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NSARB-2025-001-APP-004

EXB 004b

APPLICATION PACKAGE

Volume 2

AQ#0814x, AQ#1430, AQ#1431

Submission to the Nova Scotia Aquaculture Review Board

Nova Scotia Department of Fisheries and Aquaculture

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AQ#0814x, AQ#1430, AQ#1431

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4.0 HISTORICAL DEVELOPMENT PLAN SUBMISSIONS

4.1 Application Forms (2019)

4.1.1 AQ#0814x Application Form (2019)

NOVA SCOTIA

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Received
05 MARS 2019
Fisheries and Aquaculture
Shelburne, NS

Aquaculture Amendment Application

Licence/Lease No: 0814

Applicant Information:

Applicant: We'kogma'q First Nation Contact Person: Donald Davis

Nova Scotia Registry of Joint Stocks Number: _____

Revenue Canada Business Number: [redacted]

Telephone No. (Work): [redacted] (Home): _____ (Cell): [redacted]

Fax No.: [redacted] E-mail: [redacted]

Mailing Address: [redacted]

Whycocomagh, NS Postal Code: B0E 3M0

Civic Address: [redacted]

Whycocomagh, NS Postal Code: B0E 3M0

Amendment Request:

The amendment is requested for: (Check all appropriate boxes)

- ☐ Land-based
- ☑ Marine
- ☐ Marine Plants
- ☑ Finfish
- ☐ Shellfish
- ☐ Other species
- ☐ Change or addition of species
- ☐ Change of culture method
- ☑ Change of site boundaries (for marine applications)
- ☐ Other change

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Provide explanation of change requested. Add additional pages, as required.

See attached

Application Materials

A complete application includes the following:

- Amendment application fee (payable to Minister of Finance) according to Section 77 of the Aquaculture Licence and Lease Regulations for Nova Scotia made under Section 64, Chapter 25 of the Acts of 1996, *the Fisheries and Coastal Resources Act*
- Application Form
- Development Plan according to application
- Report on Public Engagement during Scoping (for adjudicative amendment applications and for other applications as applicable)
- Copy of up-to-date Shareholder's Register which sets out the shareholdings of the company (if applicable)

Public Notice and Disclosure

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Aquaculture Amendment Application Licence/Lease No. 0814

Explanation of change requested:

We'koqma'q First Nation is requesting a boundary amendment to Site 0814 which will allow the replacement of three leases/licences with a single lease of larger total area. The three current sites are #0814 (1.39 ha), #0845 (1.57 ha) and #0600 (1.39 ha). They are all licensed for the marine cage cultivation of Atlantic salmon and rainbow trout. The requested amended site overlays all of these sites, is 75 hectares in size, and includes a navigational corridor. It is located in Whycocomagh Bay, south of the village of Whycocomagh and Indian Island. This request is one part of We'koqma'q's larger plan to expand its trout aquaculture operations in Whycocomagh Bay. This expansion will increase its trout production capacity four fold to 1,000,000 fish per year. We'koqma'q has been successfully conducting rainbow trout aquaculture in this region for seven years, first as a contract grower, and for the past four years as the business owner. The proposed amended site is expected to support the grow-out of 1500 tons of rainbow trout.

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Privacy Statement

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By signing and submitting this form, I acknowledge that I have read, understand, and accept the above statements regarding the collection, use, and disclosure of the information provided on this form.

Signature of Applicant [redacted]

Date Feb 26/2019

Signature of Nova Scotia Department of Fisheries and Aquaculture Designate [redacted]

Date March 5, 2019

Submit completed applications to:

Nova Scotia Department of Fisheries and Aquaculture, Aquaculture Division
1575 Lake Road, Shelburne, NS B0T 1W0
E-mail: aquaculture@novascotia.ca

SCHEDULE A
GPS COORDINATE INFORMATION SHEET

Application #:	0814x		
Applicant:	We'Koqma'q First Nation		
Location:	Whyococomagh Bay	County:	Inverness
Hydrographic Chart:	4278	Orthophoto #:	
Dimensions of site:	See Sketch	Size:	Approx. 65.53 ha

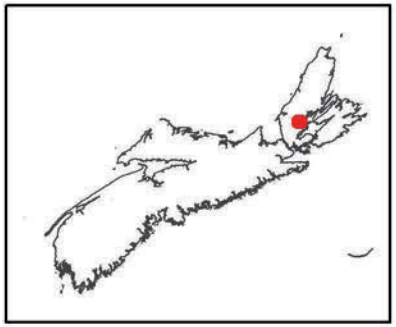
Approximate Coordinates of Application:

Datum used: NAD 83

Centre coordinates (approx.) Lat. 45° 56' 56.14"
Long. -61° 07' 38.64"

Corner #1	Lat.	45° 57' 15.95"	Corner #2	Lat.	45° 57' 08.35"
	Long.	-61° 07' 29.08"		Long.	-61° 07' 32.09"
Corner #3	Lat.	45° 57' 05.34"	Corner #4	Lat.	45° 56' 58.61"
	Long.	-61° 07' 38.06"		Long.	-61° 07' 55.83"
Corner #5	Lat.	45° 56' 51.98"	Corner #6	Lat.	45° 56' 50.99"
	Long.	-61° 08' 08.90"		Long.	-61° 08' 09.02"
Corner #7	Lat.	45° 56' 49.28"	Corner #8	Lat.	45° 56' 36.92"
	Long.	-61° 08' 13.20"		Long.	-61° 08' 02.06"
Corner #9	Lat.	45° 56' 52.60"	Corner #10	Lat.	45° 56' 54.18"
	Long.	-61° 07' 26.22"		Long.	-61° 07' 22.73"
Corner #11	Lat.	45° 57' 03.39"	Corner #12	Lat.	45° 57' 11.47"
	Long.	-61° 07' 01.69"		Long.	-61° 07' 18.88"
Corner #13	Lat.	45° 57' 13.33"			
	Long.	-61° 07' 23.09"			

NOTE: THESE COORDINATES ARE NOT FROM A LEGAL SURVEY.

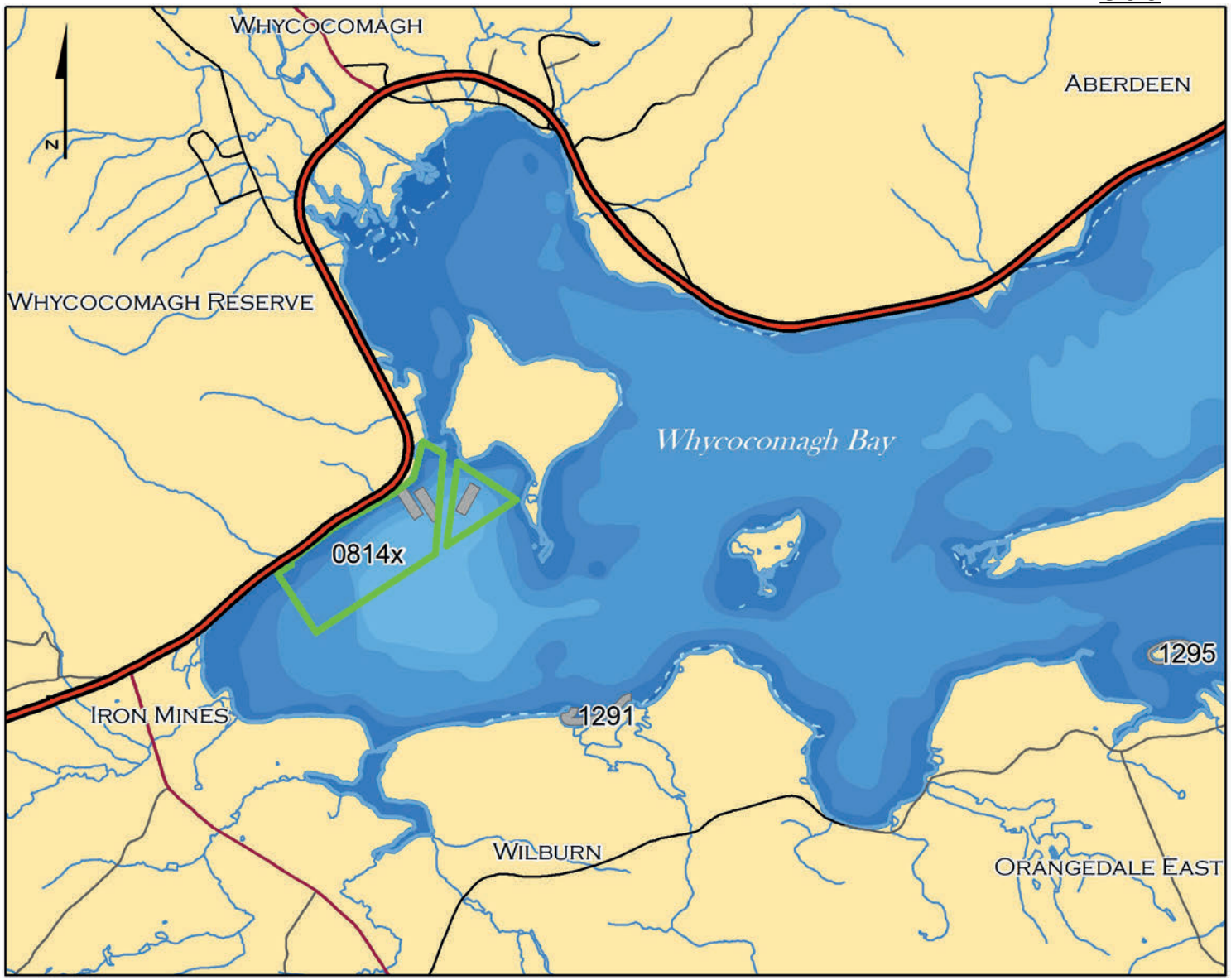


Aquaculture Site

0814x

Centre	
Lat 45° 56' 56.14"	**Long -61° 07' 38.64"**
Corner 1	
Lat 45° 57' 15.95"	**Long -61° 07' 29.08"**
Corner 2	
Lat 45° 57' 08.35"	**Long -61° 07' 32.09"**
Corner 3	
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Corner 4	
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Corner 6	
Lat 45° 56' 50.99"	**Long -61° 08' 09.02"**
Corner 7	
Lat 45° 56' 49.28"	**Long -61° 08' 13.20"**
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Lat 45° 56' 36.92"	**Long -61° 08' 02.06"**
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Corner 10	
Lat 45° 56' 54.18"	**Long -61° 07' 22.73"**
Corner 11	
Lat 45° 57' 03.39"	**Long -61° 07' 01.69"**
Corner 12	
Lat 45° 57' 11.47"	**Long -61° 07' 18.88"**
Corner 13	
Lat 45° 57' 13.33"	**Long -61° 07' 23.09"**

DATUM NAD 83
The above coordinates
are not from a legal survey



Application Information

Proponents : We'Koqma'q First Nation
Site Location : Whyococomagh Bay
Dimensions : See Sketch
Area : Approx. 65.53 ha

Proposed Application
Other Issued Lease
Other Proposed Lease
OMHW Mark
Low Water Mark

Species: Rainbow Trout

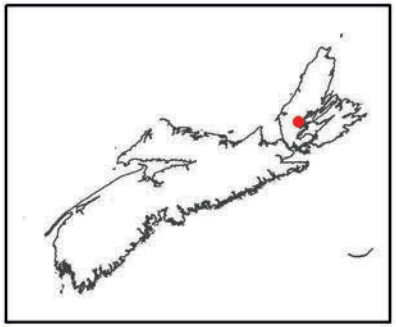
Chart No.
4278

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Fisheries and Aquaculture

Disclaimer

This map should not be used for navigation or legal purposes. It is intended for general reference use only.

MK-0814x-APR-2019

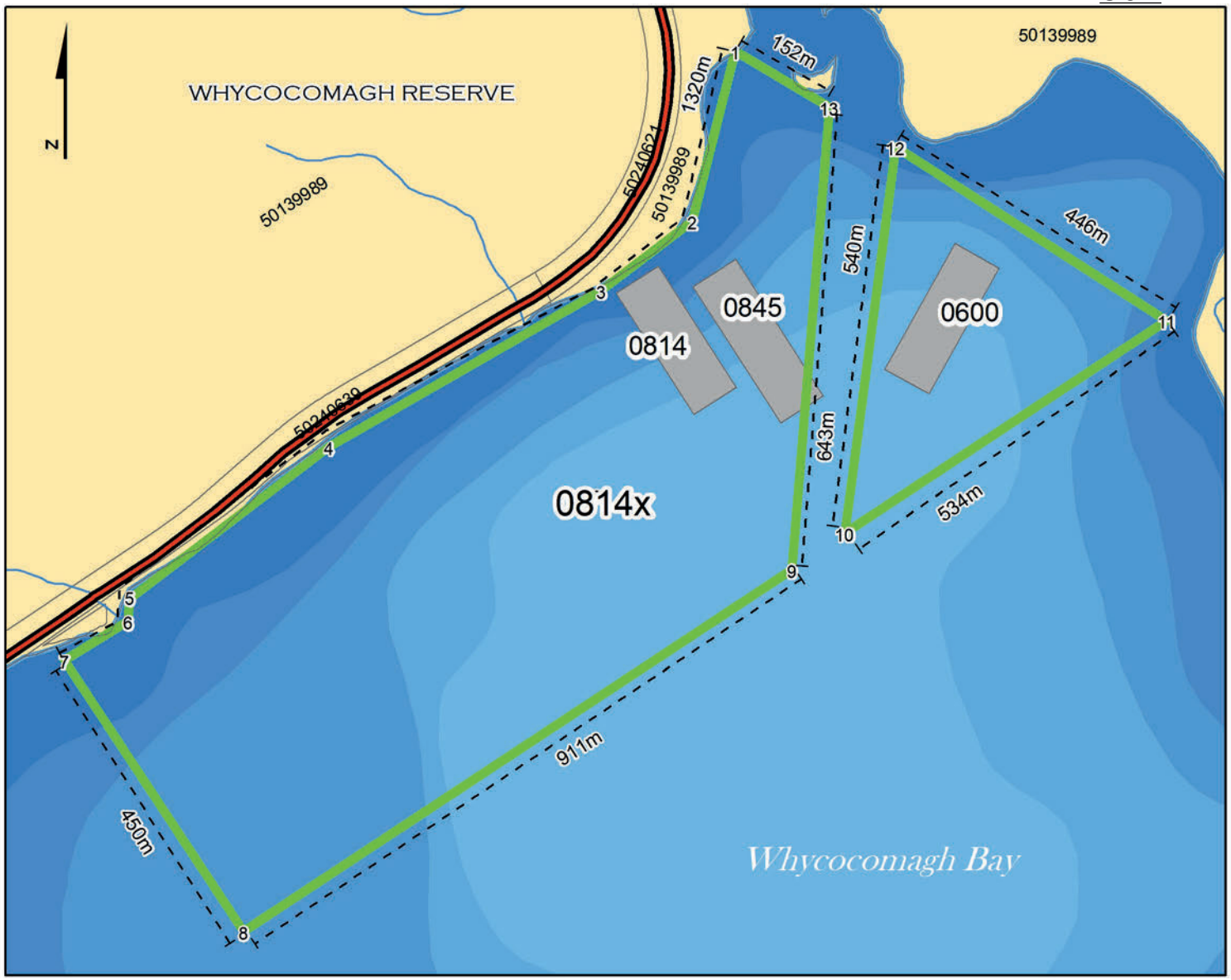


Aquaculture Site

0814x

Centre
Lat 45° 56' 56.14" Long -61° 07' 38.64"
Corner 1
Lat 45° 57' 15.95" Long -61° 07' 29.08"
Corner 2
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Corner 3
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Corner 4
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Lat 45° 56' 50.99" Long -61° 08' 09.02"
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Corner 13
Lat 45° 57' 13.33" Long -61° 07' 23.09"

DATUM NAD 83
The above coordinates
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Application Information

Proponents : We'Koqma'q First Nation
Site Location : Whycocomagh Bay
Dimensions : See Sketch
Area : Approx. 65.53 ha

Proposed Application
Other Issued Lease
Other Proposed Lease
OMHW Mark
Low Water Mark

Species: Rainbow Trout

Chart No.
4278

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Fisheries and Aquaculture

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4.1.2 AQ#1430 Application Form (2019)

NOVA SCOTIA

NORTH ABERDEEN AQ 1430

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Received

05 MARS 2019

Fisheries and Aquaculture
Shelburne, NS

Aquaculture Licence/Lease Application

Applicant Information:

Applicant: We'kogma'q First Nation Contact Person: Donald Davis

Nova Scotia Registry of Joint Stocks Number: _____

Revenue Canada Business Number: [redacted]

Telephone No. (Work): [redacted] (Home): _____ (Cell): [redacted]

Fax No.: [redacted] E-mail: [redacted]

Mailing Address: [redacted]

Whycocomagh, NS Postal Code: B0E 3M0

Civic Address: [redacted]

Whycocomagh, NS Postal Code: B0E 3M0

Proposed Site Information:

Location of Site: North Aberdeen Whycocomagh Bay County: Inverness Site Size (Ha): 3+

Site Dimensions: 370x895

Hydrographic Chart No.: CHS Chart No. 4278

Approximate Center Coordinates: Latitude: 45°58'41.78"

Longitude: -61°01'28.51"

Type of Licence Application

(Check appropriate boxes):

☑ Commercial licence/lease
☐ Experimental licence/lease

☐ Marine Plants ☑ Finfish ☐ Shellfish ☐ Other

Submit completed applications to: **Nova Scotia Department of Fisheries and Aquaculture, Aquaculture Division**
1575 Lake Road, Shelburne, NS B0T 1W0
E-mail: aquaculture@novascotia.ca

- ☐ Land-based
  - ☐ Freshwater
  - ☐ Saltwater
  - ☐ U-Fish
  - ☐ Hatchery
  - ☐ Nursery Facility
  - ☐ Growout
- ☑ Marine
  - ☑ Cage culture
  - ☐ Suspended shellfish or marine plants
  - ☐ Bottom shellfish with gear
  - ☐ Bottom shellfish without gear

Application Materials

A complete application includes the following:

- Application fee (payable to Minister of Finance) according to Section 77 of the Aquaculture Licence and Lease Regulations for Nova Scotia made under Section 64, Chapter 25 of the Acts of 1996, *the Fisheries and Coastal Resources Act*
- Application Form
- Development Plan according to application
- Report on Public Engagement during Scoping (for all Marine applications and for other applications, as applicable)
- Copy of up-to-date Shareholder's Register which sets out the shareholdings of the company (if applicable, and if not already provided during the Option to Lease application process.

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Signature of Applicant

[redacted]

Date

Feb 26/2019

Signature of Nova Scotia Department of Fisheries and Aquaculture Designate

[redacted]

Date

March 5, 2019

SCHEDULE A
GPS COORDINATE INFORMATION SHEET

Application #:	1430		
Applicant:	We'Koqma'q First Nation		
Location:	Whyococomagh Bay	County:	Inverness
Hydrographic Chart:	4278	Orthophoto #:	
Dimensions of site:	Approx. 860m x 433m x 898m 362m	Size:	Approx. 34.90 ha

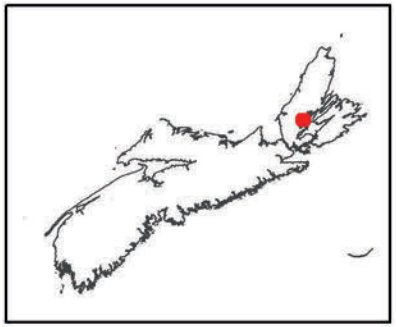
Approximate Coordinates of Application:

Datum used: NAD 83

Centre coordinates (approx.) Lat. 45° 58' 41.78"
Long. -61° 01' 28.51"

Corner #1	Lat.	45° 58' 30.40"	Corner #2	Lat.	45° 58' 40.40"
	Long.	-61° 01' 42.65"		Long.	-61° 01' 51.51"
Corner #3	Lat.	45° 58' 54.40"	Corner #4	Lat.	45° 58' 41.78"
	Long.	-61° 01' 14.92"		Long.	-61° 01' 06.14"

NOTE: THESE COORDINATES ARE NOT FROM A LEGAL SURVEY.

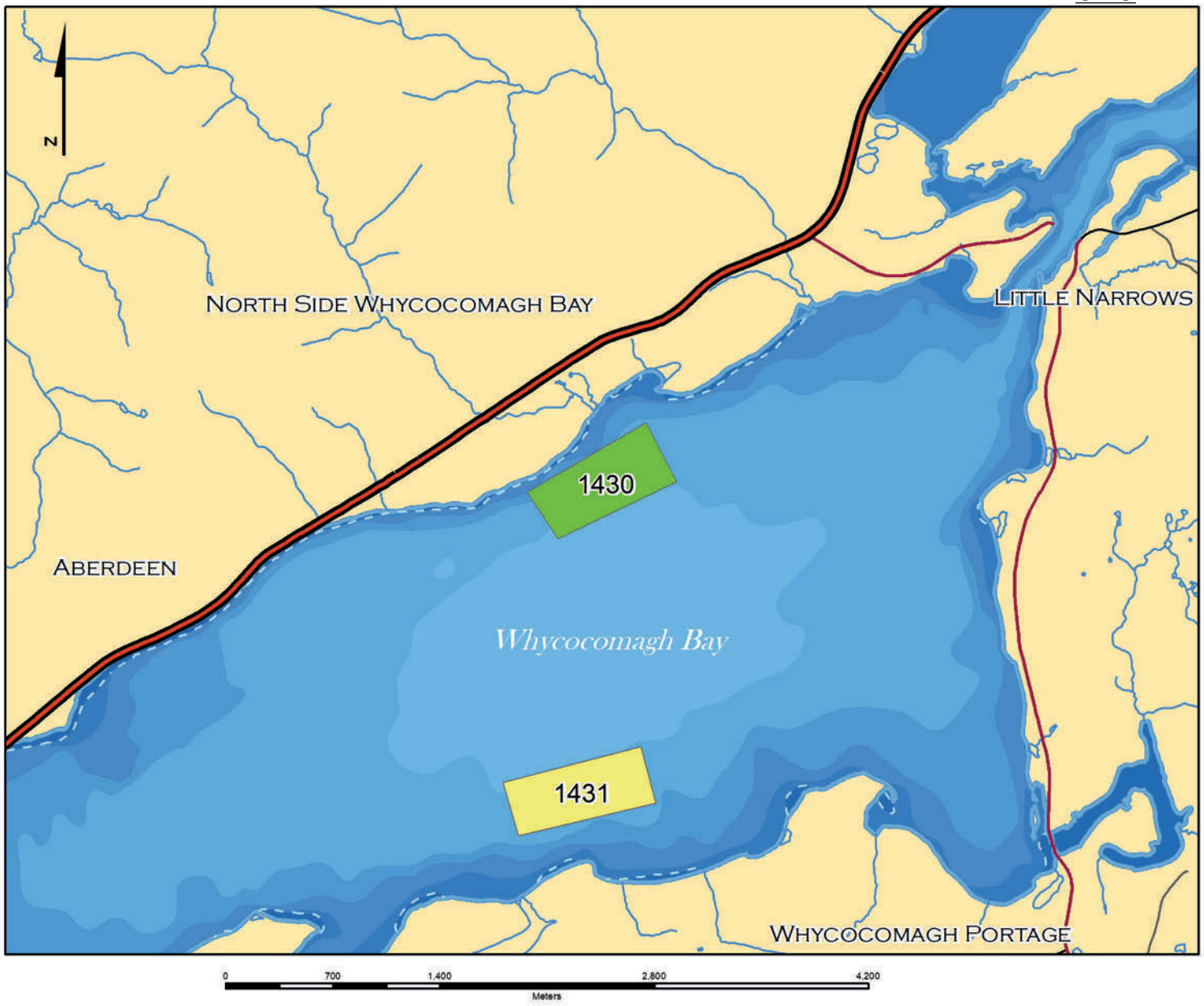


Aquaculture Site

1430

Centre
Lat 45° 58' 41.78" Long -61° 01' 28.51"
Corner 1
Lat 45° 58' 30.40" Long -61° 01' 42.65"
Corner 2
Lat 45° 58' 40.40" Long -61° 01' 51.51"
Corner 3
Lat 45° 58' 54.40" Long -61° 01' 14.92"
Corner 4
Lat 45° 58' 41.78" Long -61° 01' 06.14"

DATUM NAD 83
The above coordinates
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Application Information

Proponents : We'Koqma'q First Nation
Site Location : Whyocomagh Bay
Dimensions : Approx. 860m x 433m x 898m x 362m
Area : Approx. 34.90 ha

Proposed Application
Other Issued Lease
Other Proposed Lease
OMHW Mark
Low Water Mark

Species: Rainbow Trout

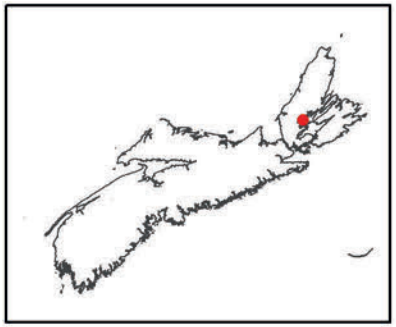
Chart No.
4278

NOVA SCOTIA
Fisheries and Aquaculture

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MK-1430-APR-2019

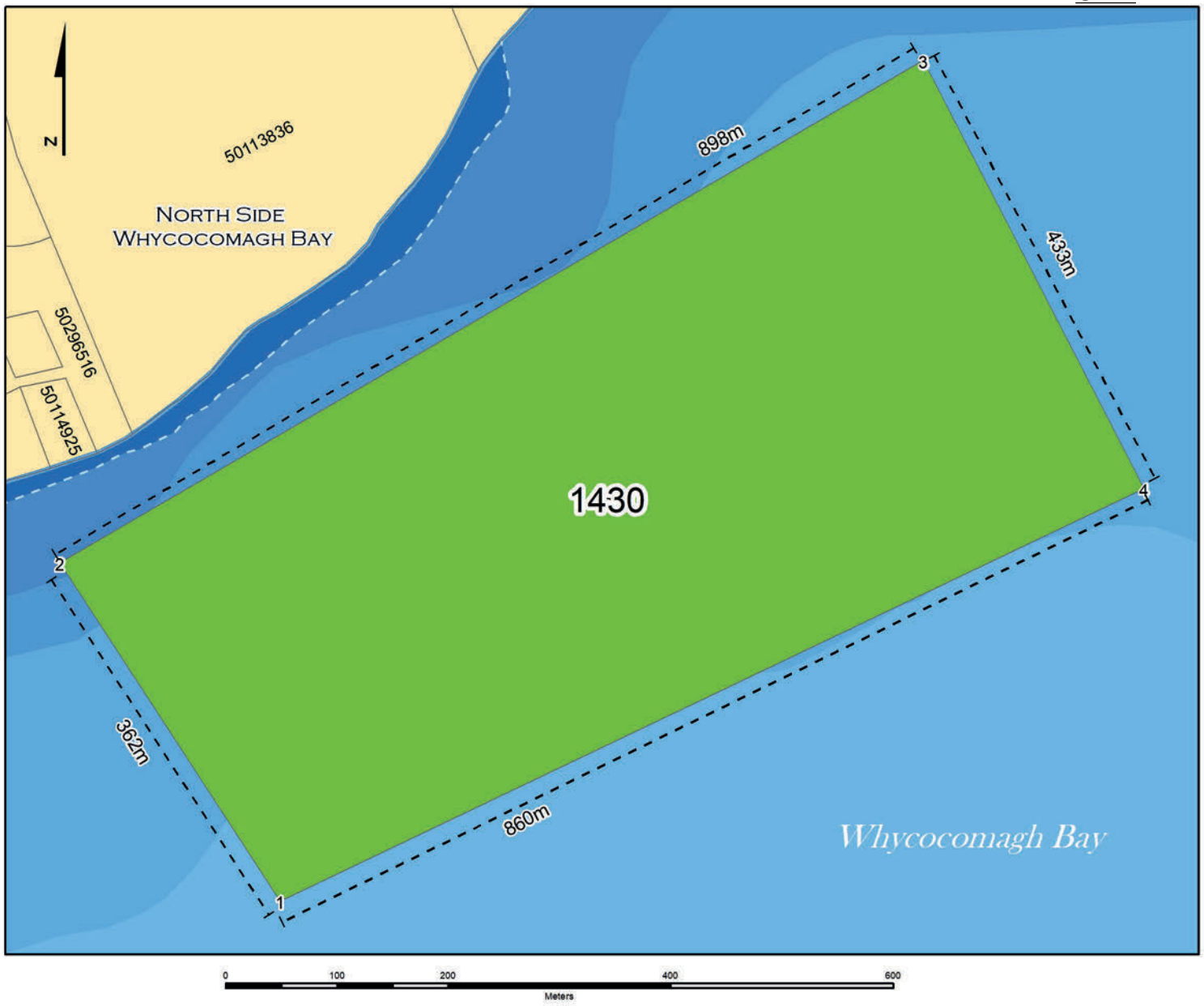


Aquaculture Site

1430

Centre
Lat 45° 58' 41.78" Long -61° 01' 28.51"
Corner 1
Lat 45° 58' 30.40" Long -61° 01' 42.65"
Corner 2
Lat 45° 58' 40.40" Long -61° 01' 51.51"
Corner 3
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Corner 4
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Application Information

Proponents : We'Koqma'q First Nation
Site Location : Whycocomagh Bay
Dimensions : Approx. 860m x 433m x 898m x 362m
Area : Approx. 34.90 ha

Proposed Application
Other Issued Lease
Other Proposed Lease
OMHW Mark
Low Water Mark

Species: Rainbow Trout

Chart No.
4278

NOVA SCOTIA
Fisheries and Aquaculture

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MK-1430-APR-2019

4.1.3 AQ#1431 Application Form (2019)

NOVA SCOTIA

Office Use Only 516
AQ 1431
Received
05 MARS 2019
Fisheries and Aquaculture
Shelburne, NS

Aquaculture Licence/Lease Application

Applicant Information:

Applicant: We'Kogma'g First NATION Contact Person: DONALD DAVIS

Nova Scotia Registry of Joint Stocks Number: _____

Revenue Canada Business Number: [redacted]

Telephone No. (Work): [redacted] (Home): _____ (Cell): [redacted]

Fax No.: [redacted] E-mail: [redacted]

Mailing Address: [redacted]

Whycocomagh, N.S. B0E 3M0 Postal Code: B0E 3M0

Civic Address: [redacted], Waycobah, N.S.

_____ Postal Code: B0E 3M0

Proposed Site Information:

Location of Site: South Aberdeen, Whycocomagh Bay County: Inverness Site Size (Ha): 34

Site Dimensions: 930m x 370m

Hydrographic Chart No.: CHS Chart No. 4278

Approximate Center Coordinates: Latitude: 45°57'38.14"

Longitude: -61°01'28.51"

Type of Licence Application

(Check appropriate boxes):

☑ Commercial licence/lease
☐ Experimental licence/lease

☐ Marine Plants ☑ Finfish ☐ Shellfish ☐ Other

Submit completed applications to: **Nova Scotia Department of Fisheries and Aquaculture, Aquaculture Division**
1575 Lake Road, Shelburne, NS B0T 1W0
E-mail: aquaculture@novascotia.ca

- ☐ Land-based
  - ☐ Freshwater
  - ☐ Saltwater
  - ☐ U-Fish
  - ☐ Hatchery
  - ☐ Nursery Facility
  - ☐ Growout
- ☑ Marine
  - ☑ Cage culture
  - ☐ Suspended shellfish or marine plants
  - ☐ Bottom shellfish with gear
  - ☐ Bottom shellfish without gear

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Signature of Applicant [redacted]

Date Feb 26, 2019

Signature of Nova Scotia Department of Fisheries and Aquaculture Designate [redacted]

Date March 5, 2019

SCHEDULE A
GPS COORDINATE INFORMATION SHEET

Application #:	1431		
Applicant:	We'Koqma'q First Nation		
Location:	Whyococomagh Bay	County:	Inverness
Hydrographic Chart:	4278	Orthophoto #:	
Dimensions of site:	Approx. 927m x 381m x 921m 364m	Size:	Approx. 34.42 ha

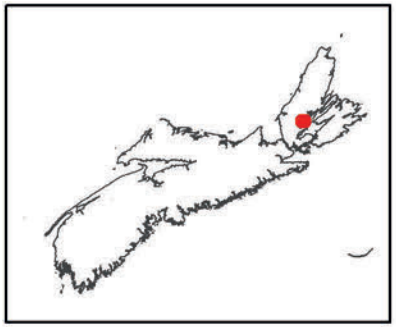
Approximate Coordinates of Application:

Datum used: NAD 83

Centre coordinates (approx.) Lat. 45° 57' 36.55"
Long. -61° 01' 37.23"

Corner #1	Lat.	45° 57' 39.10"	Corner #2	Lat.	45° 57' 45.90"
	Long.	-61° 02' 01.01"		Long.	-61° 01' 19.05"
Corner #3	Lat.	45° 57' 33.90"	Corner #4	Lat.	45° 57' 27.70"
	Long.	-61° 01' 14.86"		Long.	-61° 01' 56.71"

NOTE: THESE COORDINATES ARE NOT FROM A LEGAL SURVEY.

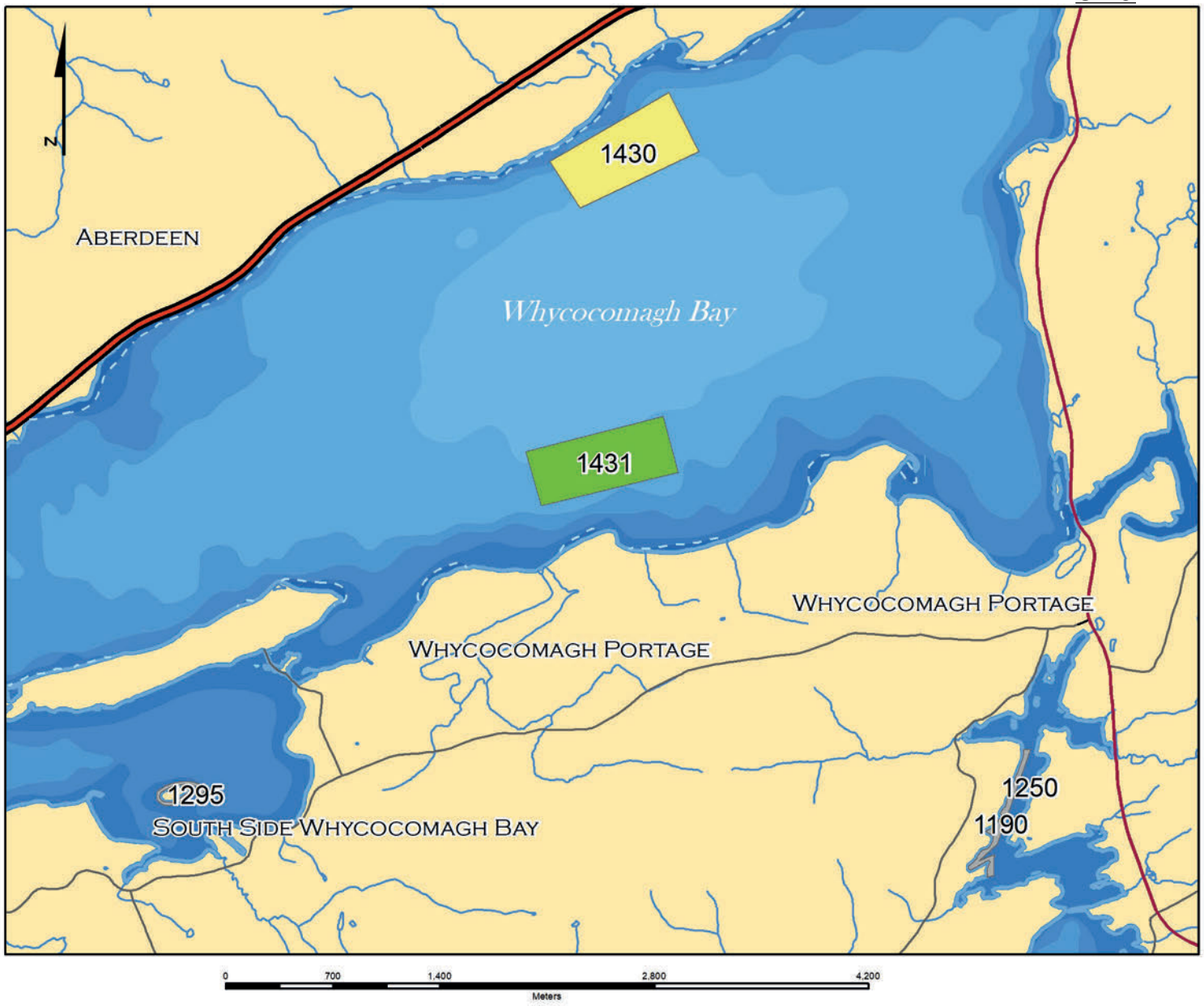


Aquaculture Site

1431

Centre
Lat 45° 57' 36.55" Long -61° 01' 37.23"
Corner 1
Lat 45° 57' 39.10" Long -61° 02' 01.01"
Corner 2
Lat 45° 57' 45.90" Long -61° 01' 19.05"
Corner 3
Lat 45° 57' 33.90" Long -61° 01' 14.86"
Corner 4
Lat 45° 57' 27.70" Long -61° 01' 56.71"

DATUM NAD 83
The above coordinates
are not from a legal survey



Application Information

Proponents : We'Koqma'q First Nation
Site Location : Whycocomagh Bay
Dimensions : Approx. 927m x 381m x 921m x 364m
Area : Approx. 34.42 ha

Proposed Application
Other Issued Lease
Other Proposed Lease
OMHW Mark
Low Water Mark

Species: Rainbow Trout

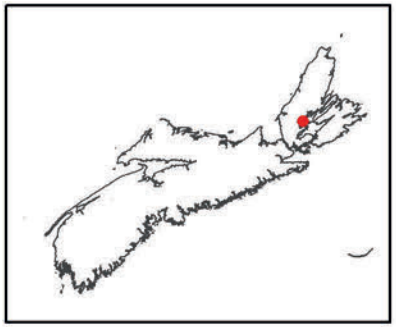
Chart No.
4278

NOVA SCOTIA
Fisheries and Aquaculture

Disclaimer

This map should not be used for navigation or legal purposes. It is intended for general reference use only.

MK-1431-APR-2019

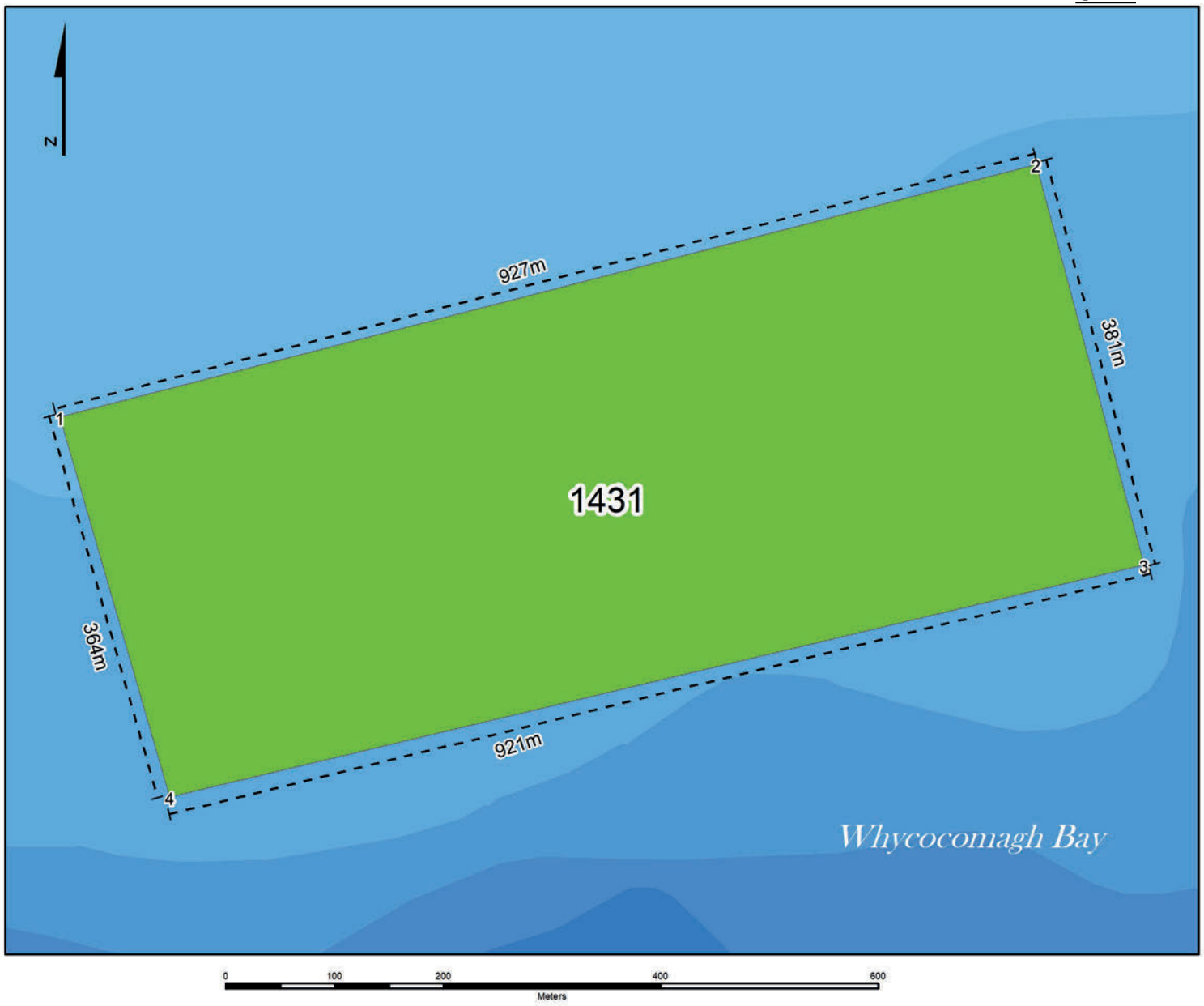


Aquaculture Site

1431

Centre
Lat 45° 57' 36.55" Long -61° 01' 37.23"
Corner 1
Lat 45° 57' 39.10" Long -61° 02' 01.01"
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DATUM NAD 83
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OMHW Mark
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MK-1431-APR-2019

4.2 Development Plans (2019)

4.2.1 AQ#0814x Development Plan (2019)

Whycocomagh Bay Boundary Amendment Lease #0814 Development Plan

SECTION 1: THE OPTIMUM USE OF MARINE RESOURCES

We'koqma'q First Nation is requesting a boundary amendment to Site 0814 which will allow the replacement of three leases/licences with a single lease of larger total area. The three current sites are #0814 (1.39 ha), #0845 (1.57 ha) and #0600 (1.39 ha). They are all licensed for the marine cage cultivation of Atlantic salmon and rainbow trout. The requested amended site overlays all of these sites, is 75 hectares in size, and includes a navigational corridor. It is located in Whycocomagh Bay, south of the village of Whycocomagh and Indian Island. This request is one part of We'koqma'q's larger plan to expand its trout aquaculture operations in Whycocomagh Bay. This expansion will increase its trout production capacity four fold to 1,000,000 fish per year. We'koqma'q has been successfully conducting rainbow trout aquaculture in this region for seven years, first as a contract grower, and for the past four years as the business owner. The proposed amended site is expected to support the grow-out of 1500 tons of rainbow trout.

The proposed site will require 30 full time positions directly while supporting the sustainability of We'koqma'q's finfish operations as a whole by increasing use of its local infrastructure, including a processing plant, a land-based storage facility, management offices and farm management software. The finfish operations are expected to employ 70 people when all proposed sites are functional. It will also promote the installation of new infrastructure and investment in new equipment, for not only the marine finfish cage operations, but also for We'koqma'q's processing plant and hatchery.

An examination of the habitat below the proposed site, published studies from the area and knowledge collected during scoping of the proposed activities suggest that this development can proceed in harmony with fishery activities in the public waters surrounding the proposed aquacultural operation. Management measures will be in place to mitigate the most significant risks of marine finfish aquaculture to the environment, these being fish escape, disease and biosecurity, and benthic environmental impacts. These measures will be supplemented by partnering on a research project aimed to tailor and improve environmental monitoring of We'koqma'q's finfish aquaculture activities.

The oceanographic and biophysical characteristics of the public waters surrounding the aquaculture operation were reviewed. This included data collected within the scoping activities, published studies, as well as the local knowledge and extensive experience of employees and contractors of the company. This information supports the feasibility of a finfish aquaculture operation at the proposed site and provides the best knowledge to inform a site design. This knowledge is also being used to develop the procedures and production plans for the site.

Consideration and respect for the other users of the public waters surrounding the site will be demonstrated by We'koqma'q's responsible farm practices which include high standards for site maintenance, noise reduction, and waste management. It is the intent of We'koqma'q for the

other users of the waters to see the finfish aquaculture site as an opportunity for the region rather than a negative development. Risks to wildlife users of the region will be mitigated via the management measures intended to reduce risk of fish escape, disease and biosecurity, and benthic environmental impacts mentioned previously. These will be further supplemented with a wildlife interaction plan that recognizes the most susceptible wildlife of the region.

A Notice of Works application accompanies this development plan. Outcomes from Transport Canada's assessment will be applied to ensure the public right of navigation through compliance with the Navigation Protection Act. A navigational corridor that bisects the site is proposed.

The region is one of a handful of regions in Nova Scotia where Atlantic salmon populations still exist. It is also the region that has experienced the longest history of rainbow trout aquaculture. The mitigation measures intended to reduce risk of fish escape, disease and biosecurity, and benthic environmental impacts mentioned previously; and the forward-looking environmental monitoring research We'koqma'q is a partner on should ensure the continued successful coexistence of wild Atlantic salmon with We'koqma'q's rainbow trout operations. Furthermore, there is environmental and oceanographic data collection in the bay being conducted by other researchers that is supported by We'koqma'q which is intended to improve understanding of the local ecosystem as a whole, as well as more broadly with regards to global warming. Although there is no direct intent to use this data to support Atlantic salmon conservation measures, an increased understanding of the environment will contribute to conservation practices in general.

With regards to the number and productivity of other aquaculture sites in the public waters surrounding the proposed aquacultural operation, We'koqma'q is currently the only aquaculture producer in Whycocomagh Bay and will manage its farms as a collective in order to ensure that fish health risks and environmental impacts are minimized. Having an increased number of sites will allow an operational expansion to proceed while availing enough area to increase fallowing.

This site is one request of several that will enable a sustainable expansion of We'koqma'q's finfish aquaculture operations. Activities will contribute to economic development of We'koqma'q First Nation and the local region in general. Site location considerations and mitigation practices will reduce impacts to other users of the local waters, including the fishery, wildlife (including Atlantic salmon), local residents, and seasonal visitors. This includes the public right to navigation. Ongoing environmental monitoring along with research assessing carrying capacity for Whycocomagh Bay should ensure that these practices are effective now, and in the future. Therefore, because of the expected minimal negative impacts and anticipated positive impacts described according to the factors to be considered in decisions related to marine aquaculture sites, this request should represent an optimum use of marine resources.

SECTION 2: THE CONTRIBUTION OF THE PROPOSED OPERATION TO COMMUNITY AND PROVINCIAL ECONOMIC DEVELOPMENT

2.1 Production plan

Species: Rainbow trout.

Maximum site biomass (kg): 1,500,000 kg

Maximum cage density during grow out period (kg/m^3): 18 kg/m^3. Normal operating density will be <15 kg/m^3

Expected time to achieve maximum production: 5 months from stocking

Size(s) of cages, including net volumes (m^3): 60 m polar circle; 6 m depth; 1,700m^3 per cage

Maximum cage number, maximum total net volume (m^3): 6 arrays of 8 cages = 81,600m^3

Maximum number of fish per cage during grow out period: 15,000

Intended initial stocking date and seed source: The existing leases are currently stocked. Additional stocks will be received in May 2019, from Big Falls Hatchery (AQ # 1028).

Expected grow out period: Fish will be stocked in spring and fall and grown to 2 kg. This will require a grow-out period of 5 to 10 months, depending on stocking time. Harvesting will be conducted year round.

Expected fallow period: Cages will be moved around the lease, with parts of the lease left fallow, according to results from environmental monitoring. The lease has been sized to allow ample movement of the cage arrays within the lease boundaries so that fallowing of sections within the lease can easily occur.

Additional notes: This request represents one of several new or amended sites planned for We'koqma'q's finfish aquaculture operations. We'koqma'q is expanding its infrastructure and assets in order to accommodate a planned expansion in production capacity to over 1,000,000 fish per year. A summary of the overall expected plans for sites can be found in Section 8.1.

2.2 Infrastructure

This site is to be serviced by We'koqma'q's facilities in and around Whycocomagh and Aberdeen. These services include the land-based facilities for holding and managing nets and feed in Whycocomagh; barges, boats and vehicles based in Whycocomagh; management offices at the We'koqma'q Band office; a FishTalk farm management database housed at the We'koqma'q Band office; and the CFIA registered processing facility in Aberdeen. Additional investments in infrastructure and equipment are occurring in conjunction with the site requests, of which this site is only one of a part, as explained above. These investments include the addition of a deboning machine and active trimming line as well as a packaging storage building for the processing plant; the addition of a winter harvest system and oxygenation system for the cage operations; and the addition of equipment, including new cages, nets, a net cleaner and forklift, among other smaller requirements. The addition of a new wharf toward the east end of Whycocomagh is also planned along with the purchase of a new barge to service new sites in the east end of Whycocomagh Bay that have been requested in other applications.

We'koqma'q recently acquired Big Falls Fish Growers in Wolfville, NS, in order to increase juvenile production to service the intended increased capacity of the sea cage aquaculture operations. This facility (Big Falls) is undergoing significant upgrades to enable it to better meet the need the demands of the sea cage operations.

2.3 Services and suppliers

Increased local (NS) service requirements in terms of contractors (welders, carpenters, others) and suppliers of general merchandise will be necessary to support the expanded operations. These requirements are anticipated to increase at the same scale of the operations – four fold – when all of the planned sites are in operation. Processing will occur at We'koqma'q's facility in Aberdeen, NS, upgraded as described above. Juveniles will come from the improved Big Falls Hatchery in Wolfville, NS, described above. Feed will continue to be purchased from outside of the province (Skretting in NB) because of the requirement that the feed mill be BAP certified in order to assist We'koqma'q's goal of achieving four-star BAP certification. Eggs will be purchased from international suppliers since there is no local supply. The development of a local broodstock is under investigation and achieving a critical production mass will be critical for its success.

2.4 Employment

This site will directly require 30 persons to operate. These employees will consist of a site manager, feeders, and site technicians. Putting this site into use will also improve the security of employment of the rest of the employees of We'koqma'q since it will optimize the use of the processing facility in Aberdeen, NS, hatchery in Wolfville, NS, land-based storage facility in Whycocomagh, NS, as well as the maintenance personnel for the finfish operations and the management and data entry personnel at the We'koqma'q First Nation Band Office.

As stated previously, this site represents one of several site requests made to support We'koqma'q's finfish aquaculture operations. In total, We'koqma'q's planned expansion activities are expected to require 70 direct employees over the next year.

2.5 Other economic contributions to the local community and Province

Fulfillment of the amendment request will promote the success of We'koqma'q's expansion plans. This has ramifications for several proposed new sites and existing sites in the Aberdeen and Whycocomagh area.[1] A summary of the overall expected plans for sites can be found in Section 8.1.

Spin off economic benefits to the local communities would be expected to occur. A recent report on the economic impact of aquaculture in Nova Scotia indicates that 1.55 indirect jobs result from every person directly employed at an aquaculture operation (Foster, 2019).

2.6 Financial viability

We'koqma'q's business development plan has been submitted as a separate document.

[1] The potential economic benefits to the area was brought up during scoping. See page 5 of Report on Public Engagement During Scoping.

2.7 Adverse economic impacts

There are no adverse economic impacts expected from fulfillment of this request.

SECTON 3: FISHERIES ACTIVITIES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

3.1 Status of fisheries activities

Recreational fishery

Trout

(Reference: https://novascotia.ca/fish/documents/Anglers-Handbook-2018.pdf)

The aquaculture site is located in NS Recreational Fishing Area 1: Cape Breton, Inverness, Richmond and Victoria Counties, specifically within the Bras D'Or Lake. Here the speckled (brook) trout, brown trout and rainbow trout recreational fishing season is open in the tidal waters of the Bras D'Or Lake, including Whycocomagh Bay in which the site is located, from April 1 to September 30 with some restrictions (no speckled trout September 1 to September 30). Skye River which feeds into the subwatershed of Whycocomagh Bay of the Bras D'Or within 2 km of the site is open for the same period. Other major recreational fishing rivers in the area feed into different subwatersheds. These include River Denys which feeds into the Denys Basin, and Middle River and Baddeck River which feed into the St. Patricks Channel. River Denys, Middle and Baddeck Rivers are Special Trout Management Areas with minimum size and bag limits. For further reference, the locations of these rivers are shown on a map in Section 7.1.

A resident population of rainbow trout exists in the Bras D'Or Lake area. This is enhanced every year by the release of juveniles reared in Provincial hatcheries to support the above described rainbow trout sport fishery.

Non-salmonid species

(Reference: https://novascotia.ca/fish/documents/Anglers-Handbook-2018.pdf)

Recreational fishing for the following species is also conducted in the Bras D'Or Lake: smallmouth (black) bass, white perch, yellow perch, brown bullhead, white sucker, chain pickerel, lake whitefish, striped bass, shad, gaspereau, smelt, and eel.

Atlantic salmon

(Reference: CSAS Science Response 2017/20)

The site is located within Salmon Fishing Area 19. There is no recreational salmon fishing permitted in Whycocomagh Bay, where the site is located. The Middle and Baddeck Rivers, which feed into the Bras D'Or to an adjacent subwatershed (St. Patricks Channel), have an open catch and release fall season for Atlantic salmon. Social and Ceremonial (FSC) allocations are also available on these rivers. For more discussion on this site and these rivers relative to the salmon populations, see Section 7.

Commercial Fishery

Historically, the Bras D'Or Lake has supported some limited fisheries activities. The bottom trawl fishery was banned in the Bras D'Or Lake in 1992. The local herring fishery closed in 1999. This left only lobster and oyster fishing.

Lobster

In 2016, there were 14 licences for commercial lobster fishing in the Bras D'Or Lake (Lobster Fishing Area (LFA) 28), with a trap limit of 250 and a minimum legal size limit of 84mm. The season runs annually from April 30 to June 30.

Historical landings from LFA 28 are shown in Figure 1.

