1.40	2.10	8.82	15.40	14.73
20	7.44	5.55	13.12	17.20	9.42	3.35	0.91	0.69	1.30	6.61	12.47	11.70
25	6.17	4.46	10.68	14.97	7.81	2.67	0.53	0.29	0.82	5.14	10.55	9.75
30	5.24	3.71	8.90	13.10	6.65	2.03	0.32	0.08	0.48	4.15	9.05	8.30
35	4.46	3.17	7.42	11.34	5.71	1.59	0.12	-0.15	0.14	3.35	8.01	7.21
40	3.81	2.65	6.07	10.30	4.93	1.24	-0.03	-0.33	-0.04	2.62	7.16	6.46
45	3.17	2.26	5.01	9.06	4.34	0.97	-0.19	-0.47	-0.21	1.92	6.25	5.73
50	2.70	1.84	4.23	8.17	3.92	0.70	-0.34	-0.57	-0.34	1.35	5.47	4.98
55	2.36	1.48	3.61	7.50	3.38	0.50	-0.45	-0.66	-0.45	0.90	4.72	4.49
60	1.95	1.21	2.93	6.75	2.91	0.34	-0.55	-0.76	-0.55	0.60	3.94	4.07
65	1.61	0.96	2.52	6.13	2.34	0.21	-0.64	-0.85	-0.62	0.31	3.30	3.63
70	1.25	0.70	2.08	5.50	1.90	0.07	-0.70	-0.94	-0.71	0.03	2.57	3.09
75	0.89	0.37	1.48	4.96	1.49	-0.07	-0.80	-1.00	-0.81	-0.17	1.95	2.65
80	0.59	0.03	0.95	4.44	1.15	-0.21	-0.90	-1.04	-0.90	-0.39	1.31	2.13
85	0.29	-0.25	0.46	3.72	0.84	-0.36	-0.98	-1.07	-0.97	-0.59	0.84	1.59
90	-0.12	-0.51	-0.07	2.68	0.34	-0.52	-1.03	-1.12	-1.04	-0.79	0.54	0.81
95	-0.66	-0.85	-0.60	0.40	-0.06	-0.71	-1.13	-1.20	-1.14	-0.97	-0.03	0.21
100		0	0	0	0	0	0	0	0	0	0	0

Table 4. Monthly Flow Volumes (1,000,000 m^3)

Exc Prob %	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0	108.5	102.6	142.5	157.3	113.3	80.1	41.5	70.3	67.3	131.4	139.2	141.1
5	48.8	40.6	79.3	88.1	58.8	26.0	13.1	18.7	18.8	50.4	71.4	70.3
10	31.7	24.7	55.9	65.3	39.5	15.8	6.5	8.1	10.3	32.0	48.8	50.8
15	24.5	17.9	42.6	53.1	30.4	11.5	4.0	3.8	5.5	23.6	39.9	39.4
20	19.9	13.6	35.1	44.6	25.2	8.7	2.4	1.8	3.4	17.7	32.3	31.3
25	16.5	10.9	28.6	38.8	20.9	6.9	1.4	0.8	2.1	13.8	27.4	26.1
30	14.0	9.1	23.8	34.0	17.8	5.3	0.8	0.2	1.2	11.1	23.5	22.2
35	12.0	7.7	19.9	29.4	15.3	4.1	0.3	-0.4	0.4	9.0	20.8	19.3
40	10.2	6.5	16.3	26.7	13.2	3.2	-0.1	-0.9	-0.1	7.0	18.6	17.3
45	8.5	5.5	13.4	23.5	11.6	2.5	-0.5	-1.3	-0.5	5.1	16.2	15.4
50	7.2	4.5	11.3	21.2	10.5	1.8	-0.9	-1.5	-0.9	3.6	14.2	13.3
55	6.3	3.6	9.7	19.4	9.1	1.3	-1.2	-1.8	-1.2	2.4	12.2	12.0
60	5.2	3.0	7.9	17.5	7.8	0.9	-1.5	-2.0	-1.4	1.6	10.2	10.9
65	4.3	2.4	6.7	15.9	6.3	0.5	-1.7	-2.3	-1.6	0.8	8.5	9.7
70	3.3	1.7	5.6	14.3	5.1	0.2	-1.9	-2.5	-1.8	0.1	6.7	8.3
75	2.4	0.9	4.0	12.9	4.0	-0.2	-2.2	-2.7	-2.1	-0.5	5.1	7.1
80	1.6	0.1	2.5	11.5	3.1	-0.5	-2.4	-2.8	-2.3	-1.1	3.4	5.7
85	0.8	-0.6	1.2	9.6	2.3	-0.9	-2.6	-2.9	-2.5	-1.6	2.2	4.2
90	-0.3	-1.3	-0.2	6.9	0.9	-1.4	-2.8	-3.0	-2.7	-2.1	1.4	2.2
95	-1.8	-2.1	-1.6	1.0	-0.2	-1.8	-3.0	-3.2	-2.9	-2.6	-0.1	0.6
100		0	0	0	0	0	0	0	0	0	0	0
Days	31	28.25	31	30	31	30	31	31	30	31	30	31

Table 5. Monthly Reservoir Water Level Change (m)

Exc Prob %	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0	20.86	19.74	27.40	30.25	21.78	15.40	7.99	13.51	12.95	25.26	26.77	27.13
5	9.38	7.81	15.25	16.94	11.31	5.00	2.51	3.59	3.61	9.70	13.72	13.51
10	6.10	4.76	10.75	12.55	7.60	3.04	1.26	1.56	1.98	6.16	9.38	9.78
15	4.70	3.43	8.20	10.21	5.84	2.21	0.76	0.72	1.05	4.54	7.68	7.59
20	3.83	2.61	6.76	8.57	4.85	1.67	0.47	0.35	0.65	3.41	6.22	6.02
25	3.18	2.09	5.50	7.46	4.02	1.33	0.27	0.15	0.41	2.65	5.26	5.02
30	2.70	1.74	4.58	6.53	3.42	1.01	0.16	0.04	0.24	2.14	4.51	4.27
35	2.30	1.49	3.82	5.65	2.94	0.79	0.06	-0.08	0.07	1.72	3.99	3.71
40	1.96	1.24	3.13	5.13	2.54	0.62	-0.02	-0.17	-0.02	1.35	3.57	3.33
45	1.63	1.06	2.58	4.51	2.23	0.48	-0.10	-0.24	-0.10	0.99	3.12	2.95
50	1.39	0.87	2.18	4.07	2.02	0.35	-0.17	-0.29	-0.17	0.70	2.73	2.57
55	1.22	0.70	1.86	3.74	1.74	0.25	-0.23	-0.34	-0.22	0.47	2.35	2.31
60	1.00	0.57	1.51	3.36	1.50	0.17	-0.28	-0.39	-0.27	0.31	1.97	2.10
65	0.83	0.45	1.30	3.05	1.21	0.10	-0.33	-0.44	-0.31	0.16	1.64	1.87
70	0.64	0.33	1.07	2.74	0.98	0.04	-0.36	-0.48	-0.35	0.02	1.28	1.59
75	0.46	0.18	0.76	2.47	0.77	-0.03	-0.41	-0.51	-0.40	-0.09	0.97	1.36
80	0.30	0.01	0.49	2.21	0.59	-0.10	-0.46	-0.53	-0.45	-0.20	0.65	1.10
85	0.15	-0.12	0.24	1.85	0.43	-0.18	-0.50	-0.55	-0.48	-0.31	0.42	0.82
90	-0.06	-0.24	-0.04	1.34	0.17	-0.26	-0.53	-0.58	-0.52	-0.41	0.27	0.42
95	-0.34	-0.40	-0.31	0.20	-0.03	-0.35	-0.58	-0.62	-0.57	-0.50	-0.02	0.11
100		0	0	0	0	0	0	0	0	0	0	0

Table 6. Estimated Reservoir Water Level (ft)

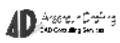
Exc Prob %	Start WL	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
5	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
10	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
15	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
20	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
25	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
30	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
35	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.74	14.97	15.00	15.00	15.00
40	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.95	14.39	14.31	15.00	15.00	15.00
45	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.68	13.88	13.53	15.00	15.00	15.00
50	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.42	13.45	12.88	15.00	15.00	15.00
55	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.23	13.10	12.35	13.91	15.00	15.00
60	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.06	12.76	11.86	12.88	15.00	15.00
65	15.00	15.00	15.00	15.00	15.00	15.00	15.00	13.89	12.44	11.40	11.94	15.00	15.00
70	15.00	15.00	15.00	15.00	15.00	15.00	15.00	13.80	12.19	11.01	11.06	15.00	15.00
75	15.00	15.00	15.00	15.00	15.00	15.00	14.89	13.51	11.80	10.46	10.16	13.40	15.00
80	15.00	15.00	15.00	15.00	15.00	15.00	14.65	13.12	11.34	9.85	9.17	11.35	15.00
85	12.39	12.89	12.49	13.27	15.00	15.00	14.40	12.73	10.89	9.29	8.26	9.67	12.39
90	15.00	14.80	13.99	13.87	15.00	15.00	14.13	12.37	10.44	8.72	7.36	8.25	9.64
95	15.00	13.87	12.54	11.51	12.18	12.08	10.90	8.96	6.90	5.01	3.34	3.28	3.64
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

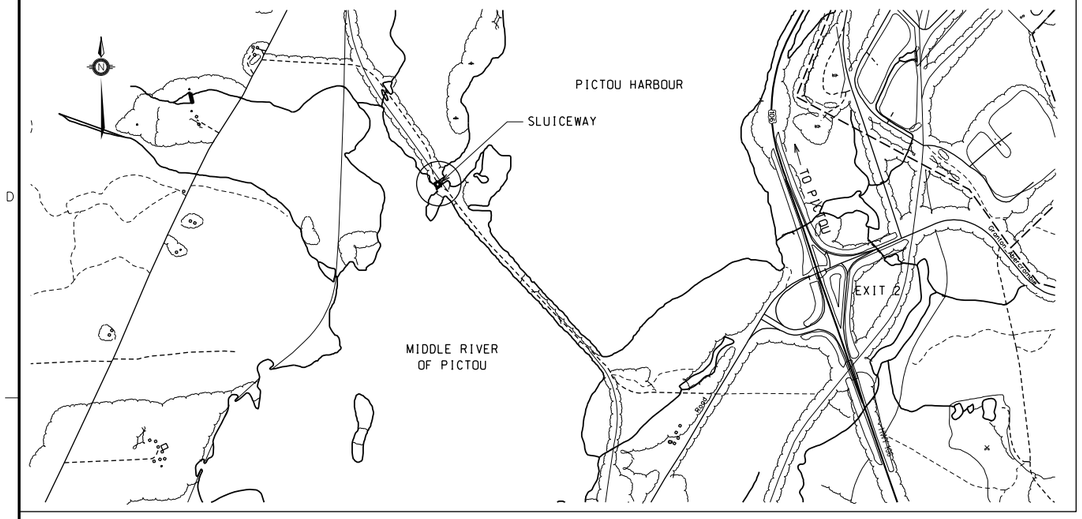
APPENDIX B

Fish Ladder As-Built Record Drawings

Nova Scotia Transportation and Infrastructure Renewal
December 09, 2015

M5





SITE LOCATION
1:10.000

GENERAL NOTES:

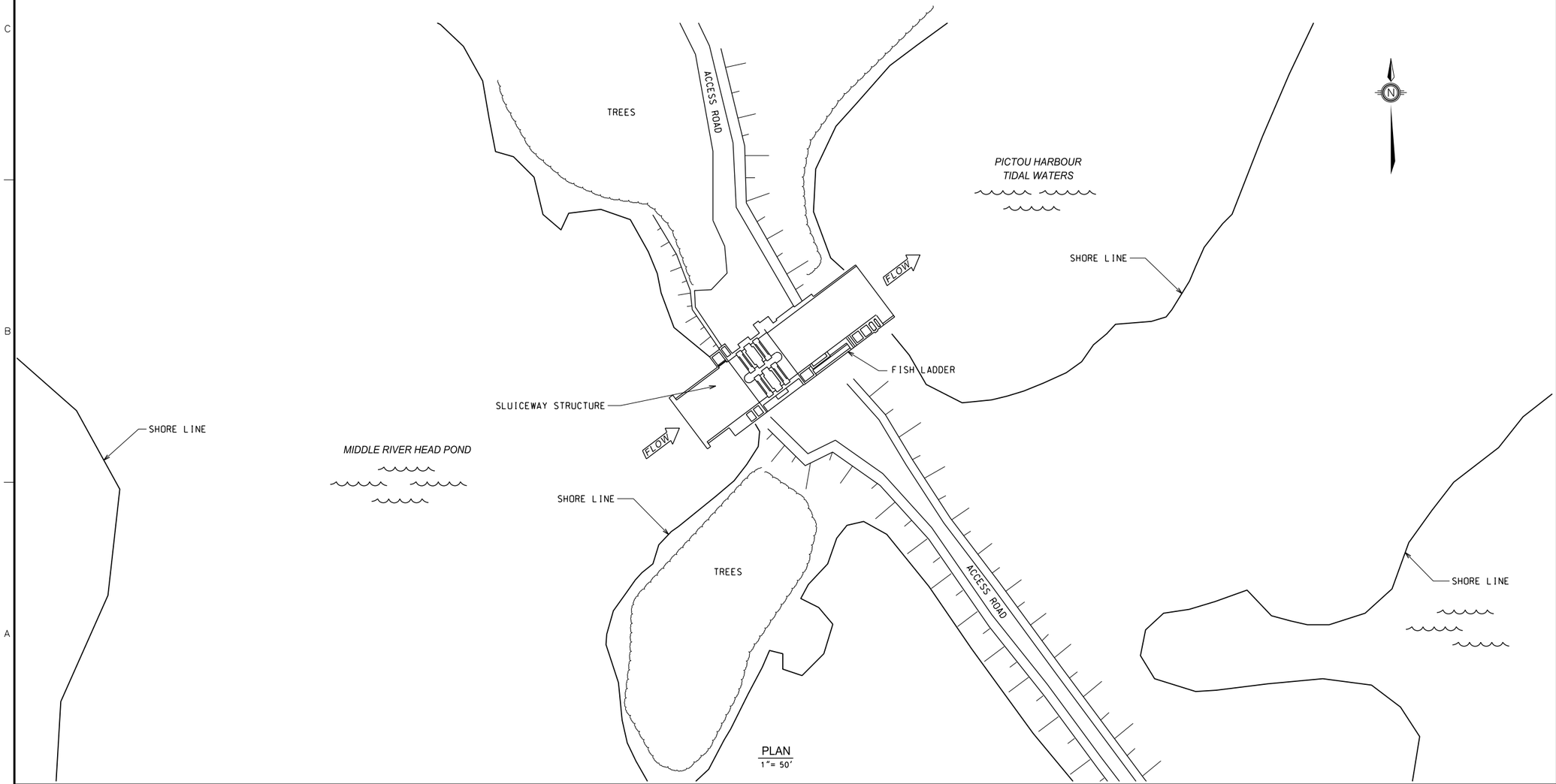
1.) ALL ELEVATIONS ARE INDICATED IN FEET, DIMENSIONS ARE IN FEET AND INCHES.

2.) ELEVATIONS SHOWN ARE TO SITE DATUM BASED, TOP OF SLUICEWAY CONCRETE DECK ELEVATION 20.0 FEET.

3.) DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS ONLY.

4.) ALL MEASUREMENTS AND DIMENSIONS ARE BASED ON SITE SURVEY CONDUCTED 14 SEPTEMBER, 2015 AND SUPPLEMENTAL MEASUREMENTS TAKEN AT SITE ON 09 NOVEMBER, 2015. MANY MEASUREMENTS WERE TAKEN UNDERWATER.

5.) AS CONSTRUCTED DIMENSIONS ARE BASED ON ORIGINAL CONSTRUCTION (DRAWINGS DATED 1965), AND FISH LADDER IMPROVEMENTS AND ALTERATIONS AS DIRECTED BY FISHERIES AND OCEANS CANADA (DFO) IN 1985 AND 1995, AND LOCALIZED REPAIRS CARRIED OUT IN 2015 AS PART OF MIDDLE RIVER SLUICEWAY REPAIRS.