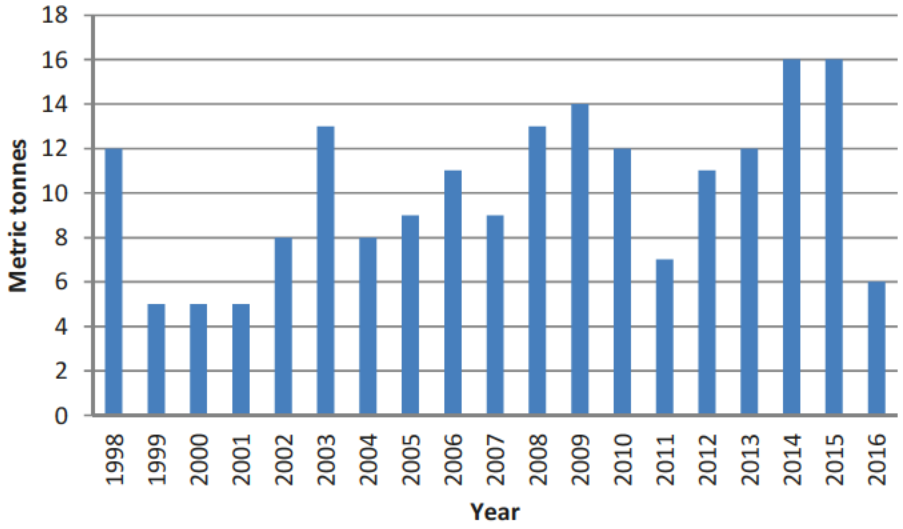


Figure 1: Historical lobster landings from LFA 28 (the Bras D'Or Lake). Graph generated from 2017 Stock Status Update (DFO, 2017).

The lobster industry in LFA 28 is small relative to that of Nova Scotia in general. The mean landings for 2013-2015 for LFA 28 represent 0.8% of the mean landings for Nova Scotia for the same period, as calculated from data within the 2017 Stock Status Update (DFO, 2017).

Oyster

Oysters were an important harvest for local Mi'kmaw and, likely, non-native settlers of the Bras D'Or Lake region (Tremblay et al., 2002). Traditional knowledge of the area indicates that oyster populations were all along the north, west, and south west coasts of Whycocomagh Bay at one time (Eskasoni Fish and Wildlife Commission and Dept. of Fisheries and Oceans. 1996, cited not seen). However, populations declined due to over-fishing, degradation of habitats and the appearance of the MSX parasite (*Haplosporidium nelsonii)* in 2002 (Stephenson et al., 2003).

Traditional Mi'kmaq Fishery

We'koqma'q First Nation has traditionally fished in Whycocomagh Bay for a number of species including cod, hake, smelts, trout (speckled and brown), herring, mackerel, gaspereau, cod, eels, flounder, lobster, softshell clams, mussels and oysters. Currently, smelts, trout (speckled, brown and rainbow), eels, winter flounder, striped bass, softshell clams, mussels and oysters are fished (Joe Googoo, We'koqma'q Elder, personal communication).

3.2 Impacts on fisheries activities

Recreational

Trout

Although rainbow trout are not indigenous to the Bras d'Or Lake area, it has a resident population that has developed from stocking efforts for the sport fishery, with the first trout introduced in 1899. These introduced fish have been shown to be successfully reproducing in some regions in the wild and are contributing to the fishery numbers (Madden et al., 2010). Rainbow trout continue to be stocked by the Province through an enhancement program. Other trout populations do not seem to be affected by this enhancement, as exemplified by the fact that speckled trout populations are thought to be recovering in the Whycocomagh area (CEPI, 2006; Joe Googoo, We'koqma'q Elder, personal communication).

Rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the trout fishery have not been raised. Anglers of the area have historically been supportive of the trout operations. Recently, Robin Stuart of We'koqma'q was approached to collaborate with anglers to increase rainbow populations in the lake[2].

We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

The successful historical co-existence of the recreational trout fishery with trout aquaculture operations combined with We'koqma'q's intended enhanced management procedures suggest that there will be minimal impacts on the recreational trout fishery.

Non-salmonid species

As stated for the recreational trout fishery, rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the sport fishery have not been raised. As also stated previously, We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

Because of the successful historical co-existence of rainbow trout aquaculture operations with the sport fishery and the enhanced fishery risk mitigation efforts, there are no impacts on recreational fisheries activities anticipated for any species.

Atlantic salmon

Interactions with Atlantic salmon are described in Section 7 of the Development Plan.

[2] See page 6 of Report on Public Engagement During Scoping.

Commercial Fishery

Lobster

Although lobster were in Whycocomagh Bay in the mid 60's they have disappeared from the Bay since that time (Joe Googoo, We'koqma'q Elder, personal communication). Traditional knowledge collected in 1996 (Eskasoni Fish and Wildlife Commission and Dept. of Fisheries and Oceans. 1996, cited not seen) and trawl surveys from 1999 indicate no lobster inhabited Whycocomagh Bay (Tremblay et al., 2002). This proposed finfish aquaculture site will, therefore, likely not impact the lobster fishery.

Oyster

Some populations of oysters remain in the Lake today, including in Whycocomagh Bay; and initiatives are underway to understand why these populations survive. This knowledge will be used to develop stocks or culture practices that allow rejuvenation of the oyster populations (Vercaemer et al., 2010; Robin Stuart, personal communication). We'koqma'q First Nation is part of these efforts, have a vested interest in the rejuvenation of the oyster populations, and will continue to support developments along this line.

Traditional Mi'kmaq Fishery

As stated for the recreational fishery, rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the traditional fishery have not been raised. As also stated previously, We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

Because of the successful historical co-existence of rainbow trout aquaculture operations with the traditional fishery and the enhanced fishery risk mitigation efforts, there are no impacts on traditional fisheries activities anticipated for any species. This aquaculture development will be managed in association with the other Mi'kmaq activities in the waters, including fishing. A single group manages both the fisheries and aquaculture portfolio of the Band and will ensure that they are complementary.

It is notable that there were no fisheries concerns raised during the scoping process conducted for this application.

Habitat beneath the proposed site - summary of baseline monitoring

This summary is provided only to describe the habitat observed beneath the proposed site. Complete baseline monitoring results were submitted to DFO and NSDFA for their review as per Section 4.2.

Location Name	Coordinates	Benthic sediment description	Station Classification
Whycocomagh, Center Lease 1	Lat: 45.95050; Long: -61.12716	Black mud with strong sulfurous odor	Oxic B by sulfide level, Anoxic by redox value
Whycocomagh, Center Lease 2	Lat: 45.95047; Long: -61.12773	Brown/black mud or brown mud with strong sulfurous odor	Oxic A by sulfide level, Oxic B by redox value
Whycocomagh, Center Lease 3	Lat: 45.95039; Long: -61.12804	Black or brown mud with strong sulfurous odor	Oxic A by sulfide level, Oxic B by redox value
Whycocomagh, Center Lease 4	Lat: 45.95045; Long: -61.12853	Brown mud, no odor	Oxic A
Whycocomagh, Corner Lease 1	Lat: 45.95094; Long: -61.11714	Sediment could not be retrieved according to required standard. Hard bottom video transect was completed in its stead with video taken every 10m. Video revealed a brown sediment of rock, cobble, hard packed sand, and some silt in varying degrees along transect. Starfish and small bivalves were seen at every location. Crab shells seen at one location. Green algae, filamentous algae and kelp each seen at one station along transect.	
Whycocomagh, Corner Lease 2	Lat: 45.94359; Long: -61.13391	Brown mud, no odor	Oxic A
Whycocomagh, Corner Lease 3	Lat: 45.94746; Long: -61.13477	Black mud, no odor	Oxic A
Whycocomagh, Corner Lease 4	Lat: 45.95312; Long: -61.12462	Black mud with very strong sulfurous odor	Oxic A by sulfide level, Hypoxic A by redox value
Whycocomagh, Reference A	Lat: 45.94560 Long: -61.13488	Brown mud, some rocks with slight sulfurous odour	Oxic A
Whycocomagh Reference B	Lat: 45.94744; Long: -61.12128	Black mud with strong sulfurous odour	Oxic A by sulfide level, Oxic B by redox value
Whycocomagh Reference C	Lat: 45.94785; Long: -61.11970	Black brown or brown mud with slight sulfurous odour	Oxic A

Published descriptions of the benthos of Whycocomagh Bay

As extracted from Parker et al., 2007: "Whycocomagh Bay has two deep basins and a flushing time of approximately two years. This slow water exchange facilitates the unique anoxic and hypoxic character of the deep basins within the Bay (Petrie and Bugden 2002). The eastern basin in Whycocomagh Bay, immediately west of St. Patricks Channel, has DO levels as low as 38% at the bottom (38 m) (Strain and Yeats 2002). The 48 m deep western basin has only 47% saturation at 15 m depth, and is typically anoxic below 25 m (Krauel 1975), a characteristic that appears consistent over the year and over time (Strain and Yeats 2002). Black's (1958) observation of only a few organisms of two shallow water species of mysid shrimp in Whycocomagh Bay is a further indication that low dissolved oxygen levels have likely existed for some time in the deeper waters at this location." In the same review paper, a limited diversity of copepods was also noted for Whycocomagh Bay, with only the four most common copepod species typically being found.

Previous internal studies on the site area

Several years ago, baseline information on the benthos of this area was conducted. Although the environmental monitoring data did not meet the QA/QC guidelines of the Nova Scotia Department of Fisheries and Aquaculture, the information is still relevant. The internal report produced as a result of this study is attached as Appendix A. This study indicated that the benthic flora and fauna in the area of the site were limited in diversity.

Mitigating Fisheries Impacts through Operational Procedures

Three of the greatest perceived risks of finfish aquaculture operations to fisheries and fisheries' habitats are fish escape, disease, and impact on the benthos and water quality. We'koqma'q will institute operational procedures to mitigate these risks as described below.

Fish Escape

All of We'koqma'q First Nation finfish aquaculture operations will follow the fish containment management requirements described in their Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. This containment management plan includes:

- Described and approved operating procedures that limit the risk of a breach, including the identification of critical control points, critical control limits, monitoring and corrective actions. The controls are identified through conducting a site specific hazard analysis.
- Described and approved procedures for site management if unusual events or severe weather occurs.
- Minimum infrastructure requirements, and minimum infrastructure maintenance and inspection requirements –including proof of a professional engineer's approval of the design of the structures in place for containment management.
- Described and approved responses to breaches or suspected breaches, including mandatory reporting.

The above plan will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

In addition, We'koqma'q's finfish operation hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices (BAP). This science-based and continuously-improved global performance standard is third party audited and assures "healthful foods produced through environmentally and socially responsible means". The BAP standard requires the application of a

Fish Containment Plan to cover fish escape prevention. This would be above and beyond the FMP containment requirements described above and it would be third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Finally, the regulatory and certification minimum requirements will be enhanced with the extensive practical knowledge and experience of the managers responsible for We'koqma'q's finfish aquaculture operations. Resumes for senior management are attached as Appendix C.

Disease and Biosecurity

All of We'koqma'q First Nation's finfish aquaculture operations will follow the fish health requirements within their Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. These requirements include:

- Described and approved finfish husbandry and welfare, veterinary care and disease surveillance practices. These practices include following the NSDFA marine finfish disease surveillance program and adhering to the multi-governmental agency (NSDFA, DFO, CFIA) Introductions and Transfers disease screening and permitting requirements.
- Described and approved biosecurity measures appropriate to the operation and its risk.
- Prescribed mortality and disease reporting requirements.
- Prescribed reporting of antibiotic and products used to treat sea lice.
- Described and approved procedures and measures to be followed in the case of a disease outbreak.

The above elements will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

An additional relevant aspect regarding disease concerns the unique low salinity waters of Whycocomagh Bay, the region of the proposed site. This site has a salinity of 17-18 ppt at the surface, approximately 20 ppt within a few meters. This has a number of fish health advantages that mitigate disease risk. Sea lice, which are ectoparasites of salmonids that may transfer between cultured and wild fish populations, and are often a great concern for salmonid fisheries enthusiasts, have never been observed in the waters of Whycocomagh Bay. It is likely that the low salinity of the Bay prevents this parasite from thriving (R. Wooten and C. Sommerville, personal communication). Bricknell, et al., 2006 demonstrated that sea lice (*Lepeoptheirus salmonis*) actively avoid low salinities (<27ppt) and even short term exposure to low salinity water (<27ppt) severely compromised sea lice survival and host infectivity. Low salinity waters are also known to reduce the risk of amoebic gill disease (AGD) (Mitchell & Rodger, 2011), another disease of concern for salmonid culturalists. Finally, the low salinity water reduces transfer stress from the hatchery, thereby reducing fish health and welfare risks.

As stated previously, We'koqma'q hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices. This certification includes sections addressing minimum animal health and welfare and biosecurity requirements. These requirements would be above and beyond the FMP fish health requirements and third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

As stated previously, the regulatory and certification minimum requirements will be enhanced with the extensive practical knowledge and experience of the managers responsible for We'koqma'q's finfish aquaculture operations. (See Appendix C.)

Environmental Impacts

All of We'koqma'q First Nation's finfish aquaculture operations will follow the Environmental Monitoring Program requirements dictated by NSDFA as required by the Aquaculture Management Regulations, as well as the environmental monitoring requirements required by DFO according to the Aquaculture Activities Regulations (AARs). These monitoring requirements focus primarily on potential impacts on the surrounding marine benthic environment, a primary concern regarding marine finfish aquaculture sites. They apply a risk based approach to determine monitoring requirements. Monitoring requirements for marine finfish sites include:

- A site specific benthic sampling and monitoring regime customized according to production level, site configuration, species cultured, past environmental performance of the site, and site specific oceanographic and biophysical characteristics. This must be pre-approved by NSDFA prior to the monitoring.
- Provincial and Federal review and approval of records of observations taken during monitoring and of the monitoring conducted, including Quality Assurance and Quality Control records that demonstrate adherence to procedures and protocols defined by NSDFA in their EMP Standard Operating Procedures (SOPs) and DFO within the AARs.
- Provincial and Federal review and approval of records of lab results, including Quality Assurance and Quality Control records that demonstrate adherence to procedures and protocols defined by NSDFA in their EMP Standard Operating Procedures (SOPs) and DFO within the AARs.
- Reporting of the results to NSDFA and DFO within defined timelines.

The environmental program also requires the provision of a mitigation plan which is to be applied when poor environmental performance is indicated by the monitoring.

Specific operational practices to reduce benthic impact are planned for this site. Having the enlarged lease area, as requested by this amendment, will provide the operator with more room to move cage arrays and will therefore allow greater fallowing times of sections of the lease. This strategy will be combined with increased training of staff on the use of feeding cameras and feeding techniques to try to improve food conversion and reduce benthic impacts. Oxygen supplementation will also be applied at the site to maintain optimum water quality conditions for fish growth to improve feed conversion ratios and reduce benthic impacts.

It is notable that the Manager of Aquaculture Operations for We'koqma'q (Robin Stuart) was one of the designers of the original environmental monitoring program for aquaculture in Nova Scotia (see Smith et al., 2002) and continues to contribute to its development through a seat on the Nova Scotia Aquaculture Environmental Coordinating Committee. This committee, which is co-chaired by NSDFA and DFO, is a forum for industry and regulators to provide input and exchange ideas regarding the environmental monitoring program for marine sites in Nova Scotia.

As stated previously, We'koqma'q, hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices. This certification includes sections addressing minimum environmental

monitoring requirements. These requirements would be above and beyond the FMP fish health requirements. For the We'koqma'q finfish aquaculture sites in the Bras D'Or Lake this environmental monitoring would have to include monitoring the water column itself for quality parameters including pH, total suspended solids, soluble phosphorous, total ammonia nitrogen, biochemical oxygen demand, dissolved oxygen and chloride. The BAP standard also imposes maximum feed rates according to retention time of the water body. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Mitigating Fisheries Impacts through Research and Development

We'koqma'q First Nation is committed to monitoring and mitigating impacts of its finfish aquaculture activities on the environment, including fisheries and fisheries' habitat. In this regard, We'koqma'q has historically supported and will continue to support researchers as they assess and develop techniques to monitor impacts.

Recent efforts (2018) have included collaborating with Peter Cranford of DFO Science and NSDFA to evaluate alternative means for monitoring benthic environmental impacts. This is particularly important in sites such as this one where meeting environmental indicator thresholds for benthic impacts is challenging. The unique anoxic benthic environment, as described above ("*Published descriptions of the benthos of Whycocomagh Bay*") may be interfering with the proper interpretation of monitoring results. This is further aggravated by the fact that this site has been growing finfish for so long that there is no baseline environmental monitoring to use as a comparison. Work will continue along these lines to determine how best to monitor and assess this site.

Future efforts include completing a carrying capacity analysis for finfish aquaculture in Whycocomagh Bay. This study, to be led by Dr. Christopher Algar (Dept. of Oceanography, Dalhousie University), will develop a model that can capture carbon, oxygen, and sulfur dynamics in the sediments of Whycocomagh Bay, both with and without the influence of fish cages. The model will be used to assess the impact of aquaculture on the Whycocomagh Bay benthic ecosystem and investigate how changes in fish-rearing practices, such as increased stocking levels, may affect these impacts. Additional information regarding this work can be found in Appendix D. We'koqma'q is a partner on this project, providing site access, logistics assistance, personnel, historical environmental monitoring data and production data.

SECTION 4: OCEANOGRAPHIC AND BIOPHYSICAL CHARACTERISTICS OF THE PUBLIC WATERS

4.1 Oceanographic environment

The proposed site is in Whycocomagh Bay of the Bras D'Or Lake - referred to as "Bras D'Or Lakes" by some. The following extract from Lambert, 2002, gives excellent background information on the unique oceanographic environment of the Bras D'Or Lake:

"The Bras d'Or Lakes are situated in Cape Breton Island at the northern end of Nova Scotia. This body of water of about 1,100 km^2 is essentially an enclosed estuary with three outlets to the sea. The Great Bras d'Or Channel and the Little Bras d'Or Channel connect with Sydney Bight to the north, and St. Peter's Canal gives access to Chedabucto Bay to the south. Only the Great Bras d'Or Channel is large enough to permit any significant exchange of water. The Bras d'Or Lakes watershed is about 2500 km^2; this area added to that of the Lakes themselves gives a total catchment area of 3600 km^2 (Krauel, 1976).

Input from six rivers and restricted access to the ocean keeps salinity in the range of 20 to 26, whereas, sea water just outside the Lakes in Sydney Bight ranges from about 28 to 32. The Lakes are usually ice covered in the winter and surface waters often exceed 20°C in the late summer, particularly in smaller, shallow bays (Petrie and Bugden, 2002).

The waters of the Bras d'Or Lakes are characterised by a two-layer system; a low salinity surface layer which has a wide annual range in temperature and a lower layer of higher salinity in which temperature range is much less pronounced. In general, surface water moves toward the entrance of the Lakes and out into Sydney Bight and is replaced with outside oceanic water which enters the Lakes near the bottom and flows underneath the surface layer (Krauel, 1976; Petrie and Bugden, 2002). With the exception of restricted channels, there is little mixing between these layers except for winter months when higher winds and wave action disrupt the stability of this system. In some areas where currents and exchange rates are very low, the amount of dissolved oxygen can become quite depressed and in Whycocomagh Bay, anoxic (no oxygen) conditions exist (Petrie and Bugden, 2002; Strain and Yeats, 2002)."

The biophysical characteristics of the site environment are summarized in the table below with supporting figures and tables provided, as relevant.

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomaugh since 2009.
Average wind speed (km/hr) (30m height)	22.5	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease.
Wind speed class rating (10m height)	Low to Moderate	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)	This data was not available for this area at the time of writing this development plan. It is notable however that the site is not subject to large waves since it is well protected on all sides due to the lay of the land, except southeast. Maximum wave height data was collected for North Aberdeen, a more exposed site 9km away. Here, the maximum height was 1.08m with the direction of maximum wave of 244° (WSW) – an unlikely wave direction for this site due to the shelter of the shore.		
Direction of maximum wave			
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (personal communication, Robin Stuart).		
Annual maximum tide (m)			

Characteristic	Value	Reference	Comments
Current speed range and averages (m/sec)[3]	See Figure 2 a,b,c,d and statistics summary table (Table 1) that follow.		
Annual minimum salinity (ppt)	Upper 10m: 15ppt Below 10m: 17ppt	Tremblay, 2002	Throughout the Bras d'Or Lakes salinities are lower in the 0-10 m depth interval than in the 10-50 m depth interval and in the upper metre of the Whycocomagh and Denys Basins maybe 5 after rainfall (Petrie, 2001). There is also a seasonal difference in salinity, with lower salinities in spring compared to summer. Tremblay, 2002). The salinities of the area are shown in Figure 3 which was adapted from figures within Tremblay, 2002
Annual maximum salinity (ppt)	Upper 10m: 25ppt Below 10m: 27ppt	Tremblay, 2002	
Annual minimum temperature (°C)	-0.591°C	Raw data obtained from David Cook (NSDFA)	Value stated is the lowest temperature measured July 12, 2016 to May 29, 2018. See also summary temperature plot (Figure 4).
Annual maximum temperature (°C)	22.6°C	Raw data obtained from David Cook (NSDFA)	Value stated is the greatest temperature measured July 12, 2016 to May 29, 2018. See also summary temperature plot (Figure 4).
Depth of water at each corner of the site (m)	Corner 1: 1.8m Corner 2: 7.4m Corner 3: 28m Corner 4: 6.3m Center Lease: 1: 23m, 2: 13.1m, 3: 12.0m, 4: 8.2m	Depths taken during baseline EMP sampling	

[3] The oceanographic characteristics of this area were collected over the summer months of 2018 (May 31, 2018 to July 3, 2018) via deployment of an ADCP (Acoustic Doppler Current Profiler) near the site. This monitored a number of variables associated with currents at multiple levels in the water column. Although only summaries are depicted within this plan, all of the data derived from this monitoring will be used in the engineering of the cage and infrastructure for this site.

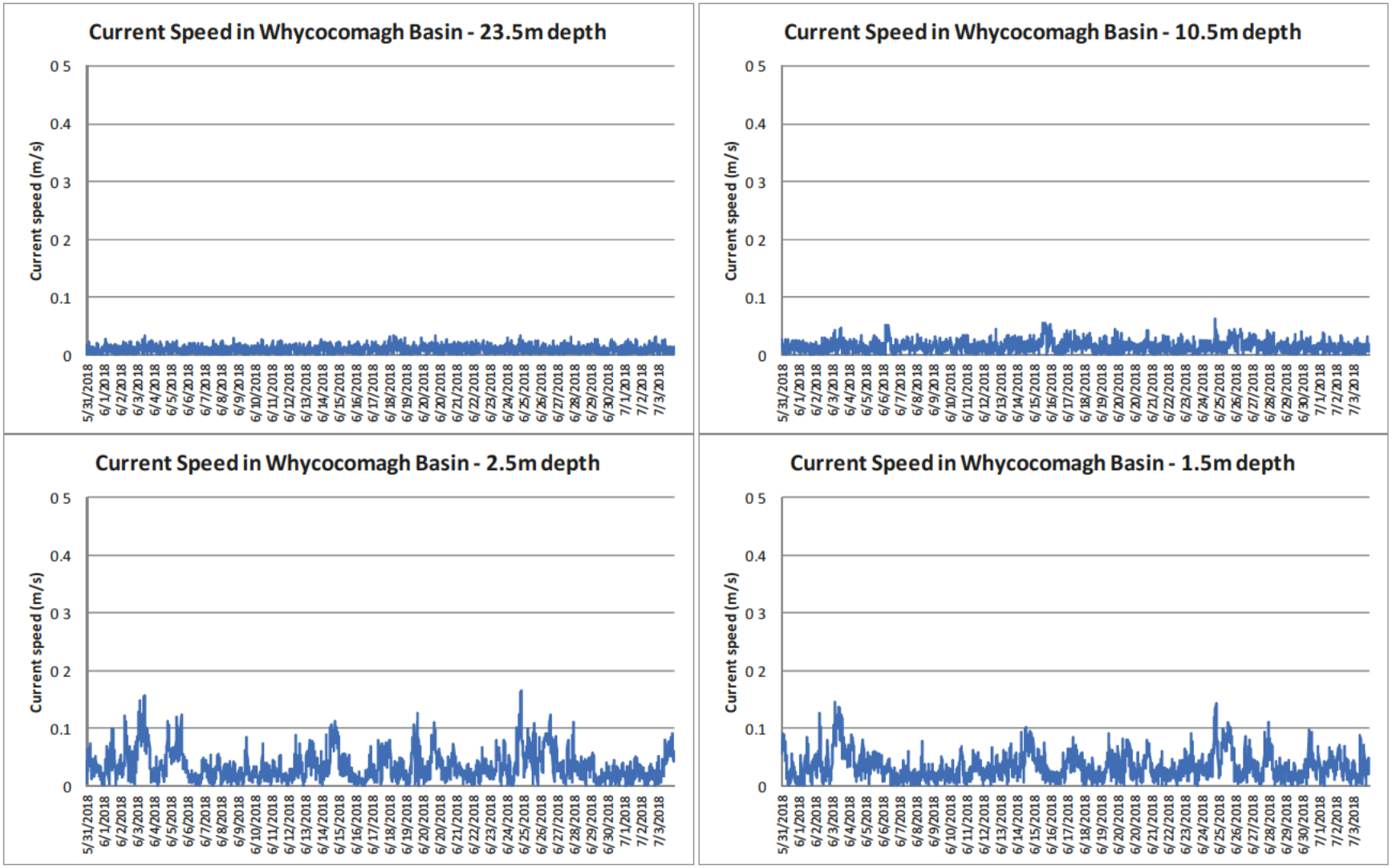


Figure 2 a,b,c,d: Current speeds measured in 2018 (May 31 to July 3, 2018). Raw data obtained from David Cook (NSDFA) from ADCP deployment. Estimated depths calculated from sensor deployment data.

Table 1: Summary table of current speeds statistics determined from data derived from ADCP deployed May 31, 2018 to July 3, 2018. Raw data obtained from David Cook (NSDFA).

Estimated depth* (m)	23.5	20.5	15.5	10.5	8.5	6.5	4.5	2.5	1.5
Min speed (m/s)	0	0	0	0	0	0	0	0	0
Max speed (m/s)	0.035	0.049	0.05	0.062	0.096	0.123	0.182	0.165	0.145
Mean speed (m/s)	0.0105	0.0128	0.0121	0.0152	0.0206	0.0247	0.0325	0.0354	0.0344

*Calculated from sensor deployment data.

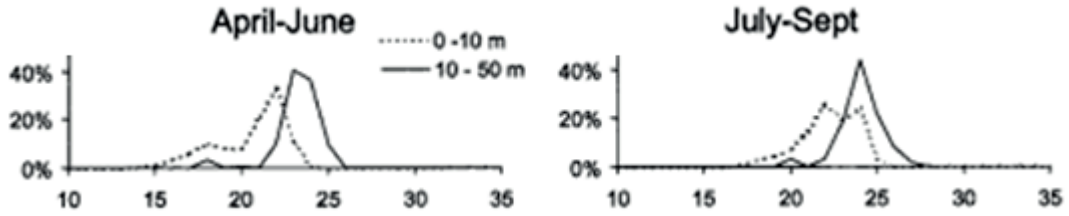


Figure 3: Frequency distribution of salinity measurements taken from Baddeck Bay, including Whycocomagh Basin, Baddeck Bay and St. Patrick's Channel. Figure adapted from Figures within Tremblay, 2002.

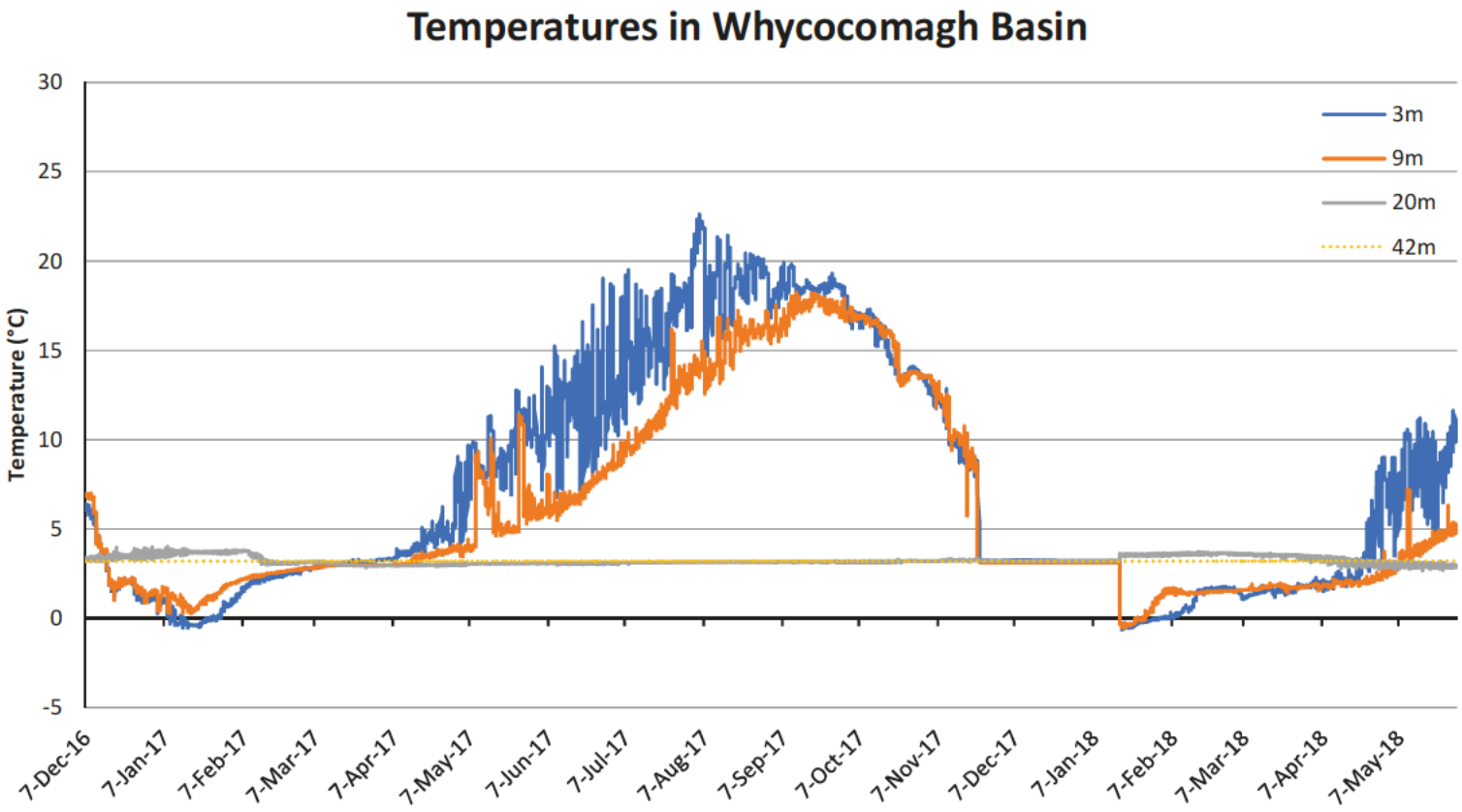


Figure 4: Whycocomagh Basin temperatures July 12, 2016 to May 29, 2018 at depths from surface. Raw data obtained from David Cook, NSDFA.

4.2 Baseline environmental monitoring

The baseline monitoring package has been submitted separately.

4.3 Site design

This site has hosted finfish aquaculture for almost 30 years. Data and experience acquired throughout that time period, along with published studies on the area and data collected recently during scoping activities all contribute to how the site will be managed and operated.

Anoxic water

Whycocomagh Bay is separated from the east (St. Patrick's Channel) via a sill less than 12 m deep. Whycocomagh Bay itself has a pair of deep basins of 38 and 46 m deep separated by a sill of approximately 7 m depth. These sills inhibit flushing below sill depth, preventing a horizontal exchange of deep water and partly isolating the physical and biological processes of one basin from the other and inhibit biota movement (Parker et al, 2007). This makes for a unique oceanographic environment that must be considered in site design and operation. In particular significant thermoclines and haloclines are known to exist and much of the benthic layer is known to be naturally anoxic (Parker at el, 2007). There is little upwelling in the Bay. In fact published reports indicate there is none (Parker et al, 2007). However some upwelling of low oxygen "fingers" of water has been experienced in this area during fish farming activities in the past. These events are thought to be caused by deep water currents caused by tide. As the deep water is pushed in by a moon tide, the low oxygen water at depth pushes to the surface, and oxygen levels decline in the fish rearing layer. This must be managed in operational procedures. In response to this risk, oxygen monitoring occurs on a continual basis and vigilance increases around wind and tidal events. An oxygen supplementation system will be part of the infrastructure for the cages in this area. This will mitigate the risk of deep low oxygen water creeping up into the fish rearing depth. The oxygen supplementation will also be applied during times of high temperatures and stocking levels to improve feed conversion ratios, as mentioned in Section 3.2 (*Mitigating Fisheries Impacts through Operational Procedures: Environmental Impacts).*

Ice cover

Another feature of Whycocomagh Bay that must be managed is the presence of ice over the bay during winter. The bay begins icing over after mid-December and generally stays covered with ice until March/April. The ice is actually an advantage since it provides a physical barrier to winds as well as an insulating layer to cold air. However, special management conditions are required for the period when the ice cover is present.

- Some surface access will need to be available for the fish to fill their swim bladders. A trout is physostomous, meaning that it maintains a connection between its swim bladder and alimentary canal for its entire life. It will gulp air at the surface to provide gas to fill the swim bladder. If surface access is not provided, a trout will be challenged to maintain its buoyancy, particularly in times of stress.
- Oxygen will be provided to fish below ice. The ice barrier reduces gas exchange with the atmosphere and consequently oxygen levels in the water may become reduced due to fish respiration. Supplementing with pure oxygen via release of small oxygen bubbles into the depth of the cage will replenish the oxygen removed from the water by the fish.

- Cages will be over-wintered at the wharves (within the amended lease area) to be more physically accessible, to have access to power, and to be out of the areas of ice movement. The fish will not be feeding or growing during this over-wintering period since temperatures will be too low. The moorings that hold the cages in place at other areas on the lease during the spring/summer/fall production period will stay in place over the winter but the large spar buoys will be replaced with temporary buoys to mark the site for the winter period. These temporary buoys will allow the ice to travel over them when it moves out in the spring. If left out, the large buoys would be dragged with the ice when it breaks up in the spring, as was experienced for three successive years (Robin Stuart, personal communication). This area is not navigable at this time due to the presence of the ice so that a navigation hazard is not created by the removal of the larger buoys.
- The risk of ice damaging the cages that are at the over-wintering location next to the wharf will be reduced by having a physical barrier in the water around the cages.
- A 2m tarp will be hung on the outside of the cages prior to freeze up. Tarping the upper part of the water column will serve two purposes. It will allow the upwellers that keep a part of the surface clear of ice (see the first bullet) to work more effectively. It will also prevent the spring algae from entering the cages. In the spring, microalgae have a tendency to grow in the fresh water layer that exists under the ice. The algae may be toxic to the fish. A fish kill from such an exposure has been experienced in the past in Whycocomagh Bay. The tarps will ensure that this fresh water layer of high microalgae concentration does not infiltrate the cages.

Water currents

The current data collected in 2018 via deployment of an ADCP (Acoustic Doppler Current Profiler) and summarized in Section 4.1 will be used to engineer the cage and infrastructure for this site. Note that the raw data is available and will be used for this purpose. The engineer engaged for this activity is Bruce Aikman from Middle River, NS.

Water temperature

As shown in Section 4.1, temperature was monitored at successive depths (3m, 9m, 20m, 42m) at a location close to the site from December 2016 to May 2018. This is not a true picture of what the fish will experience since some distance separated the recorders and the fish cages; but it gives a good general profile of the seasonal variations near the surface versus the constant low temperature of the deep water. Such a thermocline was expected and is a well-recognized phenomenon for Whycocomagh Bay. Within these plots, some upper-water temperatures recorded below 0°C could cause a superchill concern. However, temperatures closer to the over-wintering area did not reach these lows - as experienced by We'koqma'q who were holding fish on the lease near the wharves during this period.

The temperature profiles of the water depths the fish will inhabit have been incorporated into the growth model of the fish to predict feeding rates and days to harvest. They have been used to predict growth and feeding rates.

SECTION 5: THE OTHER USERS OF THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

5.1 Description of other users

This site has been used for finfish aquaculture for almost 30 years. It is located south of the town of Whycocomagh and immediately south of Indian Island which is We'koqma'q land. Highway 105 runs along the shoreline adjacent to the site although the site is not highly visible from the highway because of the aspect of the shoreline and wooded nature of the shoreline.

Users within 1 km radius (Figure 5)
West of the site is We'koqma'q land with a small residential development area on the inland side of the highway and other homes off the highway on the inland side. The only major development on the shore side are the buildings and driveway that belong to We'koqma'q which are used for site activities. North of the site is an uninhabited island – Indian Island, which is also We'koqma'q land. It is open water to the south east.

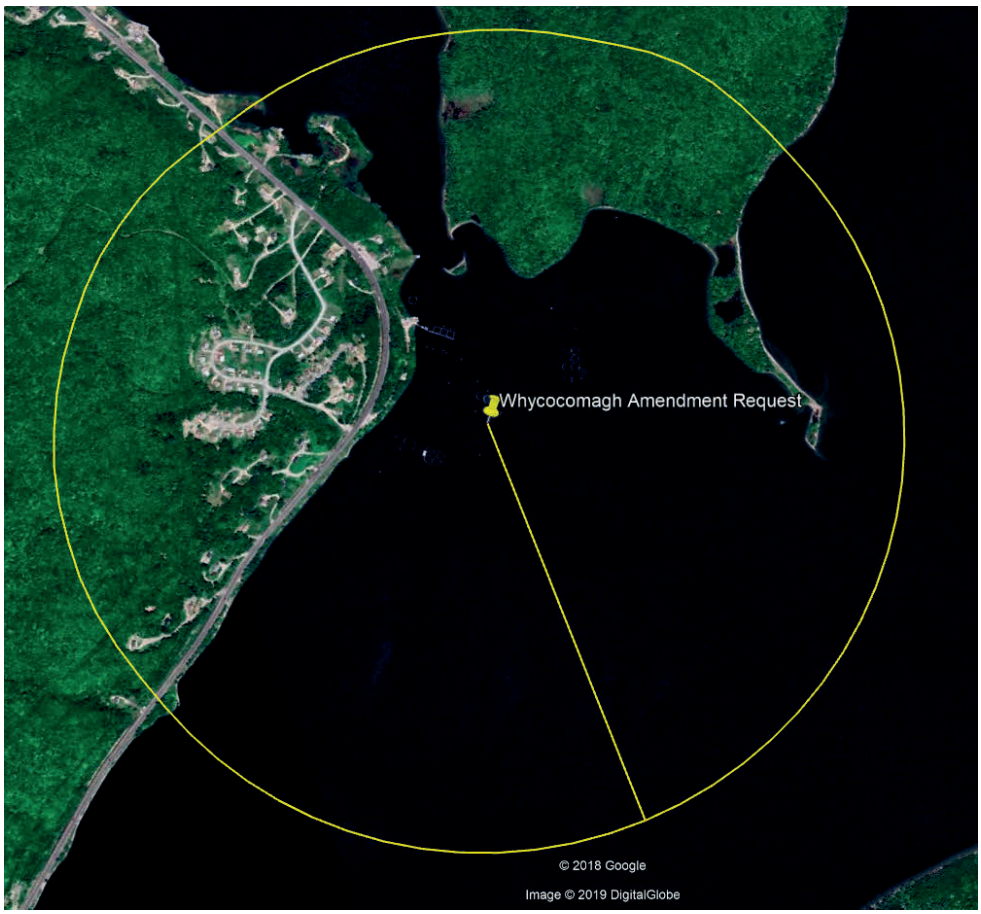


Figure 5: Google Earth image of the proposed site area with a 1 km radius drawn (yellow circle).

Users within 3 km (Figure 6)
We'koqma'q First Nation and the Whycocomagh community is within 3 km of the site.

We'koqma'q First Nation (Whycocomagh 2 Reserve) is a Mi'kmaq community in the middle of Whycocomagh with a registered population of approximately 1000 persons according to Indigenous and Northern Affairs Canada. The We'koqma'q Nation has traditionally used the public waters for fisheries activities as described in Section 3.2. Whycocomagh and Whycocomagh Bay are recognized areas of cultural, recreational, and social significance (CEPI, 2006). It is notable that We'koqma'q has been involved in shellfish and finfish aquaculture activities in the local waters for decades. The proposed aquaculture site is a significant part of the First Nation's business development plans.

The Whycocomagh community has a population of approximately 850 residents and has several small businesses that support the local residents, including gas stations, a pharmacy, grocery store, bank, several bakeries and restaurants, accommodations (Keltic Quay, Fair Isle Motel), farmer's market, school (P-8, population<200), fire department, community center and other amenities and tourist features. Although the town is in close proximity to the site, even shoreline users in the town (B&B, residents, etc.) cannot see the site as it is sheltered by Indian Island.

In Whycocomagh, a main user group of the public waters is the Whycocomagh Waterfront Centre Association which supports both a community center as well as a marina. The marina is gated access with piers and a launch ramp to the Bras D'Or, a pump station, fresh water and washrooms. Floating docks and moorings are available for member rental.

Whycocomagh Provincial Park is located east of Whycocomagh. The park features hiking (5 km of trails), camping (40 sites) and picnicing. It overlooks the Skye River Valley and the Bras D'Or Lake. The main park straddles the Trans-Canada Highway and has areas of access to the Bras D'Or Lake. As for the town, even shoreline users of the park cannot see the site as it is sheltered by Indian Island.

The closest point of the south shore of Whycocomagh Bay in this area is 1.4km away. It is rarely used and almost un-inhabited.

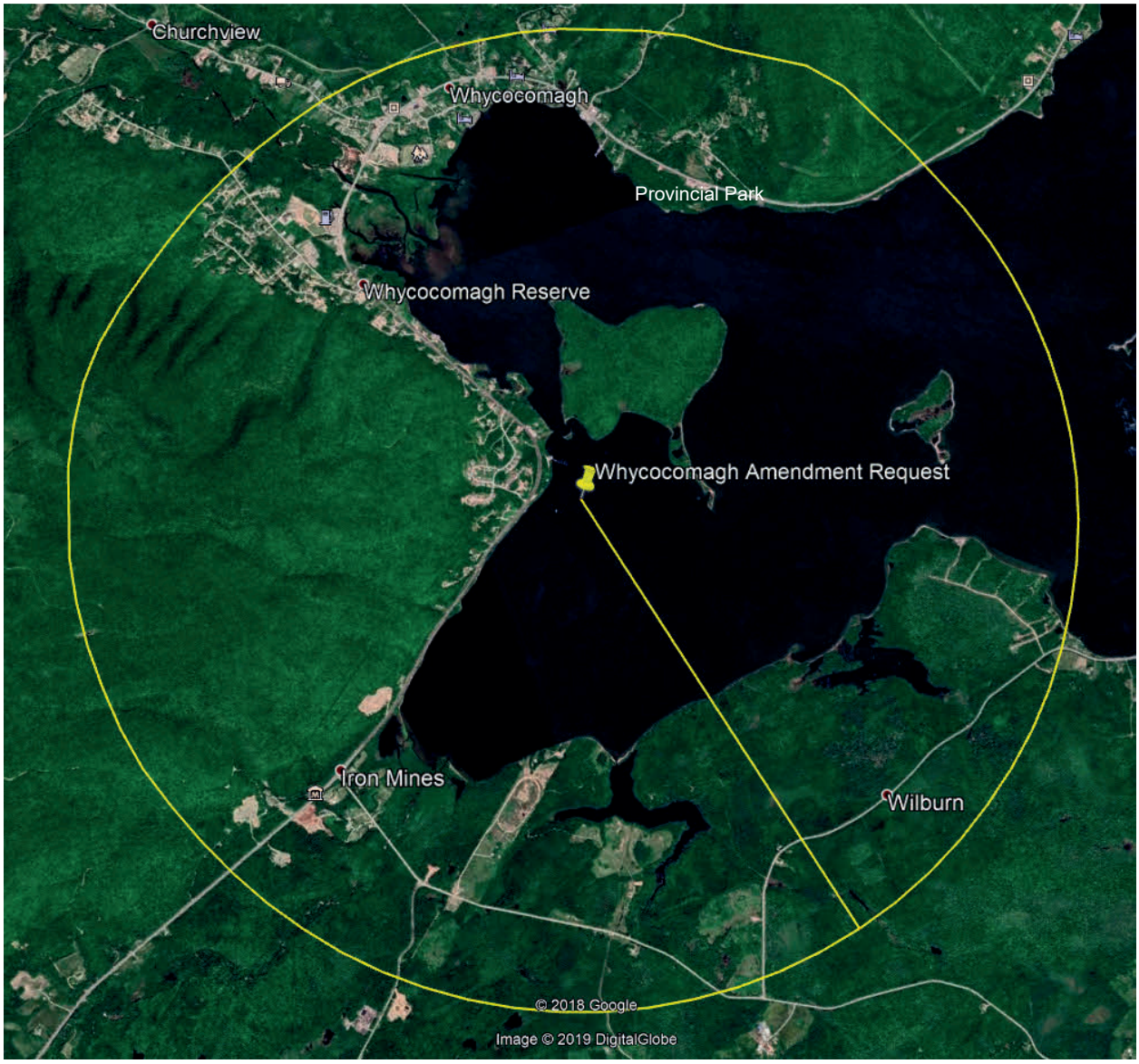


Figure 6: Google Earth image of the proposed site area with a 3 km radius (yellow circle).

Users within 5 km and 10km (Figures 7 and 8)

Outside of Whycocomagh, the shoreline is very sparsely inhabited. To the northeast, the highway runs along much of the shoreline with few shoreline properties. To the south, there is very little development and limited access. Beyond Whycocomagh, the main developments are in the northeast section of Whycocomagh Bay more than 10 km away.

Because of the distance between the proposed site and these users, it is unlikely that there will be significant visual or other impacts.

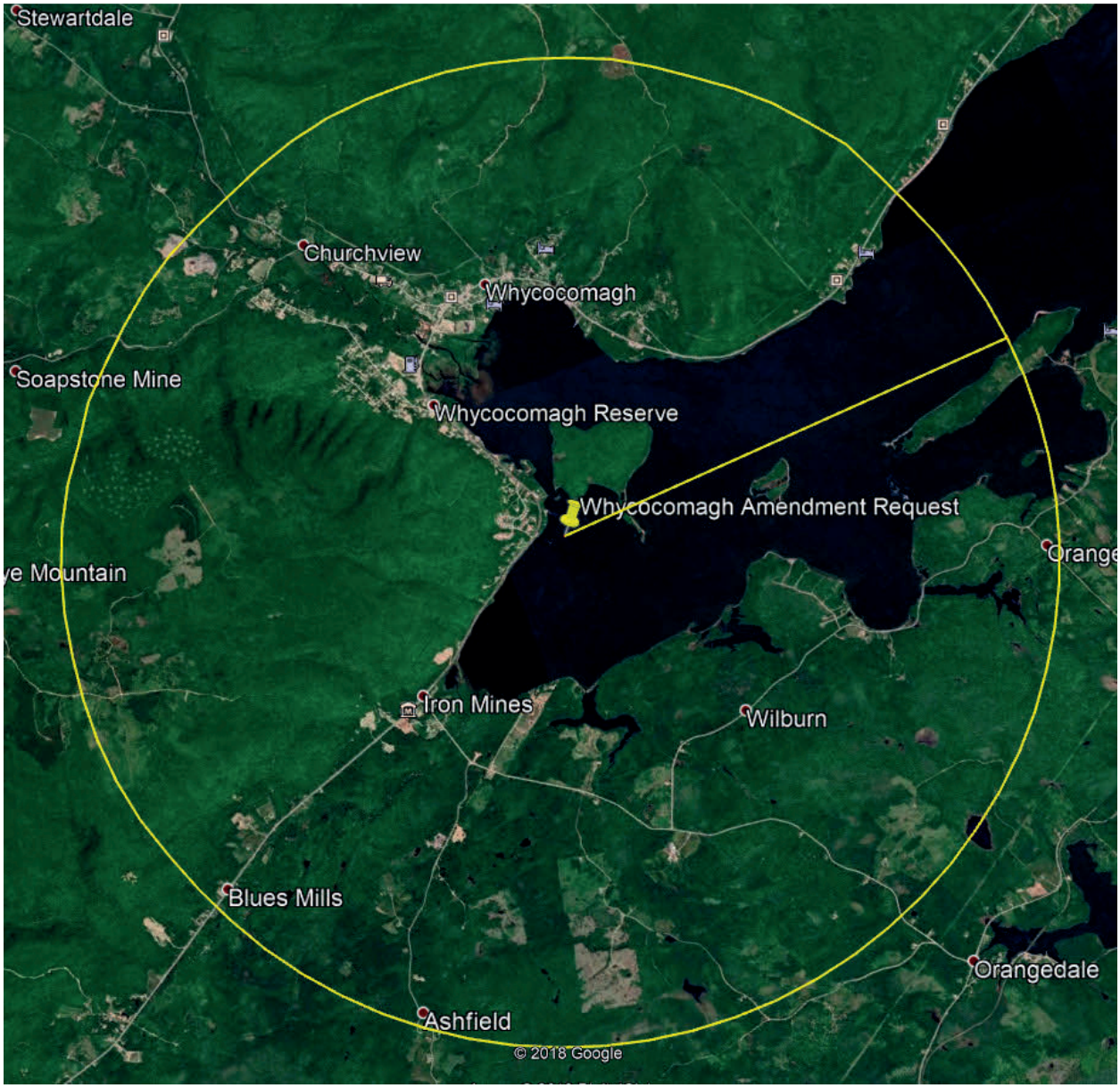


Figure 7: Google Earth image of the proposed site area with a 5 km radius (yellow circle).

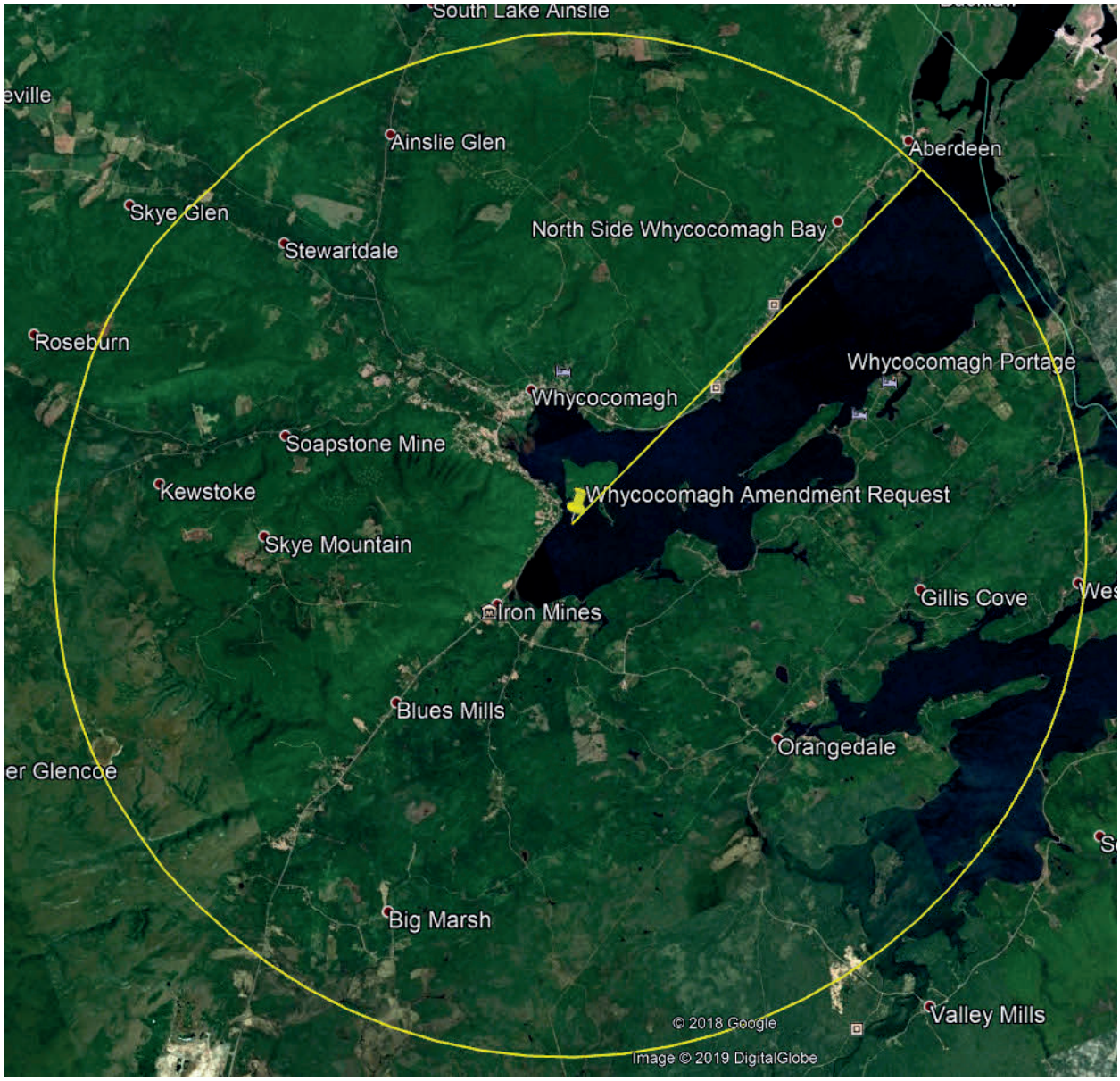


Figure 8: Google Earth image of the proposed site area with a 10 km radius (yellow circle).

Other regional users or parties interested in the public waters

The Bras D'Or Lake is a popular cruising location for pleasure crafts. Whycocomagh Bay is open to the Bras D'Or Lake only via Little Narrows Channel and yet is a popular spot, particularly for small sailing vessels, kayakers, canoeists and small fishing vessels. These may be local residents or seasonal users.

Other parties interested in the area in terms of conservation include:

Bras D'Or Stewardship Society: a non-profit organization established in 1998 committed to promoting stewardship of the Bras D'Or Lakes and their watershed. The proposed site is within the Society's area of interest.

Bras D'Or Lake Biosphere Reserve Association: a registered charity that oversees the UNESCO designated Bras D'Or Lake Biosphere Reserve[4]. Its mission is "to engage all peoples in the balanced and sustainable development of the exceptional cultural, environmental and economic assets within the Bras d'Or Lake watershed." The proposed site is within the Biosphere Reserve.

Bras d'Or Lakes Collaborative Environmental Planning Initiative (CEPI). CEPI is an alliance of federal, provincial, municipal, and First Nations governments and other interests who have signed a charter that represents "the collective intent, or "will", of the relevant governments with responsibilities for the management and protection of the Bras d'Or Lakes and its watershed".

[4] In 2011, the Bras d'Or Lake and its watershed area were designated a UNESCO Biosphere Reserve, recognizing that the locals live in harmony with nature and work to promote a healthy environment, economy and culture.