PLAN
1" = 50'

NOVA SCOTIA
Transportation and Infrastructure Renewal
Public Works Division
Industrial Utilities Section

KEY PLAN

LOGO

AS BUILT
Record Drawing

GRAPHIC SCALE

DATE	MARK	ISSUE
12/09/15	1	AS BUILT

STAMP

SCALE	AS NOTED
DRAWN BY:	BJA
CHECKED BY:	JBY
REVIEWED BY:	
APPROVED BY:	
AS-BUILT CHECK	
DATE:	DEC. 09 2015

PROJECT
MIDDLE RIVER
SLUICEWAY
FISH LADDER

PICTOU CO., GRANTON

PROJECT NO.:

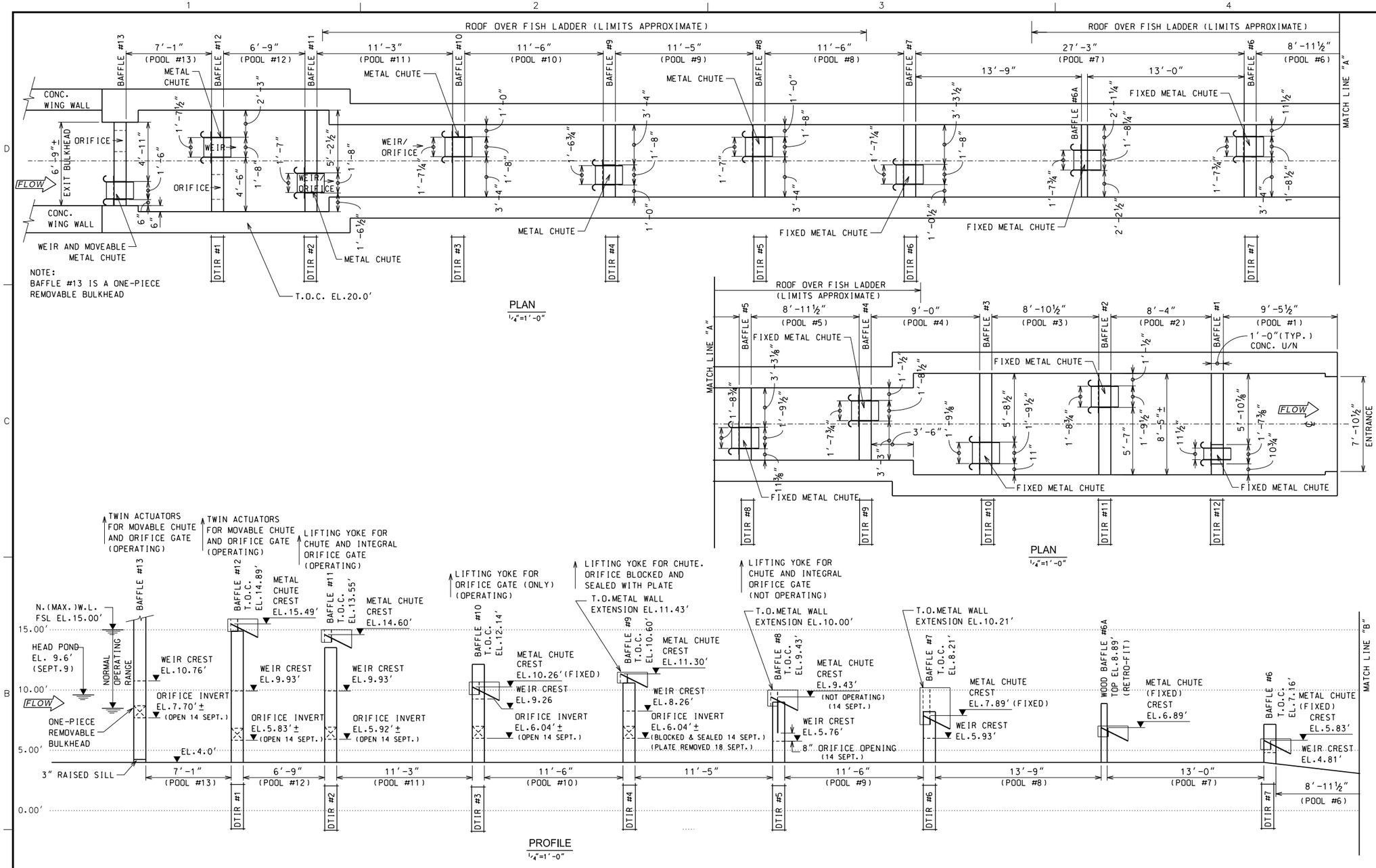
SHEET TITLE
FISH LADDER
LOCATION PLAN

INTERNAL NO.:

C-100

SHEET 1 OF 3

TPW A1 REV OC13 2003

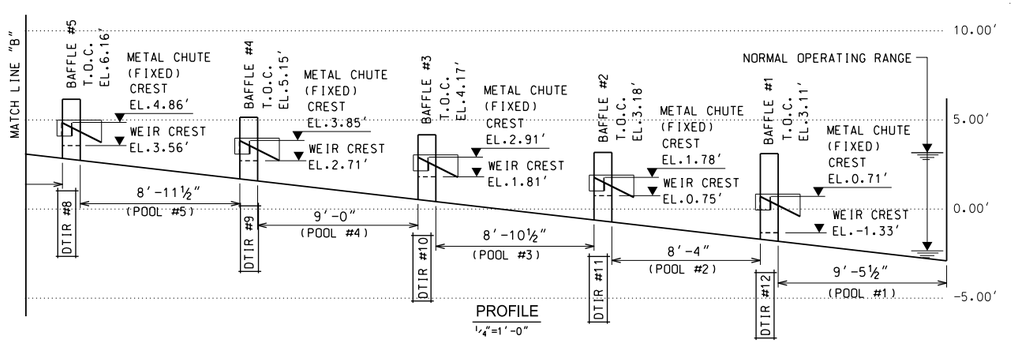


SUMMARY OF CREST ELEVATIONS (SEPT.14, 2015)

BAFFLE #	CONCRETE (ORIGINAL)	METAL	ORFICE INVERT
1	-1.33	0.17	N/A
2	0.75	1.78	N/A
3	1.81	2.91	N/A
4	2.71	3.85	N/A
5	3.56	4.86	N/A
6	4.81	5.83	N/A
6A	–	6.89	N/A
7	5.93	7.89	N/A
8	5.76	9.43	5.76
9	8.26	11.30	6.04
10	9.26	10.26	6.04
11	9.93	14.60	5.92
12	9.93	15.49	5.83
13	10.76	10.76	7.70

APPROX.

NOTE:
INFORMATION ILLUSTRATED IS AS COLLECTED BY FIELD MEASUREMENTS SETPEMBER 14 AND NOVEMBER 09 2015.



NOVA SCOTIA
Transportation and Infrastructure Renewal
Public Works Division
Industrial Utilities Section

KEY PLAN

LOGO

AS BUILT
Record Drawing

GRAPHIC SCALE

DATE	MARK	ISSUE
12/09/15	1	AS BUILT

STAMP

SCALE	AS NOTED
DRAWN BY:	BJA
CHECKED BY:	JBY
REVIEWED BY:	
APPROVED BY:	
AS-BUILT CHECK	
DATE:	DEC. 08 2015

PROJECT
MIDDLE RIVER
SLUICEWAY
FISH LADDER

PICTOU CO., GRANTON

PROJECT NO.:

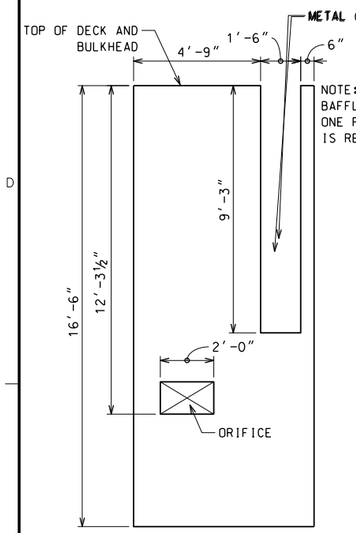
SHEET TITLE
FISH LADDER
PLAN AND PROFILE

INTERNAL NO.:

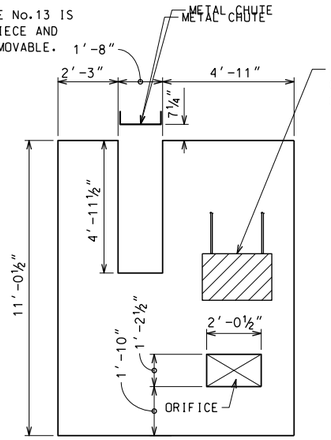
C-101

SHEET 2 OF 3

TPW A1 REV OC13 2003



BAFFLE #13 & EXIT BULKHEAD
⅜"=1'-0"



BAFFLE #12
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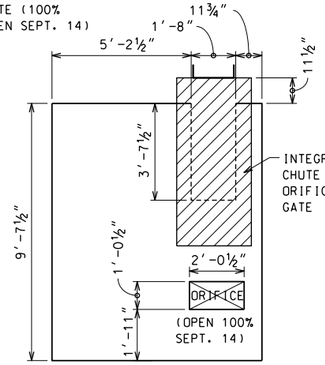
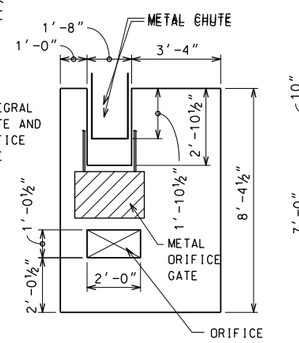
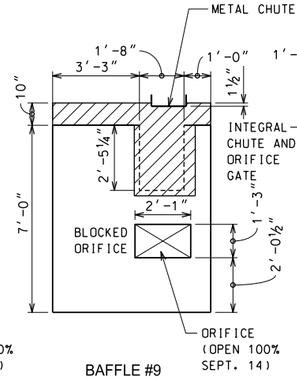


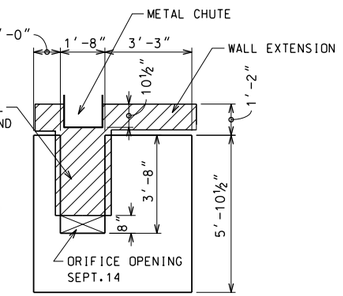
BAFFLE #11
⅜"=1'-0"



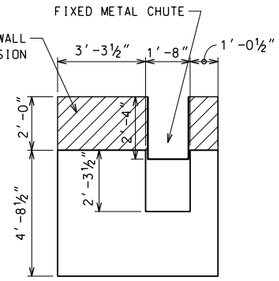
BAFFLE #10
⅜"=1'-0"



BAFFLE #9
⅜"=1'-0"



BAFFLE #8
⅜"=1'-0"



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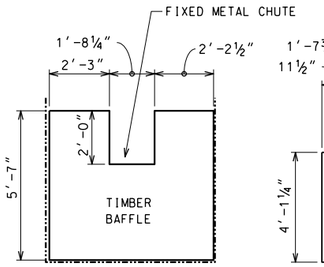

BAFFLE #6A
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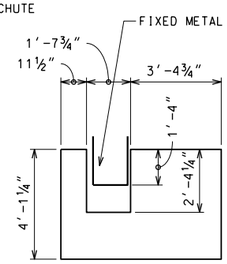

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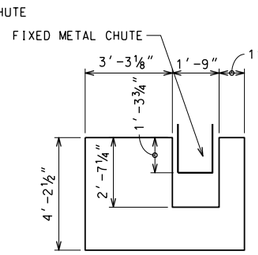

BAFFLE #5
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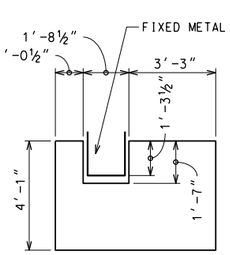

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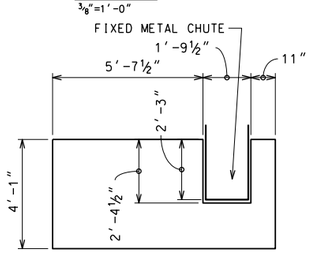

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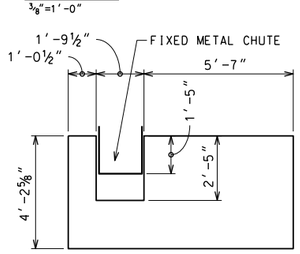

BAFFLE #2
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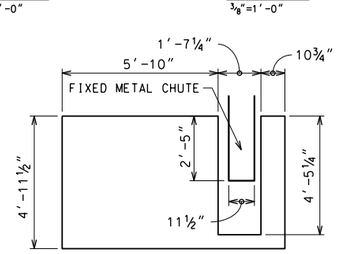

BAFFLE #1
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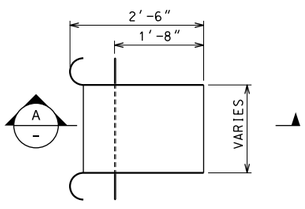
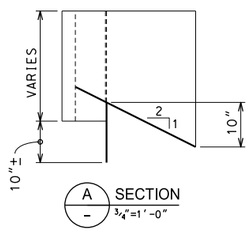


METAL CHUTE DETAIL - PLAN
¾"=1'-0"



NOTE:
BAFFLE DETAILS ARE BASED ON UPSTREAM (U/S) VIEW.
ALL DIMENSIONS ARE FIELD MEASURE ±. SEPT.14 AND NOV.09, 2015

SUPPLEMENTAL INFORMATION 09 NOV. 2015

1. ORIFICE DIMENSIONS BAFFLE No.9 ALTERED SUBSEQUENT TO NOV.09/15 SUPPLEMENTAL SURVEY. ORIFICE PLATE REINSTALLED SUBSEQUENT TO SEPT. 18 REMOVAL.
2. ORIFICE DIMENSIONS BAFFLE No.10 ADJUSTED SUBSEQUENT TO NOV. 09/15 SUPPLEMENTAL SURVEY.
3. ORIFICE DIMENSIONS BAFFLE No.11 ADJUSTED SUBSEQUENT TO NOV. 09/15 SUPPLEMENTAL SURVEY.
4. ORIFICE DIMENSIONS BAFFLE No.12 ADJUSTED SUBSEQUENT TO NOV. 09/15 SUPPLEMENTAL SURVEY.
5. BULKHEAD No.13 IS ONE-PIECE METAL CONSTRUCTION AND IS RESTING ON A 3"HIGH CONCRETE, METAL OR WOOD SILL EXTENDING ACROSS THE FISH LADDER FLOOR AT THE TOP END (OUTLET) OF THE FISH LADDER, SUBSEQUENT TO NOV.09/15 SUPPLEMENTAL SURVEY.

NOVA SCOTIA
Transportation and Infrastructure Renewal
Public Works Division
Industrial Utilities Section

KEY PLAN

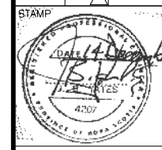
LOGO

AS BUILT
Record Drawing

GRAPHIC SCALE

DATE	MARK	ISSUE
12/09/15	1	AS BUILT

STAMP



SCALE	AS NOTED
DRAWN BY:	BJA
CHECKED BY:	JBY
REVIEWED BY:	
APPROVED BY:	
AS-BUILT CHECK	
DATE:	DEC. 09 2015

PROJECT
MIDDLE RIVER
SLUICEWAY
FISH LADDER

PICTOU CO., GRANTON

PROJECT NO.:

SHEET TITLE
FISH LADDER
BAFFLE DETAILS

INTERNAL NO.:

C-102

SHEET 3 OF 3

TPW A1 REV OC13 2003

Appendix N

Priority Species

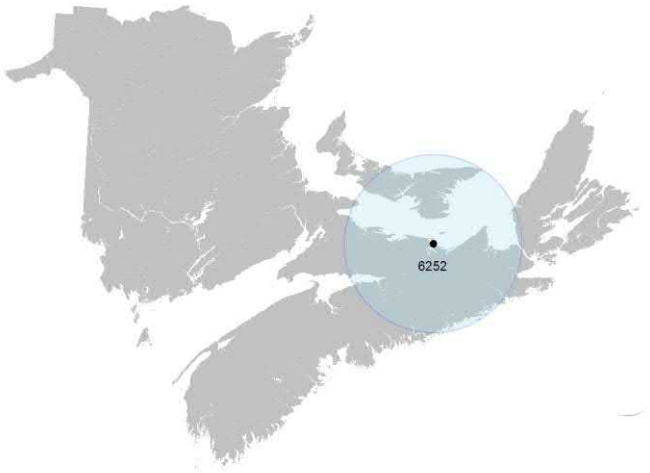
Appendix N1 – Potential Priority Animal Species
Appendix N2 – Potential Priority Plant Species

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

DATA REPORT 6252: Pictou, NS

Prepared 15 November 2018
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
PictouNS_6252ob.xls	All Rare and legally protected *Flora and Fauna* in your study area
PictouNS_6252ob100km.xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
PictouNS_6252ma.xls	All *Managed Areas* in your study area
PictouNS_6252sa.xls	All *Significant Natural Areas* in your study area
PictouNS_6252wf.xls	Rare and common *Waterfowl* in your study area (CWS database)
PictouNS_6252bc.xls	Rare and common *Colonial Birds* 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
Tel: (506) 364-2658
sean.blaney@accdc.ca

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

Plant Communities
Sarah Robinson, Community Ecologist
Tel: (506) 364-2664
sarah.robinson@accdc.ca

Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
james.churchill@accdc.ca

Billing
Jean Breau
Tel: (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: Duncan Bayne
(902) 648-3536
Duncan.Bayne@novascotia.ca

Western: Sarah Spencer
(902) 634-7555
Sarah.Spencer@novascotia.ca

Central: Shavonne Meyer
(902) 893-6350
Shavonne.Meyer@novascotia.ca

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

Eastern: Lisa Doucette
(902) 863-4513
Lisa.Doucette@novascotia.ca

Eastern: Terry Power
(902) 563-3370
Terrance.Power@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

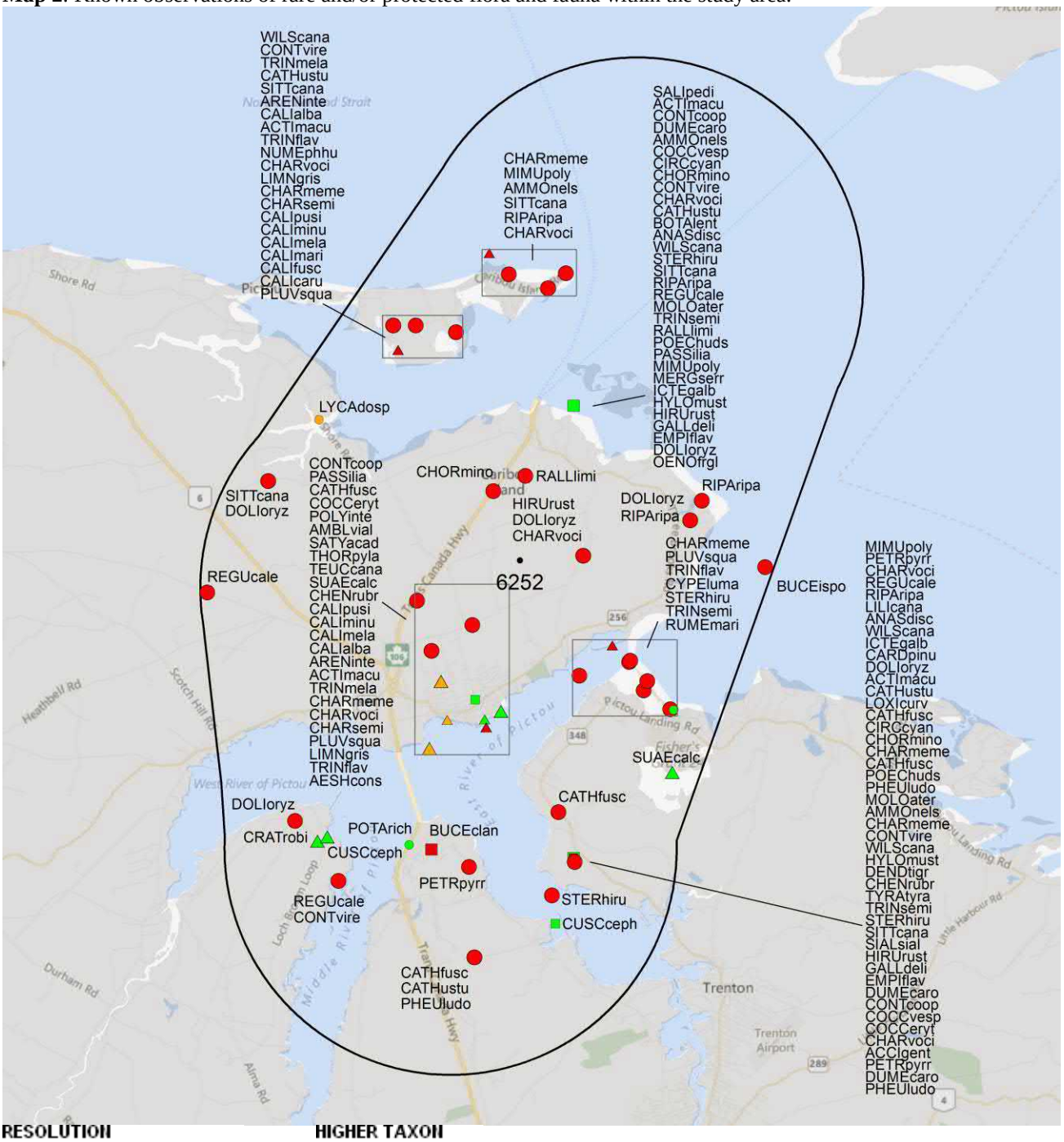
2.1 FLORA

The study area contains 15 records of 11 vascular, no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 381 records of 57 vertebrate, 12 records of 6 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.