5.2 Significance of proposed area to wildlife

Significant terrestrial habitats

Significant land habitats recognized by NSDNR along the shoreline of Whycocomagh Bay are shown in Figure 9 and include the following:

- IN418: deer wintering
- IN21: deer wintering
- IN142: bald eagle nest
- VI207: common loon habitat
- IN192: bald eagle nest
- IN17: bald eagle nest
- IN433: bald eagle nest
- IN22: bald eagle nest
- IN51: bald eagle nest
- IN37: bald eagle nest
- IN49: bald eagle nest

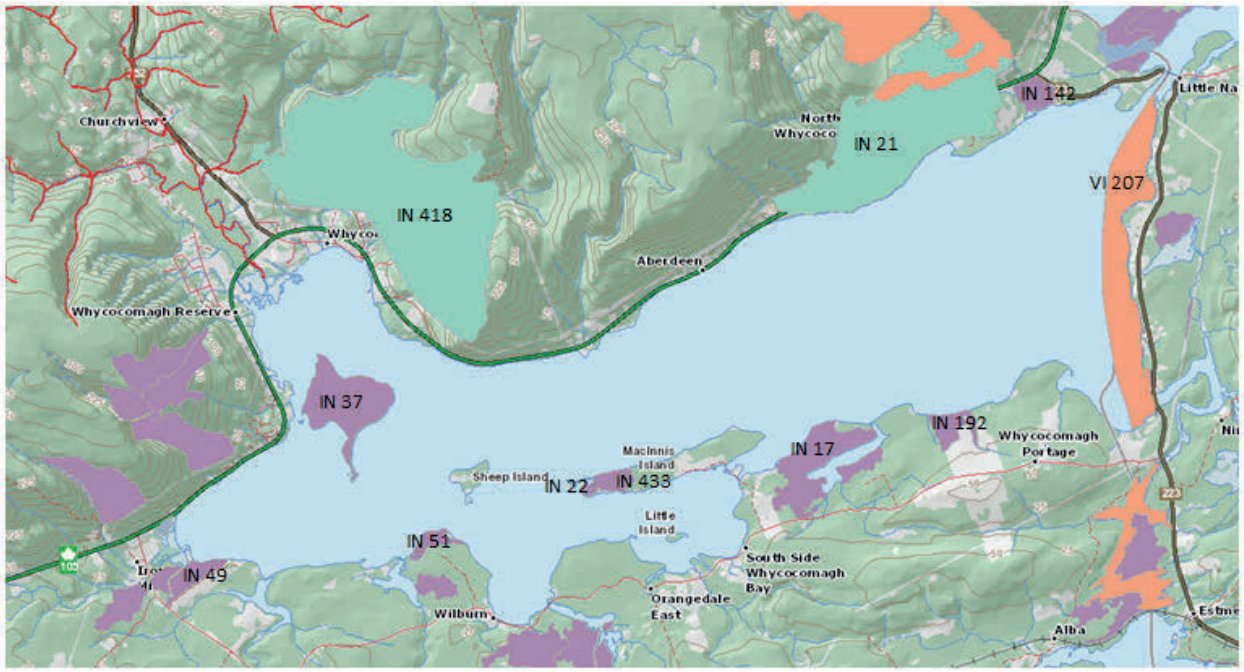


Figure 9: Significant land habitats[5] on the shoreline of Whycocomagh Bay

Rare and endangered species

A data report from the Atlantic Canada Conservation Centre provided more in depth detail on the possibility of the presence of rare and endangered species that may use the proposed development area as well as special wildlife areas of the region. The complete report generated for the proposed site location is attached as Appendix E. A summary of the report follows:

[5] Adapted from https://nsgi.novascotia.ca/plv/ ; used with permission. Additional information provided by Frances MacKinnon.

Rare species list

Within 5 km of the site center, records indicate the presence of 31 species of rare or endangered vascular plants, 3 species of rare or endangered nonvascular plants, 23 species of rare or endangered vertebrates, and 2 species on invertebrate animals. Shoreside or water dwelling plants or animals are considered those that may be most likely to be affected.

Within this list of species, three are aquatic, including:

- American eel,
- Alewife,
- Brook trout.

Shoreside species of plants include:

- Ray's knotweed,
- Seaside brookweed.

Shoreside species of animals or water birds include:

- Nelson's sparrow,
- Cliff swallow,
- Kill deer,
- Spotted sandpiper,
- Greater yellowlegs,
- Blue winged teal,
- Common goldeneye.

Species at Risk

Five Species at Risk are on record as being in the region. They are listed in the table below. None are water dwelling or expected to be found shoreside.

Table 2: Species at risk within 5 km radius of proposed site[6]

Scientific name	Common name	SARA status	Habitat, other comments
Hirundo rustica	Barn swallow	Threatened	Nests in barns, garages, houses, bridges and culverts near open areas. Part of the agricultural landscape in Nova Scotia.[7]
Contopus cooperi	Olive-sided Flycatcher	Threatened	Spruce and fir swamps and bogs[8]
Contopus virens	Eastern Wood-Pewee	Special Concern	Woodlands[9]
Degella plumbea	Blue felt lichen	Special Concern	Hardwoods in woodlands[10]

[6] Species list extracted from Atlantic Canada Conservation Center Report 6336. Species habitat and other comments obtained from sources referenced in footnotes.
[7] http://www.farmbiodiversity.ca/species-at-risk-2/birds/barn-swallow/
[8] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[9] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[10] https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=1123

Scientific name	Common name	SARA status	Habitat, other comments
Glyptemys insculpta	Wood turtle	Threatened	Clear, moderately moving rivers and tributaries in forests or flood plains.[11]

Location sensitive species

Two location sensitive species have been recorded in the region:

- Black ash: Black ash grows in swampy, low lying areas that are very wet and marshy.[12]
- Wood turtle: See Species at Risk table.

Neither are water dwelling or expected to be found shore side.

Culturally significant flora and fauna

The sweet flag is a medicinal plant in the Whycocomagh area that is of significance for the Mi'kmaq people (CEPI, 2006). CEPI, 2006 also mentioned barrows goldeneye which have been seen near Whycocomagh Bay shore and bald eagles which are more commonly seen.

General marine life

The Bras D'Or Lake marine environment is known for its uniqueness in terms of reduced salinities, limited physical exchange with the open ocean, diversity of seasonal temperature regimes, and low tides. One of the most often reported attributes of the Lake is the fact that both warm water and cold water species are found in the same water system (Lambert, 2002).

Within Whycocomagh Bay, the diversity of marine life is more limited than other areas of the Lake. It is a low salinity region with large basins of low oxygen levels. It has been suggested that these characteristics limit benthic organisms in many parts of the Bay, with the exception of micro-organisms (Lambert, 2002). Low abundance of mysids, copepods (Petrie & Bugden, 2002; Strains & Yeats, 2002) have been noted. Many invertebrate species such as lobsters and rock crab are unlikely to be in this area due to its low salinity. Similarly, scallops are unlikely to be in this area. (Tremblay, 2002)

Studies have shown that herring and gaspereau occur in Whycocomagh Bay and the presence of winter flounder, cod, skate, and windowpane flounder was evidenced by their appearance in trawl catches in Whycocomagh Bay in 1999-2000, which were similar to findings from tows conducted in 1967. The cod population in this Bay is thought to be unique from other cod populations in the lake. This is based on the low incidence of the sealworm (*Pseudoterranova decipiens*) in cod of the Bay relative to adjacent areas. This segregation is thought to be due to the restricted passageway at Little Narrows, which may discourage the movement of cod between the Bay and St. Patrick's Channel. Local knowledge suggests that cod populations are significantly reduced over previous levels (personal communication, Joe Googoo, We'koqma'q Elder).

Grey seals and harbor seals are the only marine mammals known to inhabit Whycocomagh Bay (Robin Stuart, personal communication).

[11] http://www.speciesatrisk.ca/SARGuide/download/Wood%20Turtle.pdf
[12] http://www.uinr.ca/black-ash/

5.3 Impacts to other users including wildlife

Impacts to human users of the public waters surrounding the proposed development

Tourist operators, local and seasonal residents

The village of Whycocomagh and a number of businesses within the region rely heavily on tourism. A key draw to the region is the Bras D'Or Lake. And local and seasonal residents enjoy the public waters surrounding the proposed development for its beauty, nature and recreational opportunities. Concerns that these groups of the community may have are discussed below.

Visual impact

The area is well known for the attractiveness of its landscape, including the views of the Bras D'Or Lake. We'koqma'q recognizes this value to the area's tourism industry as well as to the local community members in general.

The site is located in an area that is protected from view by most of the residents and business owners of Whycocomagh. During the scoping process,[13] one of the site's nearby residents suggested moving the cages "behind" Indian Island in order to reduce visual impact. However, the location suggested could prove to increase the visibility of the site, expose the site to higher winds (north easterly), and not provide enough depth for the culture activities. The site location was originally chosen because of its unique shelter and depth attributes.

In recognition of the importance of appearance, We'koqma'q First Nation is committed to ensuring that the cages are maintained in an orderly fashion to ensure that they properly represent the opportunity that they are bringing to the community and do not negatively impact the visual landscape. The regular inspection and maintenance of cages is a best practice of the company that is mandated under the Nova Scotia Aquaculture Management Regulations within the Farm Management Plan as mentioned in Section 3.2 (*Mitigating Fisheries Impacts through Operational Procedures)*. In addition to these Farm Management Plan requirements explained previously regarding infrastructure maintenance, all of We'koqma'q First Nation finfish aquaculture operations will follow the farm operations requirements also defined by the Nova Scotia Aquaculture Management Regulations. These requirements acknowledge that the responsible operation of a marine finfish site includes consideration of neighbors and other users of shared resources, including aspects affecting visual impact. To this effect, the Farm Management Plan must include the following:

- Described and approved management practices for removing and disposing of accumulated refuse and decommissioned farm supplies and equipment;
- Described and approved management practices for retrieving any gear or debris from the aquacultural operation that has broken loose; including timelines for completion;
- Described and approved management practices for maintaining the site in good order.

The above elements will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

[13] Refer to Page 8 of the Report on Public Engagement During Scoping

Smell and Noise

Part of the appeal of the region pertains to the rural landscape in terms of low noise pollution and high air quality. We'koqma'q recognizes the value of maintaining these local attributes and will apply and document practices that reduce noise, particularly outside of working hours, and reduce odors in general.

A complaint about the smell of We'koqma'q's current finfish operation in Whycocomagh was brought up during the scoping process [14]. It is recognized by We'koqma'q that they had an incident where smell was a problem for a couple of days in the summer of 2018. This was due to an interruption in trucking that required offal transfer during an excessively hot day (>30°C). Normal procedures for We'koqma'q's finfish operations include removing organic waste on a bi-weekly basis for transport to the Guysborough facility which is equipped to deal with such waste. Increased oversight of this procedure now occurs to ensure that the transportation will not be disrupted. And the shipping containers are sealed on site prior to transport so that spillage will not occur en route.

Other aspects of the operation that may be a risk for causing odors will be described and documented in the Farm Management Plan. This includes the storing and disposal of feed, mortalities and other organic waste. These are part of the farm operations requirements of the Nova Scotia Aquaculture Management Regulations.

It is notable that the Farm Management Plan also requires the description, application, and documentation of procedures that minimize noise.

As mentioned previously, We'koqma'q's finfish operation hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices (BAP). Section 13 of this standard requires safe and responsible storage and disposal of farm supplies and waste. Procedures required for this would be above and beyond the FMP containment requirements described above and would be third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

It is notable that finfish aquaculture operations have been operating in the community for more than 40 years, this site for almost 30 years, and the relationship between operators and local residents regarding the operation has been very positive.

Navigation for marina users, recreational boaters, fishers and others

Recreational boaters, fishers, marina users and other local residents or passersby who use the waterways for travel need to have clear delineation of safe travel paths when in or below water structures, such as finfish cages exist. We'koqma'q First Nations has ensured this by completing a Notice of Works form to Transport Canada, as required under Section 6 of this Development Plan. We'koqma'q will mark their sites in accordance with these requirements. For this site, a navigation channel has been suggested as part of the site design.

Miscellaneous concerns raised during scoping

During the public meeting held in the community, an attendee mentioned his concern that We'koqma'q's current aquaculture operation in Whycocomagh is causing the build-up of dead seaweed

[14] Refer to Page 12 of the Report on Public Engagement During Scoping

along the shore which is interfering with angling from the shore[15]. It is not clear that the association between the dead seaweed and the finfish culture activities is real and that changes to the operations would make an impact on this phenomenon. Regardless, We'koqma'q is dedicated to monitoring and measuring the environmental impact of its finfish aquaculture operations, including eutrophication. This is demonstrated by We'koqma'q's partnership in research that will model and measure nutrient level changes in the water resulting from its operations. This was previously described in Section 3.2 ("*Mitigating Fisheries Impacts through Research and Development"*).

Ensuring the proper disposal of sewage waste was brought up during the scoping process.[16] Storage and disposal of human waste must be described and documented in the Farm Management Plan as part of the farm operations requirements of the Nova Scotia Aquaculture Management Regulations.

Impacts to wildlife users of the public waters surrounding the proposed development

There are no identified rare or endangered species that are expected to be directly impacted by the operation of this site. Mitigation measures applied to reduce fisheries impacts are described in Section 3.2 and will also mitigate impacts to other wildlife in the bay in general. Measures applied to support the sustainability of wild salmon are described in section 7.2.

As described in Section 5.2, there are no SARA listed species expected to interact with the proposed site since all known SARA species in the area are terrestrial.

Any risks to aquatic rare and endangered species will be mitigated with the fish escape, disease and biosecurity, and environmental impact management[17] procedures described in Section 3.2 (*Mitigating Fisheries Impacts through Operational Procedures*). Potential risks to shoreline species and water birds, particularly those known to be rare or endangered, will be mitigated within a wildlife interaction plan. This plan will describe procedures that ensure least interference with surrounding wildlife while supporting their habitat. This will include a requirement that boat travel to and from the site is taken via the most direct route possible, without travelling near the shore or near wildlife. An exception to this will occur during a weekly sweep of the shoreline to look for debris that may inadvertently have been released during operation of the site. This will enable the upkeep of the shoreline to a level of cleanliness that promotes wildlife habitat. For these procedures, employees will be cautioned to not approach wildlife and not travel through marsh areas where sensitive species may be harbored. An annual shoreline clean-up will also occur for the adjacent area. This clean-up will not be conducted at times of the year when shoreline birds are nesting.

A wildlife interaction plan must be described in an operator's Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. It must be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements. The BAP certification standard also requires a Wildlife Interaction Plan. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

[15] Refer to Page 8 of the Report on Public Engagement During Scoping

[16] Refer to Page 8 of the Report on Public Engagement During Scoping

[17] The potential benthic environmental impacts were brought up during scoping. See page 8 of Report on Public Engagement During Scoping.

Complements to other users

Support of the local economy

Development of We'koqma'q's finfish aquaculture operations is anticipated to bring a significant number of local direct and indirect jobs to the community (see Sections 2.3, 2.4, and 2.5).

Support of conservation efforts

We'koqma'q will work with the conservation groups active in the area to help collect information on the oceanographic and ecological characteristics of this area of the Bras D'Or Lake. On this front, We'koqma'q has an established relationship with Dr. Bruce Hatcher and will continue to assist Dr. Hatcher as he collects information to: characterize the dynamics in the cline of Whycocomagh Bay, explore ice cover changes and effects in Whycocomagh Bay, explore anthropogenic effects on the Bay's characteristics, and other research efforts. We'koqma'q will also assist the Stewardship Society and Biosphere Reserve Association collect information on and educate people on the unique ecology of the Whycocomagh region.

Robin Stuart, the Manager of Aquaculture Operations for We'koqma'q, is the representative for We'koqma'q on CEPI and will help to ensure the responsible management of the Bras D'Or.

5.4 Impacts by other users including wildlife

Generally speaking We'koqma'q's finfish operations have, and hope to continue to have, an excellent and mutually beneficial relationship with the local communities.

A possible negative impact of people on the operations needs mentioning. This refers to vandalism of the fish nets. In the past, one of the nets was released manually by a non-resident. This resulted in fish release. Fishing within the pens has also occurred. Since this time, We'koqma'q has hired security to patrol their sites and mitigate these risks.

Because of the proximity of the site to a residential area, effects of sewage need to be considered. Potential risks from this are acknowledged and will be monitored.

Fish eating birds (herons, hawks, kingfisher, eagles, and other species) can be common-place in regions that support finfish aquaculture operations. If not properly managed, such birds can prey on the fish in the cages, causing stress and physical damage. We'koqma'q First Nation finfish aquaculture operations will use bird nets on their cages during seasons when bird predation is a problem. These nets will cover the surface of the water at a height from the water surface so that bird predation cannot occur. The procedures for their use and maintenance are required as part of the Farm Management Plan.

SECTION 6: THE PUBLIC RIGHT OF NAVIGATION

6.1 Navigation Protection Act approval

The Notice of Works form and required attachments are enclosed.[18]

[18] Concern regarding impediments to navigation were brought up during scoping. See page 9 of Report on Public Engagement During Scoping.

SECTION 7: THE SUSTAINABILITY OF WILD SALMON

7.1 Identification of local salmon populations

This site is within Salmon Fishing Area 19, also called the Eastern Cape Breton Designatable Unit by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Closest salmon bearing rivers that have direct connections to the body of water that contains the site include Skye River (mouth within 2 km of the site), Middle River (mouth more than 23 km from the site), and Baddeck River (mouth more than 26 km from the site). Only the Skye River opens into the Whycocomagh Bay subwatershed. The Middle and Baddeck Rivers open into an adjacent watershed (St. Patricks Channel) which is somewhat separated from the Whycocomagh Bay subwatershed via a sill less than 12 m deep. Since 2006, Middle and Baddeck Rivers have had their salmon populations enhanced through a Provincial stocking program which includes broodstock collection on these rivers. This enhancement is intended to offset anticipated catch and release mortalities on these rivers and has allowed an open catch and release fall season on the Middle and Baddeck Rivers. Food, Social and Ceremonial (FSC) allocations are also available on these rivers. Middle and Baddeck Rivers are index populations. As for all index rivers in Eastern Cape Breton, the populations were assessed to be below conservation egg requirements in 2018.

The approximate locations of all salmon bearing rivers in the vicinity of the site, as reported in the 2017 CSAS Stock Status Update for SFAs 19-21 and 23 are shown below.



Figure 10: Salmon bearing rivers within the region of the site.

7.2 Support of the sustainability of wild salmon

Although rainbow trout are not indigenous to the Bras d'Or Lakes area, it has a resident population that has developed from stocking efforts for the sport fishery, with the first trout introduced in 1899. These introduced fish have been shown to be successfully reproducing in the wild and are contributing to the fishery numbers (Madden et al., 2010). Rainbow trout continue to be stocked by the Province through an enhancement program. This would suggest that there is little concern that the presence of rainbow trout affects the sustainability of wild salmon.

Furthermore, We'koqma'q will institute operational procedures to mitigate the greatest perceived risks of finfish aquaculture operations to wild salmon populations; these being fish escape, disease and biosecurity, and environmental impact risks. These have been described in Section 3.2.

As indicated in Section 7.1, Middle and Baddeck Rivers have had their salmon populations enhanced through a Provincial stocking program which includes broodstock collection on these rivers. The assignment of this lease/licence to We'koqma'q First Nation is not anticipated to affect these efforts.

The environmental and oceanographic data collection in the bay that is supported by We'koqma'q (Section 5.3, Support of conservation efforts) is intended to improve understanding of the local ecosystem as a whole, as well as more broadly with regards to global warming. Although there is no direct intent to use this data to support Atlantic salmon conservation measures, an increased understanding of the environment will contribute to conservation practices in general.

SECTION 8: THE NUMBER AND PRODUCTIVITY OF OTHER AQUACULTURE SITES IN THE PUBLC WATERS SURROUNDING THE PROPOSED AQUACULTURAL LOCATION

8.1 Interactions with other aquaculture operations[19]

We'koqma'q First Nation is presently the lease/licence holder for all aquaculture sites within Whycocomagh Bay, both finfish and shellfish. There are a few oyster sites that are in close proximity distance-wise but the waters are not connected to Whycocomagh Bay.

We'koqma'q is making two requests for new finfish sites within this Option (one on the north side and one on the south side of the eastern end of the Bay), and a request for the amalgamation and enlargement of leased areas in Whycocomagh Bay (this application). We'koqma'q is also requesting assignments of previously active finfish sites in the region. Collectively, the sites will allow an operational expansion to proceed while availing enough area to increase fallowing times. Increased fallowing will reduce fish health risks and minimize potential environmental impacts of the operations. All of the sites planned for the area are listed below and shown in Figure 11:

1) We'koqma'q is currently the licence holder for three sites in Whycocomagh Bay. We'koqma'q is requesting an amendment to amalgamate and enlarge this area (this application).

2) Within its Option to Lease area, We'koqma'q is requesting a new marine site on the southeast end of Whycocomagh Bay (in another application).

3) Within its Option to Lease area, We'koqma'q is requesting a new marine site on the northeast end of Whycocomagh Bay (in another application).

4) We'koqma'q will pursue an assignment of an existing site in Dena's Pond, on the northeast end of Whycocomagh Bay.

5) We'koqma'q will explore the feasibility of a site on a privately leased area.

6) In the future, We'koqma'q anticipates requesting assignments for several other finfish sites in adjacent waters. (Outside of the map area.)

Existing aquaculture sites in the area are shown below, as copied from the NS GIS mapping tool website. The site referred to within this Development Plan and the other sites mentioned above are shown and numbered according to their descriptions.

[19] The potential for aquaculture in the area was brought up during scoping. See page 4 of Report on Public Engagement During Scoping.

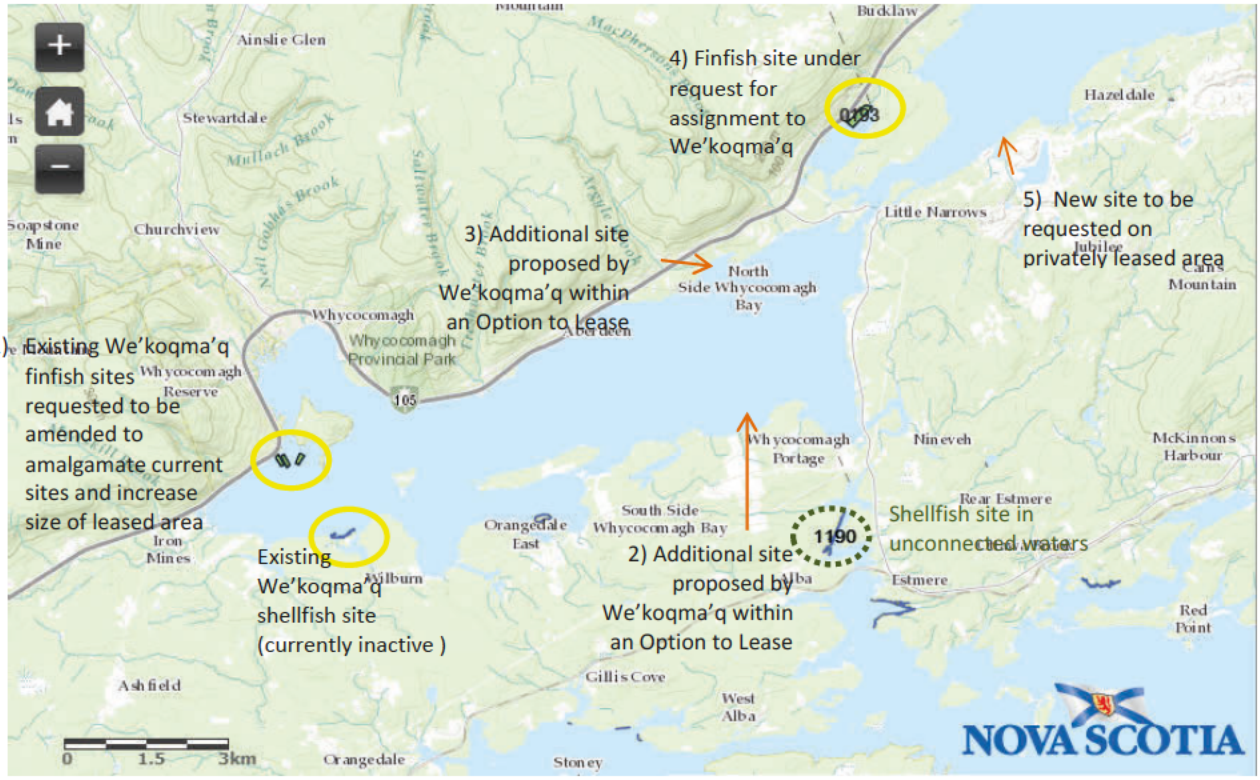


Figure 11: Map of the region of the proposed site showing existing aquaculture sites as well as sites proposed in other applications. The base map was acquired from https://novascotia.ca/fish/aquaculture/site-mapping-tool/

8.2 Interactions with other aquaculture operations

We'koqma'q's finfish sites will be managed as a single farm to promote optional fallowing regimes. These regimes will be developed in conjunction with NSDFA and DFO to maximize fish health and minimize environmental impacts. When all sites are available for use, a rotating fallowing cycle is anticipated.

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4.2.2 AQ#1430 Development Plan (2019)

Option to Lease AQ 1413 North Aberdeen Development Plan

SECTION 1: THE OPTIMUM USE OF MARINE RESOURCES

We'koqma'q First Nation is requesting a new marine finfish licence/lease in the Bras D'Or Lake in Inverness County, NS. This proposed site is within the Option to Lease # 1413 and is located on the northeast side of Whycocomagh Bay near Aberdeen. This site application is one part of We'koqma'q's larger plan to expand its trout aquaculture operations in Whycocomagh Bay. This expansion will increase its trout production capacity four fold to 1,000,000 fish per year. We'koqma'q has been successfully conducting rainbow trout aquaculture in this region for seven years, first as a contract grower, and for the past four years as the business owner. The proposed site is 34 hectares in size and expected to support the grow-out of 750 tons of rainbow trout.

This proposed site will share employment with a proposed site across the bay, requiring 15 new full time positions directly while supporting the sustainability of We'koqma'q's finfish operations as a whole by increasing use of its local infrastructure, including a processing plant, a land-based storage facility, management offices and farm management software. The finfish operations are expected to employ 70 people when all proposed sites are functional. It will also promote the installation of new infrastructure and investment in new equipment, for not only the marine finfish cage operations, but also for We'koqma'q's processing plant and hatchery.

An examination of the habitat below the proposed site, published studies from the area and knowledge collected during scoping for the proposed activities suggest that this development can proceed in harmony with fishery activities in the public waters surrounding the proposed aquacultural operation. Management measures will be in place to mitigate the most significant risks of marine finfish aquaculture to the environment, these being fish escape, disease and biosecurity, and benthic environmental impacts. These measures will be supplemented by partnering on a research project aimed to tailor and improve environmental monitoring of We'koqma'q's finfish aquaculture activities.

The oceanographic and biophysical characteristics of the public waters surrounding the aquaculture operation were reviewed. This included data collected within the scoping activities, published studies, as well as the local knowledge and extensive experience of employees and contractors of the company. This information supports the feasibility of a finfish aquaculture operation at the proposed site and provides the best knowledge to inform a site design. This knowledge is also being used to develop the procedures and production plans for the site.

Consideration and respect for the other users of the public waters surrounding the site will be demonstrated by We'koqma'q's responsible farm practices which include high standards for site maintenance, noise reduction, and waste management. It is the intent of We'koqma'q for the other users of the waters to see the finfish aquaculture site as an opportunity for the region rather than a negative development. Risks to wildlife users of the region will be mitigated via the management measures intended to reduce risk of fish escape, disease and biosecurity, and benthic

environmental impacts mentioned previously. These will be further supplemented with a wildlife interaction plan that recognizes the most susceptible wildlife of the region.

A Notice of Works application accompanies this development plan. Outcomes from Transport Canada's assessment will be applied to ensure the public right of navigation through compliance with the Navigation Protection Act.

The region is one of a handful of regions in Nova Scotia where Atlantic salmon populations still exist. It is also the region that has experienced the longest history of rainbow trout aquaculture. The mitigation measures intended to reduce risk of fish escape, disease and biosecurity, and benthic environmental impacts mentioned previously; and the forward-looking environmental monitoring research We'koqma'q is a partner on should ensure the continued successful coexistence of wild Atlantic salmon with We'koqma'q's rainbow trout operations. Furthermore, there is environmental and oceanographic data collection in the bay being conducted by other researchers that is supported by We'koqma'q which is intended to improve understanding of the local ecosystem as a whole, as well as more broadly with regards to global warming. Although there is no direct intent to use this data to support Atlantic salmon conservation measures, an increased understanding of the environment will contribute to conservation practices in general.

With regards to the number and productivity of other aquaculture sites in the public waters surrounding the proposed aquacultural operation, We'koqma'q is currently the only aquaculture producer in Whycocomagh Bay and will manage its farms as a collective in order to ensure that fish health risks and environmental impacts are minimized. Having an increased number of sites will allow an operational expansion to proceed while availing enough area to increase fallowing.

This site is one request of several that will enable a sustainable expansion of We'koqma'q's finfish aquaculture operations. Activities will contribute to economic development of We'koqma'q First Nation and the local region in general. Site location considerations and mitigation practices will reduce impacts to other users of the local waters, including the fishery, wildlife (including Atlantic salmon), local residents, and seasonal visitors. This includes the public right to navigation. Ongoing environmental monitoring along with research assessing carrying capacity for Whycocomagh Bay should ensure that these practices are effective now, and in the future. Therefore, because of the expected minimal negative impacts and anticipated positive impacts described according to the factors to be considered in decisions related to marine aquaculture sites, this request should represent an optimum use of marine resources.

SECTION 2: THE CONTRIBUTION OF THE PROPOSED OPERATION TO COMMUNITY AND PROVINCIAL ECONOMIC DEVELOPMENT

2.1 Production plan

Species: Rainbow trout.

Maximum site biomass (kg): 750,000kg

Maximum cage density during grow out period (kg/m^3): 18 kg/m^3. Normal operating density will be <15 kg/m^3

Expected time to achieve maximum production: 5 months from stocking

Size(s) of cages, including net volumes (m^3): 60m polar circle; 6 m depth; 1,700m^3 per cage

Maximum cage number, maximum total net volume (m^3): 2 arrays of 12 cages = 40,800m^3

Maximum number of fish per cage during grow out period: 15,000

Intended initial stocking date and seed source: May 2019, Big Falls Hatchery (AQ # 1028) and over-wintering stock currently at Marine Licence/Lease AQ # 0814 in Whycocomagh Bay, south of We'koqma'q Reserve.

Expected grow out period: May – December

Expected fallow period: Cages will be left in a single location for two production cycles with 3 month fallow (January to April) between each cycle. This will be followed by a 15 month fallow (January to April of the next year) of the entire lease if environmental monitoring demonstrates this necessity. The lease has been sized to allow movement of the cage arrays within the lease boundaries so that fallowing of sections within the lease can occur, if desired.

Additional notes: This site represents one site of several new or amended sites planned for We'koqma'q's finfish aquaculture operations. We'koqma'q is expanding its infrastructure and assets in order to accommodate a planned expansion in production capacity to over 1,000,000 fish per year. A summary of the overall expected plans for sites can be found in Section 8.1.

2.2 Infrastructure

This site is to be serviced by We'koqma'q's facilities in and around Whycocomagh and Aberdeen. These services include the land-based facilities for holding and managing nets and feed in Whycocomagh; barges, boats and vehicles based in Whycocomagh; management offices at the We'koqma'q Band office, a FishTalk farm management database housed at the We'koqma'q Band office; and the CFIA registered processing facility in Aberdeen. Additional investments in infrastructure and equipment are occurring in conjunction with the new site requests, of which this site is only one of a part, as explained above. These investments include the addition of a deboning machine and active trimming line as well as a packaging storage building for the processing plant; the addition of a winter harvest system and oxygenation system for the cage operations; and the addition of equipment, including new cages, nets, a net cleaner and forklift, among other smaller requirements. The addition of a new wharf toward the east end of Whycocomagh Bay is also

planned, along with the purchase of a new barge to service this and the other new site in the east end of Whycocomagh Bay that has been requested in another application.

We'koqma'q recently acquired Big Falls Fish Growers in Wolfville, NS, in order to increase juvenile production to service the intended increased capacity of the sea cage aquaculture operations. This facility (Big Falls) is undergoing significant upgrades to enable it to better meet the demands of the sea cage operations.

2.3 Services and suppliers

Increased local (NS) service requirements in terms of contractors (welders, carpenters, others) and suppliers of general merchandise will be necessary to support the expanded operations. These requirements are anticipated to increase at the same scale of the operations – four fold – when all of the planned sites are in operation. Processing will occur at We'koqma'q's facility in Aberdeen, NS, upgraded as described above. Juveniles will come from the improved Big Falls Hatchery in Wolfville, NS, described above. Feed will continue to be purchased from outside of the province (Skretting in NB) because of the requirement that the feed mill be BAP certified in order to assist We'koqma'q's goal of achieving four-star BAP certification. Eggs will be purchased from an international supplier since there is no local supply. The development of a local broodstock is under investigation and achieving a critical production mass will be imperative for its success.

2.4 Employment

This proposed site will share employment with another proposed site across the Bay ("South Aberdeen"), directly requiring 15 new full time positions. These employees will consist of a site manager, feeders, and site technicians. Putting this site into use will also improve the security of employment of the rest of the employees of We'koqma'q since it will optimize the use of the processing facility in Aberdeen, NS, hatchery in Wolfville, NS, land-based storage facility in Whycocomagh, NS, as well as the maintenance personnel for the finfish operations and the management and data entry personnel at the We'koqma'q First Nation Band Office.

As stated previously, this site represents one site of several new sites planned for We'koqma'q's finfish aquaculture operations. In total, We'koqma'q's planned expansion activities are expected to require 70 employees over the next year.

2.5 Other economic contributions to the local community and Province

Fulfillment of this site request will promote the success of We'koqma'q's expansion plans. This has ramifications for several proposed new sites and existing sites in the Aberdeen and Whycocomagh area[1]. A summary of the overall expected plans for sites can be found in Section 8.1.

[1] The potential economic benefits to the area were brought up during scoping. See page 5 of Report on Public Engagement During Scoping.

Spin off economic benefits to the local communities would be expected to occur. A recent report on the economic impact of aquaculture in Nova Scotia indicates that 1.55 indirect jobs result from every person directly employed at an aquaculture operation (Foster, 2019).

2.6 Financial viability

We'koqma'q's business development plan has been submitted as a separate document.

2.7 Adverse economic impacts

There are no adverse economic impacts expected from fulfillment of this request.

SECTON 3: FISHERIES ACTIVITIES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

3.1 Status of fisheries activities

Recreational fishery

Trout

(Reference: https://novascotia.ca/fish/documents/Anglers-Handbook-2018.pdf)

The proposed aquaculture site is located in NS Recreational Fishing Area 1: Cape Breton, Inverness, Richmond and Victoria Counties, specifically within the Bras D'Or Lake. Here the speckled (brook) trout, brown trout and rainbow trout recreational fishing season is open in the tidal waters of the Bras D'Or Lake, including Whycocomagh Bay in which the proposed site is located, from April 1 to September 30 with some restrictions (no speckled trout September 1 to September 30). Skye River which feeds into the subwatershed of Whycocomagh Bay of the Bras D'Or approximately 9 km away from the proposed site is open for the same period. Other major recreational fishing rivers in the area feed into different subwatersheds. These include River Denys which feeds into the Denys Basin, and Middle River and Baddeck River which feed into the St. Patricks Channel. River Denys, Middle and Baddeck Rivers are Special Trout Management Areas with minimum size and bag limits. For further reference, the locations of these rivers are shown on a map in Section 7.1.

A resident population of rainbow trout exists in the Bras D'Or Lake area. This is enhanced every year by the release of juveniles reared in Provincial hatcheries to support the above described rainbow trout sport fishery.

Non-salmonid species

(Reference: https://novascotia.ca/fish/documents/Anglers-Handbook-2018.pdf)

Recreational fishing for the following species is also conducted in the Bras D'Or Lake: smallmouth (black) bass, white perch, yellow perch, brown bullhead, white sucker, chain pickerel, lake whitefish, striped bass, shad, gaspereau, smelt, and eel.

Atlantic salmon

(Reference: CSAS Science Response 2017/20)

The proposed site is located within Salmon Fishing Area 19. There is no recreational salmon fishing permitted in Whycocomagh Bay, where the proposed site is located. The Middle and Baddeck Rivers, which feed into the Bras D'Or to an adjacent subwatershed (St. Patricks Channel), have an open catch and release fall season for Atlantic salmon. Social and Ceremonial (FSC) allocations are also available on these rivers. For more discussion on this site and these rivers relative to the salmon populations, see Section 7.

Commercial Fishery

Historically, the Bras D'Or Lake has supported some limited fisheries activities. The bottom trawl fishery was banned in the Bras D'Or Lake in 1992. The local herring fishery closed in 1999. This left only lobster and oyster fishing.

Lobster

In 2016, there were 14 licences for commercial lobster fishing in the Bras D'Or Lake (Lobster Fishing Area (LFA) 28), with a trap limit of 250 and a minimum legal size limit of 84mm. The season runs annually from April 30 to June 30.

Historical landings from LFA 28 are shown in Figure 1.

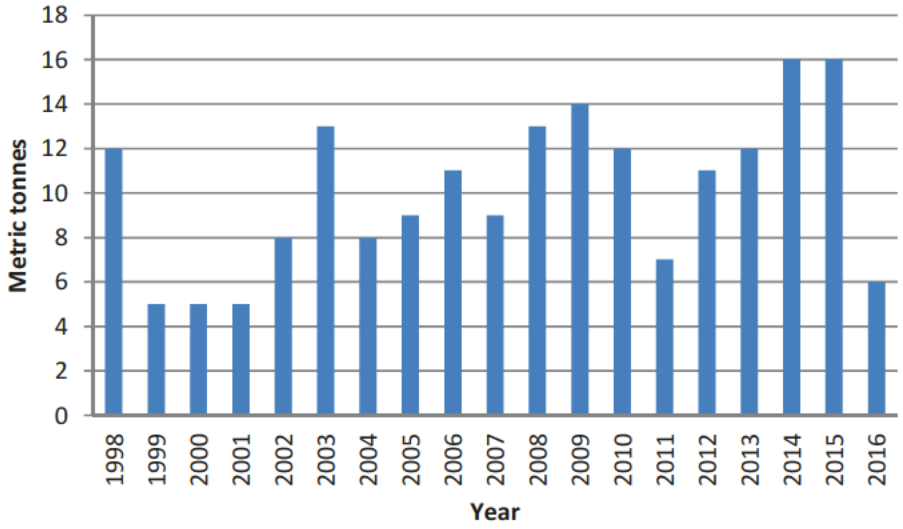


Figure 1: Historical lobster landings from LFA 28 (the Bras D'Or Lake). Graph generated from 2017 Stock Status Update (DFO, 2017).

The lobster industry in LFA 28 is small relative to that of Nova Scotia in general. The mean landings for 2013-2015 for LFA 28 represent 0.8% of the mean landings for Nova Scotia for the same period, as calculated from data within the 2017 Stock Status Update (DFO, 2017).

Oyster

Oysters were an important harvest for local Mi'kmaq and, likely, non-native settlers of the Bras D'Or Lake region (Tremblay et al., 2002). Traditional knowledge of the area indicates that oyster populations were all along the north, west, and south west coasts of Whycocomagh Bay at one time (Eskasoni Fish and Wildlife Commission and Dept. of Fisheries and Oceans. 1996, cited not seen). However, populations declined due to over-fishing, degradation of habitats and the appearance of the MSX parasite (*Haplosporidium nelsonii)* in 2002 (Stephenson et al., 2003).

Traditional Mi'kmaq Fishery

We'koqma'q First Nation has traditionally fished in Whycocomagh Bay for a number of species including cod, hake, smelts, trout (speckled and brown), herring, mackerel, gaspereau, cod, eels, flounder, lobster, softshell clams, mussels and oysters. Currently smelts, trout (speckled, brown and rainbow), eels, winter flounder, striped bass, softshell clams, mussels and oysters are fished (Joe Googoo, We'koqma'q Elder, personal communication).

3.2 Impacts on fisheries activities

Recreational

Trout

Although rainbow trout are not indigenous to the Bras d'Or Lake area, it has a resident population that has developed from stocking efforts for the sport fishery, with the first trout introduced in 1899. These introduced fish have been shown to be successfully reproducing in some regions in the wild and are contributing to the fishery numbers (Madden et al., 2010). Rainbow trout continue to be stocked by the Province through an enhancement program. Other trout populations do not seem to be affected by this enhancement, as exemplified by the fact that speckled trout populations are thought to be recovering in the Whycocomagh area (CEPI, 2006; Joe Googoo, We'koqma'q Elder, personal communication).

Rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the trout fishery have not been raised. Anglers of the area have historically been supportive of the trout operations. Recently, Robin Stuart of We'koqma'q was approached to collaborate with anglers to increase rainbow populations in the lake[2].

We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

The successful historical co-existence of the recreational trout fishery with trout aquaculture operations combined with We'koqma'q's intended enhanced management procedures suggest that there will be minimal impacts on the recreational trout fishery.

Non-salmonid species

As stated for the recreational trout fishery, rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the sport fishery have not been raised. As also stated previously, We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

[2] See page 6 of Report on Public Engagement During Scoping.

Because of the successful historical co-existence of rainbow trout aquaculture operations with the sport fishery and the enhanced fishery risk mitigation efforts, there are no impacts on recreational fisheries activities anticipated for any species.

Atlantic salmon
Interactions with Atlantic salmon are described in Section 7 of the Development Plan.

Commercial Fishery
Lobster
Although lobster were in Whycocomagh Bay in the mid 60's they have disappeared from the Bay since that time (Joe Googoo, We'koqma'q Elder, personal communication). Traditional knowledge collected in 1996 (Eskasoni Fish and Wildlife Commission and Dept. of Fisheries and Oceans. 1996, cited not seen) and trawl surveys from 1999 indicate no lobster inhabit Whycocomagh Bay (Tremblay et al., 2002). This proposed finfish aquaculture site will, therefore, likely not impact the lobster fishery.

Oyster
Some populations of oysters remain in the Lake today, including in Whycocomagh Bay; and initiatives are underway to understand why these populations survive. This knowledge will be used to develop stocks or culture practices that allow rejuvenation of the oyster populations (Vercaemer et al., 2010; Robin Stuart, personal communication). We'koqma'q First Nation is part of these efforts, have a vested interest in the rejuvenation of the oyster populations, and will continue to support developments along this line.

Traditional Mi'kmaq Fishery
As stated for the recreational fishery, rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the traditional fishery have not been raised. As also stated previously, We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

Because of the successful historical co-existence of rainbow trout aquaculture operations with the traditional fishery and the enhanced fishery risk mitigation efforts, there are no impacts on traditional fisheries activities anticipated for any species. This aquaculture development will be managed in association with the other Mi'kmaq activities in the waters, including fishing. A single group manages both the fisheries and aquaculture portfolio of the Band and will ensure that they are complementary.

It is notable that there were no fisheries concerns raised during the scoping process conducted for this application.

Habitat beneath the proposed site - summary of baseline monitoring

This summary is provided only to describe the habitat observed beneath the proposed site. Complete baseline monitoring results were submitted to DFO and NSDFA for their review as per Section 4.2.

Location Name	Coordinates	Benthic sediment description	Flora/Fauna	Station Classification
Northside Aberdeen, Center Lease	Lat: 45.97832; Long: -61.02455	Brown/black mud; two samples spongy	holes in mud (bivalves or worms?) bivalve shells; bivalves in one sample	Oxic A
Northside Aberdeen, Corner Lease 1	Lat: 45.97538; Long: -61.03527	Dark brown/black mud	n/a	Oxic A
Northside Aberdeen, Corner Lease 2	Lat: 45.97778; Long: -61.03096	Brown mud	n/a	Oxic A
Northside Aberdeen, Corner Lease 3	Lat: 45.97507; Long: -61.02795	Brown/black mud	holes in mud (bivalves or worms?) bivalve shells; clam shells in one sample	Oxic A
Northside Aberdeen, Corner Lease 4	Lat: 45.97821; Long: -61.01829	Brown/black mud with rust specks	holes in mud (bivalves or worms?); clam shells; mussel shells, dead eel grass; worm	Oxic A
Northside Aberdeen, Reference 1	Lat: 45.98206; Long: -61.01464	Sediment could not be retrieved according to required standard. Hard bottom video transect was completed in its stead with video taken every 10m. Video revealed a brown or brown/black sediment along entire transect consisting of layer of silt; hard packed sand; and cobble (only at 10m). Starfish were seen at each transect point as were leaves, dead or loose eel grass.		
Northside Aberdeen, Reference 2	Lat: 45.97538; Long: -61.03527	Dark brown mud	n/a	Oxic A

Published descriptions of the benthos of Whycocomagh Bay

As extracted from Parker et al., 2007: "Whycocomagh Bay has two deep basins and a flushing time of approximately two years. This slow water exchange facilitates the unique anoxic and hypoxic character of the deep basins within the Bay (Petrie and Bugden 2002). The eastern basin in

Whycocomagh Bay, immediately west of St. Patricks Channel, has DO levels as low as 38% at the bottom (38 m) (Strain and Yeats 2002). The 48 m deep western basin has only 47% saturation at 15 m depth, and is typically anoxic below 25 m (Krauel 1975), a characteristic that appears consistent over the year and over time (Strain and Yeats 2002). Black's (1958) observation of only a few organisms of two shallow water species of mysid shrimp in Whycocomagh Bay is a further indication that low dissolved oxygen levels have likely existed for some time in the deeper waters at this location." In the same review paper, a limited diversity of copepods was also noted for Whycocomagh Bay, with only the four most common copepod species typically being found.

Previous internal studies on the site area
Several years ago, baseline information on the benthos of this area was conducted. Although the environmental monitoring data did not meet the QA/QC guidelines of the Nova Scotia Department of Fisheries and Aquaculture, the information is still relevant. The internal report produced as a result of this study is attached as Appendix A. This study indicated that the benthic flora and fauna in the area of the site were limited in diversity.

Mitigating Fisheries Impacts through Operational Procedures
Three of the greatest perceived risks of finfish aquaculture operations to fisheries and fisheries' habitats are fish escape, disease, and impact on the benthos and water quality. We'koqma'q will institute operational procedures to mitigate these risks as described below.

Fish Escape
All of We'koqma'q First Nation finfish aquaculture operations will follow the fish containment management requirements described in their Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. This containment management plan includes:

- Described and approved operating procedures that limit the risk of a breach, including the identification of critical control points, critical control limits, monitoring and corrective actions. The controls are identified through conducting a site specific hazard analysis.
- Described and approved procedures for site management if unusual events or severe weather occurs.
- Minimum infrastructure requirements, and minimum infrastructure maintenance and inspection requirements –including proof of a professional engineer's approval of the design of the structures in place for containment management.
- Described and approved responses to breaches or suspected breaches, including mandatory reporting.

The above plan will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

In addition, We'koqma'q's finfish operation hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices (BAP). This science-based and continuously-improved global performance standard is third party audited and assures "healthful foods produced through environmentally and socially responsible means". The BAP standard requires the application of a Fish Containment Plan to cover fish escape prevention. This would be above and beyond the FMP containment requirements described above and it would be third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Finally, the regulatory and certification minimum requirements will be enhanced with the extensive practical knowledge and experience of the managers responsible for We'koqma'q's finfish aquaculture operations. Resumes for senior management are attached as Appendix C.

Disease and Biosecurity

All of We'koqma'q First Nation's finfish aquaculture operations will follow the fish health requirements within their Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. These requirements include:

- Described and approved finfish husbandry and welfare, veterinary care and disease surveillance practices. These practices include following the NSDFA marine finfish disease surveillance program and adhering to the multi-governmental agency (NSDFA, DFO, CFIA) Introductions and Transfers disease screening and permitting requirements.
- Described and approved biosecurity measures appropriate to the operation and its risk.
- Prescribed mortality and disease reporting requirements.
- Prescribed reporting of antibiotic and products used to treat sea lice.
- Described and approved procedures and measures to be followed in the case of a disease outbreak.

The above elements will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

An additional relevant aspect regarding disease concerns the unique low salinity waters of Whycocomagh Bay, the region of the proposed site. This site has a salinity of 17-18 ppt at the surface, approximately 20 ppt within a few meters. This has a number of fish health advantages that mitigate disease risk. Sea lice, which are ectoparasites of salmonids that may transfer between cultured and wild fish populations, and are often a great concern for salmonid fisheries enthusiasts, have never been observed in the waters of Whycocomagh Bay. It is likely that the low salinity of the Bay prevents this parasite from thriving (R. Wooten and C. Sommerville, personal communication). Bricknell, et al., 2006 demonstrated that sea lice (*Lepeoptheirus salmonis*) actively avoid low salinities (<27ppt) and even short term exposure to low salinity water (<27ppt) severely compromised sea lice survival and host infectivity. Low salinity waters are also known to reduce the risk of amoebic gill disease (AGD) (Mitchell & Rodger, 2011), another disease of concern for salmonid culturalists. Finally, the low salinity water reduces transfer stress from the hatchery, thereby reducing fish health and welfare risks.

As stated previously, We'koqma'q hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices. This certification includes sections addressing minimum animal health and welfare and biosecurity requirements. These requirements would be above and beyond the FMP fish health requirements and third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

As stated previously, the regulatory and certification minimum requirements will be enhanced with the extensive practical knowledge and experience of the managers responsible for We'koqma'q's finfish aquaculture operations. (See Appendix C.)

Environmental Impacts

All of We'koqma'q First Nation finfish's aquaculture operations will follow the Environmental Monitoring Program requirements dictated by NSDFA as required by the Aquaculture Management Regulations, as well as the environmental monitoring requirements required by DFO according to the Aquaculture Activities Regulations (AARs). These monitoring requirements focus primarily on potential impacts on the surrounding marine benthic environment, a primary concern regarding marine finfish aquaculture sites. They apply a risk based approach to determine monitoring requirements. Monitoring requirements for marine finfish sites include:

- A site specific benthic sampling and monitoring regime customized according to production level, site configuration, species cultured, past environmental performance of the site, and site specific oceanographic and biophysical characteristics. This must be pre-approved by NSDFA prior to the monitoring.
- Provincial and Federal review and approval of records of observations taken during monitoring and of the monitoring conducted, including Quality Assurance and Quality Control records that demonstrate adherence to procedures and protocols defined by NSDFA in their EMP Standard Operating Procedures (SOPs) and DFO within the AARs.
- Provincial and Federal review and approval of records of lab results, including Quality Assurance and Quality Control records that demonstrate adherence to procedures and protocols defined by NSDFA in their EMP Standard Operating Procedures (SOPs) and DFO within the AARs.
- Reporting of the results to NSDFA and DFO within defined timelines.

The environmental program also requires the provision of a mitigation plan which is to be applied when poor environmental performance is indicated by the monitoring.

Specific operational practices to reduce benthic impact are planned for this site. Having more available lease area, as will be achieved in part with this new site, the operator will have more room to grow fish and will be able to allow greater fallowing times of leases and sections of the leases. This strategy will be combined with increased training of staff on the use of feeding cameras and feeding techniques to try to improve food conversion and reduce benthic impacts.

It is notable that the Manager of Aquaculture Operations for We'koqma'q (Robin Stuart) was one of the designers of the original environmental monitoring program for aquaculture in Nova Scotia (see Smith et al., 2002) and continues to contribute to its development through a seat on the Nova Scotia Aquaculture Environmental Coordinating Committee. This committee, which is co-chaired by NSDFA and DFO, is a forum for industry and regulators to provide input and exchange ideas regarding the environmental monitoring program for marine sites in Nova Scotia.

As stated previously, We'koqma'q hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices. This certification includes sections addressing minimum environmental monitoring requirements. These requirements would be above and beyond the FMP fish health requirements. For the We'koqma'q finfish aquaculture sites in the Bras D'Or Lake this environmental monitoring would have to include monitoring the water column itself for quality parameters including pH, total suspended solids, soluble phosphorous, total ammonia nitrogen,

biochemical oxygen demand, dissolved oxygen and chloride. The BAP standard also imposes maximum feed rates according to retention time of the water body. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Mitigating Fisheries Impacts through Research and Development

We'koqma'q First Nation is committed to monitoring and mitigating impacts of its finfish aquaculture activities on the environment, including fisheries and fisheries' habitat. In this regard, We'koqma'q has historically supported and will continue to support researchers as they assess and develop techniques to monitor impacts.

Recent efforts (2018) have included collaborating with DFO Peter Cranford of DFO Science and NSDFA to evaluate alternative means for monitoring benthic environmental impacts.

Future efforts include completing a carrying capacity analysis for finfish aquaculture in Whycocomagh Bay. This study, to be led by Dr. Christopher Algar (Dept. of Oceanography, Dalhousie University), will develop a model that can capture carbon, oxygen, and sulfur dynamics in the sediments of Whycocomagh Bay, both with and without the influence of fish cages. The model will be used to assess the impact of aquaculture on the Whycocomagh Bay benthic ecosystem and investigate how changes in fish-rearing practices, such as increased stocking levels, may affect these impacts. Additional information regarding this work can be found in Appendix D. We'koqma'q is a partner on this project, providing site access, logistics assistance, personnel, historical environmental monitoring data and production data.

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SECTION 4: OCEANOGRAPHIC AND BIOPHYSICAL CHARACTERISTICS OF THE PUBLIC WATERS

4.1 Oceanographic environment

The proposed site is in Whycocomagh Bay of the Bras D'Or Lake - referred to as "Bras D'Or Lakes" by some. The following extract from Lambert, 2002, gives excellent background information on the unique oceanographic environment of the Bras D'Or Lake:

"The Bras d'Or Lakes are situated in Cape Breton Island at the northern end of Nova Scotia. This body of water of about 1,100 km^2 is essentially an enclosed estuary with three outlets to the sea. The Great Bras d'Or Channel and the Little Bras d'Or Channel connect with Sydney Bight to the north, and St. Peter's Canal gives access to Chedabucto Bay to the south. Only the Great Bras d'Or Channel is large enough to permit any significant exchange of water. The Bras d'Or Lakes watershed is about 2500 km^2; this area added to that of the Lakes themselves gives a total catchment area of 3600 km^2 (Krauel, 1976).

Input from six rivers and restricted access to the ocean keeps salinity in the range of 20 to 26, whereas, sea water just outside the Lakes in Sydney Bight ranges from about 28 to 32. The Lakes are usually ice covered in the winter and surface waters often exceed 20°C in the late summer, particularly in smaller, shallow bays (Petrie and Bugden, 2002).

The waters of the Bras d'Or Lakes are characterised by a two-layer system; a low salinity surface layer which has a wide annual range in temperature and a lower layer of higher salinity in which temperature range is much less pronounced. In general, surface water moves toward the entrance of the Lakes and out into Sydney Bight and is replaced with outside oceanic water which enters the Lakes near the bottom and flows underneath the surface layer (Krauel, 1976; Petrie and Bugden, 2002). With the exception of restricted channels, there is little mixing between these layers except for winter months when higher winds and wave action disrupt the stability of this system. In some areas where currents and exchange rates are very low, the amount of dissolved oxygen can become quite depressed and in Whycocomagh Bay, anoxic (no oxygen) conditions exist (Petrie and Bugden, 2002; Strain and Yeats, 2002)."