3.0 SPECIAL AREAS

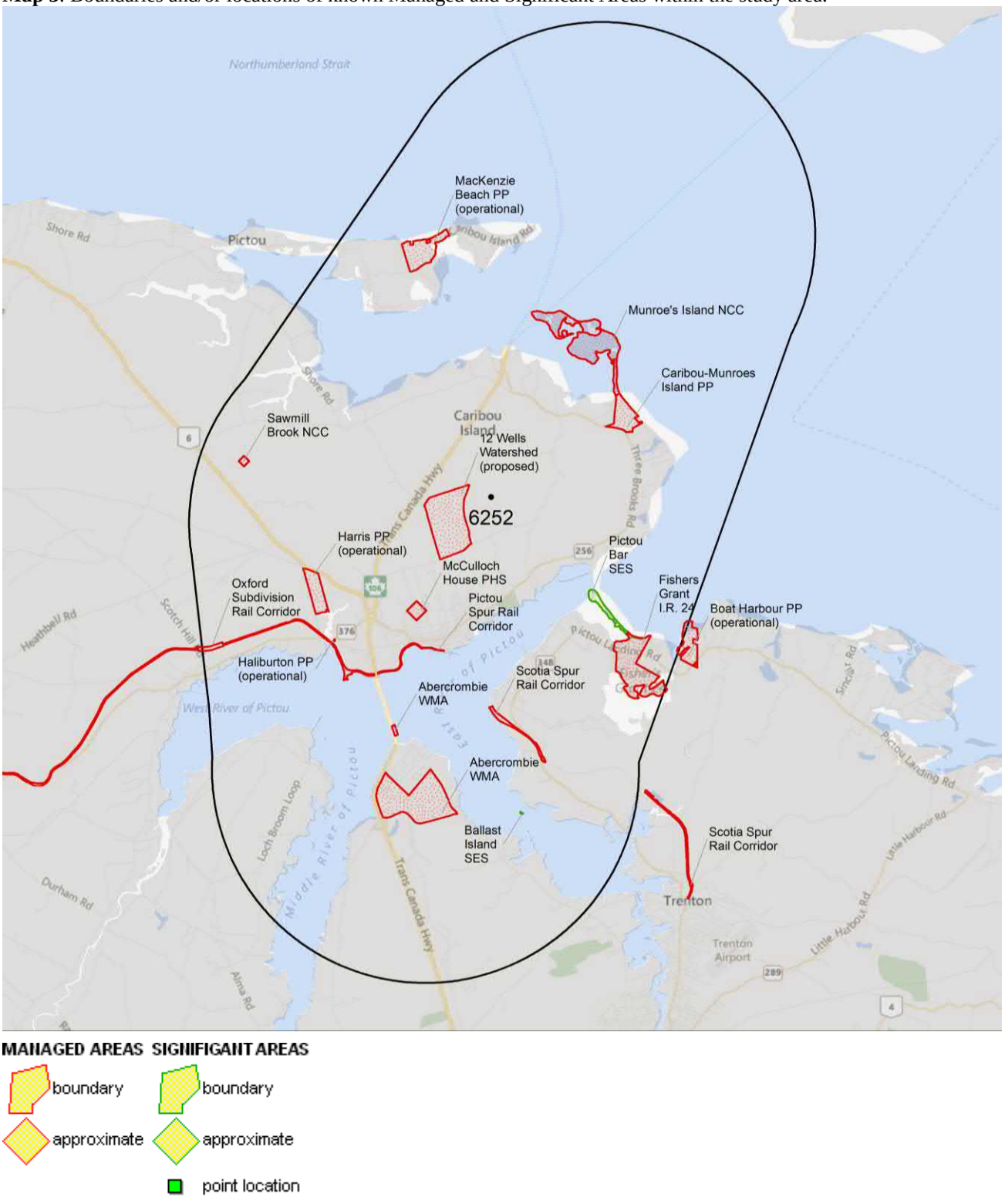
3.1 MANAGED AREAS

The GIS scan identified 14 managed areas in the vicinity of the study area (Map 3 and attached file: *ma*.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: *sa*.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	Prov GS Rank	# recs	Distance (km)
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	2	3.3 ± 0.0
P	*Crataegus robinsonii*	Robinson's Hawthorn				S1?	5 Undetermined	1	7.7 ± 1.0
P	*Chenopodium rubrum*	Red Pigweed				S2	2 May Be At Risk	2	3.6 ± 0.0
P	*Oenothera fruticosa ssp. glauca*	Narrow-leaved Evening Primrose				S2	5 Undetermined	1	3.6 ± 7.0
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	1	3.6 ± 7.0
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	1	6.7 ± 7.0
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	1	6.8 ± 0.0
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	2	7.5 ± 1.0
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	1	3.2 ± 5.0
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	2	3.4 ± 4.0
P	*Rumex maritimus*	Sea-Side Dock				S3S4		1	4.7 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	39	2.8 ± 0.0
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered		Endangered	S2M	1 At Risk	2	5.4 ± 0.0
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	5	3.6 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	7	1.4 ± 0.0
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	4	3.6 ± 7.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	9	1.4 ± 0.0
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	2	3.6 ± 7.0
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	5.4 ± 0.0
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	4	1.6 ± 0.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	5	2.5 ± 0.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	9	3.6 ± 7.0
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	2	3.6 ± 7.0
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	17	2.9 ± 0.0
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	1	6.7 ± 7.0
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	1	6.7 ± 7.0
A	*Circus cyaneus*	Northern Harrier	Not At Risk			S3S4B	4 Secure	2	3.6 ± 7.0
A	*Ammodramus nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	3	3.6 ± 7.0
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	3	3.6 ± 7.0
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	15	3.8 ± 0.0
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	23	3.8 ± 0.0
A	*Dendroica tigrina*	Cape May Warbler				S2B	3 Sensitive	1	6.7 ± 7.0
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	2	3.6 ± 7.0
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	5	6.7 ± 13.0
A	*Carduelis pinus*	Pine Siskin				S2S3	3 Sensitive	1	6.7 ± 7.0
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	2	1.9 ± 0.0
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	7	3.6 ± 7.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	3	6.7 ± 7.0
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	4	6.7 ± 7.0
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	5	3.6 ± 7.0
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	1	5.4 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	2	3.8 ± 0.0
A	*Poecile hudsonica*	Boreal Chickadee				S3	3 Sensitive	2	3.6 ± 7.0
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	9	3.6 ± 7.0
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	1	5.4 ± 0.0
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	13	1.4 ± 0.0
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	4	3.6 ± 7.0
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	2	2.8 ± 0.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	1	6.7 ± 7.0
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	6	3.6 ± 7.0
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	21	3.8 ± 0.0
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	17	2.8 ± 0.0
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	8	2.8 ± 0.0
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	14	3.8 ± 0.0
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	26	3.8 ± 0.0
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	1	5.4 ± 0.0
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	5	3.8 ± 0.0
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	16	3.8 ± 0.0
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	1	6.7 ± 7.0
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	3	3.6 ± 7.0
A	*Anas discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	4	3.6 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	13	3.6 ± 7.0
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	3	3.6 ± 7.0
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	8	3.6 ± 7.0
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	7	2.8 ± 0.0
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	4	3.6 ± 7.0
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	3	1.8 ± 0.0
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	2	3.6 ± 7.0
I	*Satyrium acadica*	Acadian Hairstreak				S1	5 Undetermined	5	3.2 ± 1.0
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	1	5.4 ± 0.0
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	1	3.2 ± 1.0
I	*Aeshna constricta*	Lance-Tipped Darner				S3	4 Secure	1	4.6 ± 1.0
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	3	3.2 ± 1.0
I	*Amblyscirtes vialis*	Common Roadside-Skipper				S3S4	4 Secure	1	3.2 ± 1.0

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		[Endangered][1]	[Endangered][1]	No

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
169	Morrison, Guy. 2011. Maritime Shorebird Survey (MSS) database. Canadian Wildlife Service, Ottawa, 15939 surveys. 86171 recs.
155	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
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11	Staff, DNR 2007. Restricted & Limited Use Land Database (RLUL).
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2	Newell, R.E. 2005. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University, Web site: http://luxor.acadiau.ca/library/Herbarium/project/. 582 recs.
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1	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
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	NCC Atlantic Canada, 2000
1	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 32207 records of 138 vertebrate and 790 records of 55 invertebrate fauna; 4264 records of 270 vascular, 1318 records of 61 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	Prov GS Rank	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	65	21.8 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	97	34.9 ± 1.0	PE
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	4	81.8 ± 5.0	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered		S1	2 May Be At Risk	14	39.0 ± 0.0	NS
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	2352	2.8 ± 0.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	18	91.1 ± 0.0	NS
A	*Morone saxatilis pop. 2*	Striped Bass- Bay of Fundy pop.	Endangered			S1B	2 May Be At Risk	1	97.4 ± 0.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered		Endangered	S2M	1 At Risk	232	5.4 ± 0.0	NS
A	*Caprimulgus vociferus*	Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	7	51.6 ± 7.0	NS
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Endangered	S1S2B	1 At Risk	1	91.9 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	220	13.1 ± 5.0	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2	2 May Be At Risk	2	84.7 ± 0.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	5	76.5 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	190	11.0 ± 7.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	513	3.6 ± 7.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	884	1.4 ± 0.0	NS
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	743	3.6 ± 7.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	679	1.4 ± 0.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	30	3.6 ± 7.0	NS
A	*Passerculus sandwichensis princeps*	Savannah Sparrow princeps ssp	Special Concern	Special Concern		S1B	3 Sensitive	1	97.5 ± 7.0	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	4	67.8 ± 0.0	PE
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	5	5.4 ± 0.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	12	16.6 ± 7.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	231	20.0 ± 7.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	285	1.6 ± 0.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	868	2.5 ± 0.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	12	92.4 ± 2.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S2S3M	3 Sensitive	6	75.5 ± 0.0	NS
A	*Morone saxatilis pop. 1*	Striped Bass- Southern Gulf of St Lawrence pop.	Special Concern			S2S3N	2 May Be At Risk	1	60.8 ± 1.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	37	17.1 ± 0.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	664	3.6 ± 7.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	385	3.6 ± 7.0	NS
A	*Phocoena phocoena (NW Atlantic pop.)*	Harbour Porpoise - Northwest Atlantic pop.	Special Concern	Threatened		S4		1	70.5 ± 5.0	PE
A	*Podiceps auritus*	Horned Grebe	Special Concern			S4N	4 Secure	5	96.2 ± 1.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B	5 Undetermined	2	18.3 ± 0.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	19	16.9 ± 7.0	NS
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	2	84.4 ± 5.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B	5 Undetermined	19	29.5 ± 0.0	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		1	82.2 ± 100.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	6	43.5 ± 0.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	455	2.9 ± 0.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	45	6.7 ± 7.0	NS
A	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	4 Secure	3	92.7 ± 4.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	102	6.7 ± 7.0	NS
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4		1	83.3 ± 1.0	PE
A	*Circus cyaneus*	Northern Harrier	Not At Risk			S3S4B	4 Secure	450	3.6 ± 7.0	NS
A	*Ammodramus nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	197	3.6 ± 7.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	60	26.6 ± 0.0	NS
A	*Salmo salar*	Atlantic Salmon				S1	2 May Be At Risk	78	18.5 ± 0.0	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1?	5 Undetermined	12	78.9 ± 7.0	PE
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	16	39.7 ± 0.0	PE
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	2 May Be At Risk	1	61.3 ± 7.0	NS
A	*Anas acuta*	Northern Pintail				S1B	2 May Be At Risk	50	35.9 ± 14.0	PE
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	4 Secure	6	53.0 ± 0.0	NS
A	*Gallinula chloropus*	Common Moorhen				S1B	5 Undetermined	11	29.6 ± 7.0	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S1B	2 May Be At Risk	12	18.8 ± 7.0	NS
A	*Cistothorus palustris*	Marsh Wren				S1B	5 Undetermined	1	96.8 ± 3.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	32	3.6 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	5 Undetermined	10	16.6 ± 7.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B	5 Undetermined	14	29.0 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Dendroica pinus*	Pine Warbler				S1B	5 Undetermined	8	18.8 ± 7.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	490	3.8 ± 0.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	967	3.8 ± 0.0	NS
A	*Lasiurus cinereus*	Hoary Bat				S1S2B, S1M	2 May Be At Risk	2	67.6 ± 1.0	PE
A	*Pluvialis dominica*	American Golden-Plover				S1S2M	3 Sensitive	82	17.7 ± 0.0	NS
A	*Limosa haemastica*	Hudsonian Godwit				S1S2M	3 Sensitive	272	60.9 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	50	36.6 ± 0.0	PE
A	*Anas clypeata*	Northern Shoveler				S2B	2 May Be At Risk	30	66.0 ± 7.0	PE
A	*Anas strepera*	Gadwall				S2B	2 May Be At Risk	73	46.2 ± 0.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	13	39.4 ± 7.0	NS
A	*Dendroica tigrina*	Cape May Warbler				S2B	3 Sensitive	161	6.7 ± 7.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	14	11.0 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	41	17.5 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	139	3.6 ± 7.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	159	6.7 ± 13.0	NS
A	*Branta bernicla*	Brant				S2M	3 Sensitive	2	89.0 ± 0.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3	3 Sensitive	185	25.0 ± 7.0	PE
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	34	33.2 ± 0.0	NS
A	*Carduelis pinus*	Pine Siskin				S2S3	3 Sensitive	303	6.7 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	5	65.7 ± 0.0	PE
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	43	1.9 ± 0.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	1141	3.6 ± 7.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	227	6.7 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	498	6.7 ± 7.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	52	3.6 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	82	11.0 ± 7.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	140	5.4 ± 0.0	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	115	3.8 ± 0.0	NS
A	*Perisoreus canadensis*	Gray Jay				S3	3 Sensitive	402	9.5 ± 7.0	NS
A	*Poecile hudsonica*	Boreal Chickadee				S3	3 Sensitive	704	3.6 ± 7.0	NS
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	731	3.6 ± 7.0	NS
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	17	18.5 ± 0.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	28	18.5 ± 0.0	NS
A	*Salvelinus namaycush*	Lake Trout				S3	3 Sensitive	1	56.4 ± 0.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	15	5.4 ± 0.0	NS
A	*Calcarius lapponicus*	Lapland Longspur				S3?N	4 Secure	2	96.9 ± 0.0	NB
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	468	8.2 ± 0.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	558	1.4 ± 0.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	582	3.6 ± 7.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	48	56.8 ± 7.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	102	2.8 ± 0.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	310	6.7 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	347	3.6 ± 7.0	NS
A	*Wilsonia pusilla*	Wilson's Warbler				S3B	3 Sensitive	64	13.0 ± 7.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	1263	3.8 ± 0.0	NS
A	*Oceanodroma leucorhoa*	Leach's Storm-Petrel				S3B,S5M	4 Secure	26	92.0 ± 7.0	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S3B,S5N	3 Sensitive	1	49.6 ± 0.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S3B,S5N	3 Sensitive	2	92.0 ± 7.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	1155	2.8 ± 0.0	NS
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	650	2.8 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	503	3.8 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	912	3.8 ± 0.0	NS
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	203	5.4 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	515	3.8 ± 0.0	NS
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	595	3.8 ± 0.0	NS
A	*Chroicocephalus ridibundus*	Black-headed Gull				S3N	4 Secure	4	92.4 ± 0.0	NB

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A	*Somateria mollissima*	Common Eider				S3S4	4 Secure	269	11.5 ± 9.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	147	11.0 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	92	6.7 ± 7.0	NS
A	*Sorex palustris*	American Water Shrew				S3S4	4 Secure	4	46.2 ± 0.0	PE
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	293	3.6 ± 7.0	NS
A	*Anas discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	322	3.6 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	682	3.6 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	558	3.6 ± 7.0	NS
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	1454	3.6 ± 7.0	NS
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	434	2.8 ± 0.0	NS
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	1221	3.6 ± 7.0	NS
A	*Vermivora peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	288	9.5 ± 7.0	NS
A	*Dendroica castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	433	9.5 ± 7.0	NS
A	*Dendroica striata*	Blackpoll Warbler				S3S4B	3 Sensitive	84	9.5 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	56	1.8 ± 0.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	86	3.6 ± 7.0	NS
A	*Bucephala albeola*	Bufflehead				S3S4N	4 Secure	17	41.5 ± 9.0	NS
A	*Leucophaeus atricilla*	Laughing Gull				SHB	4 Secure	1	96.9 ± 0.0	NB
A	*Progne subis*	Purple Martin				SHB	2 May Be At Risk	5	88.9 ± 7.0	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N	4 Secure	6	44.3 ± 7.0	PE
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	39	29.1 ± 13.0	PE
A	*Aythya americana*	Redhead				SHB,SNAM	4 Secure	1	100.0 ± 0.0	PE
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	29	14.4 ± 0.0	NS
I	*Barnea truncata*	Atlantic Mud-piddock	Threatened			S1	1 At Risk	1	91.6 ± 1.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	17	45.0 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern		Vulnerable	S3	3 Sensitive	3	65.8 ± 0.0	PE
I	*Satyrium acadica*	Acadian Hairstreak				S1	5 Undetermined	10	3.2 ± 1.0	NS
I	*Erora laeta*	Early Hairstreak				S1	2 May Be At Risk	1	74.8 ± 0.0	PE
I	*Neurocordulia michaeli*	Broadtailed Shadowdragon				S1		26	47.5 ± 0.0	NS
I	*Strophitus undulatus*	Creeper				S1	2 May Be At Risk	6	93.2 ± 1.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	6	60.5 ± 0.0	PE
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	6	58.6 ± 1.0	NS
I	*Somatochlora kennedyi*	Kennedy's Emerald				S1S2	2 May Be At Risk	2	65.9 ± 1.0	PE
I	*Coenagrion resolutum*	Taiga Bluet				S1S2	2 May Be At Risk	51	31.9 ± 1.0	PE
I	*Stylurus scudderi*	Zebra Clubtail				S1S2	2 May Be At Risk	2	96.5 ± 0.0	NS
I	*Lycaena hyllus*	Bronze Copper				S2	4 Secure	10	28.8 ± 0.0	PE
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	51	5.4 ± 0.0	NS
I	*Satyrium calanus falacer*	Banded Hairstreak				S2	1 At Risk	2	67.5 ± 1.0	NS
I	*Boloria chariclea grandis*	Purple Lesser Fritillary				S2	3 Sensitive	2	51.7 ± 1.0	NS
I	*Aglais milberti milberti*	Milbert's Tortoise Shell				S2	4 Secure	14	62.7 ± 0.0	NS
I	*Epitheca princeps*	Prince Baskettail				S2	3 Sensitive	9	64.7 ± 0.0	NS
I	*Somatochlora williamsoni*	Williamson's Emerald				S2	2 May Be At Risk	12	74.9 ± 0.0	PE
I	*Williamsonia fletcheri*	Ebony Boghaunter				S2	2 May Be At Risk	4	64.5 ± 0.0	NS
I	*Enallagma signatum*	Orange Bluet				S2	2 May Be At Risk	1	70.2 ± 0.0	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	3 Sensitive	143	13.6 ± 0.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	1	73.7 ± 1.0	NS
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	14	3.2 ± 1.0	NS
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S2S3	4 Secure	3	59.6 ± 0.0	NS
I	*Satyrium liparops strigosum*	Striped Hairstreak				S2S3	3 Sensitive	4	66.0 ± 1.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	29	8.3 ± 1.0	NS
I	*Gomphus descriptus*	Harpoon Clubtail				S2S3	3 Sensitive	4	74.5 ± 1.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	1	91.3 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	14	45.3 ± 0.0	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S2S3	2 May Be At Risk	38	52.8 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	3	60.7 ± 1.0	PE
I	*Somatochlora franklini*	Delicate Emerald				S2S3	3 Sensitive	6	60.5 ± 0.0	PE
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	15	58.0 ± 1.0	NS