The biophysical characteristics of the site environment are summarized in the table below with supporting figures and tables provided, as relevant.

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomaugh since 2009
Average wind speed (km/hr) (30m height)	19.8	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease
Wind speed class rating (10m height)	Low to Moderate	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)[3]	1.08	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the greatest Hmax measured with the ACDP during October 31, 2018 to December 11, 2018 deployment.
Direction of maximum wave[3]	244° (WSW)	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Direction stated is the direction of the maximum wave listed above.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (personal communication, Robin Stuart).		
Annual maximum tide (m)			
Current speed range and averages (cm/sec)[2]	See Figure 2 a,b,c,d and statistics summary table (Table 1) that follow.		

[3] The oceanographic characteristics of this area were collected over the autumn months and early winter months of 2018 (October 31, 2018 to December 11, 2018) via deployment of an ADCP (Acoustic Doppler Current Profiler) within the proposed site's boundaries. This monitored a number of variables associated with currents and waves at multiple levels in the water column. Although only summaries are depicted within this plan, all of the data derived from this monitoring will be used in the engineering of the cage and infrastructure for this site.

Characteristic	Value	Reference	Comments
Annual minimum salinity (ppt)	Upper 10m: 15 ppt Below 10m: 17 ppt	Tremblay, 2002	Throughout the Bras d'Or Lakes salinities are lower in the 0-10 m depth interval than in the 10-50 m depth interval and in the upper metre of the Whycocomagh and Denys Basins maybe 5 after rainfall (Petrie, 2001). There is also a seasonal difference in salinity, with lower salinities in spring compared to summer. Tremblay, 2002). The salinities of the area are shown in Figure 3 which was adapted from figures within Tremblay, 2002
Annual maximum salinity (ppt)	Upper 10m: 25 ppt Below 10m: 27 ppt	Tremblay, 2002	
Annual minimum temperature (°C)	3°C	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the lowest ADCP temperature measured during October 31, 2018 to December 11, 2018 probe deployment. See also summary temperature plot (Figure 4).
Annual maximum temperature (°C)	25°C	Raw data obtained from David Cook (NSDFA)	Value stated is the greatest "cage level" temperature measured during June 1, 2018 to August 19, 2018 probe deployment. See also summary plots (Figure 5).
Depth of water at each corner of the site (m)	Corner 1: 14.6m Corner 2: 26.6m Corner 3: 26.6m Corner 4: 26.4m Center Lease: 26.4m	Depths taken during baseline EMP sampling	

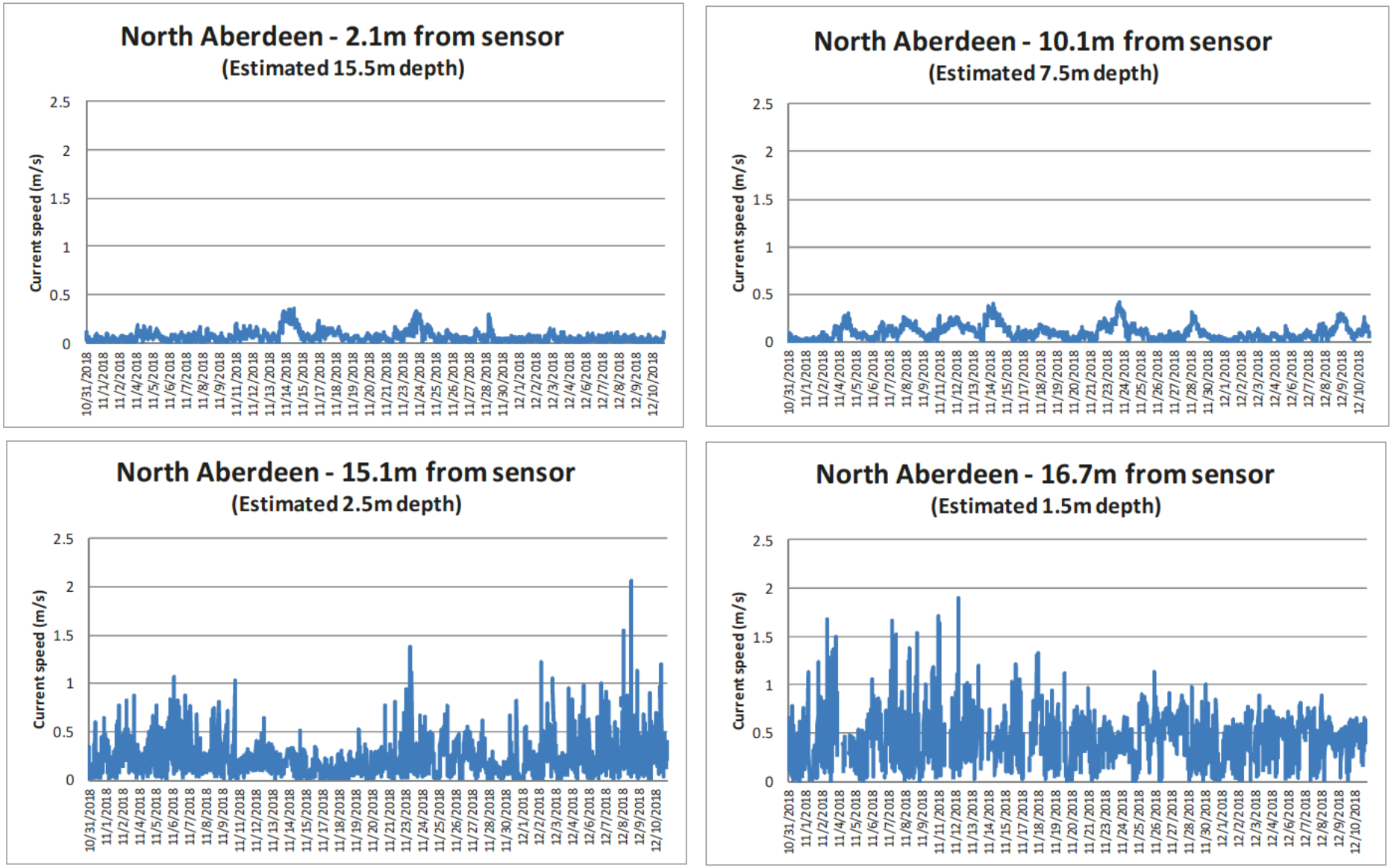


Figure 2 a,b,c,d: Current speeds measured in 2018 (October 31 to December 10, 2018). Raw data obtained from David Cook (NSDFA) from ADCP deployment. Estimated depths calculated from sensor deployment characteristics.

Table 1: Summary table of current speeds statistics determined from data derived from ADCP deployed October 31, 2018 to December 11, 2018. Raw data obtained from David Cook (NSDFA) from ADCP deployment.

Height from sensor (m)	2.1	3.1	4.1	5.1	6.1	7.1	8.1	9.1	10.1	11.1	12.1	13.1	14.1	15.1	16.1
Estimated mean depth (m)*	15.5	14.5	13.5	12.5	11.5	10.5	9.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5
Min speed (m/s)	0.001	0	0.001	0	0	0.001	0	0.001	0.001	0	0.002	0.001	0.001	0.003	0.003
Max speed (m/s)	0.354	0.352	0.374	0.378	0.392	0.407	0.407	0.408	0.415	0.408	0.394	0.42	0.487	2.061	1.892
Mean speed (m/s)	0.0633	0.0765	0.0860	0.0918	0.0936	0.0943	0.0952	0.0969	0.0998	0.1015	0.1033	0.1065	0.0777	0.2072	0.4119

*Calculated by subtracting the bin sizes from the measured sensor depth.

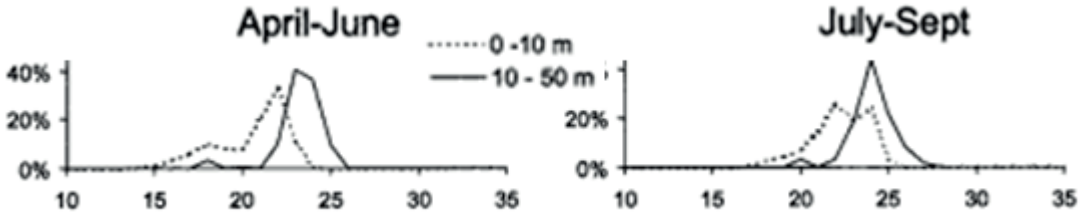


Figure 3: Frequency distribution of salinity measurements taken from Baddeck Bay, including Whycocomagh Basin, Baddeck Bay and St. Patrick's Channel. Figure adapted from figures within Tremblay, 2002.

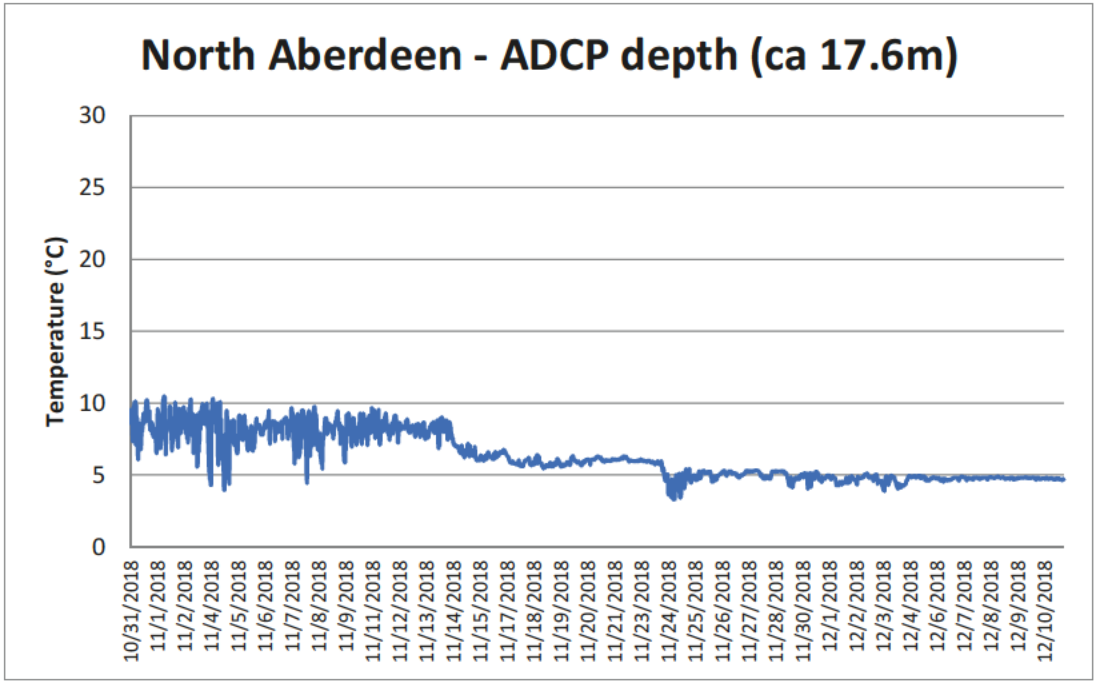


Figure 4: Winter temperatures measured in 2018 (October 31 to December 10, 2018). Raw data obtained from David Cook (NSDFA) from ADCP deployment. Depth is the average depth measured by the ADCP.

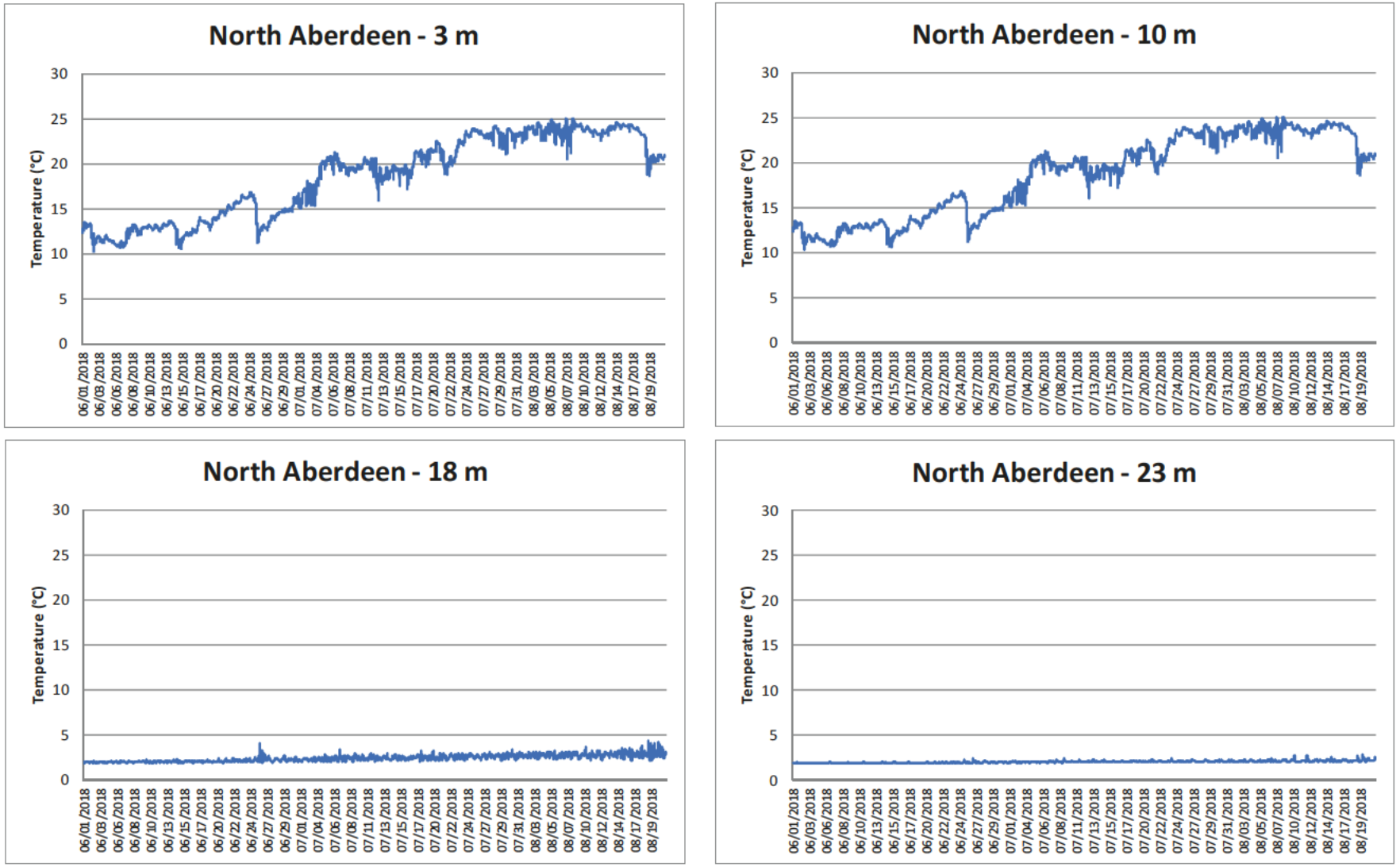


Figure 5 a,b,c,d: Summer temperatures measured in 2018 (June 1, 2018 to August 19, 2018) at depths from surface as recorded at deployment of sensors. Raw data obtained from David Cook (NSDFA).

4.2 Baseline environmental monitoring

The baseline monitoring package has been submitted separately.

4.3 Site design

Extensive depth sounding activities were conducted in Whycocomagh Bay in 2017. This allowed the creation of depth profiles to determine best locations for sites. Benthic information was also collected at that time. This information was overlapped with potential visual impacts to determine best options for the new sites. The proposed site in North Aberdeen was deemed to have suitable depths and bottom characteristics and have minimal visual impact so more intense scoping of the lease was initiated in 2018. This intense scoping included profiling of temperatures and oxygens near the proposed site, profiling of oceanographic characteristics, and baseline monitoring of the benthic environment. Results from these activities are found elsewhere in this Development Plan. Specific characteristics of this body of water that are significant and have been accounted for in terms of the site plans are described below:

Anoxic water

Whycocomagh Bay is separated from the east (St. Patrick's Channel) via a sill less than 12 m deep. Whycocomagh Bay itself has a pair of deep basins of 38 and 46 m deep separated by a sill of approximately 7 m depth. These sills inhibit flushing below sill depth, preventing a horizontal exchange of deep water and partly isolating the physical and biological processes of one basin from the other and inhibit biota movement (Parker et al, 2007). This makes for a unique oceanographic environment that must be considered in site design and operation. In particular significant thermoclines and haloclines are known to exist and much of the benthic layer is known to be naturally anoxic (Parker et al, 2007). There is little upwelling in the Bay. In fact published reports indicate there is none (Parker et al, 2007). However some upwelling of low oxygen "fingers" of water has been experienced in fish farming operations in the past. These events are thought to be caused by deep water currents caused by tide. As the deep water is pushed in by a moon tide, the low oxygen water at depth pushes to the surface and oxygen levels decline in the fish rearing layer. This must be managed in operational procedures. In response to this risk, oxygen monitoring occurs on a regular basis and increases around wind and tidal events. An oxygen supplementation system will be part of the infrastructure for the cages in susceptible areas, as determined by the oxygen profiles. The oxygen profiles of this site, as collected during scoping activities, indicate that oxygen levels at depth (28m) can hover between 40% to 60% saturation so this will be monitored closely. Where required, oxygen supplementation is anticipated to improve environmental outcomes by reducing feed conversion rates and reducing risks to animal welfare.

Ice cover

Another feature of Whycocomagh Bay that must be managed is the presence of ice over the bay during winter. The bay begins icing over after mid-December and generally stays covered with ice until March/April. At this proposed site (North Aberdeen), the ice coverage will be managed via harvesting the fish prior to the ice forming so that special ice management measures regarding the fish will not need to be applied. In order to ensure that all fish at the site are harvest-size prior to ice forming, an assessment of fish size will occur when water temperature reaches a low of 5°C. At

this time, fish that are not expected to reach harvest size will be moved to cages at another lease site where over-wintering and winter harvest can occur. Nets will be removed from the cages after the fish are harvested or moved and the cages will be moved to Whycocomagh Bay for the winter. The moorings will stay in place over the winter. Spar buoys will be replaced with temporary buoys to mark the site for the winter period. These temporary buoys will allow the ice to travel over them when it moves out in the spring. By contrast, the large Spar buoys would get dragged with the ice when it breaks up in the spring. This has been experienced for several successive years and needs to be avoided (Robin Stuart, personal communication). The area is not navigable at this time due to the presence of the ice so that a navigation hazard is not created by the removal of the larger buoys.

Water currents and waves

The current, tide and wave data collected over the autumn months and early winter months of 2018 (October 31, 2018 to December 11, 2018) via deployment of an ADCP (Acoustic Doppler Current Profiler) and summarized in Section 4.1 will be used to engineer the cage and infrastructure for this site. Note that the raw data is available and will be used for this purpose. The engineer engaged for this activity is Bruce Aikman from Middle River.

Water temperature

As shown in Section 4.1, temperature was monitored at successive depths (3m, 10m, 18m, 23m) within the proposed site boundaries from June 1, 2018 to August 21, 2018. Graphs of the temperature profiles at these depths clearly show the presence of a thermocline. This was expected and is a well-recognized phenomenon for Whycocomagh Bay. Temperature was also monitored at 18m using the ADCP from October 31, 2018 to December 11, 2018. The temperature profiles of the water depths the fish will inhabit have been incorporated into the growth model of the fish to predict feeding rates and days to harvest. They demonstrate that fish entering the site in May at 250g will reach harvest size before the area ices up.

SECTION 5: THE OTHER USERS OF THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

5.1 Description of other users

The proposed site is located in a sparsely populated area. That was one of the reasons it was chosen. The TransCanada Highway (Route 105) runs along much of the adjacent shoreline to the west of the proposed site. The TransCanada Highway (Route 105) and Route 223 are the main thoroughfares east of the proposed site. The site is not visible from these roads. Users within different radii of the proposed site are described below.

Users within 1 km radius

Businesses within 1 km of the proposed development are shown in Figure 6, numbered according to their description below:

1. Cape Escape B&B and Therapeutics (<1km northwest, inland) – seasonally offers a single suite for rent. This business is on the Trans-Canada Highway, away from the shoreline.

There are other local property owners within one km of the site. But because of the steep aspect of the shoreline and the woodland, there is only one property owner who may be able to see the site from his home (Jim Crawford). Jim is a collaborator with We'koqma'q First Nation on a separate aquaculture development project and is aware of the development plans. Jim is also involved in the Bras D'Or Stewardship Society, described below. Two of the property owners currently do contract work for We'koqma'q's finfish operations (Gordie Ellis & Jim Johnston) and are aware of the plans.



Figure 6: Google Earth image of the proposed site area with a 1 km radius (yellow circle). The approximate location of the single known business owner within this radius is numbered according to its description in the main text of this document.

Users within 3 km

Businesses or other public users within 3 km of the proposed development are shown in Figure 7, numbered according to their descriptions below:

2. Bear on the Lake Guesthouse (southwest, along the Trans-Canada, on the same side of the Bay) – seasonally offers private rooms and hostel accommodations that overlook the Bras D'Or.
3. Little Narrows Beach Municipal Park (east, across the Bay) – offers sandy beachfront access to the public.

The opposite (south) side of the Bay is more than 2 km away. It is more populated than the north side but is still sparsely populated with a handful of property, farm and cottage owners. Part of the Little Narrows community is within this radius, including the park mentioned above (#3).

Because of the distance between the proposed site and these users, it is unlikely that there will be significant visual impact, if any at all.

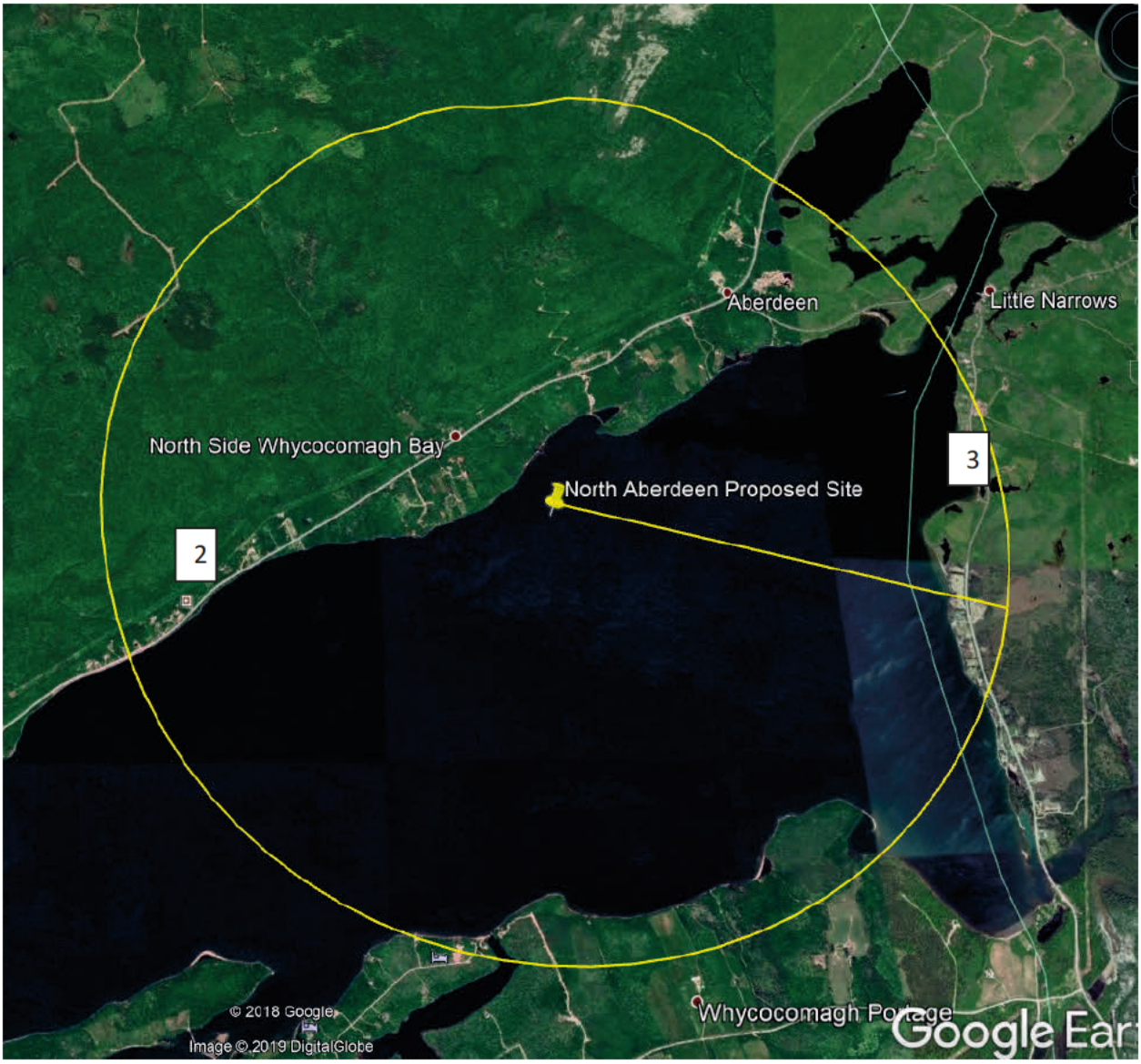


Figure 7: Google Earth image of the proposed site area with a 3 km radius (yellow circle). The approximate locations of the known users of this space within this radius are numbered according to their description in the main text of this document.

Users within 5 km

Businesses or other public users within 5 km of the proposed development are shown in Figure 8, numbered according to their descriptions below:

4. Aberdeen Motel (southwest, same side of the Bay) – classic single story motel with more than a dozen rooms. It is not on the shore of the lake.
5. We'koqma'q processing plant (northeast, same side of Bay) - CFIA registered seafood processing facility that processes the finfish aquaculture products produced by We'koqma'q.
6. Little Narrows Presbyterian Church (northeast, same side of Bay)
7. Little Narrows Ferry (northeast)

8. Little Narrows Community Center (east northeast, across the Bay): community hall which hosts local events and is available for rental.
9. Timeout Campground (southeast, across the Bay) – private 93 site camping and RV campground with 1000' of waterfront.
10. Cape Breton Cottage Bed and Breakfast (south, across the Bay) – single private cottage rental on beachfront and single B&B rental 250 feet from Bras D'Or Lake shore.
11. Eagle D'Or Cottages (southwest, across the Bay) – two cottage on Bras D'Or Lake shorefront.

All of the Little Narrows community is within this radius, across the Bay. The primary amenities in the area are listed above (#3,6,7,8).

Because of the distance between the proposed site and these users, it is unlikely that there will be significant impact, if any at all.

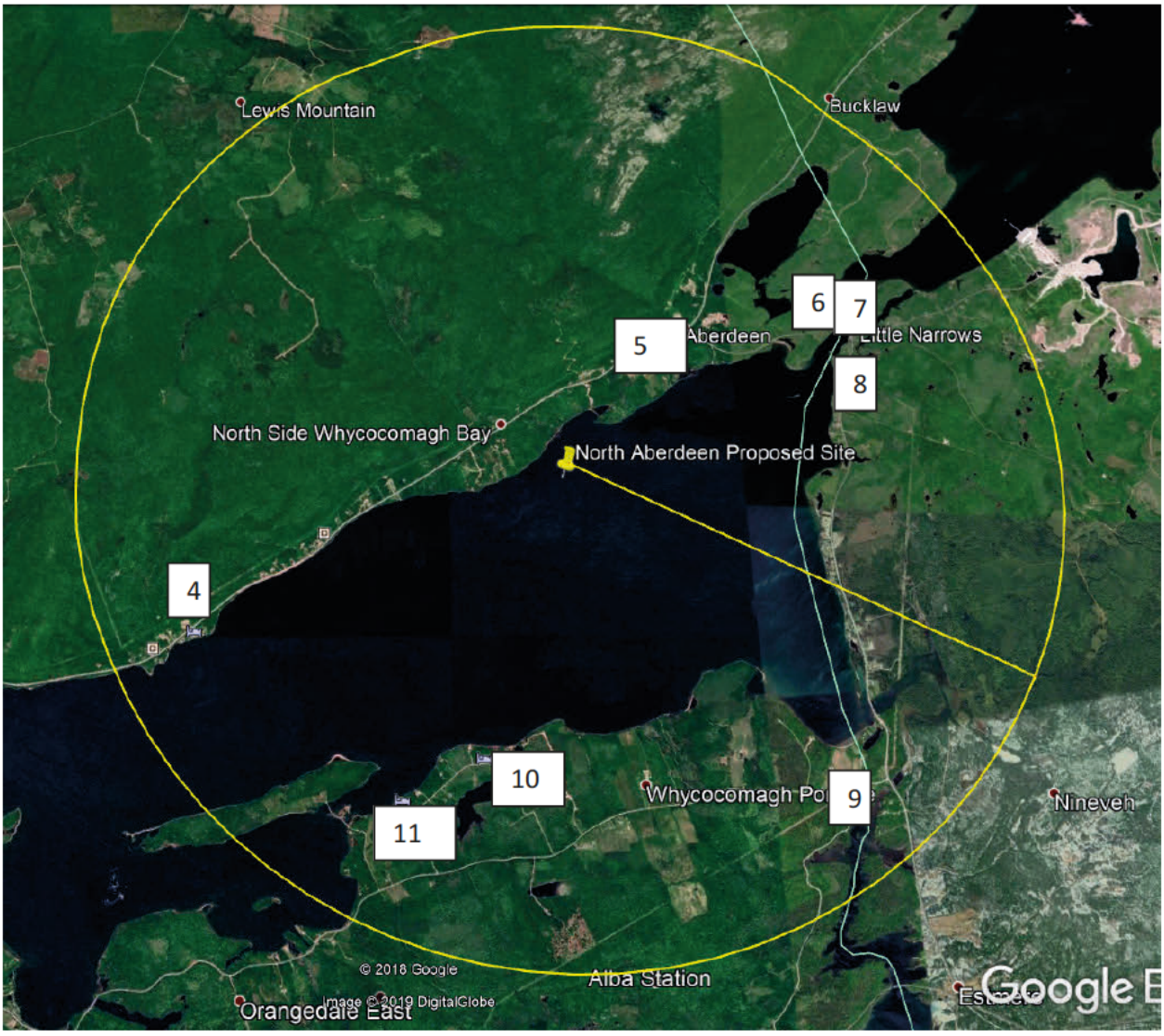


Figure 8: Google Earth image of the proposed site area with a 5 km radius (yellow circle). The approximate locations of the known users of this space within this radius are numbered according to their description in the main text of this document.

Users within 10 km

We'koqma'q First Nation (Whycocomagh 2 Reserve), and the village of Whycocomagh are within 10 km of the proposed site. They are circled in blue in Figure 9.

We'koqma'q First Nation is a Mi'kmaq community in the middle of Whycocomagh with a registered population of approximately 1000 persons according to Indigenous and Northern Affairs Canada. The We'koqma'q Nation has traditionally used the public waters for fisheries activities as described in Section 3.2. Whycocomagh and Whycocomagh Bay are recognized areas of cultural, recreational, and social significance (CEPI, 2006). It is notable that We'koqma'q has been involved in shellfish

and finfish aquaculture activities in the local waters for decades. The proposed aquaculture site is a significant part of the First Nation's business development plans. It will be managed in association with the other Mi'kmaq activities in the waters. A single group manages both the fisheries and aquaculture portfolio of the Band and will ensure that they are complementary.

The Whycocomagh community has a population of approximately 850 residents and has several small businesses that support the local residents, including gas stations, a pharmacy, grocery store, bank, several bakeries and restaurants, accommodations (Keltic Quay, Fair Isle Motel), farmer's market, school (P-8, population<200), fire department, community center and other amenities and tourist features.

In Whycocomagh, a main user group of the public waters is the Whycocomagh Waterfront Centre Association which supports both a community center as well as a marina. The marina is gated access with piers and a launch ramp to the Bras D'Or, a pump station, fresh water and washrooms. Floating docks and moorings are available for member rental.

Whycocomagh Provincial Park is located east of Whycocomagh. The park features hiking (5 km of trails), camping (40 sites) and picnicking. It overlooks the Skye River Valley and the Bras D'Or Lake. The main park straddles the Trans-Canada Highway and has areas of access to the Bras D'Or Lake.



Figure 9: Google Earth image of the proposed site area with a 10 km radius (yellow circle). Whycocomagh, including the We'koqma'q community is circled in blue.

Other regional users or parties interested in the public waters

The Bras D'Or Lake is a popular cruising location for pleasure crafts. Whycocomagh Bay is open to the Bras D'Or Lake only via Little Narrows Channel and yet is a popular spot, particularly for small sailing vessels, kayakers, canoeists and small fishing vessels. These may be local residents or seasonal users.

Other parties interested in the area in terms of conservation include:

Bras D'Or Stewardship Society: a non-profit organization established in 1998 committed to promoting stewardship of the Bras D'Or Lakes and their watershed. The proposed site is within the Society's area of interest.

Bras D'Or Lake Biosphere Reserve Association: a registered charity that oversees the UNESCO designated Bras D'Or Lake Biosphere Reserve[4]. Its mission is "to engage all peoples in the balanced and sustainable development of the exceptional cultural, environmental and economic assets within the Bras d'Or Lake watershed." The proposed site is within the Biosphere Reserve.

Bras d'Or Lakes Collaborative Environmental Planning Initiative (CEPI): CEPI is an alliance of federal, provincial, municipal, and First Nations governments and other interests who have signed a charter that represents "the collective intent, or "will", of the relevant governments with responsibilities for the management and protection of the Bras d'Or Lakes and its watershed".

5.2 Significance of proposed area to wildlife

Significant terrestrial habitats

Significant land habitats recognized by NSDNR along the shoreline of Whycocomagh Bay are shown in Figure 10 and include the following:

- IN418: deer wintering
- IN21: deer wintering
- IN142: bald eagle nest
- VI207: common loon habitat
- IN192: bald eagle nest
- IN17: bald eagle nest
- IN433: bald eagle nest
- IN22: bald eagle nest
- IN51: bald eagle nest
- IN37: bald eagle nest
- IN49: bald eagle nest

[4] In 2011, the Bras d'Or Lake and its watershed area were designated a UNESCO Biosphere Reserve, recognizing that the locals live in harmony with nature and work to promote a healthy environment, economy and culture.

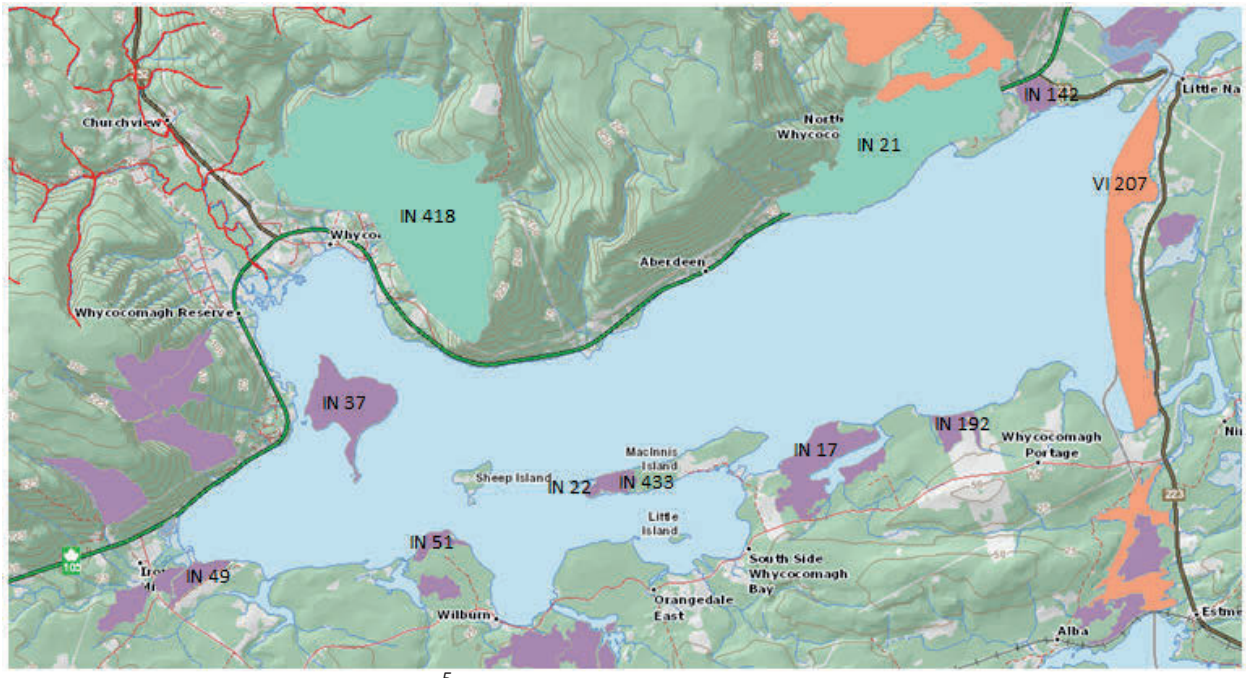


Figure 10: Significant land habitats[5] on the shoreline of Whycocomagh Bay

Rare and endangered species

A data report from the Atlantic Canada Conservation Centre provides more in depth detail on the possibility of the presence of rare and endangered species that may use the proposed development area as well as special wildlife areas of the region. The complete report generated for the proposed site location is attached as Appendix E. A summary of this report follows:

Rare species list

Within 5 km of the site centers, records indicate the presence of 25 species of rare or endangered vascular plants and 23 species of rare or endangered vertebrates. Within this list of species, only Atlantic salmon are aquatic. All others are terrestrial flora or fauna.

Shoreside species of plants include:

- Ray's knotweed
- Seaside brookweed

Shoreside species of animals include:

- Nelson's sparrow
- Cliff swallow
- Kill deer
- Spotted sandpiper

[5] Adapted from https://nsgi.novascotia.ca/plv/ : used with permission. Additional information provided by Frances MacKinnon.

Species at Risk

Six Species at Risk are on record as being in the region. They are listed in the table below. None are water dwelling or expected to be found shoreside.

Table 2: Species at risk within 5 km radius of proposed site[6]

Scientific name	Common name	SARA status	Habitat, other comments
Riparia riparia	Bank swallow	Threatened	Nests in burrows excavated in eroding banks of coastal cliffs and other steep vertical soft soil faces[7]
Hirundo rustica	Barn swallow	Threatened	Nests in barns, garages, houses, bridges and culverts near open areas. Part of the agricultural landscape in Nova Scotia.[8]
Dolichonyx oryzivorus	Bobolink	Threatened	Open grasslands and hayfields[9]
Contopus cooperi	Olive-sided Flycatcher	Threatened	Spruce and fir swamps and bogs[10]
Contopus virens	Eastern Wood-Pewee	Special Concern	Woodlands[11]
Sorex dispar	Long-tailed Shrew	Special Concern	Mountainous, forested areas; may occur along small mountain streams[12]

Location sensitive species

One location sensitive species has been recorded in the region: black ash. Black ash grows in swampy, low lying areas that are very wet and marshy.[13]

Culturally significant flora and fauna

The sweet flag is a medicinal plant in the Whycocomagh area that is of significance for the Mi'kmaq people (CEPI, 2006). CEPI, 2006 also mentioned barrows goldeneye which have been seen near Whycocomagh Bay shore and bald eagles which are more commonly seen.

General marine life

The Bras D'Or Lake marine environment is known for its uniqueness in terms of reduced salinities, limited physical exchange with the open ocean, diversity of seasonal temperature regimes, and low

[6] Species list extracted from Atlantic Canada Conservation Center Report 6326. Species habitat and other comments obtained from sources referenced in footnotes.
[7] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[8] http://www.farmbiodiversity.ca/species-at-risk-2/birds/barn-swallow/
[9] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[10] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[11] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[12] https://www.iucnredlist.org/species/41394/115183478#habitat-ecology
[13] http://www.uinr.ca/black-ash/

tides. One of the most often reported attributes of the Lake is the fact that both warm water and cold water species are found in the same water system (Tremblay, 2002).

Within Whycocomagh Bay, the diversity of marine life is more limited than other areas of the Lake. It is a low salinity region with large basins of low oxygen levels. It has been suggested that these characteristics limit benthic organisms in many parts of the Bay, with the exception of micro-organisms (Lambert, 2002). Low abundance of mysids, copepods (Petrie & Bugden, 2002; Strains & Yeats, 2002) have been noted. Many invertebrate species such as lobsters and rock crab are unlikely to be in this area due to its low salinity. Similarly, scallops are unlikely to be in this area. (Tremblay, 2002)

Studies have shown that herring and gaspereau occur in Whycocomagh Bay and the presence of winter flounder, cod, skate, and windowpane flounder was evidenced by their appearance in trawl catches in Whycocomagh Bay in 1999-2000, which were similar to findings from tows conducted in 1967. The cod population in this Bay is thought to be unique from other cod populations in the lake. This is based on the low incidence of the sealworm (*Pseudoterranova decipiens*) in cod of the Bay relative to adjacent areas. This segregation is thought to be due to the restricted passageway at Little Narrows, which may discourage the movement of cod between the Bay and St. Patrick's Channel. Local knowledge suggests that cod populations are significantly reduced over previous levels (personal communication, Joe Googoo, We'koqma'q Elder).

Grey seals and harbor seals are the only marine mammals known to inhabit Whycocomagh Bay (Robin Stuart, personal communication).

5.3 Impacts to other users including wildlife

Impacts to human users of the public waters surrounding the proposed development

Tourist operators, local and seasonal residents

A number of businesses within the region that were identified in Section 5.1 rely on tourism. A key draw to the region is the Bras D'Or Lake. And local and seasonal residents enjoy the public waters surrounding the proposed development for its beauty, nature and recreational opportunities. Concerns that these groups of the community may have are discussed below.

Visual impact

The area is well known for the attractiveness of its landscape, including the views of the Bras D'Or Lake. We'koqma'q recognizes this value to the area's tourism industry as well as to the local community members in general.

For this proposed site, the cages will not be highly visible from the highway nor by local property owners, with one exception as described in Section 5.1. They will be visible from the immediate shoreline. As shown in Figure 6, there are not many users of this immediate shoreline. There is likely no place in the region that is more sheltered from view. This was one of the reasons for

choosing this site. Moving cages to locations where they would be hidden from public view was suggested during the scoping process[14]. This comment was made specific to the Whycocomagh site, not this proposed site.

In recognition of the importance of appearance, We'koqma'q First Nation is committed to ensuring that the cages are maintained in an orderly fashion to ensure that they properly represent the opportunity that they are bringing to the community and do not negatively impact the visual landscape. The regular inspection and maintenance of cages is a best practice of the company that is mandated under the Nova Scotia Aquaculture Management Regulations within the Farm Management Plan as mentioned in Section 3.2 (*Mitigating Fisheries Impacts through Operational Procedures*). In addition to these Farm Management Plan requirements explained previously regarding infrastructure maintenance, all of We'koqma'q First Nation finfish aquaculture operations will follow the farm operations requirements also defined by the Nova Scotia Aquaculture Management Regulations. These requirements acknowledge that the responsible operation of a marine finfish site includes consideration of neighbors and other users of shared resources, including aspects affecting visual impact. To this effect, the Farm Management Plan must include the following:

- Described and approved management practices for removing and disposing of accumulated refuse and decommissioned farm supplies and equipment;
- Described and approved management practices for retrieving any gear or debris from the aquacultural operation that has broken loose; including timelines for completion;
- Described and approved management practices for maintaining the site in good order.

The above elements will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

Smell and Noise

Part of the appeal of the region pertains to the rural landscape in terms of low noise pollution and high air quality. We'koqma'q recognizes the value of maintaining these local attributes and will apply and document practices that reduce noise, particularly outside of working hours, and reduce odors in general.

A complaint about the smell of We'koqma'q's current finfish operation in Whycocomagh was brought up during the scoping process [15]. It is recognized by We'koqma'q that they had an incident where smell was a problem for a couple of days in the summer of 2018. This was due to an interruption in trucking that required offal transfer during an excessively hot day (>30°C). Normal procedures for We'koqma'q's finfish operations include removing organic waste on a bi-weekly basis for transport to the Guysborough facility which is equipped to deal with such waste. Increased oversight of this procedure now occurs to ensure that the transportation will not be disrupted. And the shipping containers are sealed on site prior to transport so that spillage will not occur en route.

[14] Refer to Page 8 of the Report on Public Engagement During Scoping
[15] Refer to Page 12 of the Report on Public Engagement During Scoping

Other aspects of the operation that may be a risk for causing odors will be described and documented in the Farm Management Plan. This includes the storing and disposal of feed, mortalities and other organic waste. These are part of the farm operations requirements of the Nova Scotia Aquaculture Management Regulations.

It is notable that the Farm Management Plan also requires the description, application, and documentation of procedures that minimize noise.

As mentioned previously, We'koqma'q's finfish operation hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices (BAP). Section 13 of this standard requires safe and responsible storage and disposal of farm supplies and waste. Procedures required for this would be above and beyond the FMP containment requirements described above and would be third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

It is notable that the finfish aquaculture operations have been operating in the community for more than 40 years and the relationships with local residents regarding the operation have been very positive.

Navigation for marina users, recreational boaters, fishers and others
Recreational boaters, fishers, marina users and other local residents or passersby who use the waterways for travel need to have clear delineation of safe travel paths when in or below water structures, such as finfish cages exist. We'koqma'q First Nations has ensured this by completing a Notice of Works form to Transport Canada, as required under Section 6 of this Development Plan. We'koqma'q will mark their sites in accordance with these requirements.

Miscellaneous concerns raised during scoping
During the public meeting held in the community, an attendee mentioned his concern that We'koqma'q's current aquaculture operation in Whycocomagh is causing the build-up of dead seaweed along the shore which is interfering with angling from the shore.[16] It is not clear that the association between the dead seaweed and the finfish culture activities is real and that changes to the operations would make an impact on this phenomenon. Regardless, We'koqma'q is dedicated to monitoring and measuring the environmental impact of its finfish aquaculture operations, including eutrophication. This is demonstrated by We'koqma'q's partnership in research that will model and measure nutrient level changes in the water resulting from its operations. This was previously described in Section 3.2 ("*Mitigating Fisheries Impacts through Research and Development"*).

Ensuring the proper disposal of sewage waste was brought up during the scoping process.[17] Storage and disposal of human waste must be described and documented in the Farm Management Plan as part of the farm operations requirements of the Nova Scotia Aquaculture Management Regulations.

[16] Refer to Page 8 of the Report on Public Engagement During Scoping
[17] Refer to Page 8 of the Report on Public Engagement During Scoping

Impacts to wildlife users of the public waters surrounding the proposed development

There are no identified rare or endangered species that are expected to be directly impacted by the operation of this site. Mitigation measures applied to reduce fisheries impacts are described in Section 3.2 and will also mitigate impacts to other wildlife in the bay in general.[18] Measures applied to support the sustainability of wild salmon are described in section 7.2.

As described in Section 5.2, there are no SARA listed species expected to interact with the proposed site since all known SARA species in the area are terrestrial.

Similarly, all rare and endangered species, with the exception of Atlantic salmon, are terrestrial and not expected to be encountered during normal operation of the site. Potential risks to shoreline species and water birds, particularly those known to be rare or endangered, will be mitigated within a wildlife interaction plan. This plan will describe procedures that ensure least interference with surrounding wildlife while supporting their habitat. This will include a requirement that boat travel to and from the site is taken via the most direct route possible, without travelling near the shore or near wildlife. An exception to this will occur during a weekly sweep of the shoreline to look for debris that may inadvertently have been released during operation of the site. This will enable the upkeep of the shoreline to a level of cleanliness that promotes wildlife habitat. For these procedures, employees will be cautioned to not approach wildlife and not travel through marsh areas where sensitive species may be harbored. An annual shoreline clean-up will also occur for the adjacent area. This clean-up will not be conducted at times of the year when shoreline birds are nesting.

A wildlife interaction plan must be described in an operator's Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. It must be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements. The BAP certification standard also requires a Wildlife Interaction Plan. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Complements to other users

Support of the local economy

Development of We'koqma'q's finfish aquaculture operations is anticipated to bring a significant number of local direct and indirect jobs to the community (see Sections 2.3, 2.4, and 2.5).

Support of conservation efforts

We'koqma'q will work with the conservation groups active in the area to help collect information on the oceanographic and ecological characteristics of this area of the Bras D'Or Lake. On this front, We'koqma'q has an established relationship with Dr. Bruce Hatcher and will continue to assist Dr. Hatcher as he collects information to: characterize the dynamics in the cline of Whycocomagh Bay, explore ice cover changes and effects in Whycocomagh Bay, explore anthropogenic effects on the Bay's characteristics, and other research efforts. We'koqma'q will also assist the Stewardship Society and Biosphere Reserve Association collect information on and educate people on the unique ecology of the Whycocomagh region.

[18] The potential benthic environmental impacts were brought up during scoping. See page 8 of Report on Public Engagement During Scoping.

Robin Stuart, the Manager of Aquaculture Operations for We'koqma'q, is the representative for We'koqma'q on CEPI and will help to ensure the responsible management of the Bras D'Or.

5.4 Impacts by other users including wildlife

Generally speaking We'koqma'q's finfish operations have, and hope to continue to have an excellent and mutually beneficial relationship with the local communities.

A possible negative impact of people on the operations needs mentioning. This refers to vandalism of the fish nets. In the past, one of the nets was released manually by a non-resident. This resulted in fish release. Fishing within the pens has also occurred. Since this time, We'koqma'q has hired security to patrol their sites and mitigate these risks. For the sites in Aberdeen, security cameras will monitor activities.

Fish eating birds (herons, hawks, kingfisher, eagles, and other species) can be common-place in regions that support finfish aquaculture operations. If not properly managed, such birds can prey on the fish in the cages, causing stress and physical damage. We'koqma'q First Nation finfish aquaculture operations will use bird nets on their cages during seasons when bird predation is a problem. These nets will cover the surface of the water at a height from the water surface so that bird predation cannot occur. The procedures for their use and maintenance are required as part of the Farm Management Plan.

SECTION 6: THE PUBLIC RIGHT OF NAVIGATION

6.1 Navigation Protection Act approval

The Notice of Works form and required attachments are enclosed.

SECTION 7: THE SUSTAINABILITY OF WILD SALMON

7.1 Identification of local salmon populations

The proposed North Aberdeen site is within Salmon Fishing Area 19, also called the Eastern Cape Breton Designatable Unit by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Closest salmon bearing rivers that have direct connections to the body of water that contains the proposed site include Skye River (mouth within 9 km of the site), Middle River (mouth approximately 14 km from the site), and Baddeck River (mouth approximately 17 km from the site). Only the Skye River opens into the Whycocomagh Bay subwatershed. The Middle and Baddeck Rivers open into an adjacent watershed (St. Patricks Channel) which is somewhat separated from the Whycocomagh Bay subwatershed via a sill less than 12 m deep. Since 2006, Middle and Baddeck Rivers have had their salmon populations enhanced through a Provincial stocking program which includes broodstock collection on these rivers. This enhancement is intended to offset anticipated catch and release mortalities on these rivers and has allowed an open catch and release fall season on the Middle and Baddeck Rivers. Food, Social and Ceremonial (FSC) allocations are also available on these rivers. Middle and Baddeck Rivers are index populations. As for all index rivers in Eastern Cape Breton, the populations were assessed to be below conservation egg requirements in 2018.

The approximate locations of all salmon bearing rivers in the vicinity of the site, as reported in the 2017 CSAS Stock Status Update for SFAs 19-21 and 23 are shown below.



Figure 11: Salmon bearing rivers within the region of the site.

7.2 Support of the sustainability of wild salmon

Although rainbow trout are not indigenous to the Bras d'Or Lakes area, it has a resident population that has developed from stocking efforts for the sport fishery, with the first trout introduced in 1899. These introduced fish have been shown to be successfully reproducing in the wild and are contributing to the fishery numbers (Madden et al., 2010). Rainbow trout continue to be stocked by the Province through an enhancement program. This would suggest that there is little concern that the presence of rainbow trout affects the sustainability of wild salmon.

Furthermore, We'koqma'q will institute operational procedures to mitigate the greatest perceived risks of finfish aquaculture operations to wild salmon populations; these being fish escape, disease and biosecurity, and environmental impact risks. These have been described in Section 3.2.

As indicated in Section 7.1, Middle and Baddeck Rivers have had their salmon populations enhanced through a Provincial stocking program which includes broodstock collection on these rivers. Approval of this lease/licence is not anticipated to affect these efforts.

The environmental and oceanographic data collection in the Bay that is supported by We'koqma'q (Section 5.3, Support of conservation efforts*)* is intended to improve understanding of the local ecosystem as a whole, as well as more broadly with regards to global warming. Although there is no direct intent to use this data to support Atlantic salmon conservation measures, an increased understanding of the environment will contribute to conservation practices in general.

SECTION 8: THE NUMBER AND PRODUCTIVITY OF OTHER AQUACULTURE SITES IN THE PUBLC WATERS SURROUNDING THE PROPOSED AQUACULTURAL LOCATION

8.1 Interactions with other aquaculture operations[19]

We'koqma'q First Nation is presently the lease/licence holder for all aquaculture sites within Whycocomagh Bay, both finfish and shellfish. There are a few oyster sites that are in close proximity distance-wise but the waters are not connected to Whycocomagh Bay.

We'koqma'q is making two requests for new finfish sites within this Option (one on the north side – this application, and one on the south side of the eastern end of the Bay), and a request for the amalgamation and enlargement of leased areas in Whycocomagh Bay. We'koqma'q is also requesting assignments of previously active finfish sites in the region. Collectively, the sites will allow an operational expansion to proceed while availing enough area to increase fallowing times. Increased fallowing will reduce fish health risks and minimize potential environmental impacts of the operations. All of the sites planned for the area are listed below and shown in Figure 12:

1) We'koqma'q is currently the licence holder for three sites in Whycocomagh Bay, 10km to the southwest of the site proposed in this Development Plan. We'koqma'q is requesting an amendment to amalgamate and enlarge this area in another application.

2) Within this Option to Lease area, We'koqma'q is requesting an additional new marine site south of the site proposed in this Development Plan (in another application).

3) We'koqma'q is in the process of completing a request for an assignment of a site northeast of this proposed site (in another application).

4) We'koqma'q will explore the feasibility of a site on a privately leased area.

5) In the future, We'koqma'q anticipates requesting assignments for several other finfish sites in adjacent waters. (Outside of the map area.)

Existing aquaculture sites in the area are shown below, as copied from the NS GIS mapping tool website. The site proposed within this Development Plan and the other sites mentioned above are shown and numbered according to their descriptions.

[19] The potential for aquaculture in the area was brought up during scoping. See page 4 of Report on Public Engagement During Scoping.