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I	*Callophrys henrici*	Henry's Elfin				S3	4 Secure	3	60.7 ± 0.0	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	2 May Be At Risk	4	52.7 ± 0.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	12	19.2 ± 100.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	15	37.7 ± 0.0	NS
I	*Megisto cymela*	Little Wood-satyr				S3	4 Secure	9	66.5 ± 0.0	PE
I	*Oeneis jutta*	Jutta Arctic				S3	2 May Be At Risk	7	32.6 ± 0.0	PE
I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	3	89.4 ± 1.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3	4 Secure	26	4.6 ± 1.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	11	59.2 ± 0.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	1	60.8 ± 0.0	PE
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	1	83.9 ± 1.0	PE
I	*Sympetrum danae*	Black Meadowhawk				S3	3 Sensitive	9	60.6 ± 1.0	PE
I	*Enallagma vernale*	Vernal Bluet				S3	5 Undetermined	3	60.5 ± 0.0	PE
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	2	43.1 ± 0.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	46	3.2 ± 1.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	2	58.3 ± 1.0	NS
I	*Amblyscirtes vialis*	Common Roadside-Skipper				S3S4	4 Secure	4	3.2 ± 1.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	22	7.0 ± 1.0	NS
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3S4	4 Secure	14	43.8 ± 1.0	NS
I	*Lampsilis radiata*	Eastern Lampmussel				S3S4	3 Sensitive	56	23.2 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	433	60.1 ± 0.0	NS
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered		Endangered	S1S2	2 May Be At Risk	14	80.5 ± 0.0	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened		Threatened	S1	2 May Be At Risk	2	72.6 ± 0.0	NS
N	*Pannaria lurida*	Veined Shingle Lichen	Threatened		Threatened	S1S2	2 May Be At Risk	11	94.5 ± 0.0	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened		Threatened	S3	3 Sensitive	2	85.2 ± 0.0	NS
N	*Sclerophora peronella (Nova Scotia pop.)*	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		11	71.4 ± 0.0	NS
N	*Degelia plumbea*	BluDegelia plumbeae Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	49	36.9 ± 0.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	1	81.2 ± 0.0	NS
N	*Cladonia brevis*	Short Peg Lichen				S1		1	89.5 ± 4.0	PE
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1?	2 May Be At Risk	1	67.2 ± 0.0	NS
N	*Brachythecium erythrorrhizon*	Taiga Ragged Moss				S1?		2	83.3 ± 0.0	PE
N	*Campylostelium saxicola*	a Moss				S1?	3 Sensitive	3	74.5 ± 0.0	PE
N	*Tortula obtusifolia*	a Moss				S1?	5 Undetermined	2	57.2 ± 2.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	1	98.6 ± 0.0	NS
N	*Tetrodontium brownianum*	Little Georgia				S1S2	3 Sensitive	1	88.2 ± 0.0	PE
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S1S2	3 Sensitive	1	68.0 ± 0.0	NS
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				S1S2	3 Sensitive	1	61.0 ± 0.0	NS
N	*Bryohaplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2		1	76.3 ± 5.0	NS
N	*Anomodon viticulosus*	a Moss				S2?	3 Sensitive	1	66.5 ± 5.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	3	51.4 ± 2.0	NS
N	*Campylium polygamum*	a Moss				S2?	5 Undetermined	1	78.9 ± 0.0	PE
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	5 Undetermined	1	87.7 ± 0.0	PE
N	*Ditrichum rhynchostegium*	a Moss				S2?	3 Sensitive	1	36.3 ± 0.0	PE
N	*Philonotis marchica*	a Moss				S2?	5 Undetermined	2	50.3 ± 0.0	NS
N	*Saelania glaucescens*	Blue Dew Moss				S2?	3 Sensitive	1	44.1 ± 0.0	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	1	44.1 ± 0.0	NS
N	*Leptogium teretiusculum*	Beaded Jellyskin Lichen				S2?	3 Sensitive	2	32.3 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2?	3 Sensitive	3	75.1 ± 5.0	NS
N	*Ephemerum serratum*	a Moss				S2S3	3 Sensitive	1	17.0 ± 3.0	NS
N	*Eurhynchium hians*	Light Beaked Moss				S2S3	3 Sensitive	1	87.0 ± 25.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3 Sensitive	2	74.5 ± 0.0	PE
N	*Tortula truncata*	a Moss				S2S3	3 Sensitive	1	72.5 ± 300.0	NS

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N	*Usnocetraria oakesiana*	Yellow Band Lichen				S2S3	2 May Be At Risk	1	85.7 ± 0.0	PE
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S2S3	2 May Be At Risk	5	72.9 ± 0.0	NS
N	*Leptogium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	1	95.1 ± 0.0	NS
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	3 Sensitive	1	89.5 ± 4.0	PE
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S3	3 Sensitive	1	72.1 ± 0.0	PE
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	3 Sensitive	6	72.2 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	12	29.5 ± 2.0	NS
N	*Leptogium subtile*	Appressed Jellyskin Lichen				S3	3 Sensitive	2	74.8 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	4 Secure	33	60.5 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3	4 Secure	5	37.0 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3	3 Sensitive	25	60.5 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	2	45.7 ± 0.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	37	70.7 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S3?	3 Sensitive	1	64.4 ± 2.0	PE
N	*Helodium blandowii*	Wetland-plume Moss				S3?	4 Secure	1	24.2 ± 3.0	NS
N	*Cladina stygia*	Black-footed Reindeer Lichen				S3?	3 Sensitive	2	89.4 ± 0.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	1	92.7 ± 1.0	PE
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	4 Secure	2	59.8 ± 0.0	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	3 Sensitive	1	44.1 ± 0.0	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	4 Secure	1	83.8 ± 3.0	NS
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	4 Secure	51	79.1 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4		1	32.3 ± 0.0	NS
N	*Parmeliopsis hyperopta*	Gray Starburst Lichen				S3S4	5 Undetermined	2	21.2 ± 1.0	NS
N	*Physconia detersa*	Bottlebrush Frost Lichen				S3S4	3 Sensitive	3	84.3 ± 0.0	PE
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	520	68.5 ± 0.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	4 Secure	14	53.4 ± 0.0	NS
N	*Bryoria capillaris*	Gray Horsehair Lichen				S3S4	5 Undetermined	11	67.6 ± 0.0	PE
N	*Evernia prunastri*	Valley Oakmoss Lichen				S3S4	3 Sensitive	3	56.2 ± 0.0	PE
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	15	73.4 ± 0.0	NS
P	*Bartonia paniculata ssp. paniculata*	Branched Bartonia	Threatened	Threatened		SNA		1	57.3 ± 10.0	NS
P	*Lilaeopsis chinensis*	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	16	84.1 ± 0.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	13	79.5 ± 0.0	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	3	53.3 ± 7.0	NS
P	*Cypripedium arietinum*	Ram's-Head Lady's-Slipper			Endangered	S1	1 At Risk	8	64.3 ± 0.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	42	51.6 ± 7.0	NS
P	*Acer saccharinum*	Silver Maple				S1	5 Undetermined	1	91.0 ± 20.0	PE
P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	4	11.0 ± 7.0	NS
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	43	41.8 ± 1.0	NS
P	*Antennaria parlinii*	a Pussytoes				S1	2 May Be At Risk	1	24.4 ± 0.0	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S1	2 May Be At Risk	3	61.0 ± 1.0	NS
P	*Prenanthes racemosa*	Glaucous Rattlesnakeroot				S1	2 May Be At Risk	1	91.0 ± 20.0	PE
P	*Ageratina altissima*	White Snakeroot				S1	2 May Be At Risk	2	60.6 ± 1.0	NS
P	*Barbarea orthoceras*	American Yellow Rocket				S1	2 May Be At Risk	5	61.5 ± 0.0	NS
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	2 May Be At Risk	1	97.8 ± 0.0	NS
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	2 May Be At Risk	6	60.3 ± 7.0	NS
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	2	78.9 ± 5.0	PE
P	*Suaeda maritima ssp. richii*	White Sea-blite				S1	5 Undetermined	3	61.3 ± 7.0	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	2 May Be At Risk	54	13.0 ± 7.0	NS
P	*Elatine americana*	American Waterwort				S1	2 May Be At Risk	1	91.3 ± 0.0	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S1	2 May Be At Risk	20	19.4 ± 0.0	NS
P	*Ribes americanum*	Wild Black Currant				S1	5 Undetermined	2	59.3 ± 5.0	NS
P	*Fraxinus pennsylvanica*	Red Ash				S1	2 May Be At Risk	3	53.9 ± 0.0	PE
P	*Polygonum careyi*	Carey's Smartweed				S1	5 Undetermined	1	71.8 ± 3.0	NS
P	*Ranunculus pensylvanicus*	Pennsylvania Buttercup				S1	2 May Be At Risk	25	69.9 ± 0.0	NS

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P	*Salix myrtillifolia*	Blueberry Willow				S1	2 May Be At Risk	1	87.1 ± 0.0	NS
P	*Salix serissima*	Autumn Willow				S1	2 May Be At Risk	2	87.1 ± 0.0	NS
P	*Agalinis paupercula var. borealis*	Small-flowered Agalinis				S1		1	12.0 ± 0.0	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	5 Undetermined	1	97.9 ± 1.0	NS
P	*Dirca palustris*	Eastern Leatherwood				S1	2 May Be At Risk	5	88.8 ± 7.0	NS
P	*Boehmeria cylindrica*	Small-spike False-nettle				S1	2 May Be At Risk	2	98.6 ± 0.0	NS
P	*Pilea pumila*	Dwarf Clearweed				S1	2 May Be At Risk	25	25.5 ± 6.0	NS
P	*Carex alopecoidea*	Foxtail Sedge				S1	2 May Be At Risk	2	71.2 ± 0.0	NS
P	*Carex chordorrhiza*	Creeping Sedge				S1	2 May Be At Risk	1	78.2 ± 1.0	PE
P	*Carex garberi*	Garber's Sedge				S1	2 May Be At Risk	4	42.8 ± 0.0	NS
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	2	87.1 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	3	40.1 ± 5.0	NS
P	*Carex pellita*	Woolly Sedge				S1	2 May Be At Risk	12	19.3 ± 0.0	NS
P	*Carex plantaginea*	Plantain-Leaved Sedge				S1	2 May Be At Risk	3	47.0 ± 0.0	NS
P	*Carex prairea*	Prairie Sedge				S1	2 May Be At Risk	1	74.8 ± 0.0	PE
P	*Carex tincta*	Tinged Sedge				S1	2 May Be At Risk	3	71.2 ± 1.0	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	6	61.8 ± 0.0	NS
P	*Cyperus lupulinus*	Hop Flatsedge				S1	2 May Be At Risk	5	69.7 ± 0.0	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	10	3.3 ± 0.0	NS
P	*Blysmus rufus*	Red Bulrush				S1	2 May Be At Risk	3	87.4 ± 5.0	PE
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	2	66.1 ± 1.0	NS
P	*Juncus vaseyi*	Vasey Rush				S1	2 May Be At Risk	3	47.5 ± 0.0	NS
P	*Allium tricoccum*	Wild Leek				S1	2 May Be At Risk	8	39.0 ± 0.0	NS
P	*Malaxis brachypoda*	White Adder's-Mouth				S1	2 May Be At Risk	2	83.8 ± 0.0	PE
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	31	50.1 ± 0.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	21	14.8 ± 1.0	NS
P	*Elymus hystrix var. bigeloviana*	Spreading Wild Rye				S1	2 May Be At Risk	4	32.4 ± 1.0	NS
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	2 May Be At Risk	1	95.6 ± 5.0	NS
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2 May Be At Risk	1	60.4 ± 1.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	2 May Be At Risk	1	57.7 ± 7.0	NS
P	*Crataegus robinsonii*	Robinson's Hawthorn				S1?	5 Undetermined	3	7.7 ± 1.0	NS
P	*Carex pensylvanica*	Pennsylvania Sedge				S1?	2 May Be At Risk	1	77.7 ± 0.0	NS
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S1?	2 May Be At Risk	1	79.6 ± 5.0	PE
P	*Schoenoplectus robustus*	Sturdy Bulrush				S1?	5 Undetermined	2	60.3 ± 7.0	NS
P	*Dichanthelium acuminatum var. lindheimeri*	Woolly Panic Grass				S1?	5 Undetermined	1	16.4 ± 0.0	NS
P	*Fraxinus nigra*	Black Ash			Threatened	S1S2	1 At Risk	168	7.1 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	24	39.1 ± 0.0	NS
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1S2	2 May Be At Risk	1	92.0 ± 0.0	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	5	50.9 ± 5.0	NS
P	*Hepatica nobilis var. obtusa*	Round-lobed Hepatica				S1S2	2 May Be At Risk	23	26.1 ± 0.0	NS
P	*Parnassia palustris var. parviflora*	Marsh Grass-of-Parnassus				S1S2	2 May Be At Risk	1	41.5 ± 1.0	NS
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S1S2	3 Sensitive	5	63.9 ± 0.0	NS
P	*Carex livida var. radicaulis*	Livid Sedge				S1S2	2 May Be At Risk	12	67.4 ± 0.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	4	69.2 ± 1.0	NS
P	*Juncus alpinoarticulatus ssp. nodulosus*	Richardson's Rush				S1S2	2 May Be At Risk	6	82.1 ± 3.0	PE
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	5 Undetermined	3	44.4 ± 10.0	NS
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	3 Sensitive	1	88.4 ± 2.0	PE
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	19	60.3 ± 0.0	NS

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P	*Festuca subverticillata*	Nodding Fescue				S1S2	2 May Be At Risk	3	89.3 ± 1.0	NS
P	*Cryptogramma stelleri*	Steller's Rockbrake				S1S2	2 May Be At Risk	1	100.0 ± 0.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	2	71.2 ± 0.0	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	1	25.1 ± 5.0	NS
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	2 May Be At Risk	20	17.3 ± 0.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	4	51.6 ± 7.0	NS
P	*Lactuca hirsuta var. sanguinea*	Hairy Lettuce				S2	3 Sensitive	2	65.9 ± 5.0	PE
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2	3 Sensitive	18	20.4 ± 0.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	2	61.3 ± 7.0	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	48	13.6 ± 1.0	NS
P	*Arabis drummondii*	Drummond's Rockcress				S2	3 Sensitive	6	48.4 ± 0.0	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	8	65.2 ± 1.0	PE
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	11	33.5 ± 0.0	NS
P	*Chenopodium rubrum*	Red Pigweed				S2	2 May Be At Risk	7	3.6 ± 0.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	12	82.1 ± 25.0	PE
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	6	75.0 ± 0.0	PE
P	*Crassula aquatica*	Water Pygmyweed				S2	3 Sensitive	6	74.5 ± 5.0	PE
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	10	44.3 ± 1.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	1	59.7 ± 0.0	NS
P	*Oenothera fruticosa ssp. glauca*	Narrow-leaved Evening Primrose				S2	5 Undetermined	3	3.6 ± 7.0	NS
P	*Polygonum arifolium*	Halberd-leaved Tearthumb				S2	3 Sensitive	16	29.3 ± 1.0	PE
P	*Rumex salicifolius var. mexicanus*	Triangular-valve Dock				S2	3 Sensitive	4	74.8 ± 0.0	NS
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	16	50.1 ± 0.0	NS
P	*Anemone canadensis*	Canada Anemone				S2	2 May Be At Risk	2	88.0 ± 1.0	NS
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	17	58.7 ± 0.0	NS
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	21	20.8 ± 1.0	NS
P	*Anemone virginiana var. virginiana*	Virginia Anemone				S2	3 Sensitive	1	67.5 ± 7.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	36	19.3 ± 0.0	NS
P	*Galium boreale*	Northern Bedstraw				S2	2 May Be At Risk	2	78.6 ± 5.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	96	58.5 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	46	3.6 ± 7.0	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	2 May Be At Risk	42	67.4 ± 5.0	NS
P	*Tiarella cordifolia*	Heart-leaved Foamflower				S2	3 Sensitive	217	29.6 ± 7.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	9	21.3 ± 0.0	NS
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	20	32.8 ± 0.0	PE
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	22	86.7 ± 0.0	NS
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	3	50.5 ± 0.0	PE
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	5	27.3 ± 0.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	8	24.2 ± 1.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S2	3 Sensitive	6	15.3 ± 0.0	NS
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S2	3 Sensitive	1	82.9 ± 3.0	PE
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	2	72.9 ± 1.0	NS
P	*Allium schoenoprasum*	Wild Chives				S2	2 May Be At Risk	1	95.8 ± 0.0	PE
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	1	61.0 ± 7.0	NS
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	85	6.7 ± 7.0	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	7	9.5 ± 7.0	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	74	9.8 ± 0.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2	3 Sensitive	1	93.9 ± 1.0	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S2	5 Undetermined	8	27.4 ± 0.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	12	27.3 ± 5.0	NS

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P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	21	18.9 ± 1.0	NS
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S2	3 Sensitive	16	60.8 ± 0.0	PE
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	4	16.6 ± 7.0	NS
P	*Piptatherum canadense*	Canada Rice Grass				S2	3 Sensitive	6	65.9 ± 1.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	23	34.0 ± 0.0	PE
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	5	6.8 ± 0.0	NS
P	*Dryopteris fragrans var. remotiuscula*	Fragrant Wood Fern				S2	3 Sensitive	4	47.0 ± 7.0	NS
P	*Woodsia glabella*	Smooth Cliff Fern				S2	3 Sensitive	1	75.7 ± 1.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	24	61.0 ± 7.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	5	7.5 ± 1.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	3	10.6 ± 1.0	NS
P	*Rumex maritimus var. persicarioides*	Peach-leaved Dock				S2?	2 May Be At Risk	6	62.9 ± 5.0	PE
P	*Crataegus submollis*	Quebec Hawthorn				S2?	5 Undetermined	4	31.9 ± 7.0	NS
P	*Carex peckii*	White-Tinged Sedge				S2?	2 May Be At Risk	3	55.1 ± 0.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	6	37.8 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	9	60.2 ± 0.0	NS
P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S2S3	3 Sensitive	3	67.5 ± 2.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2S3	3 Sensitive	3	33.0 ± 7.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2S3	3 Sensitive	2	61.0 ± 7.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2S3	3 Sensitive	15	72.0 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	3	80.6 ± 0.0	PE
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	5	81.0 ± 5.0	PE
P	*Ceratophyllum echinatum*	Prickly Hornwort				S2S3	3 Sensitive	8	60.2 ± 0.0	NS
P	*Hypericum dissimulatum*	Disguised St John's-wort				S2S3	3 Sensitive	2	80.0 ± 1.0	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	75	13.6 ± 1.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	2	97.0 ± 0.0	NS
P	*Empetrum eamesii ssp. atropurpureum*	Pink Crowberry				S2S3	3 Sensitive	6	82.4 ± 5.0	PE
P	*Empetrum eamesii ssp. eamesii*	Pink Crowberry				S2S3	3 Sensitive	2	66.0 ± 5.0	PE
P	*Chamaesyce polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	14	25.9 ± 2.0	NS
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	2	82.7 ± 1.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	6	13.3 ± 5.0	NS
P	*Polygonum buxiforme*	Small's Knotweed				S2S3	5 Undetermined	3	12.1 ± 0.0	NS
P	*Polygonum raii*	Sharp-fruited Knotweed				S2S3	5 Undetermined	8	81.7 ± 5.0	PE
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	5 Undetermined	4	82.0 ± 0.0	PE
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	1	79.1 ± 5.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	5	22.1 ± 4.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3 Sensitive	5	63.8 ± 0.0	NS
P	*Veronica serpyllifolia ssp. humifusa*	Thyme-Leaved Speedwell				S2S3	3 Sensitive	1	55.9 ± 0.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	6	59.7 ± 0.0	NS
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	43	15.9 ± 0.0	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	3 Sensitive	4	74.6 ± 1.0	NS
P	*Eleocharis olivacea*	Yellow Spikerush				S2S3	3 Sensitive	7	56.0 ± 5.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2S3	3 Sensitive	12	59.1 ± 10.0	NS
P	*Coeloglossum viride var. virescens*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	1	84.0 ± 0.0	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	20	9.9 ± 0.0	NS
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	4	67.1 ± 0.0	PE
P	*Stuckenia filiformis ssp. alpina*	Thread-leaved Pondweed				S2S3	3 Sensitive	4	78.2 ± 1.0	PE
P	*Botrychium lanceolatum var. angustisegmentum*	Lance-Leaf Grape-Fern				S2S3	3 Sensitive	12	19.3 ± 0.0	NS

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P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	3	23.5 ± 0.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	7	30.7 ± 0.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	4 Secure	8	31.5 ± 1.0	PE
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	19	49.0 ± 0.0	NS
P	*Hieracium paniculatum*	Panicled Hawkweed				S3	4 Secure	6	30.9 ± 0.0	NS
P	*Megalodonta beckii*	Water Beggarticks				S3	4 Secure	10	29.5 ± 0.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	52	19.6 ± 0.0	NS
P	*Betula pumila*	Bog Birch				S3	3 Sensitive	21	59.6 ± 0.0	PE
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	32	15.3 ± 0.0	NS
P	*Viburnum edule*	Squashberry				S3	3 Sensitive	2	26.0 ± 0.0	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	13	82.0 ± 0.0	PE
P	*Vaccinium boreale*	Northern Blueberry				S3	3 Sensitive	2	93.5 ± 1.0	NS
P	*Vaccinium caespitosum*	Dwarf Bilberry				S3	4 Secure	53	44.2 ± 0.0	NS
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	3	64.5 ± 2.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	14	59.8 ± 0.0	NS
P	*Proserpinaca palustris var. crebra*	Marsh Mermaidweed				S3	4 Secure	14	58.4 ± 0.0	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3	4 Secure	2	51.8 ± 1.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	22	3.2 ± 5.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3	4 Secure	1	78.7 ± 0.0	PE
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	30	58.9 ± 5.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	3 Sensitive	13	13.4 ± 1.0	NS
P	*Polygonum pensylvanicum*	Pennsylvania Smartweed				S3	4 Secure	13	15.1 ± 0.0	NS
P	*Polygonum scandens*	Climbing False Buckwheat				S3	3 Sensitive	45	15.8 ± 0.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	5	16.4 ± 0.0	NS
P	*Samolus valerandi ssp. parviflorus*	Seaside Brookweed				S3	3 Sensitive	17	56.7 ± 1.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	16	43.7 ± 0.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	2	30.6 ± 0.0	NS
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	64	29.4 ± 5.0	PE
P	*Rhamnus alnifolia*	Alder-leaved Buckthorn				S3	4 Secure	153	48.4 ± 5.0	PE
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	110	19.5 ± 0.0	NS
P	*Amelanchier stolonifera*	Running Serviceberry				S3	4 Secure	14	12.2 ± 2.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	5	68.7 ± 0.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	44	34.8 ± 1.0	PE
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	24	15.4 ± 0.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	38	16.8 ± 0.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	106	15.8 ± 0.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	4 Secure	10	58.9 ± 10.0	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	27	49.1 ± 0.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	25	15.1 ± 0.0	NS
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	16	16.6 ± 0.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	4 Secure	9	26.8 ± 2.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	5	34.9 ± 5.0	PE
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	15	35.1 ± 0.0	NS
P	*Elodea canadensis*	Canada Waterweed				S3	4 Secure	6	37.8 ± 0.0	NS
P	*Juncus subcaudatus var. planisepalus*	Woods-Rush				S3	3 Sensitive	7	11.1 ± 5.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	39	19.4 ± 0.0	NS
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S3	3 Sensitive	1	84.6 ± 0.0	PE
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	19	30.0 ± 1.0	PE
P	*Listera australis*	Southern Twayblade				S3	4 Secure	13	47.8 ± 0.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	95	29.6 ± 0.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	5	54.6 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	40	19.4 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	7	44.6 ± 0.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3	4 Secure	21	47.2 ± 1.0	NS
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3	4 Secure	83	57.5 ± 0.0	NS
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	11	51.0 ± 0.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	3 Sensitive	40	23.5 ± 5.0	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	3 Sensitive	11	61.1 ± 0.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	16	43.0 ± 1.0	NS
P	*Asplenium trichomanes-ramosum*	Green Spleenwort				S3	3 Sensitive	1	80.5 ± 7.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3	3 Sensitive	10	50.8 ± 0.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	20	19.4 ± 0.0	NS
P	*Isoetes acadiensis*	Acadian Quillwort				S3	3 Sensitive	2	69.1 ± 1.0	NS
P	*Lycopodium sitchense*	Sitka Clubmoss				S3	4 Secure	7	52.6 ± 5.0	NS
P	*Huperzia appalachiana*	Appalachian Fir-Clubmoss				S3	3 Sensitive	6	51.3 ± 5.0	NS
P	*Botrychium dissectum*	Cut-leaved Moonwort				S3	4 Secure	5	27.9 ± 5.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	5 Undetermined	10	32.7 ± 0.0	NS
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	43	67.1 ± 0.0	NS
P	*Polygonum amphibium var. emersum*	Water Smartweed				S3?	5 Undetermined	1	97.5 ± 0.0	NS
P	*Lycopodium sabinifolium*	Ground-Fir				S3?	4 Secure	11	40.8 ± 1.0	NS
P	*Atriplex franktonii*	Frankton's Saltbush				S3S4	4 Secure	8	33.1 ± 2.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	9	3.4 ± 4.0	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	4 Secure	1	82.3 ± 3.0	PE
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	32	45.7 ± 0.0	PE
P	*Nuphar lutea ssp. pumila*	Small Yellow Pond-lily				S3S4	4 Secure	3	17.3 ± 2.0	NS
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	107	16.8 ± 0.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	4	61.6 ± 0.0	NS
P	*Rumex maritimus*	Sea-Side Dock				S3S4		38	4.7 ± 0.0	NS
P	*Rumex maritimus var. fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	6	66.7 ± 5.0	PE
P	*Crataegus succulenta*	Fleshy Hawthorn				S3S4	5 Undetermined	5	74.3 ± 5.0	PE
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	59	43.3 ± 1.0	NS
P	*Salix petiolaris*	Meadow Willow				S3S4	4 Secure	22	26.3 ± 0.0	NS
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3S4	4 Secure	2	95.9 ± 0.0	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	4 Secure	3	65.6 ± 1.0	PE
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	4 Secure	1	40.2 ± 5.0	PE
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	14	33.3 ± 5.0	NS
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	5 Undetermined	7	79.2 ± 5.0	PE
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	2	91.3 ± 2.0	NS
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	3	56.4 ± 0.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	18	29.2 ± 5.0	PE
P	*Panicum tuckermanii*	Tuckerman's Panic Grass				S3S4	4 Secure	11	68.7 ± 0.0	NS
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	9	22.1 ± 0.0	NS
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	123	49.1 ± 0.0	NS
P	*Equisetum hyemale var. affine*	Common Scouring-rush				S3S4	4 Secure	22	50.0 ± 0.0	NS
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	37	50.6 ± 0.0	NS
P	*Lycopodium complanatum*	Northern Clubmoss				S3S4	4 Secure	7	36.6 ± 0.0	PE
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	2	81.5 ± 0.0	NS
P	*Solidago simplex var. randii*	Sticky Goldenrod				SH	0.1 Extirpated	1	92.9 ± 1.0	NS
P	*Viola canadensis*	Canada Violet				SH	0.1 Extirpated	1	53.3 ± 7.0	NS

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

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6	Clayden, S.R. 2007. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, download Mar. 2007, 6914 recs.
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6	Hill, N.M. 1994. Status report on the Long's bulrush Scirpus longii in Canada. Committee on the Status of Endangered Wildlife in Canada, 7 recs.
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5	MacQuarrie, K. 1991-1999. Site survey files, maps. Island Nature Trust, Charlottetown PE, 60 recs.
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5	Towell, C. 2014. 2014 Northern Goshawk and Common Nighthawk email reports, NS. NS Department of Natural Resources.
4	Belliveau, A. 2013. Rare species records from Nova Scotia. Mersey Tobeatic Research Institute, 296 records. 296 recs.
4	Blaney, C.S. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre, 6719 recs.
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4	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
4	Erskine, A.J. 1999. Maritime Nest Records Scheme (MNRS) 1937-1999. Canadian Wildlife Service, Sackville, 313 recs.
4	Gagnon, J. 2004. Specimen data from 2002 visit to Prince Edward Island. , 104 recs.
4	O'Neil, S. 1998. Atlantic Salmon: Eastern Shore Nova Scotia SFA 20. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-10. 4 recs.
4	Prince Edward Island National Park. 2014. Prince Edward Island National Park Herbarium. Parks Canada Agency, PEINP, 39 recs.
4	Robinson, S.L. 2014. 2013 Field Data. Atlantic Canada Conservation Data Centre.
4	Sollows, M.C,. 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
4	Speers, L. 2001. Butterflies of Canada database. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 190 recs.
4	Spicer, C.D. 2004. Specimens from CWS Herbarium, Mount Allison Herbarium Database. Mount Allison University, 5939 recs.
3	Basquill, S.P. 2012. 2012 Bryophyte specimen data. Nova Scotia Department of Natural Resources, 37 recs.
3	Benjamin, L.K. 2006. Cypripedium arietinum. Pers. comm. to D. Mazerolle. 9 recs, 9 recs.
3	Blaney, C.S. Miscellaneous specimens received by ACCDC (botany). Various persons. 2001-08.
3	Boyne, A.W. & Grecian, V.D. 1999. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 23 recs.
3	Churchill, J.L.; Walker, J. 2017. Species at Risk Surveys at Correctional Services Canada Properties in Nova Scotia and New Brunswick. Atlantic Canada Conservation Data Centre.
3	Kelly, Glen 2004. Botanical records from 2004 PEI Forestry fieldwork. Dept of Environment, Energy & Forestry, 71 recs.
2	Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
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2	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
2	Cameron, B. 2005. C. palmicola, E. pedicellatum records from Sixth Lake. Pers. comm. to C.S. Blaney. 3 recs, 3 recs.
2	Cameron, R.P. 2006. Erioderma pedicellatum 2006 field data. NS Dept of Environment, 9 recs.
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2	Curley, F.R. 2003. Glen Kelly records for Betula pumila & Asclepias syriaca on PEI. , Pers. comm. to C.S. Blaney. 9 recs.
2	Frittaion, C. 2012. NSNT 2012 Field Observations. Nova Scotia Nature Trust, Pers comm. to S. Blaney Feb. 7, 34 recs.
2	Giroux, P. 2013. Personal communication concerning species at risk in and around PEI NP, PE. Winter 2013. Pers. comm.
2	Guignion, M; Ristau, C.; Lemon, D. 1995. The distribution & abundance of the Gulf of St. Lawrence Aster, Aster laurentianus in Prince Edward Island National Park. Can. Field-Nat, 109:462-464. 10 recs.
2	Hill, N. 2003. Floerkea proserpinacoides at Heatherdale, Antigonish Co. 2002. , Pers. comm. to C.S. Blaney. 2 recs.
2	Hinds, H.R. 1989. Greenwich, Blooming Point plant collections in Plant locations. Pers. Comm. to Robin Day (Ag. Can). 2pp, 8 recs, 8 recs.
2	Klymko, J.J.D.; Robinson, S.L. 2014. 2013 field data. Atlantic Canada Conservation Data Centre.

# recs	CITATION
2	Macaulay, M. Notes on newly discovered Hepatica nobilis var. obtusa population in Cumberland Co. NS. Pers. comm. to S. Blaney, 1 rec.
2	Macauley, M. 2008. Email to Sean Blaney regarding rich hardwood floodplain site at Howards Pool, Wallace River, NS.
2	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
2	Parks Canada. 2010. Specimens in or near National Parks in Atlantic Canada. Canadian National Museum, 3925 recs.
2	Standley, L.A. 2002. Carex haydenii in Nova Scotia. , Pers. comm. to C.S. Blaney. 4 recs.
2	Thomas, H.H., Jones, G.S. & Diblee, R.L. 1980. Sorex palustris on Prince Edward Island. Can. Field Nat., vol 94:329-331. 2 recs.
2	Webster, R.P. & Edsall, J. 2007. 2005 New Brunswick Rare Butterfly Survey. Environmental Trust Fund, unpublished report, 232 recs.
2	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
2	WIlliams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
1	Amirault, D.L. 2003. 2003 Peregrine Falcon Survey. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
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	Bateman, M.C. & Prescott, W.H. 1984. The Mammals of Prince Edward Island National Park. Canadian Wildife Service, vol 2:5. 3 recs.
1	Bateman, M.C. 2001. Coastal Waterfowl Surveys Database, 1965-2001. Canadian Wildlife Service, Sackville, 667 recs.
1	Belland, R.J. 2012. PEI moss records from New York Botanical Garden. NYBG Virtual Herbarium, Web site: http://sciweb.nybg.org/science2/vii2.asp 135 recs.
1	Benedict, B. Connell Herbarium Specimens, Digital photos. University New Brunswick, Fredericton. 2005.
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1	Blaney, C.S. & Whittam, R.M. 2003. Botanical & freshwater mussel observations at Lake Killarney, Cumberland Co., NS - Sept. 27, 2003. Atlantic Canada Conservation Data Centre, 3 recs.
1	Bridgehouse, D. Email communication (July 3, 2014) to John Klymko regarding hairstreak butterfly observations made Nova Scotia. 2014.
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1	Doucet, D.A. 2007. PEI National Park Odonata Survey. Parks Canada, PEI National Park, 1 rec.
1	Doucet, D.A. ACCDC Reference Collection. Atlantic Canada Conservation Data Centre, Sackville NB. 2008.
1	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
1	Gagnon, J. 2003. Prince Edward Island plant records. Societe de la faune et des parcs Quebec, 13 recs.
1	Gillis, J. 2015. Rare plant records from Cape Breton gypsum sites. Pers. comm., 25 rare plant records.
1	Glen, W. 1991. 1991 Prince Edward Island Forest Biomass Inventory Data. PEI Dept of Energy and Forestry, 10059 recs.
1	Harling, L. & Silva, M. 2004. Abundance & species richness of shrews within forested habitats on PEI. Am. Midl. Nat., 151:399-407. 2 recs.
1	Haughian, S.R. 2018. Description of Fuscopannaria leucosticta field work in 2017 . New Brunswick Museum, 314 recs.
1	Klymko, J.J.D. 2010. Miscellaneous observations reported to ACCDC (zoology). Pers. comm. from various persons, 3 recs.
1	MacPhail, V. Bee and syrphid specimens from MSc research. Pers. comm., J. Klymko. 2006.
1	MacQuarrie, K. and R. Sharkie. 2004. Plant lists for selected areas at Brackley and Dalvay, Prince Edward Island National Park. Island Nature Trust, 168 recs.
1	Neily, P.D. Plant Specimens. Nova Scotia Dept Natural Resources, Truro. 2006.
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1	New York Botanical Garden. 2006. Virtual Plant Herbarium - Vascular Plant Types Catalog. Sylva, S.; Kallunki, J. (ed.) International Plant Science Centre, Web site: http://sciweb.nybg.org/science2/vii2.asp. 4 recs.
1	Newell, R.B.; Sam, D. 2014. 2014 Bloodroot personal communication report, Antigonish, NS. NS Department of Natural Resources.
1	Quigley, E.J. 2006. Plant records, Mabou & Port Hood. Pers. comm. to S.P. Basquill, Jun. 12. 4 recs, 4 recs.
1	Robinson, C.B. 1907. Early intervale flora of eastern Nova Scotia. Transactions of the Nova Scotia Institute of Science, 10:502-506. 1 rec.
1	Sabine, D.L. 2012. Bronze Copper records, 2003-06. New Brunswick Dept of Natural Resources, 5 recs.
1	Speers, L. 2008. Butterflies of Canada database: New Brunswick 1897-1999. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 2048 recs.
1	Spicer, C.D. & Harries, H. 2001. Mount Allison Herbarium Specimens. Mount Allison University, 128 recs.
1	Stewart, J.I. 2010. Peregrine Falcon Surveys in New Brunswick, 2002-09. Canadian Wildlife Service, Sackville, 58 recs.
1	te Raa, J. 2016. Island Naturalist. Nature PEI, 219.
1	Wilson, G. 2013. 2013 Snapping Turtle email report, Wentworth, NS. Pers. comm.