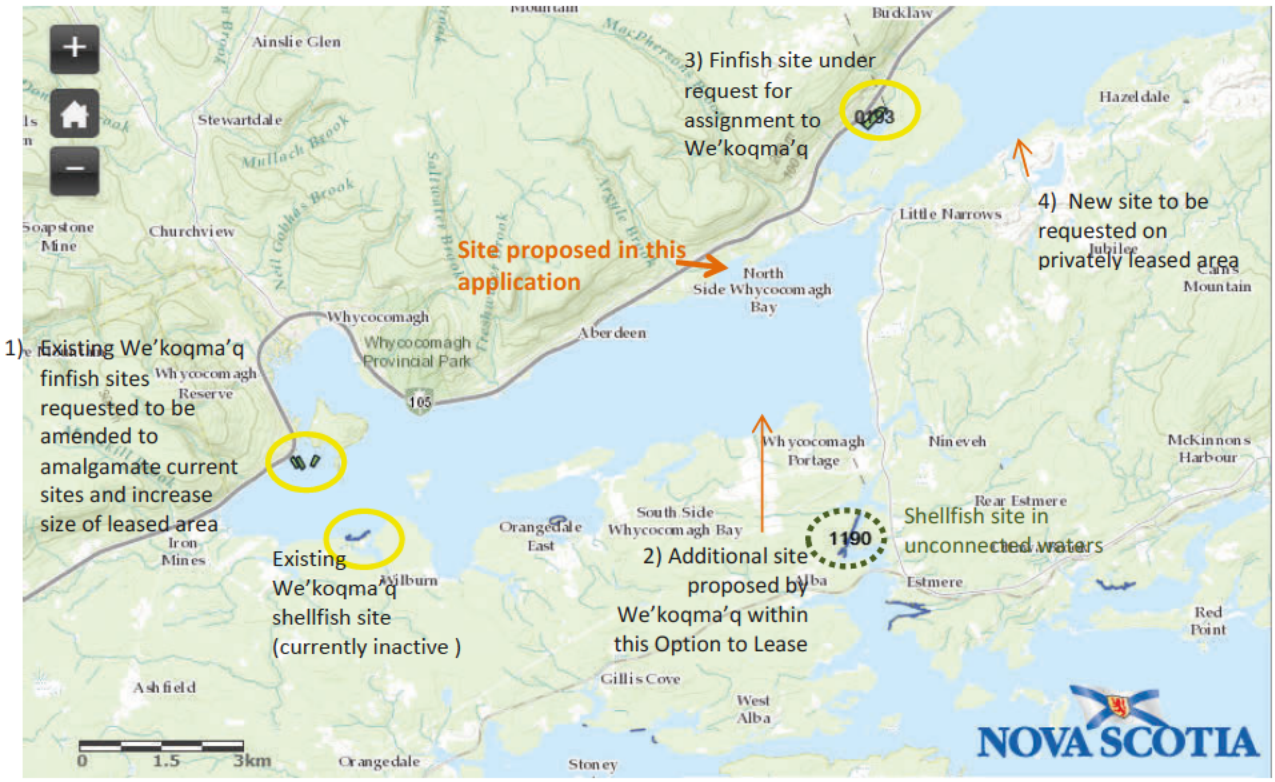


Figure 12: Map of the region of the proposed site showing existing aquaculture sites as well as sites proposed in other applications. The base map was acquired from https://novascotia.ca/fish/aquaculture/site-mapping-tool/

8.2 Interactions with other aquaculture operations

We'koqma'q's finfish sites will be managed as a single farm to promote optional fallowing regimes. These regimes will be developed in conjunction with NSDFA and DFO to maximize fish health and minimize environmental impacts. When all sites are available for use, a rotating fallowing cycle is anticipated.

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4.2.3 AQ#1431 Development Plan (2019)

Option to Lease AQ 1413: South Aberdeen Development Plan

SECTION 1: THE OPTIMUM USE OF MARINE RESOURCES

We'koqma'q First Nation is requesting a new marine finfish licence/lease in the Bras D'Or Lake in Inverness County, NS. This proposed site is within the Option to Lease # 1413 and is located on the southeast side of Whycocomagh Bay near Whycocomagh Portage. This site application is one part of We'koqma'q's larger plan to expand its trout aquaculture operations in Whycocomagh Bay. This expansion will increase its trout production capacity four fold to 1,000,000 fish per year. We'koqma'q has been successfully conducting rainbow trout aquaculture in this region for seven years, first as a contract grower, and for the past four years as the business owner. The proposed site is 34 hectares in size and expected to support the grow-out of 750 tons of rainbow trout.

This proposed site will share employment with a proposed site across the bay, requiring 15 new full time positions directly while supporting the sustainability of We'koqma'q's finfish operations as a whole by increasing use of its local infrastructure, including a processing plant, a land-based storage facility, management offices and farm management software. The finfish operations are expected to employ 70 people when all proposed sites are functional. It will also promote the installation of new infrastructure and investment in new equipment, for not only the marine finfish cage operations, but also for We'koqma'q's processing plant and hatchery.

An examination of the habitat below the proposed site, published studies from the area, and knowledge collected during scoping for the proposed activities suggest that this development can proceed in harmony with fishery activities in the public waters surrounding the proposed aquacultural operation. Management measures will be in place to mitigate the most significant risks of marine finfish aquaculture to the environment, these being fish escape, disease and biosecurity, and benthic environmental impacts. These measures will be supplemented by partnering on a research project aimed to tailor and improve environmental monitoring of We'koqma'q's finfish aquaculture activities.

The oceanographic and biophysical characteristics of the public waters surrounding the aquaculture operation were reviewed. This included data collected within the scoping activities, published studies, as well as the local knowledge and extensive experience of employees and contractors of the company. This information supports the feasibility of a finfish aquaculture operation at the proposed site and provides the best knowledge to inform a site design. This knowledge is also being used to develop the procedures and production plans for the site.

Consideration and respect for the other users of the public waters surrounding the site will be demonstrated by We'koqma'q's responsible farm practices which include high standards for site maintenance, noise reduction, and waste management. It is the intent of We'koqma'q for the other users of the waters to see the finfish aquaculture site as an opportunity for the region rather than a negative development. Risks to wildlife users of the region will be mitigated via the management measures intended to reduce risk of fish escape, disease and biosecurity, and benthic

environmental impacts mentioned previously. These will be further supplemented with a wildlife interaction plan that recognizes the most susceptible wildlife of the region.

A Notice of Works application accompanies this development plan. Outcomes from Transport Canada's assessment will be applied to ensure the public right of navigation through compliance with the Navigation Protection Act.

The region is one of a handful of regions in Nova Scotia where Atlantic salmon populations still exist. It is also the region that has experienced the longest history of rainbow trout aquaculture. The mitigation measures intended to reduce risk of fish escape, disease and biosecurity, and benthic environmental impacts mentioned previously; and the forward-looking environmental monitoring research We'koqma'q is a partner on should ensure the continued successful coexistence of wild Atlantic salmon with We'koqma'q's rainbow trout operations. Furthermore, there is environmental and oceanographic data collection in the bay being conducted by other researchers that is supported by We'koqma'q which is intended to improve understanding of the local ecosystem as a whole, as well as more broadly with regards to global warming. Although there is no direct intent to use this data to support Atlantic salmon conservation measures, an increased understanding of the environment will contribute to conservation practices in general.

With regards to the number and productivity of other aquaculture sites in the public waters surrounding the proposed aquacultural operation, We'koqma'q is currently the only aquaculture producer in Whycocomagh Bay and will manage its farms as a collective in order to ensure that fish health risks and environmental impacts are minimized. Having an increased number of sites will allow an operational expansion to proceed while availing enough area to increase fallowing.

This site is one request of several that will enable a sustainable expansion of We'koqma'q's finfish aquaculture operations. Activities will contribute to economic development of We'koqma'q First Nation and the local region in general. Site location considerations and mitigation practices will reduce impacts to other users of the local waters, including the fishery, wildlife (including Atlantic salmon), local residents, and seasonal visitors. This includes the public right to navigation. Ongoing environmental monitoring along with research assessing the carrying capacity for Whycocomagh Bay should ensure that these practices are effective now, and in the future. Therefore, because of the expected minimal negative impacts and anticipated positive impacts as described according to the factors to be considered in decisions related to marine aquaculture sites, this request should represent an optimum use of marine resources.

SECTION 2: THE CONTRIBUTION OF THE PROPOSED OPERATION TO COMMUNITY AND PROVINCIAL ECONOMIC DEVELOPMENT

2.1 Production plan

Species: Rainbow trout.

Maximum site biomass (kg): 750,000kg

Maximum cage density during grow out period (kg/m^3): 18 kg/m^3. Normal operating density will be <15 kg/m^3

Expected time to achieve maximum production: 5 months from stocking

Size(s) of cages, including net volumes (m^3): 60m polar circle; 6 m depth; 1,700m^3 per cage

Maximum cage number, maximum total net volume (m^3): 2 arrays of 12 cages = 40,800m^3

Maximum number of fish per cage during grow out period: 15,000

Intended initial stocking date and seed source: May 2019, Big Falls Hatchery (AQ # 1028) and over-wintering stock currently at Marine Licence/Lease AQ # 0814 in Whycocomaugh Bay, south of We'koqma'q Reserve.

Expected grow out period: May – December

Expected fallow period: Cages will be left in a single location for two production cycles with 3 month fallow (January to April) between each cycle. This will be followed by a 15 month fallow (January to April of the next year) of the entire lease if environmental monitoring demonstrates this necessity. The lease has been sized to allow movement of the cage arrays within the lease boundaries so that fallowing of sections within the lease can occur, if desired.

Additional notes: This site represents one site of several new or amended sites planned for We'koqma'q's finfish aquaculture operations. We'koqma'q is expanding its infrastructure and assets in order to accommodate an expansion in production capacity to over 1,000,000 fish per year. A summary of the overall expected plans for sites can be found in Section 8.1.

2.2 Infrastructure

This site is to be serviced by We'koqma'q's facilities in and around Whycocomagh and Aberdeen. These services include the land-based facilities for holding and managing nets and feed in Whycocomagh; barges, boats and vehicles based in Whycocomagh; management offices at the We'koqma'q Band office, a FishTalk farm management database housed at the We'koqma'q Band office; and the CFIA registered processing facility in Aberdeen. Additional investments in infrastructure and equipment are occurring in conjunction with the new site requests, of which this site is only one of a part, as explained above. These investments include the addition of a deboning machine and active trimming line as well as a packaging storage building for the processing plant; the addition of a winter harvest system and oxygenation system for the cage operations; and the addition of equipment, including new cages, nets, a net cleaner and forklift, among other smaller requirements. The addition of a new wharf toward the east end of Whycocomagh Bay is also

planned, along with the purchase of a new barge to service this and the other new site in the east end of Whycocomagh Bay that has been requested in another application.

We'koqma'q recently acquired Big Falls Fish Growers in Wolfville, NS, in order to increase juvenile production to service the intended increased capacity of the sea cage aquaculture operations. This facility (Big Falls) is undergoing significant upgrades to enable it to better meet the demands of the sea cage operations.

2.3 Services and suppliers

Increased local (NS) service requirements in terms of contractors (welders, carpenters, others) and suppliers of general merchandise will be necessary to support the expanded operations. These requirements are anticipated to increase at the same scale of the operations – four fold – when all of the planned sites are in operation. Processing will occur at We'koqma'q's facility in Aberdeen, NS, upgraded as described above. Juveniles will come from the improved Big Falls Hatchery in Wolfville, NS, described above. Feed will continue to be purchased from outside of the province (Skretting in NB) because of the requirement that the feed mill be BAP certified in order to assist We'koqma'q's goal of achieving four-star BAP certification. Eggs will be purchased from an international supplier since there is no local supply. The development of a local broodstock is under investigation and achieving a critical production mass will be imperative for its success.

2.4 Employment

This proposed site will share employment with another proposed site across the Bay ("North Aberdeen"), directly requiring 15 new full time positions. These employees will consist of a site manager, feeders, and site technicians. Putting this site into use will also improve the security of employment of the rest of the employees of We'koqma'q since it will optimize the use of the processing facility in Aberdeen, NS, hatchery in Wolfville, NS, land-based storage facility in Whycocomagh, NS, as well as the maintenance personnel for the finfish operations and the management and data entry personnel at the We'koqma'q First Nation Band Office.

As stated previously, this site represents one site of several new sites planned for We'koqma'q's finfish aquaculture operations. In total, We'koqma'q's planned expansion activities are expected to require 70 employees over the next year.

2.5 Other economic contributions to the local community and Province

Fulfillment of this site request will promote the success of We'koqma'q's expansion plans. This has ramifications for several proposed new sites and existing sites in the Aberdeen and Whycocomagh area[1]. A summary of the overall expected plans for sites can be found in Section 8.1.

Spin off economic benefits to the local communities would be expected to occur. A recent report on the economic impact of aquaculture in Nova Scotia indicates that 1.55 indirect jobs result from every person directly employed at an aquaculture operation (Foster, 2019).

[1] The potential economic benefits to the area were brought up during scoping. See page 5 of Report on Public Engagement during Scoping.

2.6 Financial viability

We'koqma'q's business development plan has been submitted as a separate document.

2.7 Adverse economic impacts

There are no adverse economic impacts expected from fulfillment of this request.

SECTON 3: FISHERIES ACTIVITIES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

3.1 Status of fisheries activities

Recreational fishery

Trout

(Reference: https://novascotia.ca/fish/documents/Anglers-Handbook-2018.pdf)

The proposed aquaculture site is located in NS Recreational Fishing Area 1: Cape Breton, Inverness, Richmond and Victoria Counties, specifically within the Bras D'Or Lake. Here the speckled (brook) trout, brown trout and rainbow trout recreational fishing season is open in the tidal waters of the Bras D'Or Lake, including Whycocomagh Bay in which the proposed site is located, from April 1 to September 30 with some restrictions (no speckled trout September 1 to September 30). Skye River which feeds into the subwatershed of Whycocomagh Bay of the Bras D'Or approximately 8 km away from the proposed site is open for the same period. Other major recreational fishing rivers in the area feed into different subwatersheds. These include River Denys which feeds into the Denys Basin, and Middle River and Baddeck River which feed into the St. Patricks Channel. River Denys, Middle and Baddeck Rivers are Special Trout Management Areas with minimum size and bag limits. For further reference, the locations of these rivers are shown on a map in Section 7.1.

A resident population of rainbow trout exists in the Bras D'Or Lake area. This is enhanced every year by the release of juveniles reared in Provincial hatcheries to support the above described rainbow trout sport fishery.

Non-salmonid species

(Reference: https://novascotia.ca/fish/documents/Anglers-Handbook-2018.pdf)

Recreational fishing for the following species is also conducted in the Bras D'Or Lake: smallmouth (black) bass, white perch, yellow perch, brown bullhead, white sucker, chain pickerel, lake whitefish, striped bass, shad, gaspereau, smelt, and eel.

Atlantic salmon

(Reference: CSAS Science Response 2017/20)

The proposed site is located within Salmon Fishing Area 19. There is no recreational salmon fishing permitted in Whycocomagh Bay, where the proposed site is located. The Middle and Baddeck Rivers, which feed into the Bras D'Or to an adjacent subwatershed (St. Patricks Channel), have an open catch and release fall season for Atlantic salmon. Social and Ceremonial (FSC) allocations are also available on these rivers. For more discussion on this site and these rivers relative to the salmon populations, see Section 7.

Commercial Fishery

Historically, the Bras D'Or Lake has supported some limited fisheries activities. The bottom trawl fishery was banned in the Bras D'Or Lake in 1992. The local herring fishery closed in 1999. This left only lobster and oyster fishing.

Lobster

In 2016, there were 14 licences for commercial lobster fishing in the Bras D'Or Lake (Lobster Fishing Area (LFA) 28), with a trap limit of 250 and a minimum legal size limit of 84mm. The season runs annually from April 30 to June 30.

Historical landings from LFA 28 are shown in Figure 1.

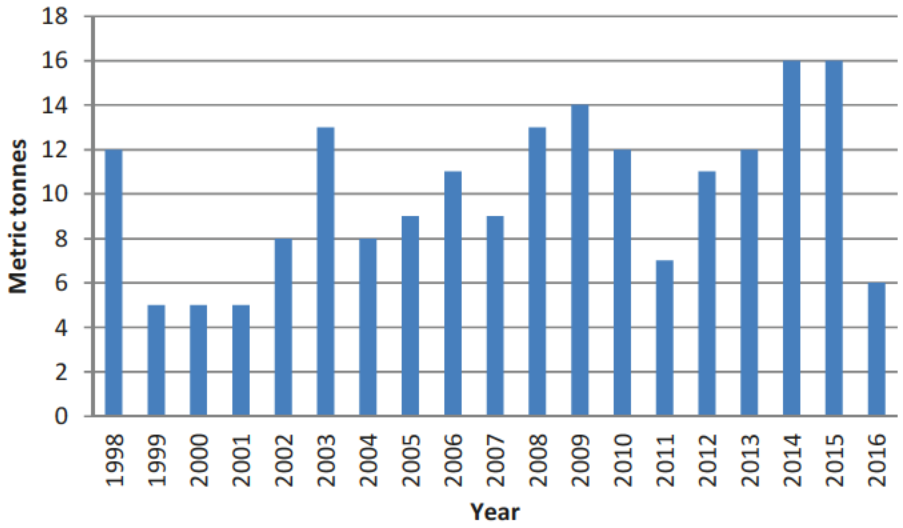


Figure 1: Historical lobster landings from LFA 28 (the Bras D'Or Lake). Graph generated from 2017 Stock Status Update (DFO, 2017).

The lobster industry in LFA 28 is small relative to that of Nova Scotia in general. The mean landings for 2013-2015 for LFA 28 represent 0.8% of the mean landings for Nova Scotia for the same period, as calculated from data within the 2017 Stock Status Update (DFO, 2017).

Oyster

Oysters were an important harvest for local Mi'kmaq and, likely, non-native settlers of the Bras D'Or Lakes region (Tremblay et al., 2002). Traditional knowledge of the area indicates that oyster populations were all along the north, west, and south west coasts of Whycocomagh Bay at one time (Eskasoni Fish and Wildlife Commission and Dept. of Fisheries and Oceans. 1996, cited not seen). However, populations declined due to over-fishing, degradation of habitats and the appearance of the MSX parasite (*Haplosporidium nelsonii)* in 2002 (Stephenson et al., 2003).

Traditional Mi'kmaq Fishery

We'koqma'q First Nation has traditionally fished in Whycocomagh Bay for a number of species including cod, hake, smelts, trout (speckled and brown), herring, mackerel, gaspereau, cod, eels, flounder, lobster, softshell clams, mussels and oysters. Currently smelts, trout (speckled, brown and rainbow), eels, winter flounder, striped bass, softshell clams, mussels and oysters are fished (Joe Googoo, We'koqma'q Elder, personal communication).

3.2 Impacts on fisheries activities

Recreational

Trout

Although rainbow trout are not indigenous to the Bras d'Or Lake area, it has a resident population that has developed from stocking efforts for the sport fishery, with the first trout introduced in 1899. These introduced fish have been shown to be successfully reproducing in some regions in the wild and are contributing to the fishery numbers (Madden et al., 2010). Rainbow trout continue to be stocked by the Province through an enhancement program. Other trout populations do not seem to be affected by this enhancement, as exemplified by the fact that speckled trout populations are thought to be recovering in the Whycocomagh area (CEPI, 2006; Joe Googoo, We'koqma'q Elder, personal communication).

Rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the trout fishery have not been raised. Anglers of the area have historically been supportive of the trout operations. Recently, Robin Stuart of We'koqma'q was approached to collaborate with anglers to increase rainbow populations in the lake[2].

We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

The successful historical co-existence of the recreational trout fishery with trout aquaculture operations combined with We'koqma'q's intended enhanced management procedures suggest that there will be minimal impacts on the recreational trout fishery.

Non-salmonid species

As stated for the recreational trout fishery, rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the sport fishery have not been raised. As also stated previously, We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

[2] See page 6 of Report on Public Engagement during Scoping.

Because of the successful historical co-existence of rainbow trout aquaculture operations with the sport fishery and the enhanced fishery risk mitigation efforts, there are no impacts on recreational fisheries activities anticipated for any species.

Atlantic salmon
Interactions with Atlantic salmon are described in Section 7 of the Development Plan.

Commercial Fishery

Lobster
Although lobster were in Whycocomagh Bay in the mid 60's they have disappeared from the Bay since that time (Joe Googoo, We'koqma'q Elder, personal communication). Traditional knowledge collected in 1996 (Eskasoni Fish and Wildlife Commission and Dept. of Fisheries and Oceans. 1996, cited not seen) and trawl surveys from 1999 indicate no lobster inhabit Whycocomagh Bay (Tremblay et al., 2002). This proposed finfish aquaculture site will, therefore, likely not impact the lobster fishery.

Oyster
Some populations of oysters remain in the Lake today, including in Whycocomagh Bay, and initiatives are underway to understand why these populations survive. This knowledge will be used to develop stocks or culture practices that allow rejuvenation of the oyster populations (Vercaemer et al., 2010; Robin Stuart, personal communication). We'koqma'q First Nation is part of these efforts, have a vested interest in the rejuvenation of the oyster populations, and will continue to support developments along this line.

Traditional Mi'kmaq Fishery
As stated for the recreational fishery, rainbow trout aquaculture operations have been operating in Whycocomagh Bay for over 40 years and issues regarding the traditional fishery have not been raised. As also stated previously, We'koqma'q will conduct their operations under strict containment management procedures, disease and biosecurity procedures, and environmental monitoring procedures as described below under "Mitigating Fisheries Impacts through Operational Procedures".

Because of the successful historical co-existence of rainbow trout aquaculture operations with the traditional fishery and the enhanced fishery risk mitigation efforts, there are no impacts on traditional fisheries activities anticipated for any species. This aquaculture development will be managed in association with the other Mi'kmaq activities in the waters, including fishing. A single group manages both the fisheries and aquaculture portfolio of the Band and will ensure that they are complementary.

It is notable that there were no fisheries concerns raised during the scoping process conducted for this application.

Habitat beneath the proposed site - summary of baseline monitoring

This summary is provided only to describe the habitat observed beneath the proposed site. Complete baseline monitoring results were submitted to DFO and NSDFA for their review as per Section 4.2.

Location Name	**Coordinates**	**Benthic sediment description**	**Flora/Fauna**	**Station Classification**
Southside Aberdeen, Center Lease	Lat: 45.96054; Long: -61.02726	Brown mud with some greyish mud	Holes, mussel shells	Oxic A
Southside Aberdeen, Corner Lease 1	Lat: 45.9627; Long: -61.02195	Dark brown mud; holes in mud	n/a	Oxic A
Southside Aberdeen, Corner Lease 2	Lat: 45.96081; Long: -61.03368	Brown mud; holes in mud	Dead roots	Oxic A
Southside Aberdeen, Corner Lease 3	Lat: 45.95756; Long: -61.03232	Sediment could not be retrieved according to required standard. Hard bottom video transect was completed in its stead with video taken every 10m. Video revealed a mixed bottom: rock and hard packed sand with some silt. Starfish, small bivalves all along transect. Algae at three points. A rock crab was visible at one point on transect. Bivalve shells at three points on transect. Eel grass or eel grass strands at three points along transect.		
Southside Aberdeen, Corner Lease 4	Lat: 45.9594; Long: -61.02065	Dark brown mud	n/a	Oxic A
Southside Aberdeen, Reference 1	Lat: 45.975882; Long: -61.03986	Brown/black mud	n/a	Oxic A
Southside Aberdeen, Reference 2	Lat: 45.9622; Long: -61.01108	Sediment could not be retrieved according to required standard. Hard bottom video transect was completed in its stead with video taken every 10m. Video revealed sediment of rock and hard packed sand; cobble; rock; and some silt all along transect. Star fish visible at each point along transect. Small bivalves at four points along transect. Mussels and clams at one point and algae at one point. Bivalve shells visible along transect. Leaves visible at two adjacent stations along transect.		

Published descriptions of the benthos of Whycocomagh Bay

As extracted from Parker et al., 2007: "Whycocomagh Bay has two deep basins and a flushing time of approximately two years. This slow water exchange facilitates the unique anoxic and hypoxic

character of the deep basins within the Bay (Petrie and Bugden 2002). The eastern basin in Whycocomagh Bay, immediately west of St. Patricks Channel, has DO levels as low as 38% at the bottom (38 m) (Strain and Yeats 2002). The 48 m deep western basin has only 47% saturation at 15 m depth, and is typically anoxic below 25 m (Krauel 1975), a characteristic that appears consistent over the year and over time (Strain and Yeats 2002). Black's (1958) observation of only a few organisms of two shallow water species of mysid shrimp in Whycocomagh Bay is a further indication that low dissolved oxygen levels have likely existed for some time in the deeper waters at this location." In the same review paper, a limited diversity of copepods was also noted for Whycocomagh Bay, with only the four most common copepod species typically being found.

Previous internal studies on the site area

Several years ago, baseline information on the benthos of this area was conducted. Although the environmental monitoring data did not meet the QA/QC guidelines of the Nova Scotia Department of Fisheries and Aquaculture, the information is still relevant. The internal report produced as a result of this study is attached as Appendix A. This study indicated that the benthic flora and fauna in the area of the site were limited in diversity.

Mitigating Fisheries Impacts through Operational Procedures

Three of the greatest perceived risks of finfish aquaculture operations to fisheries and fisheries' habitats are fish escape, disease, and impact on the benthos and water quality. We'koqma'q will institute operational procedures to mitigate these risks as described below.

Fish Escape

All of We'koqma'q First Nation finfish aquaculture operations will follow the fish containment management requirements described in their Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. This containment management plan includes:

- Described and approved operating procedures that limit the risk of a breach, including the identification of critical control points, critical control limits, monitoring and corrective actions. The controls are identified through conducting a site specific hazard analysis.
- Described and approved procedures for site management if unusual events or severe weather occurs.
- Minimum infrastructure requirements, and minimum infrastructure maintenance and inspection requirements –including proof of a professional engineer's approval of the design of the structures in place for containment management.
- Described and approved responses to breaches or suspected breaches, including mandatory reporting.

The above plan will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

In addition, We'koqma'q's finfish operation hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices (BAP). This science-based and continuously-improved global performance standard is third party audited and assures "healthful foods produced through environmentally and socially responsible means". The BAP standard requires the application of a Fish Containment Plan to cover fish escape prevention. This would be above and beyond the FMP

containment requirements described above and it would be third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Finally, the regulatory and certification minimum requirements will be enhanced with the extensive practical knowledge and experience of the managers responsible for We'koqma'q's finfish aquaculture operations. Resumes for senior management are attached as Appendix C.

Disease and Biosecurity

All of We'koqma'q First Nation's finfish aquaculture operations will follow the fish health requirements within their Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. These requirements include:

- Described and approved finfish husbandry and welfare, veterinary care and disease surveillance practices. These practices include following the NSDFA marine finfish disease surveillance program and adhering to the multi-governmental agency (NSDFA, DFO, CFIA) Introductions and Transfers disease screening and permitting requirements.
- Described and approved biosecurity measures appropriate to the operation and its risk.
- Prescribed mortality and disease reporting requirements.
- Prescribed reporting of antibiotic and products used to treat sea lice.
- Described and approved procedures and measures to be followed in the case of a disease outbreak.

The above elements will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

An additional relevant aspect regarding disease concerns the unique low salinity waters of Whycocomagh Bay, the region of the proposed site. This site has a salinity of 17-18 ppt at the surface, approximately 20 ppt within a few meters. This has a number of fish health advantages that mitigate disease risk. Sea lice, which are ectoparasites of salmonids that may transfer between cultured and wild fish populations, and are often a great concern for salmonid fisheries enthusiasts, have never been observed in the waters of Whycocomagh Bay. It is likely that the low salinity of the Bay prevents this parasite from thriving (R. Wooten and C. Sommerville, personal communication). Bricknell, et al., 2006 demonstrated that sea lice (*Lepeoptheirus salmonis*) actively avoid low salinities (<27ppt) and even short term exposure to low salinity water (<27ppt) severely compromised sea lice survival and host infectivity. Low salinity waters are also known to reduce the risk of amoebic gill disease (AGD) (Mitchell & Rodger, 2011), another disease of concern for salmonid culturalists. Finally, the low salinity water reduces transfer stress from the hatchery, thereby reducing fish health and welfare risks.

As stated previously, We'koqma'q hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices. This certification includes sections addressing minimum animal health and welfare and biosecurity requirements. These requirements would be above and beyond the FMP fish health requirements and third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

As stated previously, the regulatory and certification minimum requirements will be enhanced with the extensive practical knowledge and experience of the managers responsible for We'koqma'q's finfish aquaculture operations. (See Appendix C.)

Environmental Impacts

All of We'koqma'q First Nation's finfish aquaculture operations will follow the Environmental Monitoring Program requirements dictated by NSDFA as required by the Aquaculture Management Regulations, as well as the environmental monitoring requirements required by DFO according to the Aquaculture Activities Regulations (AARs). These monitoring requirements focus primarily on potential impacts on the surrounding marine benthic environment, a primary concern regarding marine finfish aquaculture sites. They apply a risk based approach to determine monitoring requirements. Monitoring requirements for marine finfish sites include:

- A site specific benthic sampling and monitoring regime customized according to production level, site configuration, species cultured, past environmental performance of the site, and site specific oceanographic and biophysical characteristics. This must be pre-approved by NSDFA prior to the monitoring.
- Provincial and Federal review and approval of records of observations taken during monitoring and of the monitoring conducted, including Quality Assurance and Quality Control records that demonstrate adherence to procedures and protocols defined by NSDFA in their EMP Standard Operating Procedures (SOPs) and DFO within the AARs.
- Provincial and Federal review and approval of records of lab results, including Quality Assurance and Quality Control records that demonstrate adherence to procedures and protocols defined by NSDFA in their EMP Standard Operating Procedures (SOPs) and DFO within the AARs.
- Reporting of the results to NSDFA and DFO within defined timelines.

The environmental program also requires the provision of a mitigation plan which is to be applied when poor environmental performance is indicated by the monitoring.

Specific operational practices to reduce benthic impact are planned for this site. Having more available lease area, as will be achieved in part with this new site, the operator will have more room to grow fish and will be able to allow greater fallowing times of leases and sections of the leases. This strategy will be combined with increased training of staff on the use of feeding cameras and feeding techniques to try to improve food conversion and reduce benthic impacts.

It is notable that the Manager of Aquaculture Operations for We'koqma'q (Robin Stuart) was one of the designers of the original environmental monitoring program for aquaculture in Nova Scotia (see Smith et al., 2002) and continues to contribute to its development through a seat on the Nova Scotia Aquaculture Environmental Coordinating Committee. This committee, which is co-chaired by NSDFA and DFO, is a forum for industry and regulators to provide input and exchange ideas regarding the environmental monitoring program for marine sites in Nova Scotia.

As stated previously, We'koqma'q hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices. This certification includes sections addressing minimum environmental monitoring requirements. These requirements would be above and beyond the FMP fish health

requirements. For the We'koqma'q finfish aquaculture sites in the Bras D'Or Lake this environmental monitoring would have to include monitoring the water column itself for quality parameters including pH, total suspended solids, soluble phosphorous, total ammonia nitrogen, biochemical oxygen demand, dissolved oxygen and chloride. The BAP standard also imposes maximum feed rates according to retention time of the water body. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Mitigating Fisheries Impacts through Research and Development

We'koqma'q First Nation is committed to monitoring and mitigating impacts of its finfish aquaculture activities on the environment, including fisheries and fisheries' habitat. In this regard, We'koqma'q has historically supported and will continue to support researchers as they assess and develop techniques to monitor impacts.

Recent efforts (2018) have included collaborating with DFO Peter Cranford of DFO Science and NSDFA to evaluate alternative means for monitoring benthic environmental impacts.

Future efforts include completing a carrying capacity analysis for finfish aquaculture in Whycocomagh Bay. This study, to be led by Dr. Christopher Algar (Dept. of Oceanography, Dalhousie University), will develop a model that can capture carbon, oxygen, and sulfur dynamics in the sediments of Whycocomagh Bay, both with and without the influence of fish cages. The model will be used to assess the impact of aquaculture on the Whycocomagh Bay benthic ecosystem and investigate how changes in fish-rearing practices, such as increased stocking levels, may affect these impacts. Additional information regarding this work can be found in Appendix D. We'koqma'q is a partner on this project, providing site access, logistics assistance, personnel, historical environmental monitoring data and production data.

SECTION 4: OCEANOGRAPHIC AND BIOPHYSICAL CHARACTERISTICS OF THE PUBLIC WATERS

4.1 Oceanographic environment

The proposed site is in Whycocomagh Bay of the Bras D'Or Lake - referred to as "Bras D'Or Lakes" by some. The following extract from Lambert, 2002, gives excellent background information on the unique oceanographic environment of the Bras D'Or Lake:

"The Bras d'Or Lakes are situated in Cape Breton Island at the northern end of Nova Scotia. This body of water of about 1,100 km^2 is essentially an enclosed estuary with three outlets to the sea. The Great Bras d'Or Channel and the Little Bras d'Or Channel connect with Sydney Bight to the north, and St. Peter's Canal gives access to Chedabucto Bay to the south. Only the Great Bras d'Or Channel is large enough to permit any significant exchange of water. The Bras d'Or Lakes watershed is about 2500 km^2; this area added to that of the Lakes themselves gives a total catchment area of 3600 km^2 (Krauel, 1976).

Input from six rivers and restricted access to the ocean keeps salinity in the range of 20 to 26, whereas, sea water just outside the Lakes in Sydney Bight ranges from about 28 to 32. The Lakes are usually ice covered in the winter and surface waters often exceed 20°C in the late summer, particularly in smaller, shallow bays (Petrie and Bugden, 2002).

The waters of the Bras d'Or Lakes are characterised by a two-layer system; a low salinity surface layer which has a wide annual range in temperature and a lower layer of higher salinity in which temperature range is much less pronounced. In general, surface water moves toward the entrance of the Lakes and out into Sydney Bight and is replaced with outside oceanic water which enters the Lakes near the bottom and flows underneath the surface layer (Krauel, 1976; Petrie and Bugden, 2002). With the exception of restricted channels, there is little mixing between these layers except for winter months when higher winds and wave action disrupt the stability of this system. In some areas where currents and exchange rates are very low, the amount of dissolved oxygen can become quite depressed and in Whycocomagh Bay, anoxic (no oxygen) conditions exist (Petrie and Bugden, 2002; Strain and Yeats, 2002)."

The biophysical characteristics of the site environment are summarized in the table below with supporting figures and tables provided, as relevant.

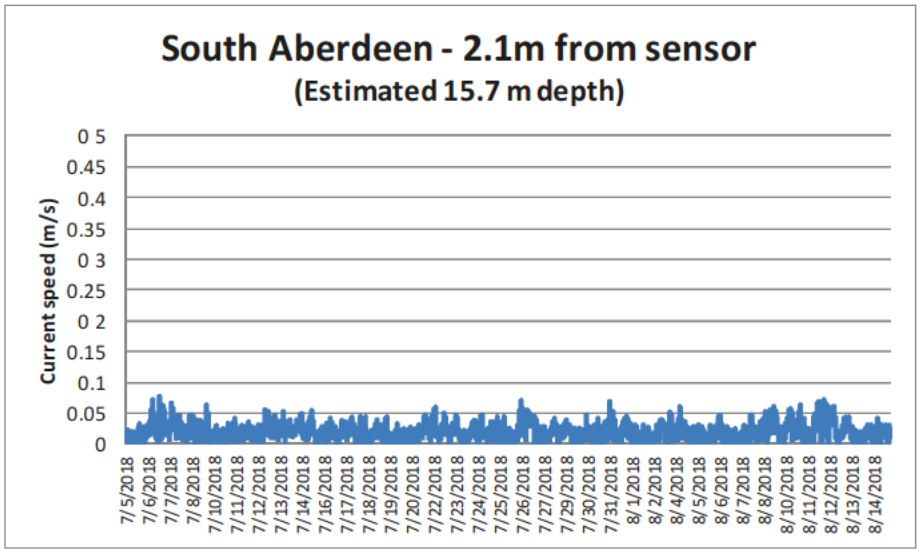
Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomagh since 2009
Average wind speed (km/hr) (30m height)	24.3	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease
Wind speed class rating (10m height)	Moderate to High	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)[3]	1.08	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the greatest Hmax measured with the ACDP during October 31, 2018 to December 11, 2018 deployment at a site across the Bay but within 2 km of this site.
Direction of maximum wave[3]	244° (WSW)	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Direction stated is the direction of the maximum wave listed above.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (personal communication, Robin Stuart).		
Annual maximum tide (m)			
Current speed range and averages (cm/sec)[4]	See Figure 2 a,b,c,d and statistics summary table (Table 1) that follow.		

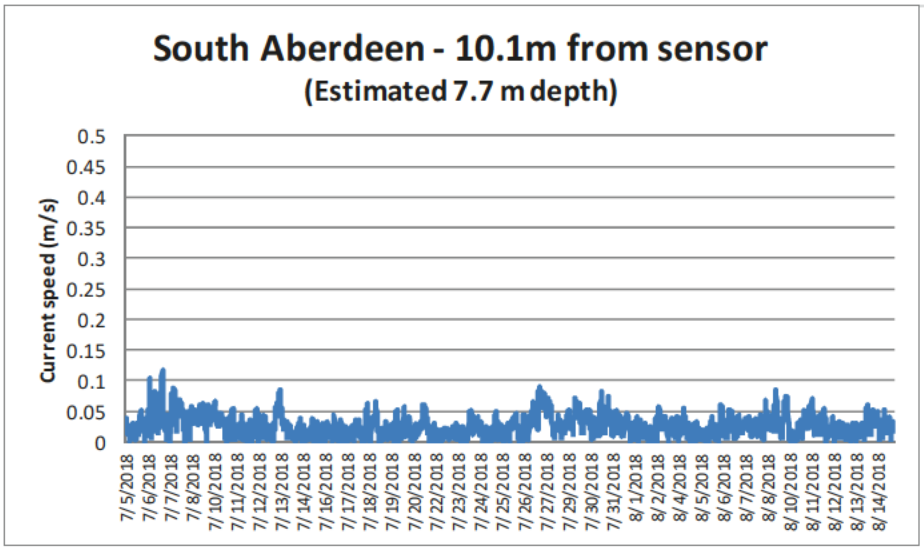
[3] The wave characteristics were collected off site but within 2 km of this proposed site. They were collected over the autumn months and early winter months of 2018 (October 31, 2018 to December 11, 2018) via deployment of an ADCP (Acoustic Doppler Current Profiler). This monitored a number of variables at multiple levels in the water column. Although only summaries are depicted within this plan, all of the data derived from this monitoring will be used in the engineering of the cage and infrastructure for this site.

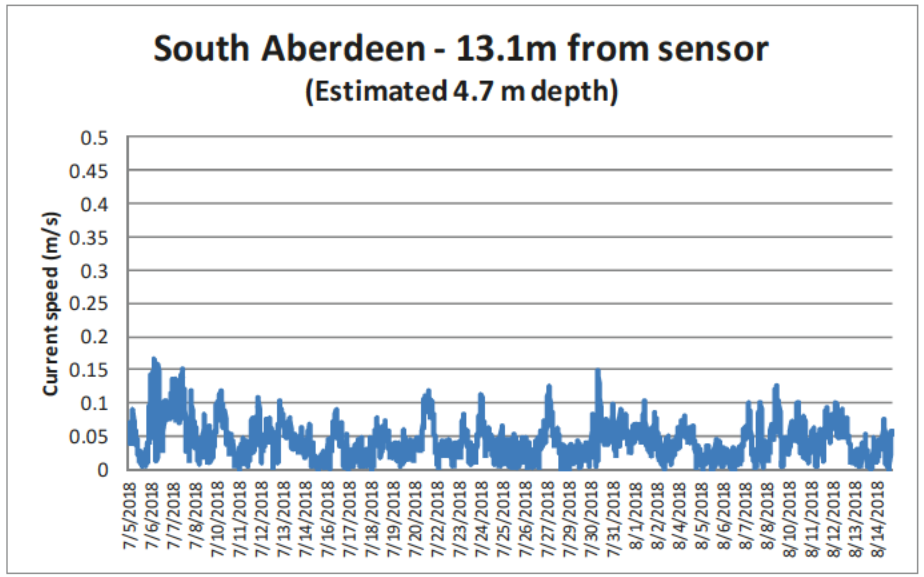
[4] The current speed and direction values of this area were collected from July 5, 2018 to August 15, 2018 via deployment of an ADCP (Acoustic Doppler Current Profiler). This monitored a number of variables associated with currents at multiple levels in the water column. Although only summaries are depicted within this plan, all of the data derived from this monitoring will be used in the engineering of the cage and infrastructure for this site.

Characteristic	Value	Reference	Comments
Annual minimum salinity (ppt)	Upper 10m: 15 ppt Below 10m: 17 ppt	Tremblay, 2002	Throughout the Bras d'Or Lakes salinities are lower in the 0-10 m depth interval than in the 10-50 m depth interval and in the upper metre of the Whycocomagh and Denys Basins maybe 5 after rainfall (Petrie, 2001). There is also a seasonal difference in salinity, with lower salinities in spring compared to summer. Tremblay, 2002). The salinities of the area are shown in Figure 3 which was adapted from figures within Tremblay, 2002
Annual maximum salinity (ppt)	Upper 10m: 25 ppt Below 10m: 27 ppt	Tremblay, 2002	
Annual minimum temperature (°C)	3°C	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the lowest ADCP temperature measured during October 31, 2018 to December 11, 2018 probe deployment at a site across the Bay but within 2 km of this site. See also summary temperature plots (Figures 4, 5).
Annual maximum temperature (°C)	25°C	Raw data obtained from David Cook (NSDFA).	Value stated is the greatest "cage level" temperature measured during June 1, 2018 to August 19, 2018 probe deployment at a site across the Bay but within 2 km of this site. See also summary plots (Figures 4, 5). Although some temperature data was also recorded on this site, the recording occurred below the thermocline so that it was not reflective of the maximum temperatures that would be experienced by the fish.

Characteristic	Value	Reference	Comments
Depth of water at each corner of the site (m)	Corner 1: 25.4m Corner 2: 26.1m Corner 3: 13.0m Corner 4: 14.0m Center Lease: 27.9m	Depths taken during baseline EMP sampling	







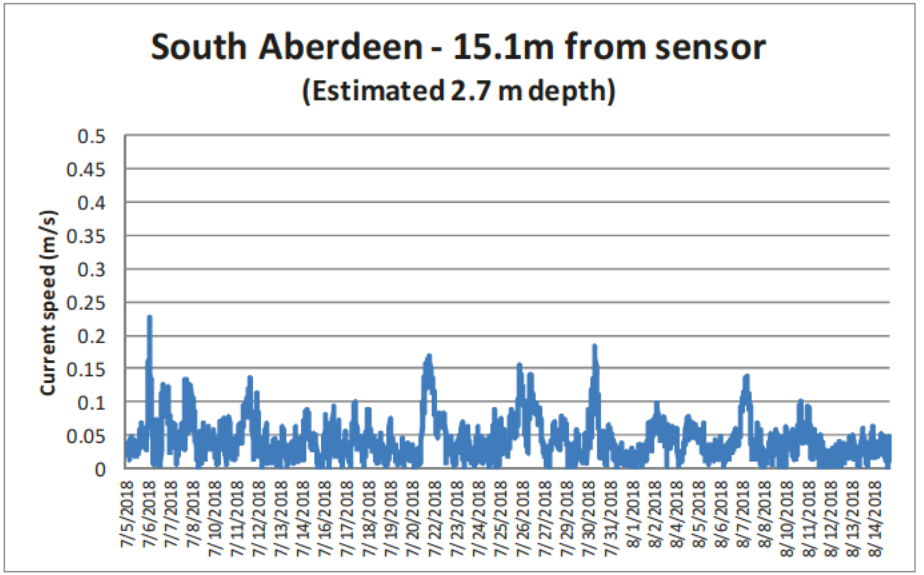


Figure2 a,b,c,d: Current speeds measured on site in 2018 (July 5 to August 15, 2018). Raw data obtained from David Cook (NSDFA) from ADCP deployment. Estimated depths calculated from sensor deployment characteristics.

Table 1: Summary table of current speeds statistics determined from data derived from ADCP deployed on site July 5, 2018 to August 15, 2018. Raw data obtained from David Cook (NSDFA) from ADCP deployment.

Height from sensor (m)	2.1	3.1	4.1	5.1	6.1	7.1	8.1	9.1	10.1	11.1	12.1	13.1	14.1	15.1
Estimated mean depth* (m)	15.7	14.7	13.7	12.7	11.7	10.7	9.7	8.7	7.7	6.7	5.7	4.7	3.7	2.7
Min speed (m/s)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Max speed (m/s)	0.077	0.087	0.084	0.100	0.101	0.120	0.122	0.102	0.117	0.123	0.130	0.165	0.231	0.226
Mean speed (m/s)	0.021	0.021	0.021	0.022	0.021	0.021	0.022	0.023	0.026	0.031	0.036	0.043	0.046	0.043

*Calculated by subtracting the bin sizes from the measured sensor depth.

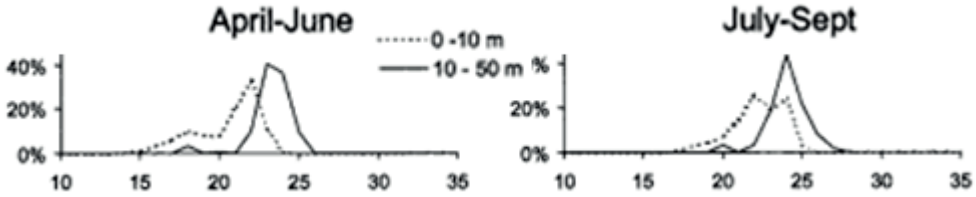
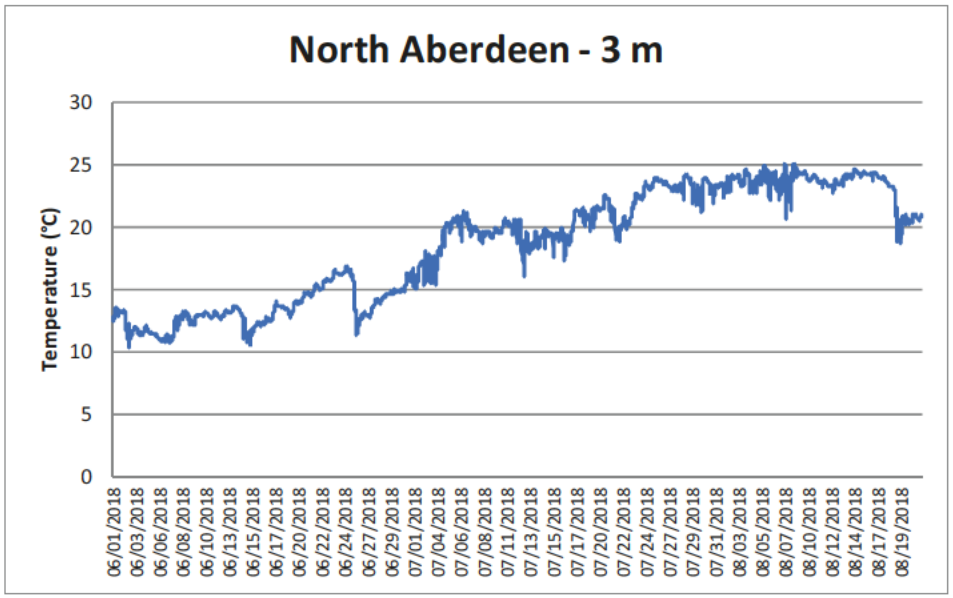
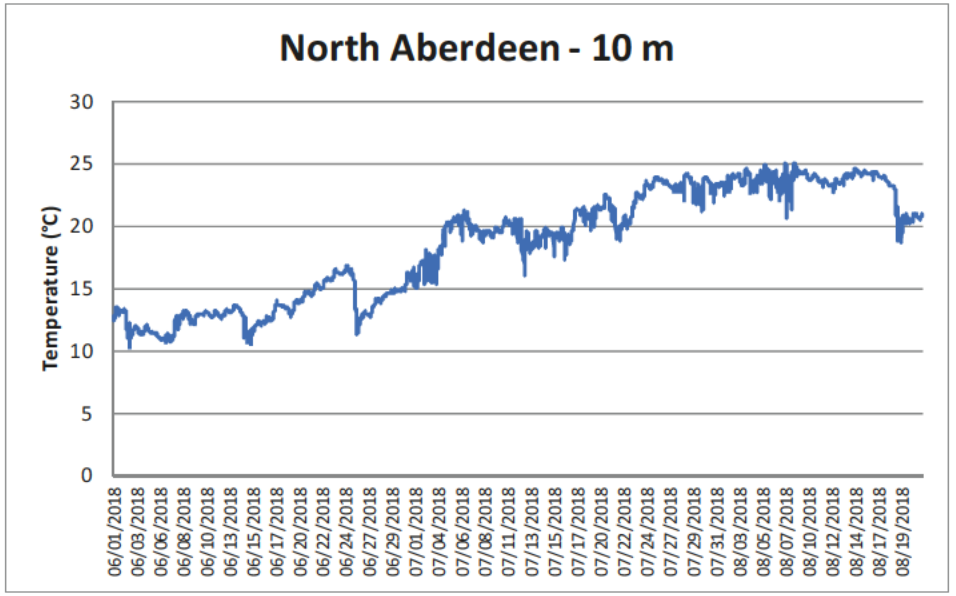
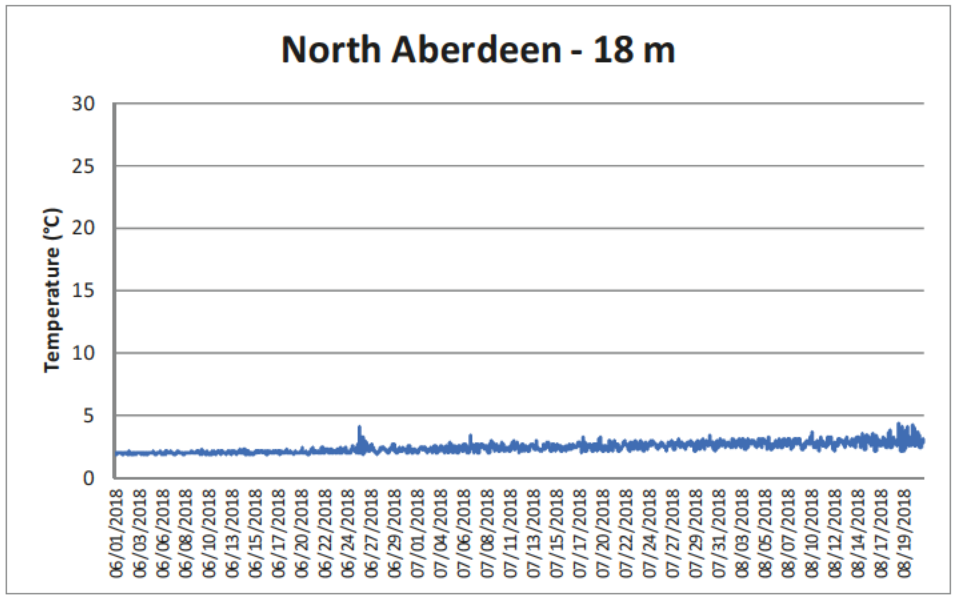


Figure 3: Frequency distribution of salinity measurements taken from Baddeck Bay, including Whycocomagh Basin, Baddeck Bay and St. Patrick's Channel. Figure adapted from figures within Tremblay, 2002.







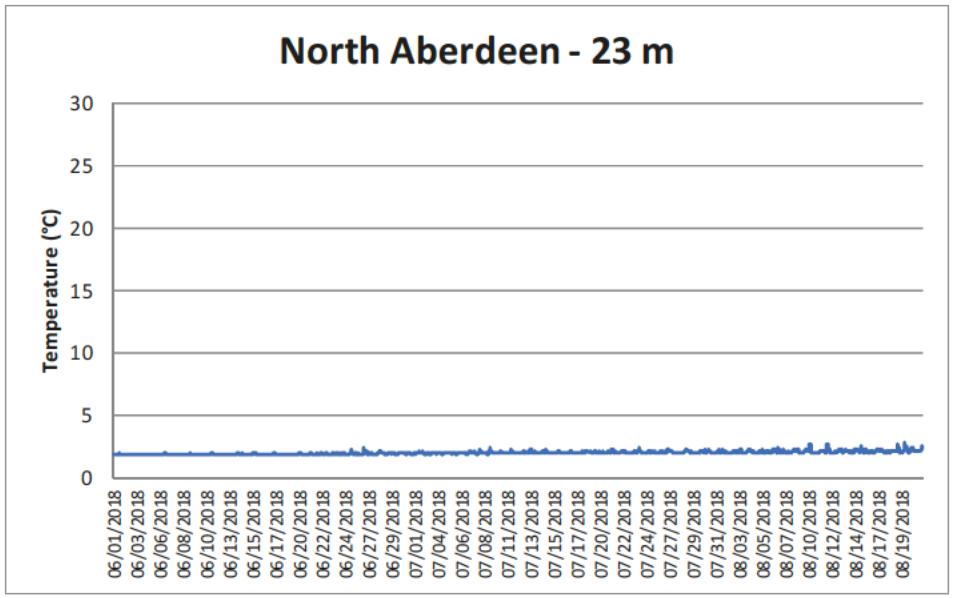


Figure 4 a,b,c,d: Summer temperatures measured in 2018 (June 1, 2018 to August 19, 2018) at depths from surface as recorded at deployment of sensors. Sensors were deployed within a few km of the site proposed in this Development Plan. Raw data obtained from David Cook (NSDFA).

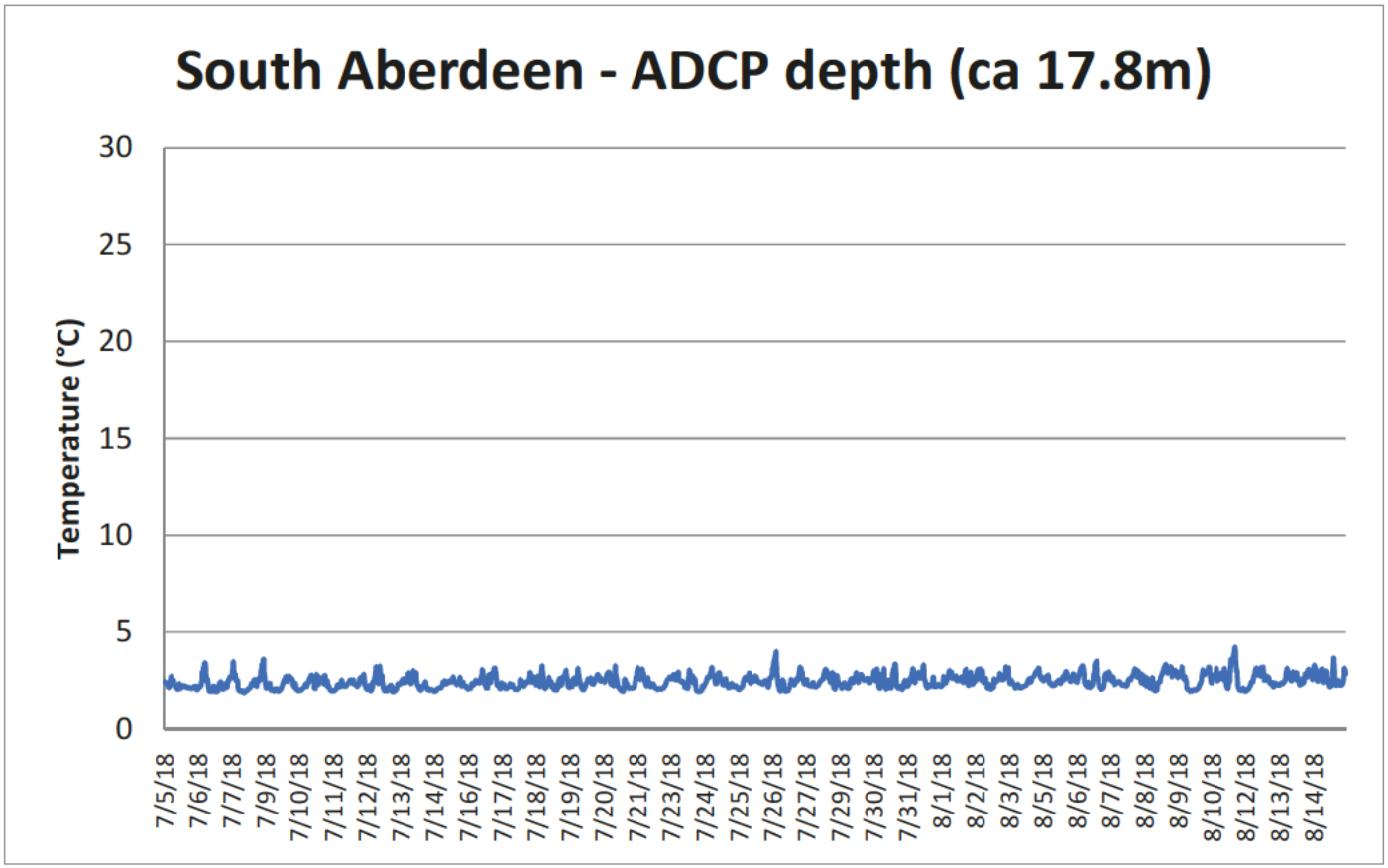


Figure 5: Summer temperatures measured in 2018 (July 5 to August 14, 2018) at the proposed site. Raw data obtained from David Cook (NSDFA) from ADCP deployment. Depth is the average depth measured by the ADCP. The stable low temperature recorded suggests that the probe was deployed below the thermocline so that these temperatures should not be used to estimate site maximum temperatures.

4.2 Baseline environmental monitoring

The baseline monitoring package has been submitted separately.

4.3 Site design

Extensive depth sounding activities were conducted in Whycocomagh Bay in 2017. This allowed the creation of depth profiles to determine best locations for sites. Benthic information was also collected at that time. This information was overlapped with potential visual impacts to determine best options for the new sites. The proposed site in South Aberdeen was deemed to have suitable depths and bottom characteristics and have minimal visual impact so more intense scoping of the lease was initiated in 2018. This intense scoping included profiling of temperatures and oxygens near the proposed site, profiling of oceanographic characteristics, and baseline monitoring of the benthic environment. Results from these activities are found elsewhere in this Development Plan. Specific characteristics of this body of water that are significant and have been accounted for in terms of site plans are described below:

Anoxic water

Whycocomagh Bay is separated from the east (St. Patrick's Channel) via a sill less than 12 m deep. Whycocomagh Bay itself has a pair of deep basins of 38 and 46 m deep separated by a sill of approximately 7 m depth. These sills inhibit flushing below sill depth, preventing a horizontal exchange of deep water and partly isolating the physical and biological processes of one basin from the other and inhibit biota movement (Parker et al, 2007). This makes for a unique oceanographic environment that must be considered in site design and operation. In particular significant thermoclines and haloclines are known to exist and much of the benthic layer is known to be naturally anoxic (Parker et al, 2007). There is little upwelling in the Bay. In fact published reports indicate there is none (Parker et al, 2007). However some upwelling of low oxygen "fingers" of water has been experienced in fish farming operations in the past. These events are thought to be caused by deep water currents caused by tide. As the deep water is pushed in by a moon tide, the low oxygen water at depth pushes to the surface and oxygen levels decline in the fish rearing layer. This must be managed in operational procedures. In response to this risk, oxygen monitoring occurs on a regular basis and increases around wind and tidal events. An oxygen supplementation system will be part of the infrastructure for the cages in susceptible areas, as determined by the oxygen profiles. There were no oxygen profiles of this site collected during scoping activities so that this will be monitored closely. Where required, oxygen supplementation is anticipated to improve environmental outcomes by reducing feed conversion rates and reducing risks to animal welfare.

Ice cover

Another feature of Whycocomagh Bay that must be managed is the presence of ice over the bay during winter. The bay begins icing over after mid-December and generally stays covered with ice until March/April. At this proposed site (South Aberdeen), the ice coverage will be managed via harvesting the fish prior to the ice forming so that special ice management measures regarding the fish will not need to be applied. In order to ensure that all fish at the site are harvest-size prior to ice forming, an assessment of fish size will occur when water temperature reaches a low of 5°C. At

this time, fish that are not expected to reach harvest size will be moved to cages at another lease site where over-wintering and winter harvest can occur. Nets will be removed from the cages after the fish are harvested or moved and the cages will be moved to Whycocomagh Bay for the winter. The moorings will stay in place over the winter. Spar buoys will be replaced with temporary buoys to mark the site for the winter period. These temporary buoys will allow the ice to travel over them when it moves out in the spring. By contrast, the large Spar buoys would get dragged with the ice when it breaks up in the spring. This has been experienced for several successive years and needs to be avoided (Robin Stuart, personal communication). The area is not navigable at this time due to the presence of the ice so that a navigation hazard is not created by the removal of the larger buoys.

Water currents and waves

The current, tide and wave data collected over the autumn months and early winter months of 2018 via deployment of ADCPs (Acoustic Doppler Current Profilers) and summarized in Section 4.1 will be used to engineer the cage and infrastructure for this site. Note that the raw data is available and will be used for this purpose. The engineer engaged for this activity is Bruce Aikman from Middle River.

Water temperature

As shown in Section 4.1, temperature was monitored at successive depths (3m, 10m, 18m, 23m) at a location within a few kms of the proposed site from June 1, 2018 to August 21, 2018. Graphs of the temperature profiles at these depths clearly show the presence of a thermocline. This was expected and is a well-recognized phenomenon for Whycocomagh Bay Temperature was also monitored at 18m using the ADCP from July 5, 2018 to August 14, 2018 but this information was not useful for production planning since the probe was deployed below the thermocline and the temperatures recorded were not reflective of temperatures that the fish would experience in the cages. The temperature profiles of the water depths the fish will inhabit have been incorporated into the growth model of the fish to predict feeding rates and days to harvest. They demonstrate that fish entering the site in May at 250g will reach harvest size before the area ices up.

SECTION 5: THE OTHER USERS OF THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

5.1 Description of other users

The proposed site is located in a sparsely populated area. That was one of the reasons it was chosen. Portage Road is the main thoroughfare in this region, running east-west parallel to the shore but distant from it. A number of private drives lead off from Portage Road towards the Lake. The densest population resides on Joseph MacFarlane Drive which runs north off Portage Road towards and along the lakeshore.

Users within 1 km radius

There are no known businesses within a one km radius. Eagle D'Or Cottages is just outside of this radius and is shown in Figures 6 and 7. There are no cottages or homes on the shoreline directly adjacent to this area.



Figure 6: Google Earth image of the proposed site area with a 1 km radius around the site center (yellow circle).

Users within 2 km

There are at least four property owners within this radius with access to the water via private wharves, all to the southwest of the proposed site. Known businesses within 2 km of the proposed development are shown in Figure 7, numbered according to their descriptions below:

1. Eagle D'Or Cottages – two cottages for rent with Bras D'Or Lake shorefront.
2. Cape Breton Cottage Bed and Breakfast – single private cottage rental on beachfront and single B&B rental 250 feet from Bras D'Or Lake shore. It is unlikely the cage site will be visible from this shorefront because of the lay of the land in this area.

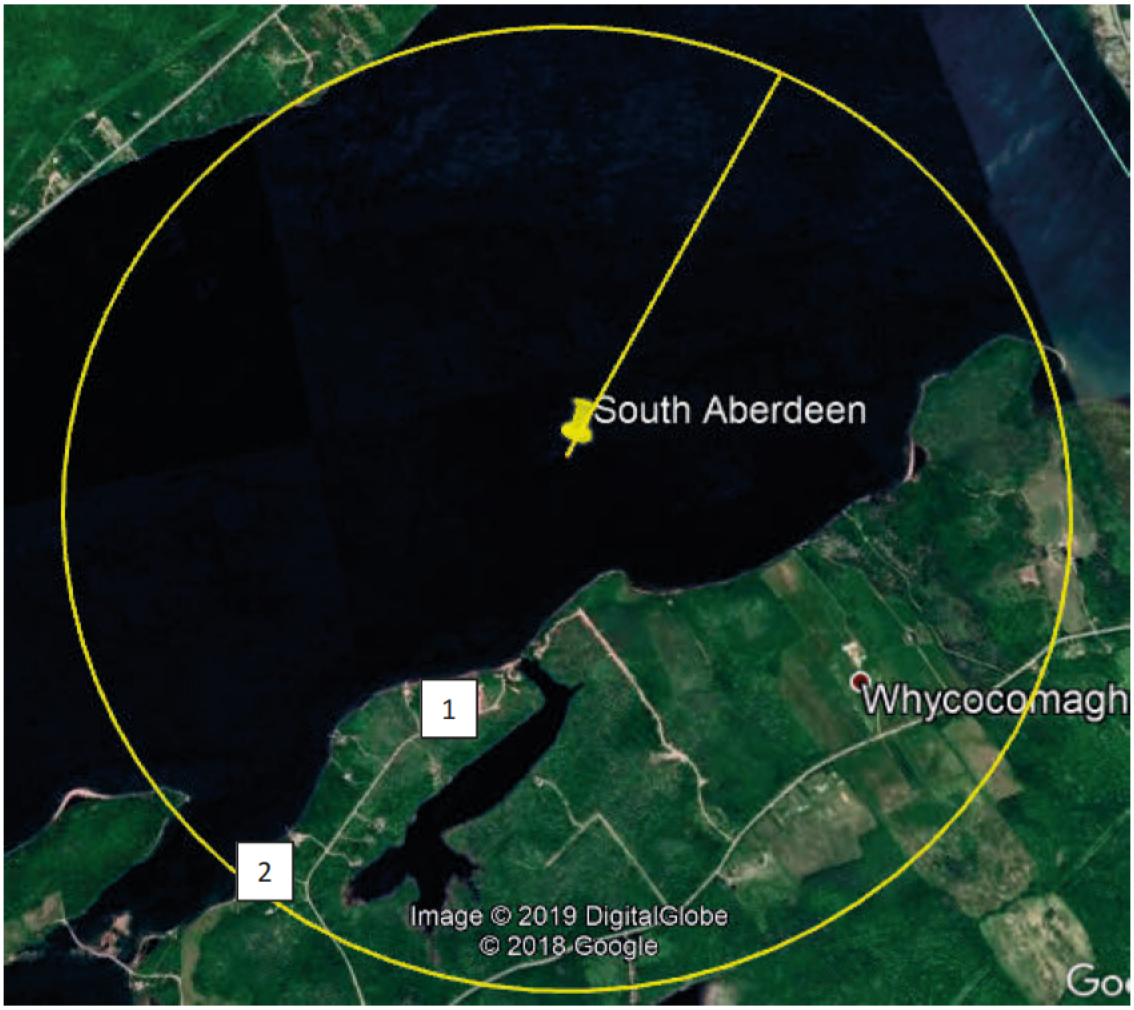


Figure 7: Google Earth image of the proposed site area with a 2 km radius around the site center (yellow circle).

Users within 3 km

Businesses or other public users within 3 km of the proposed development are shown in Figure 8, numbered according to their descriptions below:

3. Cape Escape B&B and Therapeutics (north side of Bay, inland) – seasonally offers a single suite for rent. This business is on the Trans-Canada Highway, away from the shoreline.
4. Bear on the Lake Guesthouse (north side of Bay) – seasonally offers private rooms and hostel accommodations that overlook the Bras D'Or.
5. Timeout Campground – private 93 site camping and RV campground with 1000' of waterfront.

The opposite (north) side of the Bay is more than 2 km away, but within 3 km. It is less populated than the south side.



Figure 8: Google Earth image of the proposed site area with a 3 km radius (yellow circle). The approximate locations of the known users of this space within this radius are numbered according to their description in the main text of this document.

Users within 5 km

Businesses or other public users within 5 km of the proposed development are shown in Figure 9, numbered according to their descriptions below:

6. We'koqma'q processing plant (northeast, opposite side of Bay)- CFIA registered seafood processing facility that processes the finfish aquaculture products produced by We'koqma'q.
7. Little Narrows Presbyterian Church (northeast)
8. Little Narrows Ferry (northeast)
9. Little Narrows Community Center (northeast): community hall which hosts local events and is available for rental.
10. Little Narrows Beach Municipal Park (northeast) – offers sandy beachfront access to the public.
11. Aberdeen Motel- (north side of the Bay) – classic single story motel with more than a dozen rooms. It is not on the shore of the lake.

All of the Little Narrows community is within this radius. The primary amenities in the area are listed above (#7,8,9,10)

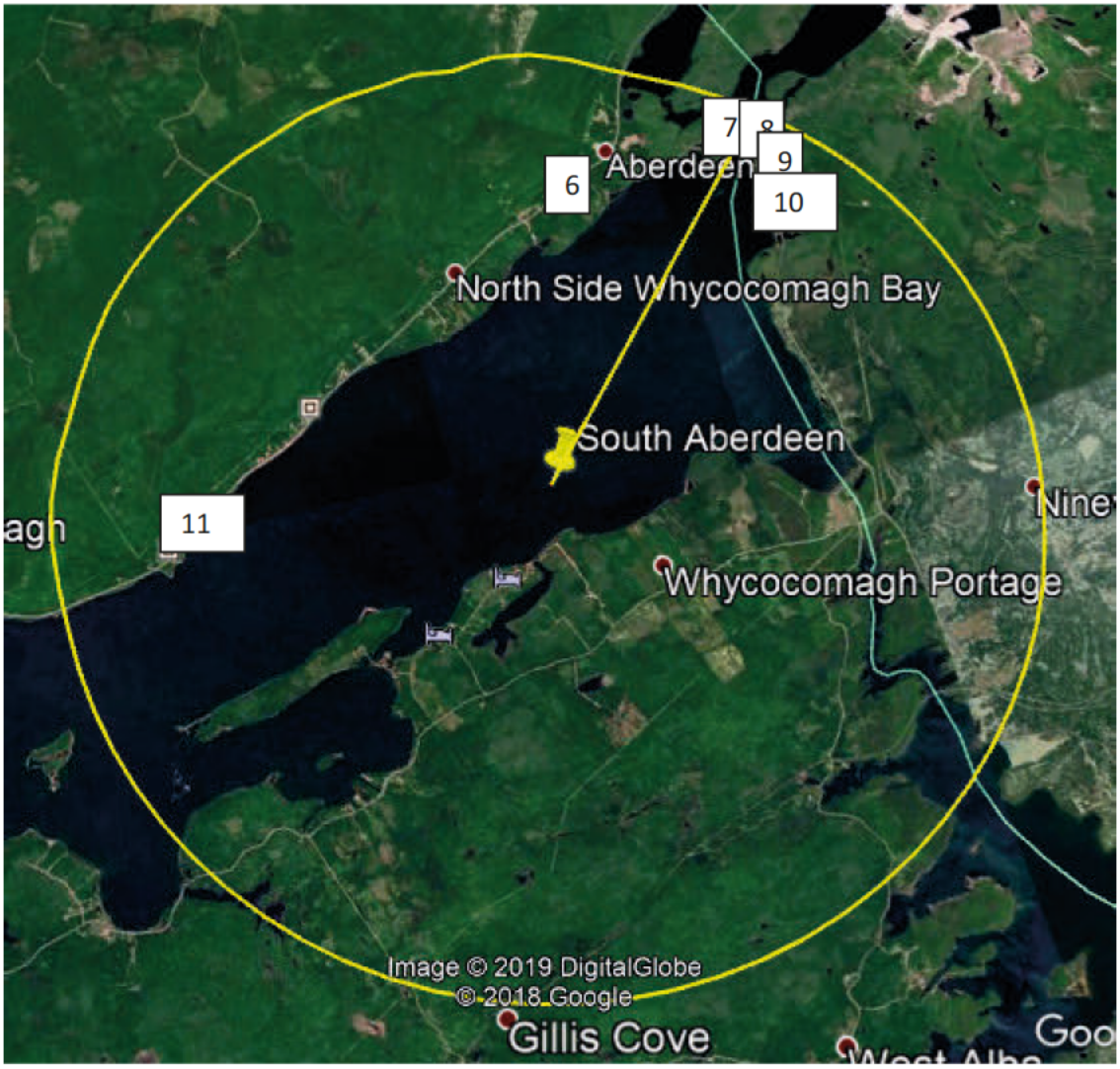


Figure 9: Google Earth image of the proposed site area with a 5 km radius (yellow circle). . The approximate locations of the known users of this space within this radius are numbered according to their description in the main text of this document.

Users within 10 km

We'koqma'q First Nation (Whycocomagh 2 Reserve), and the village of Whycocomagh are within 10 km of the proposed site. They are circled in blue in Figure 10.

We'koqma'q First Nation is a Mi'kmaq community in the middle of Whycocomagh with a registered population of approximately 1000 persons according to Indigenous and Northern Affairs Canada. The We'koqma'q Nation has traditionally used the public waters for fisheries activities as described in Section 3.2. Whycocomagh and Whycocomagh Bay are recognized areas of cultural, recreational, and social significance (CEPI, 2006). It is notable that We'koqma'q has been involved in shellfish and finfish aquaculture activities in the local waters for decades. The proposed aquaculture site is a significant part of the First Nation's business development plans. It will be managed in association with the other Mi'kmaq activities in the waters. A single group manages both the fisheries and aquaculture portfolio of the Band and will ensure that they are complementary.

The Whycocomagh community has a population of approximately 850 residents and has several small businesses that support the local residents, including gas stations, a pharmacy, grocery store, bank, several bakeries and restaurants, accommodations (Keltic Quay, Fair Isle Motel), farmer's market, school (P-8, population<200), fire department, community center and other amenities and tourist features.

In Whycocomagh, a main user group of the public waters is the Whycocomagh Waterfront Centre Association which supports both a community center as well as a marina. The marina is gated access with piers and a launch ramp to the Bras D'Or, a pump station, fresh water and washrooms. Floating docks and moorings are available for member rental.

Whycocomagh Provincial Park is located east of Whycocomagh. The park features hiking (5 km of trails), camping (40 sites) and picnicking. It overlooks the Skye River Valley and the Bras D'Or Lake. The main park straddles the Trans-Canada Highway and has areas of access to the Bras D'Or Lake.

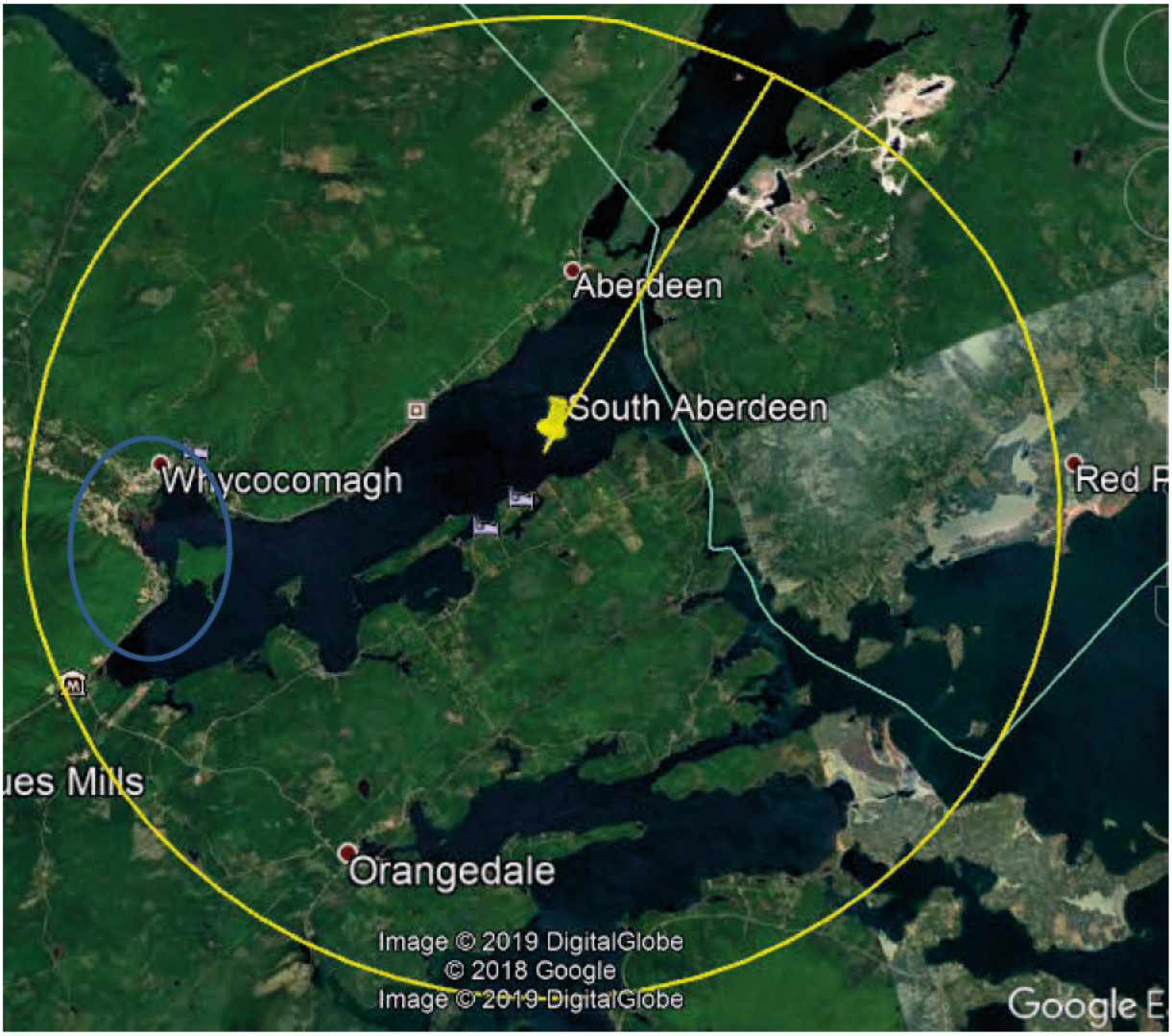


Figure 10: Google Earth image of the proposed site area with a 10 km radius (yellow circle). Whycocomagh, including the We'koqma'q First Nation is circled in blue.

Other regional users or parties interested in the public waters

The Bras D'Or Lake is a popular cruising location for pleasure crafts. Whycocomagh Bay is open to the Bras D'Or Lake only via Little Narrows Channel and yet is a popular spot, particularly for small sailing vessels, kayakers, canoeists and small fishing vessels. These may be local residents or seasonal users.

Other parties interested in the area in terms of conservation include:

Bras D'Or Stewardship Society: a non-profit organization established in 1998 committed to promoting stewardship of the Bras D'Or Lakes and their watershed. The proposed site is within the Society's area of interest.

Bras D'Or Lake Biosphere Reserve Association: a registered charity that oversees the UNESCO designated Bras D'Or Lake Biosphere Reserve[5]. Its mission is "to engage all peoples in the balanced and sustainable development of the exceptional cultural, environmental and economic assets within the Bras d'Or Lake watershed." The proposed site is within the Biosphere Reserve.

Bras d'Or Lakes Collaborative Environmental Planning Initiative (CEPI): CEPI is an alliance of federal, provincial, municipal, and First Nations governments and other interests who have signed a charter that represents "the collective intent, or "will", of the relevant governments with responsibilities for the management and protection of the Bras d'Or Lakes and its watershed".

[5] In 2011, the Bras d'Or Lake and its watershed area were designated a UNESCO Biosphere Reserve, recognizing that the locals live in harmony with nature and work to promote a healthy environment, economy and culture.

5.2 Significance of proposed area to wildlife

Significant terrestrial habitats

Significant land habitats recognized by NSDNR along the shoreline of Whycocomagh Bay are shown in Figure 11 and include the following:

- IN418: deer wintering
- IN21: deer wintering
- IN142: bald eagle nest
- VI207: common loon habitat
- IN192: bald eagle nest
- IN17: bald eagle nest
- IN433: bald eagle nest
- IN22: bald eagle nest
- IN51: bald eagle nest
- IN37: bald eagle nest
- IN49: bald eagle nest

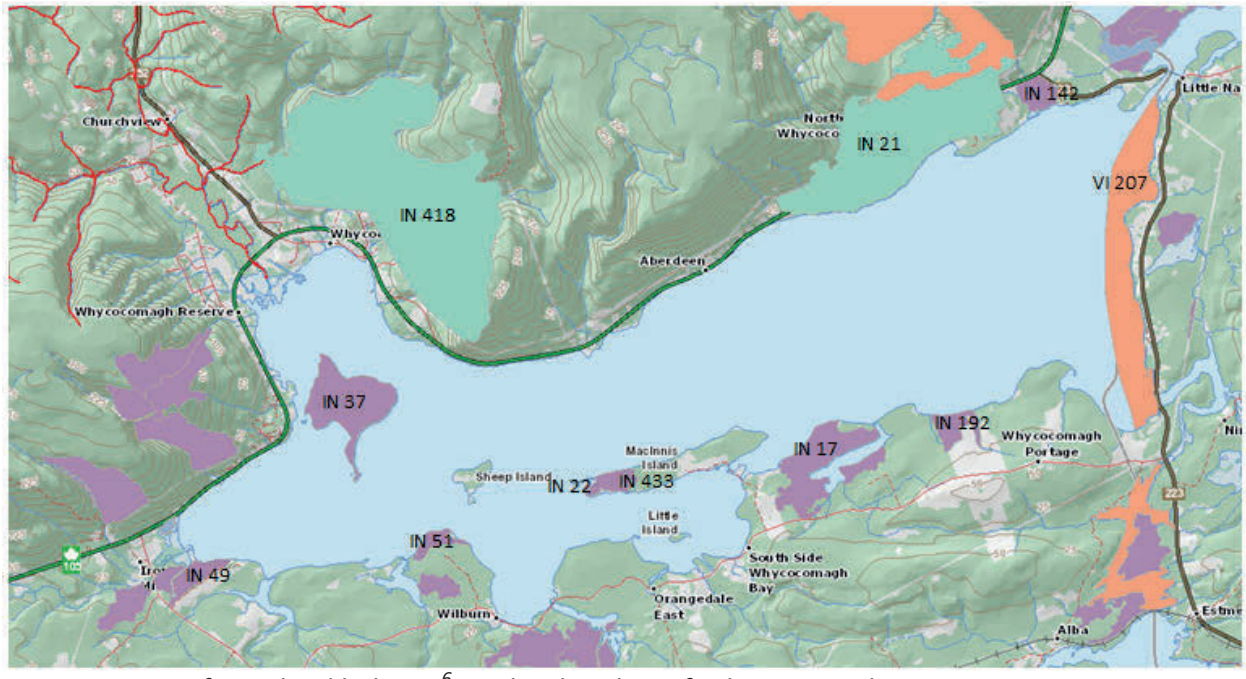


Figure 11: Significant land habitats[6] on the shoreline of Whycocomagh Bay

Rare and endangered species

A data report from the Atlantic Canada Conservation Centre provides more in depth detail on the possibility of the presence of rare and endangered species that may use the proposed development

[6] Adapted from https://nsgi.novascotia.ca/plv/ ; used with permission. Additional information provided by Frances MacKinnon.

area as well as special wildlife areas of the region. The complete report generated for the proposed site location is attached as Appendix E. A summary of the report follows:

Rare species list

Within 5 km of the site centers, records indicate the presence of 26 species of rare or endangered vascular plants, 1 species of rare or endangered nonvascular plant, and 24 species of rare or endangered vertebrates.

Within this list of species, two are aquatic, including:

- Alewife
- Atlantic salmon

Shoreside species of plants include:

- Ray's knotweed
- Seaside brookweed

Shoreside species of animals or water birds include:

- Nelson's sparrow
- Cliff swallow
- Kill deer
- Wilson's snipe
- Spotted sandpiper

Species at Risk

Seven Species at Risk are on record as being in the region. They are listed in the table below. None are water dwelling or expected to be found shoreside.

Table 2: Species at risk within 5 km radius of proposed site[7]

Scientific name	**Common name**	**SARA status**	**Habitat, other comments**
Degella plumbea	Blue felt lichen	Special Concern	Hardwoods in woodlands[8]
Riparia riparia	Bank swallow	Threatened	Nests in burrows excavated in eroding banks of coastal cliffs and other steep vertical soft soil faces[9]
Hirundo rustica	Barn swallow	Threatened	Nests in barns, garages, houses, bridges and culverts near open areas. Part of the agricultural landscape in Nova Scotia.[10]

[7] Species list extracted from Atlantic Canada Conservation Center Report 6327. Species habitat and other comments obtained from sources referenced in footnotes.

[8] https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=1123

[9] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp

[10] http://www.farmbiodiversity.ca/species-at-risk-2/birds/barn-swallow/

Scientific name	Common name	SARA status	Habitat, other comments
Dolichonyx oryzivorus	Bobolink	Threatened	Open grasslands and hayfields[11]
Contopus cooperi	Olive-sided Flycatcher	Threatened	Spruce and fir swamps and bogs[12]
Contopus virens	Eastern Wood-Pewee	Special Concern	Woodlands[13]
Sorex dispar	Long-tailed Shrew	Special Concern	Mountainous, forested areas; may occur along small mountain streams[14]

Location sensitive species

One location sensitive species has been recorded in the region: black ash. Black ash grows in swampy, low lying areas that are very wet and marshy.[15]

Culturally significant flora and fauna

The sweet flag is a medicinal plant in the Whycocomagh area that is of significance for the Mi'kmaq people (CEPI, 2006). CEPI, 2006 also mentioned barrows goldeneye which have been seen near Whycocomagh Bay shore and bald eagles which are more commonly seen.

General marine life

The Bras D'Or Lake marine environment is known for its uniqueness in terms of reduced salinities, limited physical exchange with the open ocean, diversity of seasonal temperature regimes, and low tides. One of the most often reported attributes of the Lake is the fact that both warm water and cold water species are found in the same water system (Lambert, 2002).

Within Whycocomagh Bay, the diversity of marine life is more limited than other areas of the Lake. It is a low salinity region with large basins of low oxygen levels. It has been suggested that these characteristics limit benthic organisms in many parts of the Bay, with the exception of micro-organisms (Lambert, 2002). Low abundance of mysids, copepods (Petrie & Bugden, 2002; Strains & Yeats, 2002) have been noted. Many invertebrate species such as lobsters and rock crab are unlikely to be in this area due to its low salinity. Similarly, scallops are unlikely to be in this area (Tremblay, 2002).

Studies have shown that herring and gaspereau occur in Whycocomagh Bay and the presence of winter flounder, cod, skate, and windowpane flounder was evidenced by their appearance in trawl catches in Whycocomagh Bay in 1999-2000, which were similar to findings from tows conducted in 1967. The cod population in this Bay is thought to be unique from other cod populations in the lake. This is based on the low incidence of the sealworm (*Pseudoterranova decipiens*) in cod of the Bay relative to adjacent areas. This segregation is thought to be due to the restricted passageway at Little Narrows, which may discourage the movement of cod between the Bay and St. Patrick's

[11] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[12] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[13] https://novascotia.ca/natr/wildlife/biodiversity/species-list.asp
[14] https://www.iucnredlist.org/species/41394/115183478#habitat-ecology
[15] http://www.uinr.ca/black-ash/

Channel. Local knowledge suggests that cod populations are significantly reduced over previous levels (personal communication, Joe Googoo, We'koqma'q Elder).

Grey seals and harbor seals are the only marine mammals known to inhabit Whycocomagh Bay (Robin Stuart, personal communication).

5.3 Impacts to other users including wildlife

Impacts to human users of the public waters surrounding the proposed development

Tourist operators, local and seasonal residents

A number of businesses within the region that were identified in Section 5.1 rely on tourism. A key draw to the region is the Bras D'Or Lake. And local and seasonal residents enjoy the public waters surrounding the proposed development for its beauty, nature and recreational opportunities. Concerns that these groups of the community may have are discussed below.

Visual impact

The area is well known for the attractiveness of its landscape, including the views of the Bras D'Or Lake. We'koqma'q recognizes this value to the area's tourism industry as well as to the local community members in general.

For this proposed site, the cages will not be visible from the highway. They will be visible from the immediate shoreline. As shown in Figures 6, and 7 there are not many users of this immediate shoreline. This was one of the reasons for choosing this site. Moving cages to locations where they would be hidden from public view was suggested during the scoping process[16]. This comment was made specific to the Whycocomagh site, not this proposed site. However, this concern should be discussed for all sites.

In recognition of the importance of appearance, We'koqma'q First Nation is committed to ensuring that the cages are maintained in an orderly fashion to ensure that they properly represent the opportunity that they are bringing to the community and do not negatively impact the visual landscape. The regular inspection and maintenance of cages is a best practice of the company that is mandated under the Nova Scotia Aquaculture Management Regulations within the Farm Management Plan as mentioned in Section 3.2 (*Mitigating Fisheries Impacts through Operational Procedures*). In addition to these Farm Management Plan requirements explained previously regarding infrastructure maintenance, all of We'koqma'q First Nation finfish aquaculture operations will follow the farm operations requirements also defined by the Nova Scotia Aquaculture Management Regulations. These requirements acknowledge that the responsible operation of a marine finfish site includes consideration of neighbors and other users of shared resources, including aspects affecting visual impact. To this effect, the Farm Management Plan must include the following:

[16] Refer to Page 8 of the Report on Public Engagement During Scoping

- Described and approved management practices for removing and disposing of accumulated refuse and decommissioned farm supplies and equipment;
- Described and approved management practices for retrieving any gear or debris from the aquacultural operation that has broken loose; including timelines for completion;
- Described and approved management practices for maintaining the site in good order.

The above elements will be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements.

Smell and Noise

Part of the appeal of the region pertains to the rural landscape in terms of low noise pollution and high air quality. We'koqma'q recognizes the value of maintaining these local attributes and will apply and document practices that reduce noise, particularly outside of working hours, and reduce odors in general.

A complaint about the smell of We'koqma'q's current finfish operation in Whycocomagh was brought up during the scoping process [17]. It is recognized by We'koqma'q that they had an incident where smell was a problem for a couple of days in the summer of 2018. This was due to an interruption in trucking that required offal transfer during an excessively hot day (>30°C). Normal procedures for We'koqma'q's finfish operations include removing organic waste on a bi-weekly basis for transport to the Guysborough facility which is equipped to deal with such waste. Increased oversight of this procedure now occurs to ensure that the transportation will not be disrupted. And the shipping containers are sealed on site prior to transport so that spillage will not occur en route.

Other aspects of the operation that pose a risk for causing odors will be described and documented in the Farm Management Plan. This includes the storing and disposal of feed, mortalities and other organic waste. These are part of the farm operations requirements of the Nova Scotia Aquaculture Management Regulations.

It is notable that the Farm Management Plan also requires the description, application, and documentation of procedures that minimize noise.

As mentioned previously, We'koqma'q's finfish operation hopes to become certified to the Global Aquaculture Alliance's Best Aquaculture Practices (BAP). Section 13 of this standard requires safe and responsible storage and disposal of farm supplies and waste. Procedures required for this would be above and beyond the FMP containment requirements described above and would be third party audited. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

It is notable that the finfish aquaculture operations have been operating in the community for more than 40 years and the relationships with local residents regarding the operation have been very positive.

[17] Refer to Page 12 of the Report on Public Engagement During Scoping

Navigation for marina users, recreational boaters, fishers and others
Recreational boaters, fishers, marina users and other local residents or passersby who use the waterways for travel need to have clear delineation of safe travel paths when in or below water structures, such as finfish cages exist. We'koqma'q First Nations has ensured this by completing a Notice of Works form to Transport Canada, as required under Section 6 of this Development Plan. We'koqma'q will mark their sites in accordance with these requirements.

Miscellaneous concerns raised during scoping
During the public meeting held in the community, an attendee mentioned his concern that We'koqma'q's current aquaculture operation in Whycocomagh is causing the build-up of dead seaweed along the shore which is interfering with angling from the shore.[18] It is not clear that the association between the dead seaweed and the finfish culture activities is real and that changes to the operations would make an impact on this phenomenon. Regardless, We'koqma'q is dedicated to monitoring and measuring the environmental impact of its finfish aquaculture operations, including eutrophication. This is demonstrated by We'koqma'q's partnership in research that will model and measure nutrient level changes in the water resulting from its operations. This was previously described in Section 3.2 ("*Mitigating Fisheries Impacts through Research and Development"*).

Ensuring the proper disposal of sewage waste was brought up during the scoping process.[19] Storage and disposal of human waste must be described and documented in the Farm Management Plan as part of the farm operations requirements of the Nova Scotia Aquaculture Management Regulations.

Impacts to wildlife users of the public waters surrounding the proposed development
There are no identified rare or endangered species that are expected to be directly impacted by the operation of this site. Mitigation measures applied to reduce fisheries impacts are described in Section 3.2 and will also mitigate impacts to other wildlife in the bay in general.[20] Measures applied to support the sustainability of wild salmon are described in section 7.2.

As described in Section 5.2, there are no SARA listed species expected to interact with the proposed site since all known SARA species in the area are terrestrial.

Similarly, all rare and endangered species, with the exception of Atlantic salmon and alewife, are terrestrial and not expected to be encountered during normal operation of the site. Potential risks to shoreline species and water birds, particularly those known to be rare or endangered, will be mitigated within a wildlife interaction plan. This plan will describe procedures that ensure least interference with surrounding wildlife while supporting their habitat. This will include a requirement that boat travel to and from the site is taken via the most direct route possible, without travelling near the shore or near wildlife. An exception to this will occur during a weekly sweep of the shoreline to look for debris that may inadvertently have been released during

[18] Refer to Page 8 of the Report on Public Engagement During Scoping
[19] Refer to Page 8 of the Report on Public Engagement During Scoping
[20] The potential benthic environmental impacts were brought up during scoping. See page 8 of Report on Public Engagement During Scoping

operation of the site. This will enable the upkeep of the shoreline to a level of cleanliness that promotes wildlife habitat. For these procedures, employees will be cautioned to not approach wildlife and not travel through marsh areas where sensitive species may be harbored. An annual shoreline clean-up will also occur for the adjacent area. This clean-up will not be conducted at times of the year when shoreline birds are nesting.

A wildlife interaction plan must be described in an operator's Farm Management Plan as defined by the Nova Scotia Aquaculture Management Regulations. It must be approved for implementation by NSDFA and operators will be audited for adherence to the plan according to NSDFA's requirements. The BAP certification standard also requires a Wildlife Interaction Plan. The complete BAP standard for Fish and Crustacean Farms (Issue 2.4) is attached as Appendix B.

Complements to other users

Support of the local economy

Development of We'koqma'q's finfish aquaculture operations is anticipated to bring a significant number of local direct and indirect jobs to the community (see Sections 2.3, 2.4, and 2.5).

Support of conservation efforts

We'koqma'q will work with the conservation groups active in the area to help collect information on the oceanographic and ecological characteristics of this area of the Bras D'Or Lake. On this front, We'koqma'q has an established relationship with Dr. Bruce Hatcher and will continue to assist Dr. Hatcher as he collects information to: characterize the dynamics in the cline of Whycocomagh Bay, explore ice cover changes and effects in Whycocomagh Bay, explore anthropogenic effects on the Bay's characteristics, and other research efforts. We'koqma'q will also assist the Stewardship Society and Biosphere Reserve Association collect information on and educate people on the unique ecology of the Whycocomagh region.

Robin Stuart, the Manager of Aquaculture Operations for We'koqma'q, is the representative for We'koqma'q on CEPI and will help to ensure the responsible management of the Bras D'Or.

5.4 Impacts by other users including wildlife

Generally speaking We'koqma'q's finfish operations have, and hope to continue to have an excellent and mutually beneficial relationship with the local communities.

A possible negative impact of people on the operations needs mentioning. This refers to vandalism of the fish nets. In the past, one of the nets was released manually by a non-resident. This resulted in fish release. Fishing within the pens has also occurred. Since this time, We'koqma'q has hired security to patrol their sites and mitigate these risks. For the sites in Aberdeen, security cameras will monitor activities.

Fish eating birds (herons, hawks, kingfisher, eagles, and other species) can be common-place in regions that support finfish aquaculture operations. If not properly managed, such birds can prey on the fish in the cages, causing stress and physical damage. We'koqma'q First Nation finfish aquaculture operations will use bird nets on their cages during seasons when bird predation is a problem. These nets will cover the surface of the water at a height from the water surface so that

bird predation cannot occur. The procedures for their use and maintenance are required as part of the Farm Management Plan.

SECTION 6: THE PUBLIC RIGHT OF NAVIGATION

6.1 Navigation Protection Act approval

The Notice of Works form and required attachments are enclosed.

SECTION 7: THE SUSTAINABILITY OF WILD SALMON

7.1 Identification of local salmon populations

The proposed South Aberdeen site is within Salmon Fishing Area 19, also called the Eastern Cape Breton Designatable Unit by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Closest salmon bearing rivers that have direct connections to the body of water that contains the proposed site include Skye River (mouth within 8 km of the site), Middle River (mouth approximately 16 km from the site), and Baddeck River (mouth approximately 19 km from the site). Only the Skye River opens into the Whycocomagh Bay subwatershed. The Middle and Baddeck Rivers open into an adjacent watershed (St. Patricks Channel) which is somewhat separated from the Whycocomagh Bay subwatershed via a sill less than 12 m deep. Since 2006, Middle and Baddeck Rivers have had their salmon populations enhanced through a Provincial stocking program which includes broodstock collection on these rivers. This enhancement is intended to offset anticipated catch and release mortalities on these rivers and has allowed an open catch and release fall season on the Middle and Baddeck Rivers. Food, Social and Ceremonial (FSC) allocations are also available on these rivers. Middle and Baddeck Rivers are index populations. As for all index rivers in Eastern Cape Breton, the populations were assessed to be below conservation egg requirements in 2018.

The approximate locations of all salmon bearing rivers in the vicinity of the site, as reported in the 2017 CSAS Stock Status Update for SFAs 19-21 and 23 are shown below.



Figure 12: Salmon bearing rivers within the region of the site.

7.2 Support of the sustainability of wild salmon

Although rainbow trout are not indigenous to the Bras d'Or Lakes area, it has a resident population that has developed from stocking efforts for the sport fishery, with the first trout introduced in 1899. These introduced fish have been shown to be successfully reproducing in the wild and are contributing to the fishery numbers (Madden et al., 2010). Rainbow trout continue to be stocked by the Province through an enhancement program. This would suggest that there is little concern that the presence of rainbow trout affects the sustainability of wild salmon.

Furthermore, We'koqma'q will institute operational procedures to mitigate the greatest perceived risks of finfish aquaculture operations to wild salmon populations; these being fish escape, disease and biosecurity, and environmental impact risks. These have been described in Section 3.2.

As indicated in Section 7.1, Middle and Baddeck Rivers have had their salmon populations enhanced through a Provincial stocking program which includes broodstock collection on these rivers. Approval of this lease/licence is not anticipated to affect these efforts.

The environmental and oceanographic data collection in the Bay that is supported by We'koqma'q (Section 5.3, Support of conservation efforts*)* is intended to improve understanding of the local ecosystem as a whole, as well as more broadly with regards to global warming. Although there is no direct intent to use this data to support Atlantic salmon conservation measures, an increased understanding of the environment will contribute to conservation practices in general.

SECTION 8: THE NUMBER AND PRODUCTIVITY OF OTHER AQUACULTURE SITES IN THE PUBLC WATERS SURROUNDING THE PROPOSED AQUACULTURAL LOCATION

8.1 Interactions with other aquaculture operations[21]

We'koqma'q First Nation is presently the lease/licence holder for all aquaculture sites within Whycocomagh Bay, both finfish and shellfish. There are a few oyster sites that are in close proximity distance-wise but the waters are not connected to Whycocomagh Bay.

We'koqma'q is making two requests for new finfish sites within this Option (one on the north side and one on the south side – this application, of the eastern end of the Bay), and a request for the amalgamation and enlargement of leased areas in Whycocomagh Bay. We'koqma'q is also requesting assignments of previously active finfish sites in the region. Collectively, the sites will allow an operational expansion to proceed while availing enough area to increase fallowing times. Increased fallowing will reduce fish health risks and minimize potential environmental impacts of the operations. All of the sites planned for the area are listed below and shown in Figure 13:

1) We'koqma'q is currently the licence holder for three sites in Whycocomagh Bay, 10km to the west of the site proposed in this Development Plan. We'koqma'q is requesting an amendment to amalgamate and enlarge this area (in another application).

2) Within this Option to Lease area, We'koqma'q is requesting an additional new marine site north of the site proposed in this Development Plan (in another application).

3) We'koqma'q is in the process of completing a request for an assignment of a site northeast of this proposed site (in another application).

4) We'koqma'q will explore the feasibility of a site on a privately leased area.

5) In the future, We'koqma'q anticipates requesting assignments for several other finfish sites in adjacent waters. (Outside of the map area.)

Existing aquaculture sites in the area are shown below, as copied from the NS GIS mapping tool website. The site proposed within this Development Plan and the other sites mentioned above are shown and numbered according to their descriptions.

[21] The potential for aquaculture in the area was brought up during scoping. See page 4 of Report on Public Engagement During Scoping.

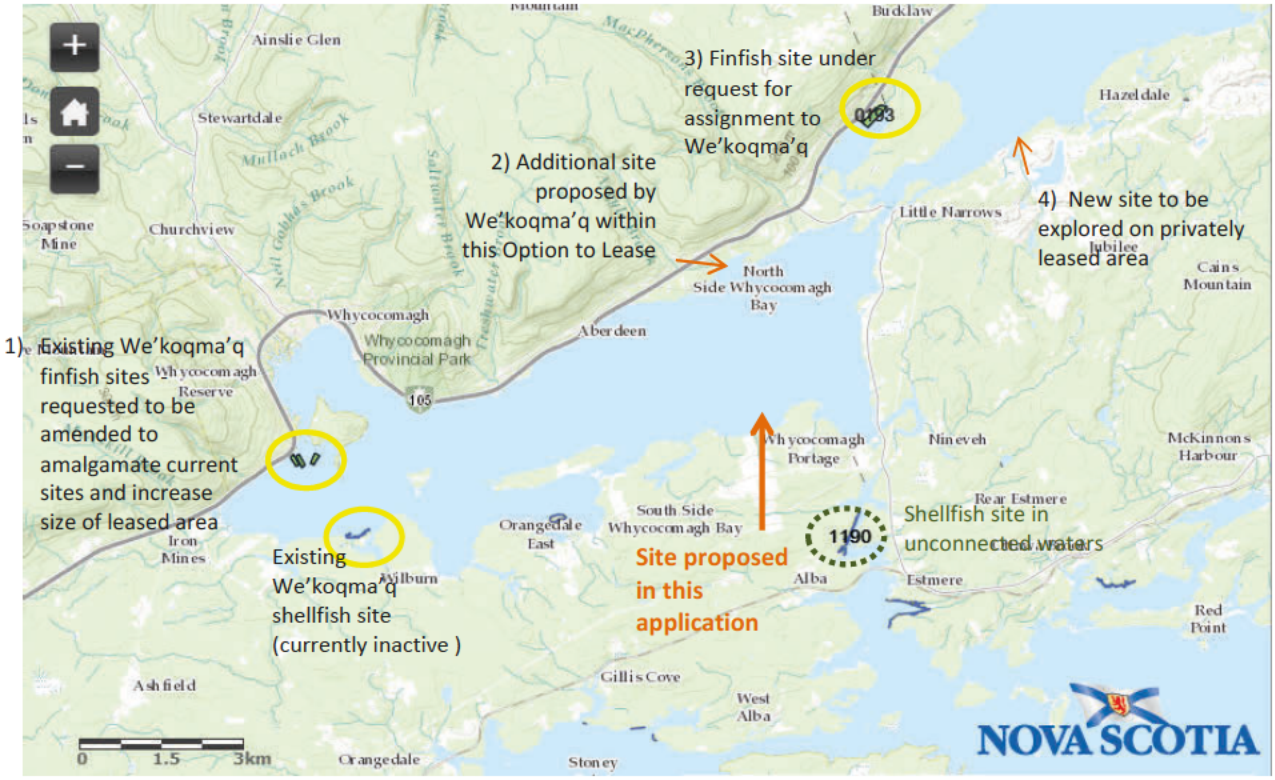


Figure 13: Map of the region of the proposed site showing existing aquaculture sites as well as sites proposed in other applications. The base map was acquired from https://novascotia.ca/fish/aquaculture/site-mapping-tool/

8.2 Interactions with other aquaculture operations

We'koqma'q's finfish sites will be managed as a single farm to promote optional fallowing regimes. These regimes will be developed in conjunction with NSDFA and DFO to maximize fish health and minimize environmental impacts. When all sites are available for use, a rotating fallowing cycle is anticipated.

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4.2.4 Development Plan Appendices (2019)

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Baseline Survey of sulfide levels in Whycocomagh Bay

Submitted to:

Waycobah Fisheries

Waycobah First Nation

June 2015

Eskasoni Fish & Wildlife Commission
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Introduction

Whycocomagh Bay is located at the base of the St. Patrick's Channel in the Bras d'Or Lakes, Unama'ki (Cape Breton Island). Whycocomagh Bay has some of the lowest flushing times in the Bras d'Or Lakes; therefore, it is very important to record baseline information of the local environment prior to and during aquaculture activities in the area to monitor environmental health. Waycobah First Nation currently has a trout farm in Whycocomagh Bay and is in the process of developing a mitigation plan that best suits the environment. While the fish farm does contribute to enrichment of the area where open fish pens are located there are also other local contributors including rivers and sewage outflows. For proper management to take place, there are several issues to investigate including:

1) The potential effect of rivers and waste water on the local environment and impact to the farm site;
2) Oxygen levels at various areas of the bay for the purpose of identifying alternate lease sites;
3) Identification of benthic organisms to indicate the health of the seabed; and
4) Baseline sulphide levels at potential pen sites.

The purpose of this project was to collect baseline data assessing seafloor and benthic boundary layer enrichment prior to the development of fish farming or processing in areas of Whycocomagh Bay. To properly mitigate enrichment from the trout farm or processing plant it is important to identify other sources of enrichment (i.e., river and sewage outflows). This information will be applied to site selection and planning before applying for new leases as well as for management decision making for the operation of both the trout farm and the processing plant. Waycobah Fisheries has made a commitment to community members to be environmentally responsible when it comes to fish farming. This commitment along with the requirements under the Nova Scotia Department of Fisheries and Aquaculture leasing requirements will assist in estimating carrying capacity and identifying suitable areas for alternate net pen sites.

Methodology

Sampling stations were identified by Waycobah Fisheries and represented current lease areas, areas identified for possible farm expansion and areas that may impact farm operations , i.e., the outlfow of Skye River and the processing plant effluent. This varies slightly from the proposed sampling plan, but it provides valuable data for future farm operations and potential expansion. The sampling stations were grouped into 5 areas (figure 1) which clusters stations for easier comparison from an operations stand point. Though not along transects, these stations provided data on the current conditions of the sites that have been proposed for farm expansion or may impact the farm and therefore are important to current and future operations.

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Figure 1: Sampling areas within Whycocomagh Bay.

Field protocols and laboratory analysis for sulphide level, redox, sediment porosity, total organic matter and video logs followed the standard operating procedures of for the environmental monitoring program outlined by the Nova Scotia Department of Fisheries and Aquaculture (NSDFA 2014) with the addition of protocols for benthic invertebrate analysis and dissolved oxygen (EFWC 2014). A summary of the methodology for the various sampling components is provided below.

Video Transect

Video was taken at each sampling station before sediment samples were collected to capture images of undisturbed sediment. A Seaviewer drop camera mounted to a metal frame with a 0.5 m^2 quadrate in viewing range was dropped at each station and video was recorded for a minimum of 2 minutes. Real time latitude and longitude were recorded by the camera which was equipped with a digital overlay, to verify station location. Video logs were kept and submitted in the electronic version of this report.

Sulphide and Benthic Community Sampling

Depending on bottom type, an Ekman or petite Ponar sediment grab was lowered in a controlled manner and deployed to collect benthic sediment samples (in triplicate) at each sample station. Pictures were taken of each sample and the depth of the sample was recorded. A 5 ml subsample was then collected to determine redox potential, total dissolved sulphide, porosity and total organic matter. A subsample of the remaining sediment was collected and brought back to the lab where they were sieved and any animals present were preserved in 10 % buffered formalin in seawater in an airtight container. All samples were kept on cool in a sealed container in the field and then placed in the refrigerator. A temperature logger was placed with the syringes from the field until laboratory analysis was complete.

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Dissolved Oxygen

After careful consideration, it was decided that a dissolved oxygen probe would provide the best results for the purposes of this project. Unfortunately, the probe did not arrive in time to be used during the sampling. The probe with be deployed at each area over a period to time to record longer term profiles of dissolved oxygen in Whycocomagh Bay.

Results and Comments

Areas A and B were comprised of 9 sampling stations each, representing typical baseline sampling required by the NSDFA for proposed leases (i.e., 4 corner stations, 3 stations through the middle of the proposed area and 2 reference stations). Area C had 15 stations which represented stations that would fall within the area of expansion as well as stations as well as areas that may be impacted by deposition of material by a local river and sewage outfalls. Areas D & E each had 1 station (figure 2) that represented areas that could impact farm operations, i.e., river/ sewage outflows (station 35) and processing plant outlflow (station 33).



Figure 2: Sampling stations located throughout Whycocomagh Bay.

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Area A

Stations 1, 2 and 3 represented the stations through the center of the proposed lease area, stations 4 through 7 serve to mark each corner of this area while stations 8 and 9 are reference stations. Reference stations would be sampled in the future to assess impacts, if any, of the farm on the local environment over time.



Figure 3: Location of stations within Area A (1 - 9).

All of the sampling stations in Area A (figure 3) were oxic (Table 1) based on the classification scheme found in the NSDFA environmental monitoring program standard operating procedures (NSDFA 2014). Brown mud was the dominant type of sediment found at stations 1 through 9.

Table 1: Summary of sediment analysis of stations within Area A.