DATA DICTIONARY: revised December 18, 2017

I. Observation Records

The following fields of data may be included (and may or may not be populated) in occurrence records.
Text fields are 255 char max. (and may truncate text).

TAXONOMY	*type*	*definition*
MCODE	TXT	8 character 'Museum Code' (1 to 4 = genus, 5 to 8 = sp+ssp)
ELCODE	TXT	Unique Identifier of taxon[1]
SCINAME	TXT	Global Scientific Name of taxon[1]
COMNAME	TXT	English Common Name of taxon[1]
NOMCOMMUN	TXT	French Common Name

LOCATION

SURVEYSITE	TXT	General locality of occurrence (not necessarily protected)
DIRECTIONS	TXT	Specific locality: e.g. bearings and distance from enduring landmark
SUBNAT	TXT	Province/State: 2 character ISO code
COCODE	TXT	County Code (2 chars for province + 4 chars for county name)
MAPCODE	TXT	Map number: NTS identifier in Canada
UTME20	NUM	Easting in UTM Zone 20
UTMN20	NUM	Northing in UTM Zone 20
LONDEC	DEC	Decimal Longitude (5 decimal places, negative for west of Greenwich)
LATDEC	DEC	Decimal Latitude (5 decimal places)
LOCUNCM	NUM	Horizontal precision in metres
PREC	DEC	Precision in metres by power of 10 (e.g. 3 = 10 to the 3rd = 1000 m = 1 km)

prec	*common speech*	*example*	*unit size*	*literal range (m)*
6.0	within province	province	1000.0 km	562.3 - 1778.3
5.7	in part of province	'NW NB'	500.0 km	281.2 - 889.1
5.0	within in county	county	100.0 km	56.2 - 177.8
4.7	within 50s of kilometres		50.0 km	28.1 - 88.9
4.0	within 10s of kilometres	BBA grid	10.0 km	5.6 - 17.8
3.7	within 5s of kilometres		5.0 km	2.8 - 8.9
3.0	within kilometres	topo grid	1.0 km	0.6 - 1.8
2.7	within 500s of metres		500.0 m	281.2 - 889.1
2.0	within 100s of metres	ball field	100.0 m	56.2 - 177.8
1.7	within 50s of metres		50.0 m	28.1 - 88.9
1.0	within 10s of metres	boxcar	10.0 m	5.6 - 17.8
0.7	within 5s of metres		5.0 m	2.8 - 8.9
0.0	within metres ***NOT USED***	pace	1.0 m	0.6 - 1.8
-1.0	within 10s of centimetres	fingernail	0.1 m	0.1 - 0.2

RARITY STATUS

NRANK	TXT	National Rarity Rank of taxon (in Canada)[1]
NPROT	TXT	National Protection Status of taxon (= COSEWIC in Canada)
NPROTSAR	TXT	National Protection Status of taxon (= SARA in Canada)

code	*rank and short definition*
X	Extinct in Canada and elsewhere
XT	Extirpated in Canada but surviving elsewhere
E	Endangered in Canada
T	Threatened in Canada
V	Vulnerable in Canada
SC	Special Concern in Canada
DD	Data Deficient: data inadequate for assessment
NAR	Not At Risk in Canada

SRANK** TXT — Subnational (Provincial) Rarity Rank of taxon[1]

code	*rank and short definition*
SX	Extinct or extirpated in province
SH	Historically occurring but currently undetected in province
S1	Extremely rare in province
S2	Rare in province
S3	Uncommon in province
S4	Widespread, common and apparently secure in province
S5	Widespread, abundant and demonstrably secure in province
SE	Exotic in province
SA	Accidental, infrequent and outside of range within province
SNA	Ranking not applicable in province
SNR	Not yet assessed in province

SPROT** TXT — Provincial rank/status of taxon; cf provincial websites

SGSRANK	TXT	Provincial General Status Rank
IUCN	TXT	International Union of Conservation Naturalists rarity rank; cf IUCN website

code	*rank and short definition*
EX	Extinct: no individuals remaining
EW	Extinct in the Wild: only captive or naturalised survivors
CR	Critically Endangered: extreme risk of extinction in wild
EN	Endangered: high risk of extinction in wild
VU	Vulnerable: high risk of endangerment in wild
NT	Near Threatened: likely to become endangered soon
LC	Least Concern: lowest risk, widespread and abundant
DD	Data Deficient: data inadequate for assessment
NE	Not Evaluated, not yet assessed against criteria

OBSERVATION

OBSERVER	TXT	Person or persons collecting specimen, in bibliographic form
OBDATE	TXT	Date of specimen collection as YYYY MM DD
OBDATA	TXT	Concatenation of fields below, relating to specimen (OBEVID, OBCOUNT etc)
OBEVID	TXT	Type of evidence (specimen, photo etc)
OBCOUNT	TXT	Number of individuals at location
OBABUN	TXT	Relative rarity of taxon at location, e.g. 'common', 'scattered'
OBSIZE	TXT	Size of specimen
SIZE	TXT	Size of occurrence 'patch' (in m2, ha or acres)
OBDESC	TXT	Details of specimen appearance
OBPHEN	TXT	Lifestage of specimen (bud, flowering etc)
OBSEX	TXT	Male/female if relevant
OBACTIV	TXT	Activity of taxon when observed (nesting, crossing road etc)
OBASSP	TXT	Other taxa associated with specimen
NOTETAX	TXT	Identifier's note on taxonomic issues
GENDESC	TXT	Concatenation of fields below, relating to site (HABITAT, ECOL etc)
HABITAT	TXT	Habitat characterization of location
ECODIST	NUM	National Ecological Framework EcoDistrict identifier
WSCODE	TXT	Quaternary Watershed identifier
GENCOM	TXT	General Comments: concatenation of Notes (NOTE1, NOTE2, NOTE3)

COLLECTION

CITATION	TXT	Primary source of data

DATA MANAGEMENT

IDNUM	TXT	Field Office Number: Internal ACCDC record reference (not the EONUM)
EDITION	TXT	Last editor's initials and date as YYYY MM DD

Notes:

[1] Methodology of NatureServe, Arlington, VA

** Field name followed by 2-character ISO provincial abbreviation.

II. Managed or Special Areas

The following fields of data may be included (and may or may not be populated) for Protected Areas and Ecologically Significant Areas.

IDENTITY

MACODE	TXT	Unique identifier for Managed Area[1] with some level of protection
SACODE	TXT	Unique identifier for Ecologically Special Area[1] with or without protection
MANAME	TXT	Name of Protected Area containing occurrence
SANAME	TXT	Name of Ecologically Special Area containing occurrence
SITECODE	TXT	External agency site identity code

JURISDICTION / OWNERSHIP

LOCALJURIS	TXT	Abbreviation for mandated agency
OWNER	TXT	Short name or category of title holder
OWNERCOM	TXT	Short detail of multiparty arrangements
OWNERCODE	TXT	Canadian Conservation Area DB ownercodes (modified)

group	*code*	*designation*
Owner	GN	government, national (federal)
	GS	government, subnational (prov., state)
	GM	government, municipal
	IN	international
	NG	non-governmental organisation
	OR	organisational
	CO	corporate
	PR	private

CLASSIFICATION

PROTSTAT	TXT	Activities permitted or restricted (when known)
LEGALACT	TXT	Short title of enabling legislation
LEGALDATE	TXT	Year of enabling legislation
ESTABDATE	TXT	Year of site designation
IBP	TXT	International Biological Program identity number (Y=unknown)
IBPSTATUS	TXT	International Biological Program status: proposed or declared
IUCN	TXT	IUCN protection level, e.g. I very restricted, VI few restrictions
LEVEL1	TXT	Canadian Conservation Area DB type
LEVEL2	TXT	Canadian Conservation Area DB subtype(s)

group	*code*	*designation*
Conservation	CEP	Conservation Easement Property
	ESA	Environmentally Sensitive Area
	NAC	Nature Conservancy
	NAT	Natural Area
	NCA	NCC Conservation Land
	PCA	Private Conservation Area
	PRA	Protected Area
	PRB	Protected Beach
	RER	Representative Area Ecological Reserve
	TRA	Nature Trail
Heritage	ARS	Archaeological Site
	HEA	Heritage Area or Park
	HEC	Heritage Canal
	HEP	Heritage Park
	HER	Heritage River
	HIA	Historic Area or Park
	NHP	National Historic Park
	NHS	National Historic Site
	PEP	Provincial Heritage Property
	PHP	Provincial Historic/Heritage Park
	PHS	Provincial Heritage Site
	WHS	World Heritage Site
Parks	CMG	Campground
	CMP	Community Park
	DUP	Day Use Park
	MUP	Municipal Park
	NAP	National Park
	NEP	Natural Environment Park
	NTP	Nature Park
	PKW	Parkway
	PNS	Picnic Site
	PPR	Provincial Park Reserve
	PVP	Provincial Park
	WAP	Wayside Park

group	*code*	*designation*
Wilderness	ECR	Ecological Reserve
	NTA	Nature Trust Area
	NTR	Nature Reserve
	SES	Significant Ecological Area
	WDA	Wilderness Area
	WDR	Wilderness Reserve
Wildlife	BSR	Bird Sanctuary
	EHJ	Eastern Habitat Joint Venture
	GAS	Game Sanctuary
	MBS	Migratory Bird Sanctuary
	NWA	National Wildlife Area
	PWA	Provincial Wildlife Area
	SBS	Sea Bird Sanctuary
	WHR	Western Hemispheric Shorebird Reserve
	WLP	Wildlife Park
	WLR	Wildlife Reserve
	WLS	Wildlife Sanctuary
	WMA	Wildlife Management Area
	WPA	Wildlife Protection Area
	WRF	Wildlife Refuge
Other	AGF	Agreement Forest
	ASI	Area of Scientific Interest
	DUN	Ducks Unlimited Canada
	EDA	Education Area
	FCP	Federal Community Pasture
	IBP	International Biological Program
	NCC	National Capital Commission
	NSA	Natural Scenic Area
	PLS	Palaeontological Site
	PSL	Public Safety Lands: watershed protection
	RAM	Ramsar Wetland Site
	RTA	Research and Teaching Area
NS SigHab	380	wetland habitat
	381	saltmarsh habitat
	382	deer/moose wintering
	383	other significant habitats

Appendix N1

Potential Priority Animal Species

Appendix N1

Potential Priority Animal Species for NPNS Proposed Replacement Effluent Treatment Facility Assessment Area based on Previous Studies; and 2018a - AC CDC data and SARA/NS ESA/COSEWIC Listings and Potential Habitat Present

Common Name	Scientific Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status, S Rank and General Status [1]	Habitat Preference and Observations in Vicinity	Timing for Investigation
INVERTEBRATES				
Acadian Hairstreak	*Satyrium acadiaca*	S1 / Undetermined	Butterfly of wet meadows, fields, and stream banks with willows. AC CDC record within 3±1 km.	Late June to mid-August.
Baltimore Checkerspot	*Euphydryas phaeton*	S2S3/ Secure	Butterfly associated with fresh-water marshes, wet roadsides, meadows (Payzant 2012). Larval foods include turtlehead (AC CDC 2018b). AC CDC record within 8±1 km.	Flight period is mid June to early August.
Banded Hairstreak	*Satyrium calanus falacer*	S2/ At Risk	Butterfly associated with woodlands, where it can be abundant on milkweed and sweet clovers, common along roadsides. Not known for Pictou area (AC CDC 2018b). Nearest AC CDC record over 50 km away.	Species flies from late June into late August in Canada. It is most numerous in July (Layberry et al. 2002).
Bog Elfin	*Callophrys lanoraieensis*	S3/ May be at risk	Butterfly species is restricted to spruce-tamarack bogs. Even there, it is often in the most inaccessible parts of the bog, usually where there is some open water and scattered stands of stunted black spruce (Layberry et al. 2002). Not known for Pictou area (AC CDC 2018b). Nearest AC CDC record over 50 km away.	Not identified.
Bronze Copper	*Lycaena hyllus*	S2/ Secure	Butterfly associated with open wet habitats usually marshes not overgrown with cattails including manmade ones. Host plants include docks and knotweeds; nectaring occurs on flowers.Recorded in Maritime Butterfly Atlas (AC CDC 2018) in adjacent West River 10 km square. Nearest AC CDC record within 30 km away.	Flight periods early July to mid September.
Brook Snaketail	*Ophiogomphus aspersus*	S2S3/ May be at risk	Dragonfly species is usually found at clear streams and rivers in open with brushy banks and sandy, gravelly, rocky riffles (IUCN 2018). Nearest AC CDC record within 90 km away.	Late April to late August.
Common Roadside-skipper	*Amblyscirtes vialis*	S3S4 / Secure	Butterfly of ground on gravelly or sandy surfaces, usually in wooded areas.AC CDC record within 3.2±1 km.	late May to mid-July.
Creeper	*Strophitus undulates*	S1/ May be at risk	Freshwater mussel associated with a wide range of habitats, including headwaters, pools and large streams. They are probably scarcer in lower river reaches, and are generally absent from land-locked lakes (Mulcrone, 2005). Nearest AC CDC record over 90 km away.	Summer.
Early Hairstreak	*Erora laeta*	S2/ May be at risk	In Canada, this butterfly is associated with fairly extensive mature beech-maple forests (Layberry	Most numerous from mid-May to mid-June.

Common Name	Scientific Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status, S Rank and General Status [1]	Habitat Preference and Observations in Vicinity	Timing for Investigation
			et al. 2002). Not known for N NS. Nearest AC CDC record over 70 km away.	
Eastern Lampmussel	*Lampsilis radiate*	S3S4/ Sensitive	Freshwater mussel species is usually found at streams and rivers that are sand bottomed (Davis 2007). Nearest AC CDC record over 70 km away.	Summer.
Ebony Boghaunter	*Williamsonia fletcheri*	S2/ May be at risk	Dragonfly species is found in bog type from white cedar, black spruce, larch, to other forests with bogs/ bog or fen pools (WOS 2018). Nearest AC CDC record over 60 km away.	Flight season May – June.
Forcipate Emerald	*Somatochlora forcipata*	S2S3/ May be at risk	Dragonfly species occurs at small spring-fed peatland streams, in or out of woodland. Larvae sprawl on bottom among detritus (IUCN 2018). Nearest AC CDC record over 50 km away.	Flight season June – September.
Grey Comma	*Polygonia progne*	S3S4/ Secure	Butterfly associated with open forests, roadsides along forested areas (Payzant 2012). Overwinter as adult and fly periods April to mid June and mid July to early September. Host plant is currents (AC CDC 2018b). Nearest AC CDC record within 10 km.	Flight periods April to mid June and mid July to early September.
Jutta Arctic	*Oeneis jutta*	S3/ May be at risk	Butterfly species is found only in black spruce-tamarack bogs and it prefers the edges of treed areas. Nearest AC CDC record over 30 km away.	Flight period mid May to early July. Host plants sedges (AC CDC 2018b).
Kennedy's Emerald	*Somatochlora kennedyi*	S1S2/ May be at risk	Dragonfly associated with open fens, small ponds, shaded bog ponds, shallow bogs, and slow open streams in bogs or marshes (WOS 2018). Nearest AC CDC record over 60 km away.	Flight period May to July.
Lance-tipped Darner	*Aeshna constricta*	S3 / Secure	Dragonfly near lakes, ponds, marshes, and slow streams. AC CDC record within 4.6±1 km.	Early June - Early October.
Monarch (Butterfly)	*Danaus plexippus*	COSEWIC Endangered SARA Special Concern Sched. 1 S2B/ Sensitive	Migrates through area, feeds on milkweed or similar wildflower; Canadian habitat not vulnerable. AC CDC record within 11 km.	Late summer.
Northern Cloudywing	*Thorybes pylades*	S2S3 / Sensitive	Butterfly of wooded places, rarely occurs in built-up areas. AC CDC record within 3.2±1 km.	Mid-May to July.
Maine Snaketail	*Ophiogomphus mainensis*	S2S3/ May be at risk	Dragonfly species occurs at small rapid rocky streams and rivers in forest. Larvae burrow in sandy substrates (IUCN 2018). Nearest AC CDC record over 40 km away.	Flight period July.
Orange Bluet	*Enallagma signatum*	S2/ May be at risk	Damselfly species is usually found at a variety of non-moving water habitats, including slow streams, small lakes, and quiet bays (WOS, 2018). Nearest AC CDC record over 70 km away.	Flight period July to Aug.
Question Mark	*Polygonia interrogationis*	S3B / Secure	Butterfly near woodlands. AC CDC record within 3.2+1 km.	Late May to early July and late July to early Sept.
Rusty Snaketail	*Ophiogomphus rupinsulensis*	S2S3/ May be at risk	Dragonfly species occurs at large streams and rivers with moderate current in forest. Larvae burrow in sandy substrates (IUCN 2018). Nearest AC CDC record over 50 km away.	Flight period June to Sep.
Salt Marsh Copper	*Lycaena dospassosi*	S2 / At Risk	Butterfly associated with salt marshes along the Northumberland Strait (Payzant 2012). AC CDC	Flight period mid July to mid