Station #	Sediment Description	Odour	Mean Redox (mV_{NHE})	Mean Sulfide (µM)	Mean Sulfide (mV)	Mean Porosity (%)	Mean Percent Organic Matter (POM)	Sediment Classification
1	Light brown mud	None	309.1	11.40	-825.9	77.2	14.3	Oxic A
2	Light brown mud	None	171.3	71.73	-855.0	73.6	15.1	Oxic A
3	Rusty color mud	None	195.2	76.53	-857.4	72.9	14.2	Oxic A
4	Rusty brown mud, some air pockets	None	135.8	60.60	-852.6	75.3	15.5	Oxic A
5	Rusty brown mud	None	143.8	57.57	-853.7	77.4	15.2	Oxic A
6	Rusty brown mud	None	219.7	6.27	-824.9	72.8	12.7	Oxic A
7	Light brown mud	None	240.3	18.50	-819.9	72.7	12.1	Oxic A

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8	Light brown mud with dark patches	None	412.5	63.50	-751.9	72.5	14.9	**Oxic A**
9	Light brown mud	None	216.1	6.20	-778.0	73.0	14.3	**Oxic A**

Area B



Figure 4: Location of stations within Areas B (10 - 18) and D (33).

All of the sampling stations in Area B (figure 4) were oxic (Table 2) based on the classification scheme (NSDFA 2014). Brown mud was the dominant type of sediment found at stations 10 through 18.

Table 2: **Summary of sediment analysis of stations within Area B.**

Station #	Sediment Description	Odour	Mean Redox (mV_{NHE})	Mean Sulfide (µM)	Mean Sulfide (mV)	Mean Porosity (%)	Mean Percent Organic Matter (POM)	Sediment Classification
10	Medium brown mud	None	315.2	2.85	-799.57	76.8	12.6	**Oxic A**
11	Medium brown mud	None	210.7	49.12	-807.4	78.8	15.1	**Oxic A**
12	Light brown mud	None	159.7	12.02	-812.13	76.9	13.9	**Oxic A**
13	Light brown mud	None	232.7	41.91	-826.4	74.3	12.8	**Oxic A**
14	Light brown mud	None	246.9	6.22	-785.9	77.3	12.8	**Oxic A**
15	Light brown mud	None	181.9	2.92	-788.67	72.0	13.0	**Oxic A**
16	Light brown mud	None	227.8	0.53	-774.77	74.9	13.3	**Oxic A**
17	Light brown mud	None	193.9	10.89	-817.77	73.5	12.6	**Oxic A**
18	Light brown mud	None	219.7	40.38	-826.3	71.5	13.4	**Oxic A**

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Area C



Figure 5: Location of sampling stations with Areas C (19-32 & 34) and E (35).

The sediment classifications for stations in Area C (figure 5) ranged from Oxic A to Hypoxic B (Table 3) based on the classification scheme (NSDFA 2014). By combining the results into 2 classifications, oxic or hypoxic, the results show that 53% of the stations were oxic while 47% were hypoxic. However, there is a requirement to classify based on the most adverse sediment condition, therefore, Area C would be classified as hypoxic overall.

Stations 19 – 23 are found along the deepest boundary of the proposed lease expansion with stations 30 – 32 as reference stations. Stations 24 – 29 represent sampling within the proposed lease area where the cages may be placed. Stations 24 – 26 are also located near a sewage outfall location and may provide information as to the impact that this input may have over time. Stations 34 was chosen in an effort to quantify the impact from a local river where local knowledge has indicated that sediments are likely to deposit.

Table 3: Summary of sediment analysis of stations within Area C.

Station #	Sediment Description	Odour	Mean Redox (mV_{NHE})	Mean Sulfide (µM)	Mean Sulfide (mV)	Mean Porosity (%)	Mean Percent Organic Matter (POM)	Sediment Classification
19	Medium brown sandy mud	Slight	289.6	73.02	-827.3	62.9	8.6	Oxic A
20	Black mud	Strong	99.4	3,483.33	-888.6	84.0	16.6	Hypoxic B
21	Black mud	Strong	-35.6	3,183.33	-887.5	82.9	16.3	Hypoxic B

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22	Black mud	Strong	-12.03	2,843.33	-844.6	**85.1**	**16.7**	**Hypoxic A**
23	Brown sand	None	217.6	166.23	-841.3	**45.9**	**7.5**	**Oxic A**
24	Brown mud	None	223.3	100.36	-834.1	**73.7**	**14.3**	**Oxic A**
25	Light brown mud	None	259.8	169.67	-848.7	**71.4**	**15.2**	**Oxic A**
26	Light brown mud	None	-70.9	2,893.33	-883.5	**84.4**	**17.9**	**Hypoxic A**
27	Light brown/ black mud	None	139.5	233.00	-849.9	**75.3**	**15.3**	**Oxic A**
28	Black mud	Slight	-75.5	2,146.67	-881.7	**79.2**	**17.4***	**Hypoxic A**
29	Black mud	Slight	-60.0	2,993.33	-884.4	**82.3**	**17.0**	**Hypoxic A**
30	Light brown mud	None	204.2	149.00	-847.6	**77.9**	**14.6**	**Oxic A**
31	Black mud	Slight	-17.0	2,120.00	-880.2	**81.3**	**17.2**	**Hypoxic A**
32	Light brown/ black mud	Slight	59.9	1,274.67	-865.7	**79.4**	**16.6**	**Oxic B**
34	Dark brown mud	Slight	105.2	1,053.00	-866.8	**75.3**	**19.3**	**Oxic B**

*This value is based on the average of replicate A and B. Replicate C was omitted due to human error.

Area D

The sediment in Area D was brown sand and classified as oxic (table 4).

Table 4: Summary of mean Redox (mV_{NHE}) and mean total sulfide (µM and mV) for Area D.

Station #	Sediment Description	Odour	Mean Redox (mV_{NHE})	Mean Sulfide (µM)	Mean Sulfide (mV)	Mean Porosity (%)	Mean Percent Organic Matter (POM)	Sediment Classification
33	Brown sand	None	375.4	55.20	-824.4	40.0	4.0	**Oxic A**

Area E

The sediment in Area E was brown sand and classified as oxic (table 5).

Table 5: Summary of mean Redox (mV_{NHE}) and mean total sulfide (µM and mV) for Area E.

Station #	Sediment Description	Odour	Mean Redox (mV_{NHE})	Mean Sulfide (µM)	Mean Sulfide (mV)	Mean Porosity (%)	Mean Percent Organic Matter (POM)	Sediment Classification
35	Brown mud	None	333.8	35.53	-826.9	40.9	5.2	**Oxic A**

Summary

The majority of the areas sampled in Whycocomagh Bay were classified as oxic based on the mean Redox and mean total sulfide data. Area C was the only area that had a mixture of classifications resulting in an overall classification of hypoxic. Mitigation measures will be required for this area.

Benthic invertebrate analysis was incomplete at the time of this report and will be added as an appendix once complete.

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Appendix: Benthic Invertebrate Analysis

Approximately one cup of sediment was collected, in a re-sealable plastic bag for infaunal invertebrate identification. Samples were placed in a cooler with ice upon collection then stored in the refrigerator at 4°C until preparation. Samples were washed through a 300µm mesh sieve and placed in a vial containing 80:2 distilled water: 10% buffered formalin solution. The samples remained in the formalin for one week prior to identification. Identification occurred using a dissecting, stereo microscope. The following groups of organisms were identified and counted in the samples:

Phylum Annelida	-Tube worm -Polychaete - Worm tube piece
Phylum Arthropoda	- Copepod exoskeleton (*Calanus finmarchicus*) -claw piece -Gammarid -Insect wing
Phylum Mollusca	-Oyster shell fragment (*Crassostrea virginicia)* -Scallop -Scallop shell fragment -Mussel shell fragment (*Mytilus sp.)* -Mussel (*Mytilus sp.)* -Clam shell fragment -Clam -Razor clam (*Ensis directus)* -Gastropod shell fragment -Gastropod
Phylum Porifera	-Sponge (Class Demospongiae)
Kingdom Protista	-Foraminiferan
Kindom Plantae	-Unknown Seed -Maple seed -Seed coat -Pine needle -Decomposing leaf

All polychaetes as well as representative samples of various organisms found within the samples were placed back in the vials for future analysis (if required).

AEM Invertebrate counts from Baseline Survey of sulfide levels in Whycocomagh Bay 2015

Mean numbers per station (calculated from 3 samples/station)

Area	Station	Worm tube pieces	Tube worm pieces	Unknown Polychaetes	Fish scales and bones	Copepod exoskeleton Calanus Finmarchicus	Oyster shell fragments *Crassostrea virginicia*	Scallop	Scallop shell fragments	Gammarid	Mussel shell fragments *Mytilus sp.*	Mussel *Mytilus sp.*	Gastropod or shell fragments	Clam pieces	Small clam	Razor clam *Ensis directus*	Piece of claw	Insect wing	Sponge (Class Demopongiae)	Foraminiferan	Seed	Pine needles	Seed coat	Maple seed	Rotting leaf
A	1	122	7	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
A	2	277	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
A	3	50	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
A	4	113	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
A	5	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
A	6	10	0	3	0	0	9	0	0	0	1	0	0	0	0	0	6	1	0	0	1	0	0	0	0
A	7	59	7	4	0	0	3	0	0	0	1	0	0	0	1	0	3	2	0	0	0	0	0	0	0
A	8	215	5	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	9	175	7	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
B	10	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0
B	11	69	6	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0
B	12	148	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
B	13	59	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	14	21	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	3	0	0	0
B	15	93	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
B	16	132	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
B	17	112	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
B	18	153	3	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	19	15	1	7	0	0	1	2	0	0	0	0	2	0	2	0	1	0	0	0	0	2	0	0	0
C	20	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
C	21	0	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C	22	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C	23	7	0	3	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0
C	24	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C	25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
C	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	27	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
C	28	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
C	29	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
C	30	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
C	31	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
C	32	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
D	33	15	0	1	0	0	0	0	0	0	14	0	0	0	2	1	0	0	0	0	0	3	0	0	0
C	34	3	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
E	35	7	1	2	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0
	Total of the mean numbers/station	**1915**	**68**	**55**	**0**	**0**	**22**	**3**	**0**	**0**	**73**	**2**	**3**	**1**	**6**	**1**	**11**	**6**	**0**	**1**	**4**	**59**	**1**	**2**	**2**

Aquaculture Facility Certification

Finfish and Crustacean Farms

Best Aquaculture Practices

Certification Standards, Guidelines

Community • Environment • Animal Welfare • Food Safety • Traceability

Aquaculture Facility Certification

Finfish and Crustacean Farm Standard (FCFS)

Issue 2.4 – 23-May-2017

Best Aquaculture Practices

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BEST AQUACULTURE PRACTICES CERTIFICATION

The following Best Aquaculture Practices standards and guidelines apply to the farming of all crustacean and finfish species except salmonids reared in cages and net pens in marine waters (refer to BAP's Salmon Standards). They cover all production methods, including flow-through, partial exchange, and closed or recirculating water systems operated in ponds, cages, net pens, tanks, raceways or closed-containment vessels.

Some requirements are system-specific, applying, for example, only to earthen ponds, farms that produce effluents, farms using cages or marine cages. Each section of the standards and guidelines identifies which standards apply to the different production systems. Please reference the chart on the following page. Several species-specific standards for shrimp and tilapia appear at the end of this document.

The BAP standards are achievable, science-based and continuously improved global performance standards for the aquaculture supply chain that assure healthful foods produced through environmentally and socially responsible means. They are designed to assist program applicants in performing self-assessments of the environmental and social impacts, and food safety controls of their facilities, and to lead to third-party certification of compliance, thereby eliminating the most significant negative impacts. For further information, please refer to the additional resources listed throughout this document.

BAP standards demand compliance with local regulations as the first step toward certification. However, not all regulations are equally rigorous. For this reason, BAP standards set out requirements for documentation and procedures that must be in farm management plans, whether they are prescribed by local regulations or not. By so doing, they seek, where possible, to impose consistency in performance among facilities in different producing regions and to engage the industry as a whole in a process of continuous improvement.

In common with ISO usage, these standards use the words "shall" to mean compliance is required and "should" to mean compliance is recommended. Auditable points are "shall" statements listed at the end of each standard.

To obtain BAP certification, applicants shall be audited by an independent, BAP-approved certification body. To apply for certification, contact:

Best Aquaculture Practices Management
2 International Drive – Suite 105
Portsmouth, NH 03801
Telephone: +603-317-5000
Web: www.bestaquaculturepractices.org – E-mail: info@aquaculturecertification.org

The audit consists of an opening meeting, a site assessment, the collection of necessary samples, a review of management records and procedures, and a closing meeting. All points in the standards shall be addressed. Any non-conformity raised during the evaluation is recorded by the auditor in the formal report as:

Critical – When there is a failure to comply with a critical food safety, social compliance or legal issue, or a risk to the integrity of the program, the auditor immediately informs the certification body, which then informs BAP Management. Pending clarifications, failure to certify
or immediate temporary suspension can ensue.

Major – When there is a substantial failure to meet the requirements of a standard but no food safety risk social accountability or immediate risk to the integrity of the program, the auditor notifies the certification body and records this in the report. Verification of the implementation of corrective actions shall be submitted to the certification body within 28 days of the evaluation. (Major non-conformities typically reflect issues with general policies.)

Minor – When full compliance with the intent of the standards has not been demonstrated, the auditor notifies the certification body and records this in the report. Verification of the implementation of corrective actions shall be submitted to the certification body within 28 days of the evaluation. (Minor non-conformities typically reflect general housekeeping issues.)

BAP standards are developed by committees of technical experts following a process aligned to the FAO Technical Guidelines on Aquaculture Certification. See www.gaalliance.org/bap/standardsdevelopment.php.

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BAP Standards Compliance Requirements

BAP Standard	Applies To
1. Community: Property Rights and Regulatory Compliance	All production systems
2. Community: Community Relations	All production systems
3. Community: Worker Safety and Employee Relations	All production systems
4. Environment: Mangrove and Wetland Conservation	Ponds and other land-based systems only
5. Environment: Effluent Management	Ponds and other land-based systems only
6. Environment: Water Quality and Sediment Control	Cages or pens in fresh or brackish water only
7. Environment: Sediment Control	Marine cages only
8. Environment: Soil and Water Conservation, Pond Sludge Management	Ponds and other land-based systems only
9. Environment: Fishmeal and Fish Oil Conservation	All production systems
10. Environment: Stocking Sources and GMOs	All production systems
11. Environment: Control of Escapes	All production systems, several sections for cages only
12. Environment: Biodiversity and Wildlife Protection	All production systems
13. Environment: Storage, Disposal of Farm Supplies and Wastes	All production systems
14. Animal Health and Welfare: Culture Conditions and Practices	All production systems
15. Food Safety: Drug and Chemical Management	All production systems
16. Food Safety: Microbial Sanitation, Hygiene, Harvest and Transport	All production systems
17. Biosecurity: Disease Control	All production systems
18. Traceability: Record-Keeping Requirement	All production systems
19. Shrimp-Specific Standards	Shrimp farms only
20. Tilapia-Specific Standards	Tilapia farms only

1. **Community** (All Production Systems)

Property Rights and Regulatory Compliance

Farms shall comply with local and national laws and environmental regulations, and provide current documentation that demonstrates legal rights for land use, water use, construction, operation and waste disposal.

Reasons for Standard

Regulations are needed to assure that farms provide pertinent information to governments and pay fees to support relevant programs. The BAP program requires compliance with applicable business-related laws and environmental regulations, including those concerning protection of sensitive habitats, effluents, operation of landfills and predator control, because it recognizes that not all governmental agencies have sufficient resources to effectively enforce laws.

Some aquaculture farms have been sited in water bodies or on coastal land to which farm owners do not have legal right. Such farms are usually found in undeveloped areas under government ownership where land use is poorly controlled. This land may be occupied by landless people or used by coastal communities for hunting, fishing and gathering. Water bodies in which cages have been installed can be an important fishery for local people. These waters can also have other important uses for domestic water supplies, irrigation, recreation or tourism.

Implementation

Regulations regarding the operation and resource use of farms vary significantly from place to place. Among other requirements, such laws can call for:

- business licenses
- aquaculture licenses
- land deeds, leases or concession agreements
- land use taxes
- construction permits
- water use permits
- protection of mangroves or other sensitive habitats
- effluent permits
- adherence to veterinary and animal health regulations
- therapeutics use
- permits related to non-native species
- predator control permits
- well operation permits
- landfill operation permits
- adherence to environmental regulations
- environmental impact assessments.

Individual auditors cannot know all laws that apply to aquaculture farms in all nations. Participating farms have the responsibility to obtain all necessary documentation for siting, constructing and operating their facilities.

Assistance in determining these necessary permits and licenses can be sought from governmental agencies responsible for agriculture, environmental protection, fisheries, aquaculture, water management and transportation, as well as local aquaculture associations. Auditors shall also become familiar with the legal requirements within the areas they service.

The BAP program imposes repeated environmental audits on participating facilities. It strengthens existing regulations that may require aquaculture facilities to perform environmental impact assessments before beginning construction and to comply with effluent standards or other regulations during operation.

During the BAP site inspection, the representative of the farm shall present all necessary documents to the auditor. Farms shall be in compliance with the requirements stipulated by the documents. For example, if a farm has an effluent discharge permit with water quality standards, those standards shall be enforced. In cases where governmental agencies have waived one or more permits, proof of these waivers shall be available

Standards

1.1: Current documents shall be available to prove legal land and water use by the applicant.
1.2: Current documents shall be available to prove all business and operating licenses have been acquired.
1.3: Current documents shall be available to prove compliance with applicable environmental regulations for construction and operation.

2. Community (All Production Systems)

Community Relations

Farms shall strive for good community relations and not block access to public areas, common land, fishing grounds or other traditional natural resources used by local communities.

Reasons for Standard

Aquaculture farms are often located in rural areas, where some individuals may rely on varied natural resources to supplement their livelihoods. Some local residents benefit from employment or infrastructure improvements associated with large-scale aquaculture development, but others may face reduced access to areas used for fishing, hunting, gathering, domestic water supply or recreation.

Implementation

Farm management shall attempt to accommodate traditional uses of coastal resources through a cooperative attitude toward established local interests and environmental stewardship. Farms shall not block traditional access corridors to public ma-n-grove areas and fishing grounds. In some cases, it may be necessary to provide a designated access route across the farm.

Farms shall maintain a neat and attractive appear-ance to avoid becoming an eyesore to local residents. Sanitary measures shall be employed to prevent odors from affecting nearby neighbors. (See Section 11.) Machinery shall be maintained in good repair to avoid unnecessary noises that may disturb neighbors.

During facility inspection, the auditor shall verify compliance with this standard through examination of maps that define public and private zones; inspection of fences, canals and other barriers; and interviews with local people and farm workers. The auditor shall select the individuals for interview. This selection can include, but not be limited to, interviewees provided by farm management.

Standards

2.1: The applicant shall accommodate local inhabitants by not blocking traditional access routes to fishing grounds, wetland areas and other public resources.
2.2: The applicant shall manage water usage to avoid restricting the amount of water available to other users.
2.3: The applicant shall demonstrate interaction with the local community to avoid or resolve conflicts through meetings, committees, correspondence, service projects or other activities performed annually or more often.

3. Community (All Production Systems)

Worker Safety and Employee Relations

Farms shall comply with local and national labor laws, including those related to young and/or underage workers,
to assure adequate worker safety, compensation and, where applicable, on-site living conditions.

Reasons for Standard

Farm work is potentially dangerous due to manual errors in the use of machinery, the risks of drowning and electrocution, and the use of hazardous materials. Workers may not be well educated nor fully appreciate

the risks at farms, and sometimes safety instruction may not be adequate.

Both local and foreign workers may be employed at farms. Instances of employment of illegal foreign workers have been reported in some countries. Therefore, BAP certification requires proof of legal foreign worker documentation.

Much aquaculture takes place in developing nations where pay scales are low, and labor laws may not be consistently enforced. Large farms that employ several hundred workers commonly provide on-site living quarters, which shall provide decent living conditions.

Implementation

At a minimum, certified farms shall provide legal wages, a safe working environment and adequate living conditions. Auditors shall take into account national regulations and local standards to evaluate this aspect. Efforts should be made to exceed the minimum requirements, because certified farms should be progressive and socially responsible. When hiring foreign workers, farms shall require documentation of legal status.

Safety equipment such as goggles, gloves, hard hats, life jackets and ear protection, shall be provided when appropriate. Machinery shall have protective guards or covers where appropriate, and electrical devices shall be correctly and safely wired. Tractors should have roll bars, shields over power take-offs and other appropriate safety devices.

Staff and workers shall be given initial training as well as refresher training on safety in all areas of farm operations. Workers shall also be trained in first aid for electrical shock, profuse bleeding, drowning and other possible medical emergencies. A plan shall be available for obtaining medical assistance for injured or ill workers.

Living quarters shall be well ventilated and have adequate shower and toilet facilities. Food services, where provided, shall provide wholesome meals for workers, with food storage and preparation done in a responsible manner. Trash and garbage shall not accumulate in living, food preparation or dining areas. (See Section 11.)

Farms that use divers to clear sludge from pond bottoms or perform other underwater tasks shall develop a written plan to assure safety and require directly employed or contracted divers to follow the plan. The plan shall require specialized diver safety training, maintenance records for diving equipment and procedures for diving emergencies. If sulphites are used during harvesting, procedures shall be adopted to minimize health risks to employees.

During facility inspection, the auditor will evaluate whether conditions comply with labor laws. The auditor will also interview a random sample of workers to obtain their opinions about wages, safety and living conditions.

Standards

Wages and Benefits

3.1: The applicant shall meet or exceed the minimum wage rate, benefits, required by local and national labor laws.

3.2: The facility shall not make deductions from wages as part of a disciplinary process.

3.3: The facility shall maintain all relevant documents that verify piece workers (those paid a fixed “piece rate” for each unit produced or action performed regardless of time) are paid in compliance with local law, including regulations regarding equivalence to or exceeding minimum requirements for wages, hours, overtime and holiday pay.

Working Hours

3.4: The applicant shall abide by the national mandated work week where applicable.

3.5: The applicant shall comply with national labor laws for pay, overtime and holiday compensation for hours worked beyond the regular work day or week.

Forced, Bonded, Indentured, Trafficked, and Prison Labor

3.6: All work, including overtime, must be voluntary. The facility shall not engage in any form of forced or bonded labor. This includes human trafficking, the holding of original identity papers, prohibiting workers from leaving the premises after their shift or other coercion intended to force anyone to work. Where the holding of original identity papers is required by national law, such papers must be immediately returned to employees upon request and readily available to them at all times.

3.7 The facility shall not require the payment of deposits, deduction from wages or withholding of pay that is not part of a legal contractual agreement with the employee and/or that is not provided for or permitted by national law.

3.8: Workers shall have the right to terminate their employment after reasonable notice.

Child Labor and Young Workers

3.9: The applicant shall not engage in or support the use of child labor. The applicant shall comply with national child labor laws regarding minimum working age or ILO Minimum Age Convention 138, whichever is higher. ILO Minimum Age Convention 138 states the minimum age shall be 15, unless local law in developing nations is set at 14 – in accordance with developing nations exceptions under this convention.

3.10: The employment of young workers above the minimum age but under 18 years old shall be in compliance with local laws, including required access to compulsory school attendance and any restrictions on hours and time of day.

3.11: Young workers above the minimum age but under 18 years old shall not be subjected to hazardous work that can compromise their health and safety.

3.12: The applicant shall only employ legally documented workers, whether nationals or migrants.

3.13: The facility shall maintain all relevant documents that verify any contracted/subcontracted workers, whether contracted through a labor service or otherwise, are paid in compliance with all local wage, hour and overtime laws.

3.14: All labor, recruiting or employment services used by the facility must be licensed to operate by the local or national government as a labor provider.

3.15: The facility shall provide to all workers, whether hourly, salaried, piece-rate, temporary, seasonal or otherwise, prior to hire and during employment, written and understandable information regarding the terms of employment, worker rights, benefits, compensation, hours expected, details of wages for each pay period and facility policies regarding disciplinary actions, grievance procedures, authorized deductions from pay and similar labor-related issues. This information must be provided in the prevalent language of the majority of employees.

3.16: Where contracted/subcontracted or temporary workers are hired through a labor or employment service, the facility shall ensure that the labor or employment service provides the above information prior to and during hire, in appropriate languages, to ensure workers are aware of their rights and conditions of employment as described above.

3.17: The facility shall appoint a management person responsible for ensuring worker health, safety and training.

3.18: The facility shall identify and eliminate or minimize any workplace health and safety hazards by conducting a thorough risk assessment. This includes a requirement for accident investigation.

3.19: If provided, employee housing shall meet local and national standards (e.g., water-tight structures, adequate space, heating/ ventilation/cooling), and shall be free of accumulated trash and garbage.

3.20: Safe drinking water shall be readily available to employees. If meals are provided, they shall be wholesome and commensurate with local eating customs.

3.21: Running water, toilets and hand-washing facilities shall be readily available to employees.

3.22: In the event of accidents or emergencies, the applicant shall provide basic medical care, including access to or communication with medical authorities. Additionally, first aid kits shall be readily available to employees, and any expired content shall be replaced.

3.23: The applicant shall provide training in general health, personal hygiene and safety (including aquatic safety and the use of boats and associated equipment), first aid and contamination risks to all employees. Safety documents must be available in a language understood by the workforce.

3.24: An emergency response plan shall be prepared for serious illnesses or accidents.

3.25: Select workers shall be made familiar with details in emergency response plans and trained in the first aid of electrical shock, profuse bleeding, drowning and other possible medical emergencies.

3.26: Protective gear and equipment in good working order shall be provided for employees (e.g., eye protection for welding, gloves for shop work, boots for wet areas). Auditor to verify deployment.

3.27: Electrical pumps and aerators shall be wired according to standard safe procedures. Machinery shall have proper driveshaft and/or drive belt safety guards.

3.28: The applicant shall comply with laws that govern diving on aquaculture farms and develop a written dive safety plan that requires diver training and the maintenance of logs that document procedures, safety-related incidents and equipment maintenance. Limits for time under water shall be established and monitored.

3.29: The applicant shall provide written procedures and staff training for handling diving emergencies and regularly audit records and procedures. Emergency response equipment for divers shall include oxygen for resuscitation.

Discrimination, Discipline, Abuse and Harassment

3.30: The facility shall provide for equal opportunity with respect to recruitment, compensation, access to training, promotion, termination and retirement.

3.31: The facility shall treat workers with respect and not engage in or permit physical, verbal or sexual abuse, bullying or harassment.

Freedom of Association and Collective Bargaining

3.32: Workers shall have the right to collective bargaining, or at least one employee shall be elected by the workers to represent them to management.

3.33: There shall be a written worker grievance process, made available to all workers, that allows for the anonymous reporting of grievances to management without fear of retaliation.

4. Environment (Ponds and Other Land-Based Systems Only)

Mangrove and Wetland Conservation

Aquaculture facilities shall not be located in mangrove or other wetland areas where they displace important natural habitats. Farm operations shall not damage wetlands except for allowable purposes, which shall be mitigated.

Mangroves and other wetlands are important components of many coastal and inland ecosystems in aquaculture producing nations. They represent important breeding and nursery grounds for many aquatic species, and provide habitat for birds and other wildlife. Wetlands are often called the “kidneys” of the landscape because of their important role in improving the quality of water runoff before it enters streams, lakes or estuaries. Wetlands and mangrove areas, in particular, protect coastal areas from heavy winds, waves and storm surges. Both coastal and inland wetlands are also important resources for local people.

Implementation

For the purposes of this standard, wetlands are defined as areas that are inundated or saturated by surface or ground--water at a frequency and duration sufficient to support – and that under normal conditions do support – a prevalence of perennial vegetation typically adapted for life in saturated soil conditions. This standard does not apply to former wetland habitats converted or lost prior to the publication of the Global Aquaculture Alliance’s *Codes of Practice for Responsible Shrimp Farming* and the signing of the Ramsar treaty in 1999.

Farm construction and operations, including all building works, shall take place outside wetland areas and not lead to their loss. In coastal zones, aquaculture ponds shall be located behind mangrove areas on land that is above the average tidal zone and inundated no more than a few times per month by the highest tides. Particular care shall be taken to assure that hydrological conditions are not altered in a way that deprives or leads to the loss of wetland vegetation, including erosion and sedimentation at farm outfalls.

In some cases, the use of constructed wetlands can provide effective treatment for effluents before they are discharged into public waters. Constructed wetlands must be wholly within farm boundaries, or the farm must have the necessary permits for off-site land use.

Excessive pond construction on a flood plain can reduce the cross-sectional area of flow and increase flood levels and water velocities. This can result in water overtopping pond embankments, erosion of farm earthwork and damage to other property on the flood plain. The problem usually can be avoided if no more than 40% of the plain is blocked by pond embankments.

Allowable Wetland Removal

If a farm operation requires access to water resources, removal of wetland vegetation shall only be allowed for the installation of inlet and outlet canals, pump stations and docks. Wetland removed for such purposes shall be mitigated by restoring an appropriately diverse area of wetland three times the size of the area removed. This practice is only allowable if local regulations don't prohibit it.

Farms constructed in former mangrove or wetland areas are encouraged to demonstrate environmental stewardship by re-establishing mangrove or wetland vegetation, or by contributing to mangrove or wetland rehabilitation projects. When ponds constructed in former mangrove or wetland areas are closed, embankments shall be breached to restore natural water flow so that wetland vegetation can reestablish. The most reliable mitigation procedure is to contribute to mangrove or wetland restoration programs, for farm operators may not have suitable habitat and expertise for creating wetland areas. The donation should be equivalent to the local cost of mangrove or wetland restoration of an appropriately sized area. Whether the restoration is conducted by the farm or through an independent restoration program, the auditor will verify that the wetland is viable by confirming it is initially healthy, appropriately diverse and still healthy at subsequent annual audits. In cases where the auditor has not been able to inspect the restored wetlands in person, the farm shall provide the auditor with evidence (e.g., maps, GPS coordinates, recent photographs and aerial photographs) of the wetland viability.

During initial inspection, the auditor will record farm areas occupied by mangroves or wetland vegetation. If dying vegetation is observed around farms, the auditor will determine if the mortality is the result of farm operations. If it is, a warning will be issued and the deficiency shall be corrected for continuation of certification. Wetland removal for unapproved purposes or failure to mitigate allowable removal will result in loss of certification.

Standards

4.1: If net loss of wetland habitat (delineated by evaluation of hydrological conditions and the presence of wetland vegetation) occurred on facility property since 1999, the loss shall have been due to allowable purposes.

4.2: If net loss of wetland habitat occurred on facility property since 1999, the loss shall have been mitigated by restoring an area three times as large or by an equivalent donation to restoration projects.

4.3: Farm activities shall not alter the hydrological conditions of the surrounding watershed, and the normal flow of brackish water to mangroves or freshwater to wetlands shall not be altered, unless specific permits apply.

4.4: If wetland restoration has been conducted, the restored vegetation shall be maintained in a healthy state, viable and appropriately diverse.

5. Environment (Ponds and Other Land-Based Systems Only)

Effluent Management

Aquaculture facilities shall monitor their effluents to confirm compliance with the BAP effluent water quality criteria defined in Appendix A. Water quality measurements taken during the audit shall meet both BAP criteria and those of applicable government permits. Facilities shall comply with BAP's final criteria within five years.

Reasons for Standard

Only a portion of the nutrients added to aquaculture facilities to increase production is converted to animal tissue. The remainder becomes waste that can cause increased concentrations of nutrients, organic matter and suspended solids in and around culture systems.

Land-based farms discharge effluents during water exchange or when growout units are cleaned or drained for harvest. Effluents can contain nitrogen, phosphorus, suspended solids and organic matter at greater than ambient concentrations.

The substances in effluents can contribute to eutrophication, sedimentation and high oxygen demand in receiving water. Effluents with low dissolved-oxygen concentrations or high pH can negatively affect aquatic organisms in receiving water bodies.

Implementation

This standard is designed to demonstrate that compliance with other BAP standards through the application of good management practices is effective in reducing the volume and improving the quality of farm effluents. The water quality criteria also assure that effluents from aquaculture facilities have no greater concentrations of pollutants than typically allowed for effluents from other point sources.

At farms supplied by naturally saline groundwater with over 550 mg/L of chloride, pond effluent should be captured in a reservoir and reused. When effluents are regularly released, applicants in the BAP program shall maintain records for effluent data. (See sample form in Appendix B). To minimize discharges of pollutants to natural waters, farms that release effluents are encouraged to use this water for irrigation or other beneficial purposes where possible.

To confirm compliance with BAP water quality criteria at farms, the auditor will during the inspection process witness effluent sampling and preparation for analysis by an independent laboratory.

Analysis of the samples collected under the supervision of the auditor shall be done by a private or government laboratory following standard methods as published by the American Public Health Association, American Water Works Association and Water Environment Federation – http://www.standardmethods.org.

Sampling

- Samples shall be collected near the point where effluents enter natural water bodies or exit the farm property. A water control structure at the sampling site or suitable sampling method should be used to prevent mixing of effluent and water from the receiving body.
- For farms with multiple effluent outfalls, all or several outfalls shall be sampled to prepare a composite sample for analysis. Where there are more than four outfalls, three outfalls shall be selected as sampling locations.
- Water shall be collected directly from the discharge stream of pipes or dipped from the surface of ditches or canals with a clean plastic bottle. The sample will be placed on ice in a closed, insulated chest to prevent exposure to light.
- Samples or direct measurements for dissolved oxygen and pH shall be obtained between 0500 and 0700 hours, and 1300 and 1500 hours on the same day. The average of the two measurements for each variable will be used for verification of compliance.
- Samples for other variables shall be collected between 0500 and 0700 hours.

- The number of ponds or growout units being drained for harvest at the time of sampling shall be recorded.
- Source water samples shall be collected quarterly directly in front of the pump station or from the pump discharge outlet but before pumped water mixes with the supply canal. These samples enable the calculation of annual loads (see Appendix C) and establish if the Limited Option is applicable.

Analysis

- Hach and Merck water analysis equipment are approved for total ammonia nitrogen, soluble phosphorus, and chloride analyses. However, auditors can reject analytical results if sampling, in situ measurements or lab protocols are deficient.
- Measurements for dissolved oxygen and pH shall be taken in situ with portable meters. Auditors shall verify the correct application of calibration procedures.
- Salinity should be determined by a conductivity meter with a salinity scale, rather than a hand-held, refractometer-type salinity meter. Alternatively, specific conductance can be measured. Assume that water with specific conductance above 2,000 mmhos/cm exceeds 1.5 ppt salinity, and water with specific conductance over 1,500 mmhos/cm exceeds 1.0 ppt salinity. Note: 1 mS/m = 10 mmhos/cm, and 1 mmho/cm = 1 mS/cm.

Rules for Compliance

At least three months of effluent data are required for initial farm certification. Initially, for each variable measured monthly, at least 10 values obtained during a 12-month period shall comply with the criteria. After five years, the target is no more than one annual case of non-compliance for each variable. For variables measured quarterly, one non-compliance is initially permitted for each variable during a 12-month period. The target after five years is no more than one case of non-compliance for each variable during a 24-month period. When non-compliances occur, farms should make every effort to correct the problems within 90 days.

Limited Option: Allowable Deviation From Standard Water Quality Criteria

Limited Option: The source water for aquaculture farms can have higher concentrations of water quality variables than allowed by the initial criteria. In these cases, demonstration that the concentrations of the variables do not increase (or, in the case of dissolved oxygen, decrease) between the source water and farm effluent is an acceptable alternative to compliance with the criteria. This option does not apply to pH and chloride.

To qualify for the Limited Option, farms must collect samples of both influent and effluent water according to the frequencies stated in Appendix A.

Exemptions from Effluent Monitoring Requirements

Irrigation Systems – Freshwater Farms

Where the farm is within an irrigation system, and effluents are used only for crop irrigation, operations shall be exempt from water quality monitoring and effluent limitations.

Limited-Exchange Systems

Where the farm maintains water-exchange rates below 1% daily on an annual basis, including harvest effluents, operations shall be exempt from water quality monitoring and effluent nutrient limitations. This exemption may not be applied for farms with more than 50 ha of production ponds

Farms qualifying for this exemption are required to report an annual effluent discharge volume.

Annual Effluent Volume

An estimation of annual effluent volume, water use and nutrient load indices shall be determined as described in Appendix C.

Production Practices for Ponds

Compliance with the effluent management standard usually requires farms to improve their production practices in some areas. These areas can include practices for erosion control, feed management, water and bottom soil quality, and water exchange that can reduce and improve pond effluents.

The main practices for improving water quality are the use of stocking and feeding rates that do not exceed the assimilative capacity of ponds, application of good-quality feed and feed management, installation of mechanical aeration, liming of acidic ponds and erosion control.

Management practices that reduce effluent volume include harvesting by seining rather than draining, maintaining storage volume to capture normal rainfall and runoff by diverting excess runoff around ponds, and maintaining water quality by mechanical aeration rather than pond flushing.

If adoption of these practices is not sufficient to meet the BAP water quality criteria, a settling basin shall be installed to provide water treatment before final discharge. If a settling basin is used, the water quality criteria shall apply to its final outfall.

In cases where source water has high concentrations of suspended solids, a pre-settling basin to improve water quality before the water reaches production ponds can lessen sediment accumulation in ponds and possibly benefit effluent quality.

In some cases, the use of a natural or constructed "filter strip" can provide effective treatment for effluents before they are discharged into public waters. Effluent water flows in a thin sheet across the strips, which allows the capture of sediment, organic matter and other pollutants by deposition, infiltration, absorption, decomposition, and volatilization.

Another approach is the use of retention, evaporation or percolation ponds in areas with highly porous soils. For freshwater effluent, application for irrigation purposes to fields with sustained vegetative cover at less than the rate that causes runoff into natural waters is an option.

Effluent Management – Flow-Through or Water-Reuse Systems

Flow-Through Systems

Fish culture in flow-through systems shall be in compliance with BAP effluent criteria. An exception shall be allowed for culture in irrigation systems where effluent is discharged back into the irrigation system, and the irrigation water has no use other than application to crops. Such culture operations shall be exempt from water quality monitoring and effluent limitations.

Water-Reuse Systems

Some water reuse systems exchange water between outdoor treatment ponds and culture units. Treatment ponds can overflow during periods of heavy rainfall or when they are drained for renovation.

Effluent samples shall be collected during discharge and shall comply with BAP effluent criteria. Indoor systems treat water from culture units for reuse by mechanical and biological means, and then discharge when dissolved-solids concentrations need to be reduced. Flushing occurs by means of exchange of culture water for fresher water or when parts of the system are cleaned.

Standards

5.1: If the facility is claiming the Limited Option as a justification for deviating from standard water quality criteria, it shall collect the requisite influent and effluent water quality data.

5.2: If the applicant's facility operates within an irrigation system such that effluent water is exclusively destined to irrigate agricultural crops, Clauses 5.5 and 5.6 do not apply. Must be verified by auditor.

5.3: Clauses 5.5 and 5.6 do not apply for farms of less than 50 ha that avoid regular discharges of effluents into natural water bodies such that less than 1% of the culture water is exchanged daily on an annual basis – for example, by reusing all water or practicing infrequent, limited exchange of water.

5.4: Records on volume of farm intake water use and results of effluent monitoring (if applicable) shall be maintained and available, as detailed in the Implementation Guidelines.

5.5: Effluent water quality concentrations shall comply with BAP water quality criteria or applicable regulations if they are equivalent or more rigorous, or if this is not possible because of high concentrations in the intake water, concentrations shall reflect no deterioration between intake and discharge.

5.6: Farms shall continue compliance with these criteria to maintain certification and comply with BAP's final criteria within five years.

5.7: The farm shall provide the auditor with an estimated annual water use during the last calendar year, as illustrated in Appendix C, and the input data shall also be available for review.

6. Environment (Cages or Pens in Fresh or Brackish Water Only)

Water Quality and Sediment Control

Aquaculture facilities with cages or net pens shall monitor water quality in compliance with BAP water quality criteria, and when limits are exceeded, shall reduce feeding rates as required until water quality improves. In lakes, reservoirs and estuaries, operations shall comply with feeding rate limits and shall monitor benthic conditions as required.

Additional Data

After the first year of water quality monitoring, the auditor will use data provided by the facility's application forms to calculate annual load indices for total suspended solids, soluble phosphorus, total ammonia nitrogen and five-day biochemical oxygen demand, determined as described below.

Load indices for nitrogen and phosphorus will be estimated for cage and net pen culture operations in lakes and reservoirs.

Implementation

Applicants to the BAP program shall maintain records for water quality data as detailed in Appendix D.

Sampling – Cages, Net Pens in Lakes, Reservoirs

- A minimum of four sampling stations shall be established. One shall be in the approximate center of the cage farm or net pen area. The other three stations must be from 50 to 500 m away from the cages, considering the direction of the predominant wind, and at regular intervals away from the cage farm or net pen area so as to create a sampling transect.
- The auditor must approve the locations of the stations, which shall be set following a study on prevailing surface currents. For methods, refer to: Estimating Surface Currents Using Dyes and Drogues, U.S. Army Corps of Engineers – http://chl.erdc.usace.army.mil/library/publications/chetn/pdf/chetn-vi-37.pdf.
- Water should be collected with a Kemmerer or van Dorn water sampler, or by use of a weighted bottle from which the stopper can be removed by jerking the calibrated line. Samples should be transferred to clean plastic bottles and placed on ice in a closed, insulated chest to avoid exposure to light.

Analysis

- Analysis of the samples shall be done by a private or government laboratory following standard methods as published by the American Public Health Association, American Water Works Association and Water Environment Federation – www.standardmethods.org.
- Hach and Merck water analysis equipment is approved for total ammonia nitrogen, soluble phosphorus, and chloride analyses. However, auditors can reject analytical results if sampling, in situ measurements or lab protocols are deficient.
- Measurements for dissolved oxygen and pH should be taken in situ with portable meters. Auditors must verify the correct application of calibration procedures.

Cages, Net Pens

Growout cages and net pens may be installed in lakes, reservoirs, rivers, streams, irrigation systems, ponds, estuaries and embayments. They do not discharge point source effluents, but uneaten feed, fish feces and metabolic excretions of fish enter the water bodies that contain the cages or net pens.

Natural water bodies can already be eutrophic when certification is sought. Sites at which water quality in the water body containing cages or net pens does not comply with BAP effluent guidelines shall not be eligible for certification.

Rules for compliance with the BAP effluent standard differ among the types of water bodies in which the cages and pens are installed.

Cages, Net Pens in Lakes, Reservoirs
The potential of cage and net pen culture to cause eutrophication of lakes and reservoirs depends primarily upon the location of facilities, the amount of feed input compared with the assimilation capacity of the water body, and the hydraulic retention time (HRT) or flushing rate of the water body.

Cages or net pens placed in areas with restricted water circulation, such as narrow embayments, can cause localized eutrophication without causing generalized water quality problems in the entire water body. The assimilation capacity is impractical to measure for purposes of aquaculture certification, but major factors governing the ability of a water body to assimilate wastes are its size and especially its volume.

Nutrients and organic matter are removed from water bodies by outflow, and systems with short HRTs are less likely to become eutrophic as a result of aquaculture operations than systems with longer HRTs. Of course, the nutrients and organic matter flushed from lakes and reservoirs enter downstream waters and can have adverse impacts.

Lakes and reservoirs used for cage and net pen culture shall be classified according to HRT as follows:

- Long HRT – Over 3 years
- Moderate HRT – 1-3 years
- Short HRT – Less than 1 year

Applicants for certification may choose to determine HRT by one of the techniques below.

Annual lake discharge is measured and recorded.
HRT = Lake volume (m^3) ÷ Lake discharge (m^3/yr)

Stream inflow to lake is measured and recorded.
HRT = Lake volume (m^3) ÷ [Stream inflow (m^3/yr) + Direct rainfall (m^3/yr)] – Lake evaporation (m^3/yr)
Where lake evaporation = Pan evaporation (m/yr) x 0.7 x Lake surface area (m^2) and direct rainfall = Annual rainfall (m/yr) x Lake surface area (m^2).

Catchment area is known, but discharge or stream inflow is measured:
HRT = Lake volume (m^3) ÷ [Catchment runoff (m^3/yr) + Direct rainfall (m^3/yr)] – Lake evaporation (m^3/yr)
Where catchment runoff = Catchment area (m^2) x Annual rainfall (m/yr) x 0.3.

See methods for direct rainfall and lake evaporation above Otherwise, the auditor and applicant seeking certification will agree upon the HRT level according to the following indicators.
Long HRT: Arid climate, catchment area:water surface area ratio of 5 or less, discharge occurs only after periods of heavy rainfall, annual water level fluctuation of 2 m or more.

Moderate HRT: Humid area, catchment area:water surface area ratio 5-15, frequent or continuous discharge, annual water level fluctuation of 2 m or less.

Short HRT: Humid area, catchment area:water surface area ratio more than 15, continuous large discharge, annual water level fluctuation of 0.5 m or less, riverine system. Note: Some riverine lakes and reservoirs in arid climates have short HRTs.

The BAP maximum allowable daily feed input to cages and net pens in lakes and reservoirs shall be based on HRT as follows.

- Long HRT – 2.5 kg/ha/day x lake water surface area (ha)
- Moderate HRT – 5.0 kg/ha/day x lake water surface area (ha)
- Short HRT – 7.5 kg/ha/day x lake water surface area (ha)

If cages or net pens are installed in an embayment with restricted water exchange, the maximum daily feed input shall be reduced by 50%. If there are multiple cage and net pen operations in a water body, the total daily feed inputs of all operations shall not exceed the maximum allowable daily feed input based on HRT.

Once every three months, a water sample shall be taken and the percentage of blue-green or other potentially

harmful algae assessed. See phytoplankton methods manual at http://npsi.gov.au/files/products/national-river-health-program/pr990300/pr990300.pdf.

Feed input shall be reduced until water quality improves when:

- Dissolved-oxygen concentrations are consistently below 5 mg/L in early morning at any sampling location.
- The average annual Secchi disk visibility decreases by 25% after certification is achieved.
- Blue-green algae or other potentially harmful algae comprise more than 60% of the phytoplankton.
- The thermocline becomes 25% shallower after certification is achieved.

Discharges from water bodies containing cages or net pens can cause water pollution downstream. Thus, if the feed input to the water body must be reduced because of signs of increasing eutrophication, the discharge of the lake shall be monitored. Aquaculture operations shall not be eligible for certification unless the discharge is in compliance with BAP effluent criteria.

Cages, Net Pens in Ponds

Ponds are privately owned but usually discharge into public waters. Effluents from ponds containing cages or net pens shall comply with BAP water quality criteria.

Cages, Net Pens in Streams and Rivers

Stream and river flow is variable and too difficult to measure to use as a guide to establish maximum daily feed inputs. Thus, soluble phosphorus and total ammonia nitrogen concentrations shall be used as indicators for cage and net pen operations.

Soluble phosphorus and total ammonia nitrogen shall be measured monthly at a depth of 50 cm and immediately upstream of cages and 200 m downstream of the cages. The downstream concentrations shall not exceed the upstream concentrations by more than 25%. Feed input shall be adjusted downward when compliance cannot be achieved.

Cages, Net Pens in Irrigation Systems

Where water from irrigation systems is used only for crop irrigation, cage and net pen operations shall be exempt from feed input limits and water quality monitoring and effluent limitations. However, if water has other uses, production facilities in irrigations systems shall be treated for BAP certification as facilities installed in streams.

Cages, Net Pens in Estuaries

As a general rule, cage and net pen areas in estuaries are well flushed. Thus, daily feed input of 7.5 kg/ha of the surface area of the estuary is allowed. Monitoring shall be the same as for operations in lakes or reservoirs with two exceptions: There is not a thermocline in estuaries as in lakes and reservoirs, and it is not necessary to monitor discharges of estuaries for compliance with BAP water quality criteria.

Load Indices for Cages, Net Pens

Water use indices cannot be applied to cages and pens. The loads of nitrogen and phosphorus imposed by cages and net pens on receiving water bodies can be estimated as indicated in Appendix E.

Production Practices for Cages, Net Pens

The most reliable way of reducing nutrient outputs from cage and net pen culture is to increase feed use efficiency. This can be done mainly by using high-quality feed that contains no more nitrogen and phosphorus than necessary and by assuring that fish consume all of the feed offered.

Thus, fish should have access to the feed for enough time so that they consume it before the pellets pass through the cage or pen mesh. Also, feeding rates should be monitored to avoid overfeeding.
Observations of fish-feeding activity are enhanced by using floating feed for certain species. For waters less than 30 m deep, a diver should periodically go beneath cages to determine if uneaten feed is accumulating on the bottom.

Dead fish should be removed promptly and disposed of on land by responsible procedures. Carcasses should never be discarded in water bodies where cage culture is conducted.
Nets of cages and pens often are removed and cleaned on shore. Cleaning waste shall be diverted into a sedimentation pond, sanitary sewer or other treatment system.

It is not feasible to treat wastes from cages and net pens. The main precaution against pollution is to locate culture units in open-water areas where water circulation is sufficiently high to transport wastes away from cages and rapidly mix and dilute wastes. The distance between cage bottoms and the bottoms of water bodies should be at least 1 to 2 m to promote water movement beneath cages.

High biomass in a particular location can obviously increase the likelihood of pollution. While there are no specific guidelines for the biomass that can be safely sustained at a particular cage site, monitoring shall be used to track the status of water quality.
In bodies of water that stratify thermally, a high biomass can result in severe organic enrichment and dissolved-oxygen depletion in the hypolimnion. Subsequent sudden thermal destratification can result in dissolved-oxygen depletion throughout the water column. This phenomenon has been responsible for serious fish mortality both inside and outside cages.

Wastes can accumulate beneath cages and cause deterioration of sediment quality. This is environmentally undesirable and can have negative impacts on the fish in cages, as well. Sediment quality in areas with fish cages can be protected by fallowing – periodically moving cages to new sites and allowing the original sites to recover. Observations on sediment quality shall be used to determine when to move cages.

Standards

Cages, Net Pens in Lakes, Reservoirs

6.1: The water quality of the water body, including its discharge point if applicable, shall meet the BAP effluent water quality criteria, with sampling conducted following the implementation guidelines above.

6.2: Facilities shall maintain accurate records of daily feed inputs that reflect compliance with the BAP maximum allowable daily feed input levels.

6.3: Total feed input for all culture operations on the lake or reservoir shall not exceed the BAP maximum allowable daily feed input.

6.4: Water quality-monitoring records shall be applied in the management of feeding rates when dissolved oxygen levels are consistently below 5 mg/L in the early morning.

6.5: Water quality-monitoring records shall be applied in the management of feeding rates when mean annual Secchi disk visibility decreases by 25% since initial certification.

6.6: Water quality-monitoring records shall be applied in the management of feeding rates when blue-green or other potentially harmful algae comprise more than 60% of total phytoplankton.

6.7: Water quality-monitoring records shall be applied in the management of feeding rates when the thermocline becomes 25% shallower since initial certification.

6.8: For cages in water less than 30m deep where sediments are (in the absence of cages) usually aerobic, divers or cameras shall periodically, at least once per production cycle, inspect for accumulation of feces and uneaten feed and where necessary sites shall restore aerobic benthic conditions by fallowing or other means.

Cages, Net Pens in Streams and Rivers

6.9: Monthly records of upstream and downstream total ammonia nitrogen and soluble phosphorus concentrations shall be available.

6.10: Maximum daily feeding rates shall be managed such that downstream concentrations of nutrients do not exceed upstream concentrations by more than 25%.

Cages, Net Pens in Estuaries

6.11: Feeding records shall demonstrate that the maximum daily feeding rate of 7.5 kg/ha of estuary is not exceeded.

6.12: Water quality-monitoring records shall be maintained as specified.

7. Environment (Marine Cages Only)

Sediment Control

Marine cage farms shall be located and operated such that they minimize negative impacts on sediment quality outside a defined sediment impact zone.

Reasons for Standard

Marine cage farms have the potential to cause environmental harm due to sediment accumulation under farms. The causes include settlement of feces and uneaten food, detachment of fouling debris from nets or sloughing of antifouling materials. Sediment monitoring is the most practical means of detecting change.

Implementation

In some countries and regions, cage farms are subject to specific regulations on benthic impacts, but in other places, regulations may be inadequate or non-existent. This standard reinforces any existing regulations and describes minimum requirements where effective rules are not already in place.

Cage farms are usually located following a hydrographic, biological and physical study of the site to determine that farm operations will not have significant negative impacts on animal populations that comprise the benthos under or near the farm. Then "allowable" benthic impacts are set as conditions in the operating permits for the farm, which are defined in terms of one or more of several chemical properties of the sediments. Sometimes these are then correlated with species density and diversity determinations, which are based on prior knowledge of local sediment biology or analysis of sediment reference samples collected from the farm location.

Production cycles and fallowing shall be coordinated with other neighboring BAP applicants or BAP-certified farms, or with members of an established Area Management Agreement. Neighbors should participate in the creation and implementation of Area Management Agreements to address cumulative impacts associated with multiple farms. BAP-certified operations that operate in isolation should have a statement of intent to enter an AMA, should another operation move into the area.

Farm permits and/or local regulations usually define an allowed "sediment impact zone," "allowable zone of effect" or "footprint of deposition," and prescribe monitoring protocols to check it. Because biological sampling of sediments requires special expertise and is time-consuming and expensive, chemical sediment properties are usually used as leading indicators of sediment condition. Biological sampling is only required in some jurisdictions if an indicator trigger point is exceeded.

Chemical indicators used for this purpose include oxygen con-centration in the sediment, sulfide, REDOX potential, total organic carbon or total volatile solids, or visual inspection with documentation by video. Some methods are better suited to some environments than others.

For example, sulfide determination works well in silt or clay sediments containing up to 50% sand, as does determination of total organic carbon. Above this level of sand, an indicator such as total organic carbon works better. On hard bottoms with over 10% gravel, visual recording by video is best because grab sampling is impossible, and many such sea bottoms are erosional in nature, not depositional.

Since different methods or combinations of methods may be required in different jurisdictions based on local hydrographic or benthic conditions, no preferred method is specified in this standard, only that whatever method is used shall be undertaken using standard methods of sampling and analysis that conform to generally accepted international standards.

In situations where sediment monitoring is a statutory requirement and allowed sediment impact zones are defined, all applicants for BAP certification shall:

- Provide documents that describe local standards for benthic impacts under cage farms.
- Existing farms shall provide at least three years of monitoring data to show that the farms meet or exceed benthic standards required by operating permits at current production levels.

- New farms shall have completed a baseline study, with review by an independent expert, that describes hydrographic and benthic conditions at the farm site, and that in the expert's opinion (given without liability), the farm can meet or exceed the benthic standards required by its operating permits at current or proposed production levels. This opinion shall be verified by reference to sampling results at the next audit.
- Provide documents to show that sediment quality was determined using generally accepted sample collection and analytical methods.
- Collect and store data from which the farm's feed-based carbon and nitrogen discharges can be calculated. This means recording the carbon and nitrogen content of feed fed, the weight of all fish harvested plus dead fish removed during farming, less the weight of the juveniles stocked.