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			record within 5.4 km.	August.
Striped Hairstreak	*Satyrium liparops strigosum*	S2S3 / Sensitive	Butterfly of forest openings and thickets as well as trails and gardens. Nectaring on flowers especially milkweed. Host plant shrubs and trees in rose family (AC CDC 2018b). Nearest AC CDC record over 60 km away.	Flight period early July to late August.
Taiga Bluet	*Coenagrion resolutum*	S1S2/ May be at risk	Damselfly, associated with a variety of non-moving waters including marshes, ponds, bogs, and sloughs (WOS 2018). Nearest AC CDC record over 30 km away.	Flight period summer.
Williamson's Emerald	*Somatochlora williamsoni*	S2/ May be at risk	Species it is usually found at slow forested streams and lakes, and sometimes bog lakes. It seems to prefer shaded habitats (WOS 2018). Nearest AC CDC record over 70 km away.	Flight period June to Aug.
Yellow-banded Bumblebee	*Bombus terricola*	SARA Schedule 1 /COSEWIC Special Concern, NS ESA Vulnerable S3/ Sensitive	The species is a habitat generalist within open coniferous, deciduous and mixed hardwood forests, wet and dry meadows and prairie grasslands, meadows bordering riparian zones, and along roadsides, in taiga adjacent to wooded areas, urban parks, gardens and agricultural areas, sub-alpine habitats and more isolated natural areas (COSEWIC 2015). Nearest AC CDC record over 60 km away.	Summer.
Zebra Clubtail	*Stylurus scudderi*	S1S2/ May be at risk	Associated with forest streams with intermittent rapids, including trout streams with sandy/mucky bottoms sloughs (WOS 2018). Nearest AC CDC record over 90 km away.	Flight period Aug. to Oct.
BIRDS				
American Bittern	*Botaurus lentiginosus*	S3S4B / Sensitive	Nests in freshwater marshes and occasionally salt marshes. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-May to mid-August.
American Coot	*Fulica americana*	COSEWIC: Not at risk S1B / Undetermined	Nests near lakes and marshes, found in aquatic habitats year around. AC CDC record within 16.9 ± 7.0 km.	Nests from early May to mid-August.
American Golden-Plover	*Pluvialis dominica*	S1S2M / Sensitive	Migratory prefers open grass areas, less often on mudflats and beaches. AC CDC record within 17.7 ± 0.0 km.	Fall migration during August to November.
American Kestrel	*Falco sparverius*	S3B / Secure	Nests in cavities of trees or structures, prefers open habitats. AC CDC record within 8.2 ± 0.0 km.	Nests from mid-April to early August.
American Three-toed Woodpecker	*Picoides dorsalis*	S1? / Undetermined	Conifer forests in far north and high mountains, uncommon. AC CDC record within 78.9 ± 7 km.	Nests in June and July.
Baltimore Oriole	*Icterus galbula*	S2S3B / May be at risk	Nest deciduous trees often suburban or water side. AC CDC record within 3.6 ± 7.0 km.	Nests from early June to mid-August.
Bank Swallow	*Riparia riparia*	COSEWIC/SARA : Threatened NS ESA: Endangered S2S3B / May be at risk	Nest banks, cliffs. AC CDC record within 3.6 ± 7.0 km	Nests from late May to late August.
Barn Swallow	*Hirundo rustica*	COSEWIC/SARA : Threatened NS ESA: Endangered S2S3B / At Risk	Nest on structures. AC CDC record within 1.4 ± 0.0 km.	Nests from late May to early September.

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Barrow's Goldeneye – Eastern pop.	*Bucephala islandica*	COSEWIC/SARA: Special Concern S1N/ At Risk	Found in coastal waters and rivers. AC CDC record within 5.4 km ± 0.0 km. Observed west of Site along Highway 106 (Jan. 2018).	Overwintering from October to April.
Bay-breasted Warbler	*Dendroica castanea*	S3S4B / Sensitive	Breeds in mature coniferous forest, particularly in areas with high spruce budworm concentrations. AC CDC record within 9.5 ± 7.0 km.	Nests from late-May to early August.
Bicknell's Thrush	*Catharus bicknelli*	COSEWIC: Threatened SARA: Special concern NS ESA: Endangered S1S2B / At Risk	Dense conifer forests. AC CDC record within 94.4±7 km	Nests in June and July.
Black-backed Woodpecker	*Picoides arcticus*	S3S4 / Sensitive	Nest in cavities. AC CDC record within 11.1±7 km.	Nests from mid-May to early August.
Black-bellied Plover	*Pluvialis squatarola*	S3M / Secure	In winter mostly on open sand beaches, tidal flats. AC CDC record within 2.8 ± 0.0 km.	Fall migration during August to early December.
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S3B / May be at Risk	Nests in forest edges and tall shrub thickets. AC CDC record within 2.8 ± 0.0 km.	Nests from early June to mid-September.
Black-crowned Night-heron	*Nycticorax nycticorax*	S1B / May be at Risk	Nests in groves of trees, in thickets, or on ground, usually on islands or above water. AC CDC record within 61.3 ± 7.0 km.	Nests from early May to early August.
Blackpoll Warbler	*Dendroica striata*	S3S4B / Sensitive	Nest in damp spruce forests. AC CDC record within 9.5 ± 7.0 km.	Nests in June and July.
Blue-winged Teal	*Anas discors*	S3S4B / May be at Risk	Nest in fertile marshes. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-May to early September.
Bobolink	*Dolichonyx oryzivorus*	COSEWIC/SARA: Threatened NS ESA: Vulnerable S3S4B / Sensitive	Nest in lush meadows, open grasslands, hayfields. AC CDC record within 1.4 ± 0.0 km.	Nests from late May to early August.
Boreal Chickadee	*Poecile hudsonica*	S3 / Sensitive	Nest cavities in rotted tree stumps. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to late August.
Boreal Owl	*Aegolius funereus*	COSEWIC: Not at risk S2?B / Undetermined	Nest in Woodpecker and other tree cavities and within northern bogs. AC CDC record within 29.5 ± 0.0 km.	Nests from late March to late May.
Brown-headed Cowbird	*Molothrus ater*	S2B / Secure	Parasitic nester. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-May to early August.
Brown Thrasher	*Toxostoma rufum*	S1B / Undetermined	Thickets, brush, shrubbery, thorn scrub. AC CDC record within 16.6 ± 7.0 km.	Nests in June and July.
Canada Warbler	*Wilsonia Canadensis*	COSEWIC/SARA: Threatened NS ESA: Endangered S3B / At Risk	Nest - mid aged mixed forest. AC CDC record within 3.6 ± 7.0 km.	Nests in June and July.
Cape May Warbler	*Dendroica tigrina*	S2B / Sensitive	Nests in conifers. AC CDC record within 6.7 ± 7.0 km.	Nests in June and July.
Chimney Swift	*Chaetura pelagica*	COSEWIC/SARA: Threatened NS ESA: Endangered	Chimneys and large hollow trees nest / roost. AC CDC record within 11 ± 7.0 km.	Nests from mid-June to mid-September.

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		S2B,S1M / At risk		
Cliff Swallow	*Petrochelidon pyrrhonota*	S2S3B / May be at Risk	Breeds in settled areas in mud nests, nesting colonially on buildings and structures such as bridges. AC CDC record within 6.7 ± 7.0 km.	Nests from late May to late August.
Common Eider	*Somateria mollissima*	S3S4 / Secure	Coastal islands. AC CDC record within 11.5 ± 9.0 km.	Nests from early May to mid-August. Overwinters from August to January.
Common Goldeneye	*Bucephala clangula*	S2B, S5N / Secure	Nests in large trees with cavities near forested lakes/ rivers. In winter found in forested lakes/rivers, salt bays and seacoasts. AC CDC record within 6.7 ± 13.0 km.	Nests from mid-April to late August. Overwinters from October to April.
Common Loon	*Gavia immer*	S3B, S4N / May be at risk	May nest in around adjacent lakes. No AC CDC records, but this species is likely within the vicinity.	Nests from early May to early October. Overwinters from November to April.
Common Nighthawk	*Chordeiles minor*	COSEWIC: Special Concern SARA: Threatened NS ESA: Threatened S2B / At Risk	Nest -sparsely vegetated or bare ground (cutover/burns, building roof). AC CDC record within 1.6 ± 0.0 km.	Nests from early June to mid-August.
Common Tern	*Sterna hirundo*	COSEWIC: Not at risk S3B / Sensitive	Islands and coastal areas. AC CDC record within 2.9 ± 0.0 km.	Nests from mid-May to mid-August.
Cooper's Hawk	*Accipiter cooperii*	COSEWIC: Not at risk S1?B / Undetermined	Nests in coniferous, deciduous, and mixed woods, near forest edge. AC CDC record within 18.3 ± 0.0 km.	Nests from mid-May to mid-July.
Double-crested Cormorant	*Phalacrocorax auritus*	S5B / Secure	Near coast, sea-cliffs, trees, islands. No AC CDC records, but has been identified as a colonial bird in the study area.	Nest from mid-April to early September. Overwinters from September to March.
Eastern Bluebird	*Sialia sialis*	COSEWIC: Not at risk S3B / Sensitive	Woodpecker holes forage low vegetation with scattered trees clear-cut near forest, favour broad-leaf. AC CDC record within 6.7 ± 7.0 km.	Nests from early May to mid-August.
Eastern Kingbird	*Tyrannus tyrannus*	S3B / Sensitive	Nest in open areas, AC CDC record within 6.7 ± 7.0 km.	Nests from late May to late August.
Eastern Wood-pewee	*Conopus virens*	COSEWIC/SARA : Special Concern NS ESA: Vulnerable S3S4B / Sensitive	Nest open forest. AC CDC record within 3.6 ± 7.0 km.	Nests from early June to early September.
Evening Grosbeak	*Coccothraustes vespertinus*	COSEWIC: Special Concern NS ESA: Vulnerable S3S4B, S3N / Secure	Nest in southern boreal forest, high in spruce tree. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-June to mid-August.
Fox Sparrow	*Passerella iliaca*	S3S4B / Secure	Nest in dense deciduous shrubs. AC CDC record within 1.8 ± 0.0 km.	Nests in June and July.
Gadwall	*Anas strepera*	S2B/ May be at risk	Lakes, ponds, marshes. AC CDC record within 46.2 ± 0.0 km.	Nests from late-July to late September. Overwinters from

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				November to April.
Golden-crowned Kinglet	*Regulus satrapa*	S4 / Sensitive	Nest in coniferous forest. No AC CDC records, but this species is expected within the vicinity.	Nests from early May to late July.
Gray Catbird	*Dumetella carolinensis*	S3B / May be at Risk	Nest shrubbery. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to late August.
Gray Jay	*Perisoreus canadensis*	S3 / Sensitive	Nests in forest. AC CDC record within 9.5 ± 7.0 km.	Nests from late-March to early July.
Great Cormorant	*Phalacrocorax carbo*	S2S3 / Sensitive	Coastal sea-cliffs, islands. AC CDC record within 25.0 ± 7.0 km.	Nests from mid-April to late August. Overwinters from September to March.
Great Crested Flycatcher	*Myiarchus crinitus*	S1B / May be at risk	Nests in hollow tree. AC CDC record within 17.1±7 km.	Nests in June and July.
Greater Yellowlegs	*Tringa melanoleuca*	S3B,S3S4M / Sensitive	Nest in wooded bogs. AC CDC record within 3.8 ± 0.0 km.	Nests in June and July. Fall migration during August to November.
Hudsonian Godwit	*Limosa haemastica*	S1S2M / Sensitive	Migrants may be on marshy ponds or tidal flats. AC CDC record within 60.9 ± 0.0 km.	Fall migration during August to November.
Hudsonian Whimbrel	*Numenius phaeopus hudsonicus*	S2S3M / Sensitive	Migratory near mudflats, also on rocky shores, sandy beaches, salt marshes and grassy fields near coast. AC CDC record within 5.4 ± 0.0 km.	Fall migration during July to October.
Killdeer	*Charadrius vociferus*	S3B / Sensitive	Nest in open areas. AC CDC record within 1.4 ± 0.0 km.	Nests from mid-April to mid-August.
Least Sandpiper	*Calidris minutilla*	S1B, S3M / Secure	Nest in sedge meadows and bogs, along cool coast. AC CDC record within 3.8 ± 0.0 km.	Nests from late May to early August. Fall migration during September and October.
Lesser Yellowlegs	*Tringa flavipes*	S3M / Secure	Migratory in coastal estuaries, marshes, edges of lakes and ponds. AC CDC record within 2.8 ± 0.0 km.	Fall migration during July to October.
Long-eared Owl	*Asio otus*	S2S3 / May be at risk	Nest in woodlands. AC CDC record within 33.2 ± 0.0 km.	Nests from early April to late July.
Nelson's Sparrow	*Ammodramus nelsoni*	COSEWIC: Not at risk S3S4B / Secure	Nests in salt marshes. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-June to early September.
Northern Goshawk	*Accipiter gentilis*	COSEWIC: Not at risk S3S4 / Secure	Woodland species. AC CDC record within 6.7 ± 7.0 km.	Nests from mid-April to late July.
Northern Harrier	*Circus cyaneus*	COSEWIC: Not at risk S3S4B / Secure	Nest in open marshes. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-May to late August.
Northern Mockingbird	*Mimus polygolottos*	S1B / Secure	Nest in gardens. AC CDC record within 3.6 ± 7.0 km.	Nests from early June to early September.
Olive-sided Flycatcher	*Contopus cooperi*	COSEWIC: Special Concern SARA: Threatened NS ESA: Threatened	Nest open forest – conifers or mixed. AC CDC record within 2.5 ± 0.0 km.	Nests from June to late August.

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		S2B / At risk		
Pectoral Sandpiper	*Calidris melanotos*	S2S3M / Secure	Migration near muddy shores and fresh and tidal marshes. AC CDC record within 3.8 ± 0.0 km.	Fall migration from August to November.
Peregrine Falcon	*Falco peregrinus* pop 1	Special Concern, NS ESA Vulnerable S1B,SNAM / Sensitive	Nesting cliffs, northwestern NS. Identified by AC CDC as location sensitive species, but not known for the study area. Nearest AC CDC within 67.8 ± 0.0 km.	Nests in June and July.
Philadelphia Vireo	*Vireo philadelphicus*	S2?B / Undetermined	Nest in broad-leafed forest. AC CDC record within 36.6 ± 0.0 km.	Nests in June and July.
Pine Grosbeak	*Pinicola enucleator*	S2S3B,S5N / May be at risk	Nests in conifers. AC CDC record within 11.0 ± 7.0 km.	Nests in May and June.
Pine Siskin	*Carduelis pinus*	S2S3 / Sensitive	Breeds in mature coniferous forest. AC CDC record within 6.7 ± 7.0 km.	Nests from late April to early August.
Pine Warbler	*Dendroica pinus*	S1B / Undetermined	Breeds in open pine woods. AC CDC record within 18.8 ± 7.0 km.	Nests in May and June.
Piping Plover melodus ssp	*Charadrius melodus melodus*	COSEWIC/SARA : Endangered NS ESA: Endangered S1B / At Risk	Sandy beaches, tidal flats. AC CDC record within 2.8 ± 0.0 km.	Nests from early May to late July. Spring migration in April and fall migration during August and September.
Purple Sandpiper	*Calidris maritima*	S3?N / Sensitive	Migratory in winter rocky shores. AC CDC record within 5.4 ± 0.0 km.	Fall migration/ overwintering during October to January.
Red-breasted Merganser	*Mergus serrator*	S3S4B,S5N / Secure	Nests around lakes and rivers, winters found on coastal waters. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to early September. Overwintering from October to April.
Red-breasted Nuthatch	*Sitta canadensis*	S3 / Secure	Nests in cavities from dead trees. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to mid-August.
Red Crossbill	*Loxia curvirostra*	S3S4 / Secure	Nests in conifers. AC CDC record within 6.7 ± 7.0 km.	Can nest from February to August.
Red Knot rufa ssp	*Calidris canutus rufa*	COSEWIC: Endangered NS ESA: Endangered S2M / At risk	In migration and winter on coastal mudflats and tidal zones, sometimes on open sandy beaches. AC CDC record within 5.4 ± 0.0 km.	Fall migration from August to November.
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S2S3B / Sensitive	Nests in Mixed and broad-leafed woods. AC CDC record within 6.7 + 7.0 km.	Nests in June and July.
Ruby-crowned Kinglet	*Regulus calendula*	S3S4B / Sensitive	Nests in conifers. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to mid-July.
Ruddy Duck	*Oxyura jamaicensis*	S1B/ Secure	Fresh marshes, ponds, lakes. In winter on protected shallow bays and estuaries along coast. AC CDC record within 53.0 ± 0.0 km.	Spring migration during February to May.
Ruddy Turnstone	*Arenaria interpres*	S3M/ Secure	Migratory and winter near rocky shorelines and beaches covered with seaweed or debris. AC CDC record within 3.8 ± 0.0 km.	Fall migration during July to November.
Rusty Blackbird	*Euphagus carolinus*	COSEWIC/SARA : Special Concern NS ESA: Endangered S2B / May be at risk	Nests in swamps and bogs along sluggish streams. Nearest AC CDC record within 20.6 ± 7.0 km.	Nests from mid-May to late July.
Sanderling	*Calidris alba*	S3M,S2N / Secure	Winter and migratory near coastal beaches, tide	Fall migration

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			flats, lake shores. AC CDC record within 3.8 ± 0.0 km.	during July to December.
Scarlet Tanager	*Piranga olivacea*	S2B / Undetermined	Nests in deciduous forest. AC CDC record within 11.0 ± 7.0 km.	Nests from mid-June to mid-August.
Semipalmated Plover	*Charadrius semipalmatus*	S1B,S3S4M / Secure	Nests on gravel beaches. AC CDC record within 3.8 ± 0.0 km.	Nests in June and July. Fall migration during August to October.
Semipalmated Sandpiper	*Calidris pusilla*	S3M / Sensitive	Migration along coast on mudflats, intertidal zone, shallow estuaries and beaches. AC CDC record within 3.8 ± 0.0 km.	Fall migration during July to November.
Short-billed Dowitcher	*Limnodromus griseus*	S3M / Secure	Migratory coastal areas incl. tidal flats, estuaries and bays, marshes, sandy beaches. AC CDC record within 3.8 ± 0.0 km.	Fall migration during July to October.
Short-eared Owl	*Asio flammeus*	COSEWIC/SARA : Special Concern S1S2B / May be at risk	Nests in open grassy habitats. AC CDC record within 16.6 ± 7.0 km.	Nests from mid-April to late July.
Spotted Sandpiper	*Actitis macularius*	S3S4B / Sensitive	Nests in open areas, particularly gravelly shores of rivers/lakes. AC CDC record within 3.6 ± 7.0 km.	Nests from mid-April to late August.
Swainson's Thrush	*Catharus ustulatus*	S3S4B / Secure	Nests in trees. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to late July.
Tennessee Warbler	*Vermivora peregrina*	S3S4B Sensitive	Nests in forest, typically small broad-leaved within conifers. AC CDC record within 9.5 ± 7.0 km.	Nests in June and July.
Veery	*Catharus fuscescens*	S3S4B / Secure	Nests in broad-leafed forests. AC CDC record within 2.8 ± 0.0 km.	Nests from late May to early August.
Vesper Sparrow	*Pooecetes gramineus*	S2B / May be at risk	Meadows, fields, prairies, roadsides. AC CDC record within 17.5 ± 7.0 km.	Nests from mid-May to late July.
Virginia Rail	*Rallus limicola*	S2S3B / Undetermined	Nests in marshes. AC CDC record within 1.9 ± 0.0 km.	Nests from late May to early August.
White-rumped Sandpiper	*Calidris fuscicollis*	S3M/ Secure	Migration, in flooded fields, shallow ponds, edges of freshwater marshes, tidal flats, and gravel beaches. AC CDC record within 5.4 ± 0.0 km.	Fall migration during July to December.
Willet	*Tringa semipalmata*	S2S3B / May be at risk	Nest coastal near marsh. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to early August.
Wilson's Snipe	*Gallinago delicata*	S3B / Sensitive	Nests in wet marshy areas. AC CDC record within 3.6 ± 7.0 km.	Nests from late April to late July.
Wilson's Warbler	*Wilsonia pusilla*	S3B / Sensitive	Nests in riparian shrub thickets. AC CDC record within 13.0 ± 7.0 km.	Nests in June and July.
Wood Thrush	*Hylocichla mustelina*	COSEWIC/SARA Threatened SUB / Undetermined	Breeds in the understory of woodlands. AC CDC record within 3.6 ± 7.0 km.	Nests from late May to late July.
Yellow-bellied Flycatcher	*Empidonax flaviventris*	S3S4B/ Sensitive	Nests on ground in conifer moss.AC CDC record within 3.6 ± 7.0 km.	Nests from late June to late August.
FISH – Freshwater and Marine (Anadromous)				
Atlantic salmon Gaspe-	*Salmo salar*	COSEWIC Special Concern S1 / May be at risk	Gravel bottomed streams, rivers. AC CDC record within 15.1 km.	Late summer/fall

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Southern Gulf of St. Lawrence				
Atlantic Sturgeon	*Acipenser oxyrinchus*	COSEWIC Threatened S2 / May be at risk	Rivers, estuaries, the nearshore marine environments and the continental shelf regions along the Atlantic coast of North America. AC CDC record within 83.5 km.	Not anticipated in assessment area.
American eel	*Anguilla rostrata*	COSEWIC Threatened S2 / Secure	Fresh water streams for adults. Migrate to sea to spawn. AC CDC record within 77 km.	Non-winter.
Brook trout	*Salvelinus fontinalis*	S3/ Sensitive	Streams, brooks. AC CDC record within 15.1±0 km.	Late summer/fall.
Gaspereau (Alewife)	*Alosa pseudoharengus*	S3/ Sensitive	Spawn above head of tide in rivers. AC CDC record within 15.1±7 km.	Spring-summer.
Striped Bass-Southern Gulf of St. Lawrence population	*Morone saxatilis* pop. 1	COSEWIC Special Concern S2S3N/ May be at risk	Estuaries and coastal waters of the southern Gulf of St. Lawrence. Spawn in fresh/brackish water and require high quality habitat and abundant aquatic species for food in estuaries and coastal waters. AC CDC record within 58.8±1 km.	Spring spawning.
FISH - Marine				
American Plaice Maritime population	*Hippoglossoides platessoides*	COSEWIC Threatened	OBIS Data	Yearround.
Atlantic Bluefin	*Tuna Thunnus thynnus*	COSEWIC Endangered	Catches in Northumberland Strait.	Yearround.
Atlantic Cod Laurentian South population	*Gadus morhua*	COSEWIC Endangered	OBIS Data.	Yearround.
Atlantic Wolffish	*Anarhichas lupus*	SARA/COSEWIC Special Concern Sched.1	OBIS Data, outside of assessment area.	Yearround.
Basking Shark	*Cetorhinus maximus*	COSEWIC Special Concern	Wandering. None in OBIS data for the Strait.	Not anticipated.
Cusk	*Brosme brosme*	COSEWIC Endangered	None in OBIS data for the Strait.	Not anticipated.
Lumpfish	*Cyclopterus lumpus*	COSEWIC Threatened	Present in OBIS Data.	Yearround.
Northern Wolffish	*Anarhichas denticulatus*	SARA/COSEWIC Threatened Sched.1	OBIS Data, outside of assessment area.	Yearround.
Porbeagle	*Lamna nasus*	COSEWIC Endangered	Wandering. OBIS Data, outside of assessment area.	Late summer, fall.
Shortfin Mako	*Isurus oxyrinchus*	COSEWIC Special Concern	Wandering. None in OBIS data for the Strait.	Not anticipated.
Smooth Skate Laurentian-Scotian population	*Malacoraja senta*	COSEWIC Special Concern	OBIS Data.	Yearround.
Spiny Dogfish	*Squalus acanthias*	COSEWIC Special Concern	OBIS Data.	Yearround.
Spotted Wolffish	*Anarhichas minor*	SARA/COSEWIC Threatened Sched. 1	OBIS Data, outside of assessment area.	Yearround.
Thorny Skate	*Amblyraja radiata*	COSEWIC Special Concern	OBIS Data, outside of assessment area.	Yearround.
White Hake Southern Gulf	*Urophycis tenuis*	COSEWIC Endangered	OBIS Data.	Yearround.

Common Name	Scientific Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status, S Rank and General Status [1]	Habitat Preference and Observations in Vicinity	Timing for Investigation
of St. Lawrence population				
White Shark	*Carcharodon carcharias*	SARA/COSEWIC Endangered Sched. 1	Wandering. None in OBIS data for the Strait.	Not anticipated.
Winter Skate Gulf of St. Lawrence population	*Leucoraja ocellata*	COSEWIC Endangered	OBIS Data.	Yearround.
Herptiles				
Blanding's turtle – NS population	*Emydoidea blandingii*	SARA Endangered, NS ESA Vulnerable	Lake shorelines and wetlands in central southwest NS. Identified by AC CDC as location sensitive species not known for the study area, no AC CDC records within 100 km.	Not anticipated for the assessment area.
Snapping turtle	*Chelydra serpentina*	SARA/COSEWIC Special Concern Sched. 1 NS ESA Vulnerable S3/ Sensitive	Vegetated lakes and streams, nest on sand / gravel. Expected in Pictou Harbour area, nearest AC CDC record 17.1 km.	Non-winter.
Wood turtle	*Glyptemys insculpta*	Threatened Sched. 1 NS ESA Threatened S2 / Sensitive	Nest on gravel bank near river, overwinter in pools, clear streams. Identified by AC CDC as location sensitive species not known for the study area, nearest location 13.1±5 km.	Late spring.
**Leatherback Sea Turtle (Atlantic Population)	*Dermochelys coriacea*	SARA/COSEWIC Endangered Sched.1	Coastal, shelf and offshore waters mostly within the photic zone foraging. Potentially found in Northumberland Strait during summer and fall.	Spring to fall.
Loggerhead Sea Turtle	*Caretta caretta*	SARA/COSEWIC Endangered Sched.1	Similar to leatherback turtle, fewer records.	Not anticipated for the assessment area.
Four-toed Salamander	*Hemidactylium scutatum*	S3/ Secure	Closely associated with sphagnum areas bordering streams and in sphagnum bogs during spring breeding season. During summer, adults have been found in woodland habitats (GNS 2018g).	Summer.
MAMMALS - terrestrial				
Moose	*Alces americanus*	NS ESA Endangered S1 / At risk	Forest – occasionally enter urban areas. Nearest AC CDC record 26.6 km.	Year-round.
Little Brown Myotis	*Myotis lucifugus*	Endangered Sched. 1 NS ESA Endangered S1 / At risk	Hibernate in caves, may feed in area. Identified by AC CDC as location sensitive species with hibernacula not known for the study area, nearest location 21.8 km away.	Summer – fall.
Northern Long-eared Myotis	*Myotis septentrionalis*	Endangered Sched. 1 NS ESA Endangered S1 / At risk	Hibernate dense forest and caves, may feed in area. Identified by AC CDC as location sensitive species with hibernacula not known for the study area, nearest location 34.9±1 km away in PE.	Summer – fall.
Tri-coloured Bat / Eastern Pipistrelle	*Pipistrellus subflavus*	Endangered Sched. 1 NS ESA Endangered S1 / At risk	Hibernate in caves, may feed in area. Identified by AC CDC as location sensitive species with hibernacula not known for the study area, nearest location over 80 km away.	Summer – fall.
MAMMALS - Marine				
Pinnipeds				
*Grey Seal	*Halichoerus grypus*	COSEWIC: Not at risk	Coastal marine waters. No nearby AC CDC record.	Yearround.

Common Name	Scientific Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status, S Rank and General Status [1]	Habitat Preference and Observations in Vicinity	Timing for Investigation
		SNR / Protected pursuant MMR.		
*Harbour Seal	*Phoca vitulina concolor*	SNR / Protected pursuant the MMR.	Coastal marine waters. No nearby AC CDC record.	Yearround.
Harp Seal	*Pagophilus groenlandicus*	SNR / Protected pursuant the MMR.	Coastal marine waters. No nearby AC CDC record.	Yearround.
Hooded Seal	*Cystophora cristata*	COSEWIC: Not at risk SNR / Protected pursuant the MMR.	Coastal marine waters. No nearby AC CDC record.	Yearround.
Cetaceans				
Atlantic White-sided Dolphin (Gulf of St. Lawrence population)	*Lagenorhynchus acutus*	COSEWIC: Not at risk S4 / Protected pursuant the MMR.	Coastal marine waters including Northumberland Strait and open ocean. AC CDC record within 83.3 ± 1.0 km.	Summer and fall.
Beluga Whale (St. Lawrence Estuary population)	*Delphinapterus leucas*	COSEWIC/SARA : Endangered SNA / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Summer and fall.
Blue Whale	*Balaenoptera musculus*	COSEWIC/SARA Endangered Sched.1	Coastal marine waters and open ocean. No nearby AC CDC record.	Not anticipated in assessment area.
*Common Minke Whale (North Atlantic subspecies)	*Balaenoptera acutorostrata acutorostrata*	COSEWIC: Not at risk S4 / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Summer and fall.
*Fin Whale Atlantic Population	*Balaenoptera physalus*	COSEWIC/SARA : Special Concern S2S3 / Protected pursuant the MMR.	Near the coast and far offshore, follow krill populations in summer. Identified by DFO within 100 km of study area.	Spring to fall.
*Harbour Porpoise (Northwest Atlantic population)	*Phocoena phocoena*	COSEWIC: Special Concern SARA: Threatened S4 / Protected pursuant the MMR.	Open ocean over continental shelves and sometimes in bays and harbours.	Summer.
Humpback Whale (NW Atlantic population)	*Megaptera novaeangliae*	COSEWIC: Not at risk S3 / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Not anticipated in assessment area.
Killer Whale (Gulf of St. Lawrence population)	*Orcinus orca*	SNA / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Not anticipated in assessment area.
Long-finned Pilot Whale	*Globicephala melas*	COSEWIC: Not at risk S2S3 / Protected pursuant the MMR.	Coastal marine waters and open ocean. AC CDC record within 82.2 ± 100.0 km	Spring to fall.
North Atlantic Right Whale	*Eubalaena glacialis*	COSEWIC/SARA : Endangered	Coastal marine waters and open ocean.	Spring to fall.

Common Name	Scientific Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status, S Rank and General Status [1]	Habitat Preference and Observations in Vicinity	Timing for Investigation
		S1 / Protected pursuant the MMR.		
Northern Bottlenose Whale (Gulf of St. Lawrence population)	*Hyperoodon ampullatus*	SNA / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Not anticipated in assessment area.
Short-beaked Common Dolphin (Gulf of St. Lawrence population)	*Delphinus delphis*	COSEWIC: Not at risk SNA / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Not anticipated in assessment area.
Sperm Whale	*Physeter macrocephalus*	COSEWIC: Not at risk SNA / Protected pursuant the MMR.	Coastal marine waters and open ocean.	Spring to fall.

[1] Status notes (as of December 2018) - S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common and apparently secure in province; S5: widespread, abundant and demonstrably secure in province, SU: unrankable (lack of info). The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2018a).
Resource: AC CDC data base search
*Resource: OBIS https://obis.org/

Appendix N2

Potential Priority Plant Species

Appendix N2

Potential Priority Plant Species for NPNS Proposed Replacement Effluent Treatment Facility Study Area based on Previous Studies; and 2018 - AC CDC data; and SARA/NS ESA/COSEWIC Listings and Potential Habitat Present

Species	Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status and AC CDC Rank / General Status [1]	Habitat[2] (nearby reference locations)	Flowers[2]
Agalinis paupercula var. borealis	Small-flowered Agalinis	S1	Wet meadows and fields; wetlands. AC CDC record within 12.0 ± 0.0 km.	Late summer.
Amelanchier stolonifera	Running Serviceberry	S3 / Secure	Sandy soils in barrens or boggy areas. AC CDC record within 12.2 ± 2.0 km.	Early June.
Caulophyllum thalictroides	Blue Cohosh	S2 / May be at risk	Deciduous-dominated floodplains and riparian areas. AC CDC record within 13.6 ± 1.0 km.	April into early June.
Chenopodium rubrum	Red Pigweed	S2 / May be at risk	Saltmarshes and beaches. AC CDC record within 3.6 ± 0.0 km.	August to November.
Crataegus robinsonii	Robinson's Hawthorn	S1? / Undetermined	Field edges and thickets. AC CDC record within 7.7 ± 1.0 km.	June.
Cuscuta cephalanthi	Buttonbush Dodder	S2? / Undetermined	Low-lying coastal areas; parasitic. AC CDC record within 7.5 ± 1.0 km.	August and September.
Cyperus lupulinus ssp. macilentus	Hop Flatsedge	S1 / May be at risk	Sandy shorelines. AC CDC record within 3.3 ± 0.0 km.	August to October.
Cypripedium parviflorum	Yellow Lady's-slipper	S2S3 / Sensitive	Grows in calcareous soils, usually in deciduous forest. AC CDC record within 9.9 ± 0.0 km.	Early June.
Cypripedium parviflorum var. pubescens	Yellow Lady's-slipper	S2 / Sensitive	Grows in calcareous soils, usually in deciduous forest. AC CDC record within 9.5 ± 7.0 km.	Early June.
Cypripedium reginae	Showy Lady's-Slipper	S2 / May be at risk	Alkaline swamps and bogs. AC CDC record within 9.8 ± 0.0 km.	June through to August.
Elymus wiegandii	Wiegand's Wild Rye	S1 / May be at risk	Alluvial soils of riparian areas and intervales. AC CDC record within 14.8 ± 1.0 km.	July and August.
Epilobium coloratum	Purple-veined Willowherb	S2? / Sensitive	Low-lying, seepy ground; wetlands. AC CDC record within 10.6 ± 1.0 km.	July to October.
Fraxinus nigra	Black Ash	NS ESA: Threatened S1S2 / At Risk	Poorly draining soils, wet woods; wetlands. Identified by AC CDC as location sensitive species **known** for the study area. AC CDC record within 7.1 km.	May and June.
Hedeoma pulegioides	American False Pennyroyal	S2S3 / Sensitive	Coarse, well-drained soils in open habitats; coastal. AC CDC record within 13.3 ± 5.0 km.	August.
Hudsonia tomentosa	Woolly Beach-heath	S1 / May be at Risk	Sandy coastlines; dunes. AC CDC record within 13 ± 7.0 km.	May to July.
Juncus subcaudatus var. planisepalus	Woods-Rush	S3 / Sensitive	Wet woods, swampy ground; wetlands. AC CDC record within 11.1 ± 5.0 km.	July to October.
Lilium canadense	Canada Lily	S2 / May be at Risk	Wet meadows, floodplains and riverbanks. AC CDC record within 6.7 ± 7.0 km.	July.
Oenothera fruticosa ssp. glauca	Narrow-leaved Evening Primrose	S2 / Undetermined	Abandoned fields, roadsides, edge habitats. AC CDC record within 3.6 ± 7.0 km.	June to August.
Polygala sanguinea	Blood Milkwort	S3 / Sensitive	Poor acidic field, damp slope, open woods/bush. AC CDC record within 13.4 ± 1.0 km.	Late June into October.
Polygonum buxiforme	Small's Knotweed	S2S3 / Undetermined	Sandy soils near the coast. AC CDC record within 12.1 ± 0.0 km.	Late July to October.
Potamogeton richardsonii	Richardson's Pondweed	S2 / May Be At Risk	Lakes and streams in brackish or alkaline water. AC CDC record within 6.8 ± 0.0 km.	July to September.
Rumex maritimus (R. persicarioides var. fueginus)	Sea-side Dock	S3S4 / No rank	Open, coastal sites; saline. AC CDC record within 4.7 ± 0.0 km.	July to October.
Salix pedicellaris	Bog Willow	S2 / Sensitive	Sphagnous substrates of bogs, marshes and swamps.	May to July.

Species	Name	SARA (or COSEWIC*) Status and Sched. and NS ESA Status and AC CDC Rank / General Status [1]	Habitat[2] (nearby reference locations)	Flowers[2]
			AC CDC record within 3.6 ± 7.0 km.	
Sanicula odorata	Clustered Sanicle	S1 / May be at Risk	Alluvial soils of riparian areas and intervales. AC CDC record within 11.1 ± 7.0 km.	July and August.
Suaeda calceoliformis	Horned Sea-blite	S3S4 / Secure	Sandy seashores and saltmarshes. AC CDC record within 3.4 ± 4.0 km.	August to October.
Teucrium canadense	Canada Germander	S3 / Sensitive	Gravelly substrates behind beaches. AC CDC record within 3.2 ± 5.0 km.	July to September.
Triosteum auranticum	Orange-fruited Tinker's Weed	S2S3 / Sensitive	Intervales, riparian areas and limestone slopes. AC CDC record within 13.6 ± 1.0 km.	July.

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[2]. Munro et al. 2014