In countries or regions where sediment monitoring is not required as described above and/or where an allowed sediment impact zone is not defined, applicants shall write and implement a monitoring plan that requires them to:

- Nominate an independent individual or company with demonstrated expertise in sediment sampling and analysis to design a sediment sampling and analysis program appropriate to the farm conditions and to conduct sediment monitoring as required below.
- Chart an allowable sediment impact zone that shall not exceed the total area of the farm plus a boundary zone of 40 m around it. The footprint may be shifted in any direction to account for normally occurring uneven current patterns, as long as the total area remains the same.
- Monitor the organic build-up on the seabed within this zone by the method deemed best for the type of sediment that exists there. The choice of method shall be justified by prior documentation of the type of sediments over which the farm is located.
- Conduct sediment sampling to coincide with the period of peak feeding during each crop cycle. Samples shall be taken along at least two transects that pass directly through the farm and align with the dominant flow of water at the farm site. One sample with three replicates shall be taken at the edge of the farm and another at the 25-m or 40-m boundary. (See above.)
- Five replicate samples shall also be taken from at least two reference stations within 1 km of the farm that have similar depth and sediment characteristics as occur at the farm and where there is no fish production.
- Demonstrate by statistical analysis of the results that there is no organic build-up due to farm activity at the boundary of the allowable sediment impact zone in comparison to the reference station, as determined by the monitoring method chosen.
- Collect and store data from which the farm's feed-based carbon and nitrogen discharges can be calculated.

Additional Information

Australia Marine Farm License Conditions, Schedule 3 Farm Site Inspection Checklist
British Columbia Salmon Farmers and Province of British Columbia – 2001
http://www.salmonfarmers.org

Guide to the Assessment of Sediment Condition at Marine Finfish Farms in Tasmania
C. Macleod and S. Forbes (editors)
Tasmanian Aquaculture and Fisheries Institute
University of Tasmania
Hobart, Tasmania, Australia
http://www.imas.utas.edu.au/__data/assets/pdf_file/0011/68384/AquafinCRC_ProjectNo4.1.pdf

Norwegian Standard N.S. 9410.E
Environmental Monitoring of Marine Fish Farms

Code of Good Practice for Scottish Finfish Culture
Scottish Salmon Producers' Organization
http://www.scottishsalmon.co.uk

Washington State Legislature, WAC 173-204-420
Sediment Impact Zone Maximum Criteria
http://apps.leg.wa.gov/WAC/default.aspx?cite=173-204-200

FAO Fisheries and Aquaculture Technical Paper No. 527
Environmental Impact Assessment and Monitoring in Aquaculture, pp. 455–535
A. Wilson, S. Magill, K. D. Black – 2009
FAO. Rome, Italy

Standards

7.1: The applicant shall provide documents that describe local standards for benthic impacts under cage farms, which shall include the benthic indicator "trigger level" above which the farm would not be in full compliance with the local standard, where this is clearly defined, or with its intent where it is not clearly defined.

7.2: For established farms, the applicant shall provide three years of monitoring data to show that the farm meets or exceeds sediment quality criteria specified in its operating permits and/or its own monitoring plan at current operating levels.

7.3: For newly established farms or farms that have expanded and do not yet have enough monitoring data, the applicant shall provide an independent study that characterizes the hydrographic and benthic characteristics of the area and provides a consultant's opinion (without liability) that the farm can meet or exceed sediment and water quality criteria if operated correctly. This opinion shall be verified by reference to sampling results at the next audit.

7.4: Monitoring of sediment conditions shall be undertaken at the time of peak feeding during the production cycle and shall be conducted according to the requirements of the farm's operating permits or its own plan in countries or regions where sediment monitoring is not required, and as specified in the implementation requirements.

7.5: Sediment sampling and analysis performed as part of the monitoring program shall apply generally accepted international methods and be adapted to the local hydrographic or benthic conditions.

7.6: The results of sediment monitoring shall be reported to and reviewed and accepted by the appropriate regulators. Where regulatory approval is conditional upon implementing a program of remedial action, this shall have been implemented and completed.

7.7: Data that will enable the farm's feed-based carbon and nitrogen discharge to be calculated shall be collected and recorded.

7.8: Production cycles and fallowing shall be coordinated with other neighboring BAP applicants or BAP-certified farms, or with members of an established Area Management Agreement.

7.9: Where an AMA has not been established, applicants shall nevertheless demonstrate cooperation on matters of stocking, fallowing, animal health and biosecurity with BAP-certified farms within an area twice the regulatory minimum separation distance to an upper limit of a 5-km radius.

8. Environment (Ponds and Other Land-Based Systems Only)

Soil and Water Conservation

Pond Sludge Management

Farm construction and operations shall not cause soil and water salinization or deplete groundwater in surrounding areas. Farms shall properly manage and dispose of sediment from ponds, raceways, canals and settling basins.

Reasons for Standard
In some locations, freshwater from underground aquifers is used to dilute salinity in brackish water ponds or as the main water supply for freshwater ponds. Farming can cause salinization if saline water from ponds infiltrates freshwater aquifers or is

discharged into freshwater lakes or streams. Farms can potentially lower water tables and negatively affect groundwater availability. Where other suitable water sources are available, the use of well water is discouraged.

Sediments that accumulate in canals, raceways, ponds and settling basins can negatively impact water movement and affect pond soil and water conditions, necessitating periodic dredging and removal. Sediments are mostly mineral soil enriched with organic material, but at some farms also contain water-soluble salt from contact with saline water. Improper disposal of salt-laden sediments from ponds can cause salinization of soil and water.

Implementation

When brackish ponds are drained into a freshwater stream, the water should be discharged when stream flow is high. The water shall be discharged slowly to avoid increases in chloride concentration greater than 250 mg/L in the receiving water body.

Several practices can be adopted to lessen the risk of salinization. One of the most important is to avoid constructing ponds in highly permeable, sandy soil, or to provide clay or plastic liners to minimize seepage. Other useful practices:

- Do not discharge saline water into freshwater areas.
- Avoid excessive pumping of groundwater from freshwater aquifers, and do not use freshwater from wells to dilute salinity in growout ponds.
- Monitor chloride concentration in freshwater wells near farms to determine if salinization is occurring.

In freshwater ponds, use the drop-fill method to capture rainfall and runoff, and reduce the use of water from other sources. In applying this method, water should not be added to ponds during dry weather until the water level has fallen 15 to 20 cm below the overflow level. Water should then be added to increase the water surface level by not more than 7.5 to 10 cm. This practice provides storage volume sufficient to capture normal rainfall and runoff.

Farm ponds should be surrounded by a ditch to intercept seepage. This ditch should be large enough to capture overflow from ponds following rainfall. When ponds are drained for harvest, water should be stored in a reservoir or transferred to other ponds for reuse. A vegetative barrier of salt-sensitive vegetation around farms can help detect movement of salt into adjacent areas.

When freshwater from wells is used to supply ponds or other production facilities, water levels in nearby wells shall be monitored by appropriate agencies to determine if aquaculture use is contributing to a decline in the water table level. Use of water from irrigation systems shall be in accordance with regulations, and effluents shall be returned to the irrigation system.

Where possible, seine harvest fish and do not drain ponds for several years. This practice is highly recommended, for it conserves water, and reduces effluent volume and pumping costs.

Sediment and Sludge Management

Aquaculture ponds have high hydraulic retention times and function as sedimentation basins, but negative environmental impacts can arise when sediments are resuspended during harvest or when sediment is pumped from ponds during the culture period and discharged as a highly fluid sludge. The sludge contains organic material from feces and uneaten feed, but often mainly comprises mineral particles that enter the ponds in source water from a river.

Discharge of sludge may not be an issue for ponds with production of less than 20 MT/ha/crop, but above this threshold, the use of sedimentation basins for sludge disposal is needed. If sediment is disposed of outside water-holding structures, care shall be exercised to prevent the formation of spoil piles that can disrupt local ecological processes through erosion and transport to surrounding areas. Runoff from spoil piles onto non-saline soil or into freshwater can cause salinization. Downward seepage can result in salinization of freshwater aquifers.

Implementation

The first principles of sediment management on farms are to prevent excessive sedimentation through good management practices and confine sedimentation to specific parts of the farm. Where farm supply water has a large sediment load, reservoirs for pre-sedimentation

can remove much of the suspended material so it will not settle in supply canals and production ponds.

Sediment accumulation in ponds and canals can be reduced by:

- implementing proper earthen infrastructure design to lessen erosion by rainfall and water currents
- placing aerators to avoid impingement of water currents on embankments
- reinforcing erosion-prone areas with stone or other lining materials
- covering bare areas with gravel or grass.

On large farms, sediments removed by dredging shall discharge into containment areas rather than directly into streams or other estuarine areas. These can be installed along the margins of canals or on areas of salt flats above high tide. Pond sediment from bank erosion can usually be placed back on eroded areas.

Farms shall not dredge or fill in sensitive wetlands or wetland buffers to increase the area available for pond construction.

Prevention of erosion avoids re-sedimentation of soil material from effluents downstream from farms. The control of erosion from effluent involves reducing the impact energy of discharges upon soil and reducing water velocity in ditches to prevent scouring. Drainpipes should extend at least 1 m beyond embankments at an elevation near the ditch bottom. The pipe outlet area should be protected with a splash shield or riprap to reduce effluent energy. Drainpipes that discharge directly into streams should extend over the stream bank to prevent erosion and be located near the stream's normal water level.

When sediment is disposed of outside the immediate farm area, it shall be confined to an earthen containment area where soils are saline to prevent runoff. Overflow or seepage of saline soil and water from the confinement shall not cause harm in the area.

In inland shrimp farming, saline sediment shall be confined to prevent overflow after rainfall events. The confinement structures shall be large enough to hold the largest amount of rainfall expected within any 24-hour period over 25 years. If the soil is highly pervious, the confinement area shall be lined to prevent seepage. Once sediment is leached of salt by rainfall, it can be used for landfill or other purposes.

When sediment is stored, it shall be confined within a diked area so that solids suspended by rainfall can be retained. When sediment must be removed, it should ideally be reused to repair pond earthworks or applied as fill material. The sediment can also be spread in a thin layer over the land and vegetative cover established.

Sedimentation Basins

The minimum required sedimentation basin volume can be estimated using the following equation:

Sedimentation basin volume = 37.5 x
[Fish production (MT) ÷ Sludge transfers (times/crop)] +
[Fish production (MT) ÷ 0.6]

In the above equation, fish production is the total quantity of fish produced in all ponds that discharge into the sedimentation basin, and sludge transfers are the mean frequency at which sludge is moved from ponds to the sedimentation basin. It is also assumed that:

- The minimum hydraulic retention time to allow coarse and medium solids to settle out is six hours.
- One MT of fish production equates to 1 MT sediment.
- Sludge removal can be spread over a 24-hour period.
- Sediment bulk density is 0.6 t/m^3.
- The solids content of sludge is 6.5 kg/m^3.
- Accumulated sediments in the basin are removed at the end of each crop to return the basin to its original capacity.

Note: If sludge is removed more frequently from ponds, the required size of the sedimentation basin is reduced. The farm operator shall provide the auditor with mean values for fish production and sludge transfer frequency so the required sedimentation basin volume can be calculated. The auditor will verify that the farm has the required volume of basins in use and available for sludge containment.

Basins should be configured so that raw sludge enters at the top of the basin and resulting effluent exits at the top on the other side of the basin. Five or six calibrated poles should be installed in basins to allow the build-up of settled solids to be monitored and ensure the

remaining capacity supports a minimum six-hour hydraulic retention time. Sediments removed from sludge basins shall be confined at the farm or used for landfill or agriculture.
Raceways or similar flow-through systems have short retention times, and in high-intensity operations, sediment loads can often exceed acceptable limits. Therefore, such farms must incorporate suitably sized settling zones or other engineered solutions that assure removal of the majority of settleable solids.
Accumulated solids must be pumped or siphoned periodically to offline sludge basins, where they can be dewatered and subsequently removed for use as fertilizer in land-based agriculture crops

Standards

8.1: If ponds are constructed on permeable soil, measures such as the use of pond liners shall be taken to control seepage and avoid contamination of aquifers, lakes, streams and other natural bodies of freshwater.

8.2: For inland brackish ponds, quarterly monitoring of neighboring well and surface water shall not show that chloride levels are increasing due to farm operations.

8.3: If a farm is extracting groundwater, water levels in nearby wells shall be monitored at least annually during the dry season to establish that aquaculture is not lowering the water table.

8.4: Use of water from wells, lakes, streams, springs or other natural sources shall not cause ecological damage or subsidence in surrounding areas.

8.5: Farm operations shall not cause wetland vegetation at the facility perimeter to die off.

8.6: Dredge and fill activities shall not be conducted in sensitive wetlands or wetland buffers to increase the area available for pond construction.

8.7: Any accumulated sludge removed from ponds, reservoirs or sedimentation basins shall be confined within the farm property or consolidated and used locally for landfill or agriculture.

8.8: Removed sediment shall be properly contained and located to prevent the salinization of soil and groundwater and not cause other ecological nuisances.

8.9: Facilities shall avoid the creation of degraded areas such as borrow pits and piles of soil.

8.10: Dredged material shall be properly contained and not placed in mangrove areas or other sensitive habitats.

8.11: The applicant shall take measures to control erosion and other impacts caused by outfalls.

8.12: If the applicant's facility produces more than 20 MT/ha/crop, the facility shall possess sufficient sedimentation basin capacity to handle the associated sludge/sediment. The facility shall process all sludge/sediment in sedimentation basins and not dump material in sensitive wetland or mangrove areas, or public water bodies.

9. Environment (All Production Systems)

Fishmeal and Fish Oil Conservation

Farms shall accurately monitor feed inputs and minimize the use of fishmeal and fish oil derived from wild fisheries.

Reasons for Standard

The majority of feeds manufactured for use in aquaculture contain fishmeal and fish oil as protein and lipid sources. Although fishmeal and fish oil are renewable resources derived primarily from small fish that are not generally utilized for direct human consumption, there are limits to the amounts of these products the world's oceans can supply.

The BAP program therefore supports the use of protein feed ingredients derived from terrestrial sources, as well as fishmeal and fish oil produced from fish processing and fishery by-products. Fishery-based ingredients from wild sources should come from responsibly managed fisheries.

In addition, by improving the efficiency with which feed is converted into fish biomass, farmers can lessen the amount of fishmeal and fish oil used. More efficient feed conversion also has a direct beneficial impact on

water quality and limits the release of excess nutrients to the environment.

Implementation

Aquaculture feeds are typically manufactured at commercial facilities and delivered to farms. Farmers shall obtain feed from suppliers that provide reliable information on the crude protein and fishmeal and fish oil content in the feeds. Farmers shall record the characteristics of all feeds used, the total amounts of each feed used each year and the total annual fish production. Although BAP criteria for feed conversion have not been established, producers should strive to reduce their facilities' feed-conversion ratios as low as practicable. Also, certified farms should maintain or lower feed conversion in the years following their initial certification. Harvest size shall be considered when assessing the evolution of feed conversion.

To promote the responsible sourcing of marine ingredients, the applicant shall obtain feed from a BAP-certified feed mill or a feed mill that declares and documents compliance with BAP feed mill standards 3.1 and 3.3. These standards address sourcing policies on marine ingredients, covering traceability for species and origin, and the exclusion of any species designated on the IUCN Redlist as endangered or critically endangered.

The BAP Feed Mill Standard requires that: After June 2015, for fishmeal and fish oil derived from reduction fisheries, at least 50% (calculation based on mass balance) shall come from sources that are certified by either the Marine Stewardship Council (MSC) or to the International Fishmeal and Fish Oil Organization Responsible Supply standards (IFFO RS).

Alternatively, where MSC- or IFFO RS certified fishmeal and fish oil are not produced nationally, the above minimum percentage can comprise material from active approved improvers programs as verified by IFFO (http://www.iffo.net/node/493), the Sustainable Fisheries Partnership (SFP, http://fisheryimprovementprojects.org/view-fips/) or World Wildlife Fund (WWF, https://sites.google.com/site/fisheryimprovementprojects/home). This 50% target will be periodically reassessed with the ultimate goal that all fishmeal and fish oil are derived from certified sources.

Additional Data

Feed-Conversion Ratio

The feed-conversion ratio is a measure of the amount of feed needed to produce a unit weight of the culture species. Farms shall calculate and record FCR yearly using the following:

Equation 1

Feed-conversion ratio = Annual feed use (MT) ÷ Net fish harvested (MT)

The feed-conversion ratio is also known as the economic FCR. Note that economic FCR is very sensitive to survival rate, rising sharply if the survival rate drops significantly. For precise calculation, the total weight of stocked juveniles is subtracted from the total weight of the harvested fish.

"Fish In:Fish Out" Ratio

The so-called "fish in:fish out" ratio is one means of measuring the ecological efficiency of an aquaculture system. It compares the amount of fish consumed by the system (usually in the form of fishmeal and fish oil) with the amount of fish produced.

Aquaculture producers should strive to obtain the lowest fish in:
fish out ratio practicable in order to conserve industrial fish resources. Since many aquaculture diets incorporate only small amounts of fishmeal and fish oil, farms that use these feeds can have fish in:fish out ratios of less than 1, indicating they actually make a net contribution to global fish supplies.

Farms shall calculate and record a final yearly fish in:fish out ratio using Equation 2 below. In the absence of better, specific data from the feed supplier, the transformation yields for industrial fish to fishmeal and fish oil to be used are 22.5% and 5%, respectively.

Metric standards for some key aquaculture species have been set, and anonymous, pooled fish in:fish out data shall be used in the future to establish metric standards for other species.

Equation 2

Fish in:fish out ratio = Feed fish inclusion factor of feed (from manufacturer) x feed-conversion ratio

Where feed fish inclusion factor = [Level of fishmeal in diet (%) + Level of fish oil in diet (%)] ÷ [Yield of fishmeal from wild fish (%) + Yield of fish oil from wild fish (%)]

The inclusion levels in Equation 2 shall include any meal or oil derived from wild-caught fish, squid, krill, mollusks or any other wild marine animals. However, they shall exclude meal or oil derived from fishery by-products such as trimmings, offal and squid liver powder and aquaculture by-products such as shrimp head meal.

Standards

9.1: The applicant's facility shall use feed for which the manufacturer has provided data on the wild fishmeal and fish oil content or feed fish inclusion factor.

9.2: The facility shall record the characteristics of all feeds used, the total amounts of each feed used each year and the total annual crustacean or fish production.

9.3: The facility shall calculate and record a yearly feed-conversion ratio for completed crops.

9.4: The facility shall calculate and record a final yearly fish in:fish out ratio for completed crops.

9.5: The fish in:fish out ratio shall not exceed the following values: *Litopenaeus vannamei* – 1.2, *Penaeus monodon* – 1.7, tilapia – 0.7, *Pangasius* – 0.5. Limits have not yet been fixed for other species, and will be added once adequate data has been accumulated. For other species the values shall be recorded as information only.

9.6: The applicant shall obtain feed from a BAP-certified feed mill or a feed mill that declares and documents compliance with standards 3.1 and 3.3 of the BAP feed mill standards.

(Note: the referenced BAP Feed Mill Standards are **FM 3.1**: The applicant shall obtain declarations from suppliers on the species and fishery origins of each batch of fishmeal and fish oil. **FM3.3**: The applicant shall develop and implement a clear, written plan of action defining policies for responsibly sourcing fishmeal and fish oil.)

10. Environment (All Production Systems)

Stocking Sources and GMOs

Wild juveniles shall not be stocked. Certified farms shall comply with governmental regulations regarding the use of native and non-native species, and genetically modified aquaculture species.

Reasons for Standard

Most nations allow the importation of native species, and some allow specified non-native imports. Among other factors, regulation is required because diseases can be transferred between countries and species by importations of eggs, fry and broodstock. Regulations usually require health certificates and quarantine.

GMOs

Genetically modified organisms (GMOs or transgenic organisms) are defined as organisms that have been genetically modified by artificial transfer of genetic material from another species. Sterile or sex-reversed organisms and their offspring, and organisms created by hybridization and polyploidy are not GMOs.

Should genetically modified fish or crustaceans be commercialized in the future, producers shall comply with all regulations in producing and consuming countries regarding such organisms. Since some consumers do not desire genetically modified foods, they should be provided with reliable information to enable informed food choices.

Implementation

Participating farms shall keep records of their sources and purchases of stocking material and record the number stocked in each culture unit for each crop. A sample Traceability Form that records these data is provided in Appendix F. In the future, farms that stock GMO species shall also note this information. During site inspection, documentation of compliance with

government regulations relating to the import of fry or postlarvae shall be available. The applicant should establish a link to the domestic competent authority (veterinary authority or other government body) to verify international importation requirements and follow the International Health Certificate protocol defined by OIE.

Regulations differ by country, and the certification body cannot maintain complete records of the requirements in every country. Auditors should become familiar with relevant regulations in countries that they serve.

Non-Native Species

Introductions of species to countries where such species are not native, not feral or not already farmed shall be subject to the provisions of the 2005 ICES Code of Practice on the Introductions and Transfers of Marine Organisms or, in the case of freshwater species, FAO 1988: Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms. To reduce the potential impact of escapes, technologies such as sterility, ploidy and monosexing are encouraged.

Additional Information

ICES Code of Practice on Introductions and Transfers of Marine Organisms 2005

International Council for the Exploration of the Sea
http://www.ices.dk/publications/Documents/Miscellaneous%20pubs/ICES%20Code%20of%20Practice.pdf

Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms

European Inland Fisheries Advisories Commission Food and Agriculture Organization of the United Nations
Rome – 1988
ftp://ftp.fao.org/docrep/fao/009/ae989e/ae989e.pdf

OIE Aquatic Animal Health Code

http://www.oie.int/doc/ged/D7821.PDF

OIE Manual of Diagnostic Tests for Aquatic Animals

http://www.oie.int/en/international-standard-setting/aquatic-manual/access-online

Standards

10.1: The facility shall maintain accurate records of the species farmed and, where relevant, any significant stock characteristics, including but not limited to non-native, specific pathogen-free, specific pathogen-resistant, hybrid, triploid, sex-reversed or genetically modified (GMO) status.

10.2: If government regulations control the use or importation of any of the species or stocks farmed, relevant permits shall be made available for inspection, even if imported fry were purchased from an intermediary.

10.3: The facility shall keep records of sources and purchases of stocking material, and record the number stocked in each culture unit for each crop.

10.4: Wild juveniles shall not be stocked, other than as incidental introductions when extensive ponds are first filled.

10.5: Where the species farmed is not native, not feral or not already farmed, further documents shall be provided to demonstrate that regulatory approval for farming is based on the 2005 ICES Code of Practice on Introductions and Transfers of Marine Organisms or, for freshwater species, the Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms, FAO 1988.

11. Environment (All Production Systems, several sections for cages only)

Control of Escapes

Certified farms shall take all practical steps to prevent escapes and minimize possible adverse effects on aquatic wildlife if escapes occur.

Reasons for Standard

The escape of domesticated and/or non-native culture species or the release of their eggs or larvae could lead through interbreeding to the alteration of the gene pools of local crustacean or fish populations. Escapes of non-native species could also lead to competition with

native species for food and/or habitat, and possibly have other detrimental ecological consequences. Diseases can also be transmitted from escapees to wild fish.

Typically escapes occur when holes develop in nets due to wear and tear, collisions with boats, human error or attack by large predators. Damage can also occur during severe weather, which can tear nets and lead to substantial losses. Escapes sometimes happen when fish are removed from the water for grading or harvesting, or if net meshes are too large for the smallest fish stocked in the cages.

Implementation

All incidents involving animal escapes shall be accurately documented. Farms should demonstrate reductions in escapes over time. All systems shall be designed to minimize the escape of culture animals. For example, ponds and other culture systems shall have intact screens on water inlets and outlets. Acceptable filter devices include a series of mesh screens capable of screening all water, dry-bed filters constructed with gravel and sand, microscreen solids filters, and pond traps with screened discharge. Production facilities shall be constructed so as to prevent overtopping by storm surges, waves or flood water. When heavy rainfall is expected, pond levels should be drawn down to prevent the rain from raising water levels and overtopping embankments.

Cages, Net Pens

Cages, nets and pens shall be tagged and maintained in good condition, and records of repairs shall be kept. Periodic inspections of mooring lines shall be documented. Jump nets that extend above the water line should surround the perimeters of net cages. Applicants shall adhere to any local cage design and construction standards approved by local producer associations.

Every effort shall be made to assure that fish do not escape from enclosures in water bodies. Cages and net pens shall be constructed of sturdy material and maintained in good condition to minimize the likelihood of holes and rips through which fish can escape. It is particularly important to use material that does not corrode, as holes can suddenly appear without warning in nets made of corrodible wire.

Cages and pens should be placed in areas where there is little danger of collisions with boats or floating debris and where heavy waves are not likely to damage them. Placement of cages and pens in navigable waters may need approval from governmental authorities. Divers or underwater cameras shall periodically inspect cages for holes, rips and tears.

Cages – Fish Containment Plan

Applicants operating cages shall have a written Fish Containment Plan that covers escape prevention and deals with known or suspected escapes.

Escape Prevention

- Documents shall show the farm's moorings were installed according to the manufacturer's and/or marine engineer's specifications.
- A site risk analysis updated at least annually shall identify the potential and actual causes of fish escapes, determine their relative likelihood of occurrence or recurrence at the farm site, and identify critical control points for effective escape risk monitoring, reduction and response by farm staff.
- Procedures based on the risk analysis shall include management protocols and actions designed to monitor escape risks, reduce them when identified and respond to escape events in a timely and effective manner. The efficacy of these measures shall be verified and documented through the year.
- Procedures shall require the main surface components of the system to be inspected at least annually and repaired or replaced as needed. The sub-surface components must be inspected and replaced as needed at least every two years or between each crop cycle, whichever is shorter. Equipment shall be replaced as needed.
- Net inventory management procedures shall track the ages of all nets on the farm or in storage, and provide strength tests on all nets between crops or every two years, whichever period is shorter. Nets shall be retired when their strength is below levels specified in local regulations or, where there are none, below the manufacturer's or supplier's recommendations.

- Cage inspection procedures shall ensure all operational nets are surface checked for holes at least weekly and checked sub-surface at least every four weeks. Nets and cage superstructure shall be checked for holes and other indications of structural damage after risk events such as storms or big tides.
- Predator deterrence procedures shall minimize the risk that predators can make holes in nets.
- Boat equipment shall include guards on propellers and staff training procedures that minimize the risk of contact between boats and farm nets.
- At marine sites, procedures and equipment consistent with local Coast Guard rules shall warn non-farm marine traffic of the farm's presence.
- Procedures for handling live fish shall prevent "spillage."
- As part of their initial training, all staff shall receive training on all procedures in the Fish Containment Plan.

Known and Suspected Escapes

- BAP applicants shall maintain equipment for attempted recapture of escaped animals and have written procedures for its use. The procedures must enable rapid response, subject to legal constraints on the types of equipment that can be used.
- If an escape is known or suspected to have occurred, the cause shall be investigated immediately, and steps shall be taken to correct it. These actions shall be documented in farm records.
- If, after investigation, there are grounds for believing an escape occurred, the fish remaining in the cage or cages shall be counted, if and/or when water and welfare indicators indicate this can be done without causing excessive distress to the fish, and any loss of inventory shall be recorded.

Standards

All Production Systems

11.1: All holding, transport and culture systems shall be designed, operated and maintained to minimize the release of eggs, larval forms, juveniles and adult animals.

11.2: Screens and nets sized to retain the smallest farmed animals present shall be installed on water outlet pumps, pipes or sluices. Screens, nets or other controls shall be installed on or near pump intakes to minimize the introduction of local aquatic fauna.

11.3: During harvesting and stock transfer operations, effective secondary containment measures shall be applied to control the escape of animals.

11.4: All incidents involving escapes of aquaculture animals shall be accurately documented.

Cages

11.5: Cages, nets and pens shall be tagged and maintained in good condition, and records of repairs shall be kept. Periodic inspections of mooring lines shall be documented. Jump nets that extend above the water line should surround the perimeters of net cages.

11.6: Applicants shall adhere to any local cage design and construction standards approved by local producer associations.

11.7: The applicant shall demonstrate that the farm meets the BAP procedural, performance, documentation and reporting requirements for fish containment required by the Fish Containment Plan outlined in the implementation requirements.

11.8: The applicant shall provide documents to show that all staff members have received training in the Fish Containment Plan, which shall be verifiable by training certificates in employees' files and verified at audit by a subset of interviews

11.9: If an escape is suspected or has occurred since the last audit, the applicant shall provide reports and farm records to show that the incident was dealt with in a manner consistent with the Fish Containment Plan.

12. Environment (All Production Systems, several standards for cages only)

Biodiversity and Wildlife Protection

Certified farms shall manage physical interactions with wildlife.

Reasons for Standard

Farms shall obey laws related to the destruction of birds and other predators. Where applicable, permits and records shall be available. The BAP program strongly encourages farms to employ humane, non-lethal measures for predator control, even when lethal methods are permitted.

Implementation

Farms shall record all predator mortalities (species and numbers). Additionally, all species listed as "endangered" and "critically endangered" by the International Union for Conservation of Nature (IUCN) Red List or protected by local or national laws shall be subjected to passive deterrence methods only, and no active or lethal means shall be used.

Cages – Wildlife Interaction Plan

Applicants operating cages shall have a written Wildlife Interaction Plan (WIP) that includes provisions stipulated in local laws and the farms' operating permits, as well as the following requirements, if not so stipulated.

The WIP shall include but not be limited to:

- A list of relevant local laws and specific conditions of the farm's operating permits that apply to wildlife management and protection.
- A list of local species classified as endangered or threatened under local laws and/or listed as "Critically Endangered" or "Endangered" on the IUCN Red List.
- At marine sites, a map that identifies officially designated "critical" and/or "sensitive" marine and coastal habitat in the region. If the farm is in an area so designated, a list of the classified or endangered sedentary species within a 2-km radius of the farm and of mobile coastal species within the region, updated where necessary to show wildlife established after the farm was started, shall also be included.
- Training for farm staff in recognizing endangered, threatened and protected species they may see from the farm and a system for recording and reporting such observations to farm management and members of the public who have expressed interest.
- Designation of one member of staff to carry out lethal control measures, if needed, and for training of that individual in humane slaughter methods.
- Description of the farm's passive measures to deter the entry into cages of predatory birds or small mammals.
- At marine sites with carnivorous marine mammals, description of the farm's passive measures to protect cages from underwater attack.
- Procedures for the regular inspection of cages to check and report the integrity of the passive measures.
- Documentation to show that any active but non-lethal deterrent measures used are approved by regulators through a review of environmental impacts with specific reference to endangered, protected, threatened or cetacean species in the area. Such devices shall not be deployed if the review shows they can adversely affect these species.
- Reporting procedures in the event that control measures cause the accidental death of wildlife and for proposed action to prevent the same from happening again.
- Procedures that state lethal methods shall only be used after all non-lethal methods are attempted and must be legally approved.
- Procedures that make it clear that deliberate lethal controls on species classified as endangered or critically endangered are not to be used except under exceptional circumstances, such as risk to human life, and

then only after specific written authorization is obtained from regulators.

- Procedures for regulatory authorization, implementation and reporting of lethal control measures when these are deemed necessary.

Standards

All Production Systems

12.1: The facility shall use humane methods of predator deterrents and actively favor non-lethal methods. Where applicable, government permits for predator control shall be made available for review. No controls, other than non-lethal exclusion, shall be applied to species that are listed as endangered or highly endangered on the IUCN Red List or that are protected by local or national laws.

12.2: The facility shall record, and report where required, the species and numbers of all avian, mammalian and reptilian mortalities.

Cages

12.3: The applicant shall have a written Wildlife Interaction Plan consistent with the implementation requirements listed above and that complies with the procedural, performance and reporting requirements therein.

12.4: Farm employees shall be familiar with the provisions of the WIP and trained in aspects of it that they may be called upon to implement.

13. Environment (All Production Systems)

Storage, Disposal of Farm Supplies and Wastes

Fuel, lubricants and agricultural chemicals shall be stored and disposed of in a safe and responsible manner. Paper and plastic refuse shall be disposed of in a prompt, sanitary and responsible way. Excessive accumulation of waste and/or discarded farm supplies and equipment shall be removed and disposed of responsibly.

Reasons for Standard

Farms use fuel, oil and grease to power and lubricate vehicles, pumps, aerators and other mechanical devices. The main agricultural chemicals used in aquaculture include fertilizers, liming materials and zeolite. Some farms use insecticides, herbicides, parasiticides and algicides. Other products employed include preservatives, paints, disinfectants, detergents and antifoulants.

Fuels and some fertilizers are highly flammable and/or explosive, and pesticides, herbicides and algicides are toxic. They shall therefore be considered potential hazards to workers.

Spills or careless disposal of petroleum products and agricultural chemicals can also affect aquatic organisms and other wildlife in the immediate vicinity, and result in water pollution over a wider area.

Farms generate considerable waste that can cause pollution, odors and human health hazards on the farm and in surrounding areas when not disposed of properly. Human food scraps, out-of-date feed, other organic waste, and discarded equipment or supplies can attract pests and scavengers. Runoff from refuse piles can cause pollution and contaminate ground water. Empty plastic bags and other containers used for feed, fertilizer and liming materials do not decompose quickly. They can be a hazard to animals.

Implementation

Fuel, lubricants and agricultural chemicals shall be labeled and safely stored. Used chemicals shall be disposed of in a responsible manner.

Secondary containment shall be provided for individual or multiple fuel storage tanks. The containment volume shall be equivalent to the total stored volume plus 10%.

Oil leaks from tractors, trucks and other equipment shall be prevented through good maintenance. Oil changes and refueling shall avoid spills, with used oil sent to a recycling center.

Chemicals such as insecticides, herbicides, algicides, sodium metabisulfite used in shrimp, and detergents shall be stored in locked, well-ventilated water-tight

buildings. The buildings' concrete floors should slope to a center basin for containing spills. Warning signs shall be posted.

Feed shall be properly stored off the floor and away from walls, and protected from moisture, pests and other contaminants.
Fertilizers, liming materials, salt and other less hazardous agricultural chemicals shall be stored under a roof, where rainfall will not wash them into surface water. Particular care shall be taken with nitrate fertilizers, which are strong oxidants that are particularly explosive when contaminated with diesel fuel or other oils.

Procedures shall be developed for managing spills of chemicals and other products, and the supplies needed for cleaning up spills shall be readily available. Workers shall be trained to properly use the equipment and handle the contained waste.

Trash, garbage and other farm waste, including discarded farm machinery and equipment, shall not be dumped in mangrove areas, wetlands or vacant land, or allowed to accumulate on farm property. Such waste shall be disposed of responsibly. Composting shall be done by a procedure that does not create an odor problem or attract wild animals.

Paper and plastic should be recycled if possible. Waste collection for recycling requires readily accessible waste containers that are serviced at regular intervals. All containers must be appropriately labeled with risk indicators (poisonous/explosive, etc.).

Standards

13.1: Fuel, lubricants, feed and agricultural chemicals shall be labeled, stored, used and disposed of in a safe and responsible manner.
13.2: Fuel, lubricants and agricultural chemicals shall not be stored near feed, in employee housing or kitchen areas, or near harvest equipment and supplies.
13.3: Fuel, lubricant and chemical storage areas shall be marked with warning signs.
13.4: Precautions shall be taken to prevent spills, fires and explosions, and procedures and supplies shall be readily available to manage chemical and fuel spills or leaks. Designated staff shall be trained to manage such spills and leaks.
13.5: Garbage from housing and food waste shall be retained in water-tight receptacles with covers to protect contents from insects, rodents and other animals.
13.6: Garbage and other solid waste, including fouling organisms, shall be disposed of to comply with local regulations and avoid environmental contamination and odor problems (e.g., recycling, burning, composting or placing in a legal landfill).
13.7: Household trash and other farm wastes shall not be dumped in mangrove areas, wetlands or other vacant land and shall be removed promptly and properly to avoid accumulation.
13.8: Discarded farm supplies and equipment (e.g., tires, pallets, bags, barrels, aeration paddles or engines) shall not be dumped in mangrove areas, wetlands or other vacant land, and shall be removed properly to avoid excessive accumulation.
13.9: Measures shall be taken to prevent infestation by animal and insect vectors and pests.
13.10: Secondary fuel containment shall conform to BAP guidelines for fuel storage.

14. Animal Health and Welfare (All Production Systems)

Culture Conditions and Practices

Producers shall demonstrate that all operations on farms are designed and operated with animal welfare in mind, and maximum survival shall be sought.

Employees shall be trained to provide appropriate levels of husbandry.
Reasons for Standard

Since society seeks to avoid needless animal suffering, numerous regulations address animal welfare. Although few such regulations address crustaceans and fish, many consumers would like to know that farmed aquatic animals were produced by humane techniques.

When farmed animals are exposed to continuing stress, their feed consumption and growth rates can decline. Stressed animals are also less resistant to diseases, and mortality usually increases.

Animal suffering can be prevented and production efficiency enhanced by applying good husbandry techniques to avoid stressful culture conditions.

Implementation

Farms shall provide well-designed facilities for holding and rearing crustaceans and fish with adequate space and shade. The temperature and chemical composition of culture water should be appropriately maintained, and changes in water quality should be made slowly so the species being cultivated can adjust to the changes. Adequate levels of dissolved oxygen shall be maintained.

Feed appropriate for the culture species should be offered at regular intervals. Although fasting periods may be needed to enable harvesting in hygienic conditions, they should be minimized.

Aquaculture farms should minimize stressful situations during handling by limiting crowding time and time out of water. Culture conditions should be managed to avoid situations that could lead to stress, injury or disease.

Accessible, dead animals shall be removed from ponds or cages at least daily and disposed of properly. Ill and unwanted fish specimens shall be eliminated in a humane fashion, for example by dispatching them with a blow to the head.

Farm staff shall regularly inspect the culture facility, noting water quality as well as the appearance (e.g., fin condition) and behavior (e.g., loss of appetite) of the animals in their charge. Swift action shall be taken to correct deficiencies or symptoms.

Although reliable scientific data on the effects of stocking density on aquatic animal welfare are limited, and many factors influence this relationship, the BAP standard requires operators to establish and implement their own limits.

The crowding and handling of aquacultured animals during harvesting and transport are potentially stressful, so measures shall be taken to prevent unnecessary animal suffering.

When aquacultured animals are rendered insensitive or their physiological activity greatly reduced during transport, the process shall be accomplished by humane methods.

Animals that are accidentally dropped on the ground during harvest should not be left out of water to suffocate. Live transport of animals should maintain adequate water quality during transport. This usually requires the application of mechanical aeration or oxygenation in the transport containers. Temperature control may also be necessary.

Standards

14.1: The applicant's facility shall apply a maximum biomass limit based on performance measures for aquatic animal health and survival records, and any applicable national regulations.

14.2: Feeding shall be managed to avoid stress caused by under- or overfeeding.

14.3: The facility shall define upper limits for time periods of fasting, crowding and time out of water to ensure best welfare practices and provide accurate records showing that these limits are respected.

14.4: Facility staff shall make regular inspections of the culture facility, water quality, and behavior and condition of crustaceans or fish.

14.5: Disease outbreaks shall be managed through rapid diagnosis and treatment, and when necessary, humane slaughter.

14.6: Humane slaughter techniques shall be used that are appropriate for the culture species.

14.7: When ill, deformed or unmarketable specimens are removed, they shall be documented and killed by humane techniques, with the carcasses disposed of responsibly in accordance with applicable local and state regulations.

14.8: Health management procedures shall be defined in a health management plan or operating manual, reviewed and approved by a fish health professional, that includes procedures to avoid the introduction of diseases, protocols for water quality management, health monitoring and disease diagnosis techniques.

14.9: The adequacy and duration of live haul transport methods shall be assessed through documented mortality rates during transport.

15. **Food Safety** (All Production Systems)

Chemical and Drug Management

Proactively prohibited antibiotics, drugs and other chemical compounds shall not be used. Other therapeutic agents shall be used as directed on product labels for control of diagnosed diseases or required pond management, and not for prophylactic purposes without veterinary oversight.

Reasons for Standard

Residues of some therapeutic agents can accumulate in fish tissue and present a potential health hazard to humans. Therefore, certain compounds have been proactively prohibited, and residue limits mandated for others. Apart from compromising food safety, failure to comply with such regulations can have serious economic consequences to all involved in the food supply chain.

Improper use of chemicals can harm other organisms that live around farms. Moreover, prolonged use of antibiotics can lead to antibiotic resistance in disease organisms that affect fish and other aquaculture species.

Some farms are built on land previously used for agricultural or other purposes. Pesticides, heavy metals and other chemicals applied during these previous uses can remain in the land's soil and water in small amounts and be taken up by fish in production ponds. Such compounds pose a potential health risk to some elements of the human population. It is also important to ensure that feed and feed ingredients do not contain unsafe levels of these or other contaminants.

Use of certain antifouling materials on farm facilities and containment structures can introduce potential environmental contaminants. The application of certain approved food additives to maintain product quality or appearance during harvest, transport and various stages of post-harvest processing can exceed recommended levels or duration of exposure and impart a residual level in excess of legal food safety limits or product-labeling requirements regarding prior use.

Critical Concerns for Antibiotic Use

- Chloramphenicol and nitrofuran antibiotics are proactively prohibited for use in food production in all countries.
- Other drugs and chemicals, such as antibiotics, malachite green, heavy metals, parasiticides and hormones, may be proactively prohibited in specific countries.

When antibiotics that are not proactively prohibited for use in both the local and importing country are used for therapeutic purposes, antibiotic residue tests shall be carried out after the withdrawal period to ensure regulatory limits on residues are met. Where available, farms may use residue testing data from government surveillance or processing plant preharvest screening programs.

- Records for disease diagnoses should provide supporting evidence to justify cases where therapeutants are used.
- Vaccines and anesthetics, where employed, shall be approved and used only according to manufacturers' instructions.
- Cage farms making use of antifoulants shall obtain all necessary authorizations for their use. Land-based farms shall obtain any required discharge permits from government agencies.

Implementation

When considering site locations for new pond construction, soil samples shall be taken in areas of high-risk contamination, such as low areas where runoff collects, previously used pesticide storage or disposal sites, and washing and loading sites for spray applicators and agricultural aircraft.

In addition to the above-mentioned risks, producers should consider prior use of a site for crops where pesticides have been used and periodically review land use changes in the immediate vicinity that may result in potential increases in environmental contaminants. Surveys of land use or agricultural practice changes can be an internally conducted and documented risk-based analysis. If contamination is suspected, laboratory analysis of the surrounding watershed may be required to verify safety of the water supply.

Any use of approved food additives must involve monitoring the amount and method of application to prevent illegal residues in the edible portion of the products and assure product labeling to designate prior usage.

Good health management focuses on the prevention of disease rather than disease treatment with chemical compounds. The best ways of controlling disease are to avoid stocking diseased fish, adopt fallowing and “all in, all out” stocking procedures at cage and net pen sites, and avoid environmental stress by maintaining good water quality in culture systems. In pond culture, limiting water exchange lessens the risk of disease spreading from one farm to another.

Health management plans shall explain the steps to be taken when a diagnosed disease will be treated with approved chemicals. Lists of approved chemicals can usually be obtained from regulatory authorities, processing plants, health and agricultural agencies, or university fisheries research and extension programs. The BAP program aims to exclude the use of antimicrobials that the World Health Organization (WHO) categorizes as ‘critically important’ to human medicine and sensitivity testing shall accompany any application of antibiotics. To promote awareness and to assess the feasibility of this target, farms shall report usage data for all antimicrobials.

During inspections, auditors shall have access to full records as described above for all applications of drugs, antibiotics and hormones. A sample Traceability Form for use at the pond, tank or cage level is provided in Appendix F.

For Additional Information: WHO (2011) Critically Important Antimicrobials for Human Medicine, 3rd Revision, 32pp.
http://www.who.int/foodsafety/publications/antimicrobials-third/en/

Standards

15.1: The facility shall conduct an assessment of the watershed surrounding the facility to identify any potential watershed contamination risks. This includes monitoring any changes to land use practices over time. Potential watershed contamination risks may involve such things as pesticides, PCBs and heavy metals introduced from nearby industrial or agricultural operations.

15.2: If used, drug treatments shall be based on recommendations and authorizations overseen by a fish health specialist only to treat diagnosed diseases, accompanied by antibiotic sensitivity testing in accordance with instructions on product labels and national regulations.

15.3: Records shall be maintained for every application of drugs and other chemicals that include the date, compound used, reason(s) for use, antibiotic sensitivity test results, dose and harvest date for treated production lots. See the Traceability requirement. Periodic verification testing of the effectiveness of the withdrawal period shall be conducted. The auditor shall collect usage data for all antimicrobials

15.4: Any use of antifouling agents must involve recognized applications of approved materials in a manner that can be monitored for potential contamination of the aquacultured animals.

15.5: Any use of food additives shall involve approved materials and be monitored for time and method of application.

15.6: Antibiotics or chemicals that are proactively prohibited in the producing or importing country shall not be used in feeds, pond additives or any other treatment.

15.7: Statements from fry, fingerling or postlarvae suppliers that declare no proactively prohibited drugs or other chemicals were applied to seed are required.

15.8: For feed suppliers that are not BAP-certified, statements are required attesting to the application of production procedures that exclude proactively prohibited drugs, by-products from same species, unsafe levels of heavy metals and physical or other contaminants.

15.9: Feed, nutritional supplements or pond additives used, manufactured, or prepared on the farm shall include procedures to ensure these substances do not contain unsafe levels of contaminants and contain only substances permitted by the appropriate national authorities.

15.10: Antibiotics, antimicrobials or hormones shall not be used as growth promoters.

15.11 All records specified in Section 15 shall be retained for a period that exceeds both 12 months and the expected shelf life of the aquaculture products.

16. **Food Safety** (All Production Systems)

Microbial Sanitation, Hygiene, Harvest and Transport

Human waste and untreated animal manure shall be prevented from contaminating pond waters. Domestic sewage shall be treated and not contaminate surrounding areas. Aquacultured products shall be harvested and transported to processing plants or other markets in a manner that maintains temperature control and prevents physical damage or contamination.

Reasons for Standard

Sewage contains microorganisms that can be harmful to humans. It can also pollute the water into which it is discharged.

Organic fertilizers have been used widely in pond aquaculture for promoting phytoplankton blooms. These materials include animal manure, grass, by-products from harvesting or processing agricultural products, and fisheries and aquaculture processing plant waste. Trash fish and processing wastes are also used as feed.

There is a possibility of health hazards to humans who consume inadequately cooked fish or crustaceans grown in waters that receive human waste, untreated animal manure or organic fertilizers containing *Salmonella* or other potential food-borne pathogens.

Manure from animal production facilities can be contaminated with drugs added to animal feeds for the prevention or treatment of disease. These substances can potentially pass from the manure to aquatic animals and cause food safety concerns.

The use of uncooked organisms and their by-products or trash fish as feed in fish ponds encourages the spread of fish diseases. Also, this raw food has a high oxygen demand that can deteriorate pond water quality.

Implementation

Housing for owners or workers sometimes is located near production ponds. Sewage from bathrooms, kitchens and other facilities shall be treated in septic tanks. Waste oxidation lagoons are also an acceptable treatment method on large farms. In all cases, raw sewage and runoff from barns and other facilities for holding livestock shall not enter ponds.

Domestic animals other than family pets or watch dogs shall not circulate freely within farms. Livestock is permitted in pastures that serve as pond watersheds, but fences shall be installed to prevent the animals from drinking or wading in ponds.

In the unlikely case that culture water is drawn from water bodies that could receive untreated human waste in the immediate vicinity of the farm, water holding or pretreatment is recommended. Also, some farms can have toilets located near canals or waste treatment systems that discharge or leak into ponds or farm canals. Such situations shall be corrected.

At cage farms, workers often spend long hours on the floating cage platforms. Portable toilets shall be provided, and sanitary procedures for disposal of wastes onshore shall be established.

It is in the best interests of the aquaculture industry to use pelleted or extruded feeds, and in ponds to use chemical fertilizers or organic manure that has been treated to kill potential food-borne pathogens.

Transport

Unclean water and transport containers can cause contamination of fish during transit from ponds to plants or markets. For fish or crustaceans placed on ice or in iced water at the farm, alternating layers of ice and product are recommended to avoid temperature fluctuations.

For Additional Information

CODEX Alimentarius, Code of Practice
for Fish and Fishery Products
ftp://ftp.fao.org/docrep/fao/011/a1553e/a1553e00.pdf

Standards

16.1: Domestic sewage shall be treated and properly disposed of to avoid contamination of surrounding areas (e.g., sewer system, septic system, portable toilet or outhouse).
16.2: Farm animals and domestic pets shall not be allowed to access production ponds.
16.3: Human waste and untreated animal manure shall not be used to fertilize ponds.
16.4: Uncooked organisms and their by-products shall not be used as feed in growout ponds.
16.5: Fish and crustaceans shall be harvested and transported in a manner that maintains temperature control.
16.6: Ice shall be made from water that complies with microbial limits for potable water.
16.7: Equipment and containers used to harvest and transport fish or crustaceans shall be cleaned, sanitized, and be free of lubricants, fuel, metal fragments and other foreign material.
16.8: Non-approved chemicals shall not be applied directly or indirectly to aquacultured products during transport.
16.9: Workers with wounds, open sores or skin infections shall be prohibited from handling harvested products.
16.10: Workers shall be trained in good hygienic practices to ensure they are aware of their roles and responsibilities for protecting aquaculture products from food safety risks such as contamination and deterioration.

17. **Biosecurity** (All Production Systems)

Disease Control

Biosecurity controls shall be in place to prevent the introduction and/or spread of disease agents and disease on the farm. These include regular disease surveillance, sanitation of equipment and personnel, quarantine of diseased animals and controlled movement of personnel and equipment. Farm staff and visitors shall be trained in and apply biosecurity measures.

Reason for Standard

Disease of aquacultured animals is considered by many to be the single largest threat to the growth and stability of the global aquaculture industry. The spread of diseases affecting aquaculture crops has been traced, in many cases, to poor biosecurity at farms.

Mass mortalities occasionally occur at aquaculture farms, and dead carcasses or animal remains can potentially spread disease. When these mortalities occur, facilities shall have a plan to dispose of the carcasses through incineration or sanitary burial.

Implementation

Measures shall be taken to avoid the spread of disease within the BAP farm or to neighboring farms or client farms to which animals are transferred for further growout. For marine cage farms, see also area management requirements, Standard 7.

Proper biosecurity controls shall prevent the introduction or spread of disease agents within the farm. The likely vectors for these risks shall be identified in a detailed written biosecurity plan that identifies specific farm staff responsible for its implementation, includes specific control measures and at a minimum:

- Identifies the likely disease risks for the culture species within its culture region.

- Links the biosecurity plan to the overall farm animal health and welfare plan.
- Requires routine disease surveillance and characterization of the health status of the farm.
- Identifies critical control points such as movement of animals and equipment, and farm access by visitors.
- Establishes active control measures to reduce the risk of introduction and/or spread of disease agents past these control points.
- Establishes hygiene and sanitization protocols and standards for equipment and personnel.
- Establishes quarantine protocols for diseased animals, where possible.
- Prevents the movement of personnel and equipment from diseased areas both within the applicant farm and from neighboring farms.
- Establishes protocols that allow the tracking of animal and equipment movements.
- Establishes a visitor and delivery log.
- Establishes a method of tracking actions taken to reduce the risk of disease and/or control disease if it occurs.

Where movement of equipment and personnel from diseased or suspect areas to other areas is unavoidable, cleaning and sanitization measures shall be employed to disinfect all equipment and personnel prior to entry to non-diseased areas.

Where slaughtering is conducted at the farm, blood water and other effluents generated through processing shall be contained or treated so they do not contaminate the environment or present a biosecurity risk.

Standards

17.1: The applicant shall have in place biosecurity controls that seek to prevent the introduction and spread of disease agents and disease on the farm, including the sanitization of equipment and personnel when disease is suspected or confirmed at the farm site, and these shall be detailed in a biosecurity plan as described in the Implementation guidelines above.

17.2: Farm staff shall be trained in biosecurity procedures and shall, along with all visitors, comply with them.

17.3: A plan for prompt and responsible disposal of excessive mortalities of culture animals by incineration, burial, composting or removal by a competent contractor shall be available for inspection and applied.

17.4: Where slaughtering is conducted at the farm, blood water and other effluents generated through processing shall be contained or treated so they do not contaminate the environment or present a biosecurity risk.

18. Traceability (All Production Systems)

Record-Keeping Requirement

To establish product traceability, the following data shall be recorded for each culture unit and each production cycle:

- culture unit identification number
- unit area or volume
- stocking date
- quantity of fingerlings or postlarvae stocked
- source of fingerlings or postlarvae (hatchery)
- antibiotic and drug use
- sulfite use in shrimp
- herbicide, algicide and other pesticide use
- manufacturer and lot number for each feed used
- harvest date
- harvest quantity
- movement document number (if applicable)
- processing plant(s) or purchaser(s) (identify all if any harvest quantity goes to more than one plant or purchaser)

Reasons for Requirement

Product traceability is a crucial component of the BAP program. It interconnects links in the production chain and allows tracing of each processed lot back to the culture unit and inputs of origin. Food quality and safety analyses by accredited laboratories can also be included. Traceability ultimately assures purchasers that

all steps in the production process were in compliance with environmental, social and food safety standards.

Implementation

Farms may utilize any traceability system that meets the BAP requirements. This can be an online system; the farm's own in-house database, paper records, files and documents; or a combination thereof.

Where paper records, documents or notebooks are used, if possible, the information should also be transferred to computer database files to allow electronic transmission. The original files or paper records shall be kept to allow verification of the electronic data.

The data referenced in BAP's standards on egg, postlarvae and fingerling sources, chemical management, etc., are required for traceability. This information and other pond-, net pen- or cage-related records can be captured on the sample Product Traceability Form in Appendix F. Each form corresponds to the harvest on a particular day from a particular culture unit.

The record-keeping process requires a high degree of care and organization. On large farms, managers could collect initial data for those aquacultured products for which they are responsible. A single clerk or team could then be given the task of collecting the data from managers and transferring it to a computer database. Farm management shall, of course, review the effort at intervals to verify it satisfies BAP requirements.

Product Identity Preservation

To assure the integrity of the Best Aquaculture Practices "star" system, traceability controls must be in place that allow verification of all facilities that contribute to the claim of multiple-star BAP-certified status.

To insure the proper separation and traceability of all farm inputs and outputs, the following components must be in place:

- Farms that purchase all of their shrimp postlarvae, fish fry or fingerlings, and feed from BAP-certified sources shall maintain records of the sources of stocking material and feeds used.
- Farms that purchase stocking material and feed from both BAP- and non-BAP-certified sources shall identify all sources and have adequate systems in place to prevent mixing of BAP and non-BAP production lots.
- To enable mass balance verification of multiple-star products, certified farms shall maintain a list, including harvest dates and volumes, of the processors to which they sell or deliver products.
- The number of backward and forward trace exercises conducted by the auditor will be determined by farm volume.

BAP Logo Use

Use of the Best Aquaculture Practices logo, a registered trademark of the Global Aquaculture Alliance, for any purpose shall be approved by BAP in advance and used in compliance with the BAP trademark usage agreement.

Customer Complaints

The applicant must prepare and implement an effective system for the management of complaints and complaint data to control and correct shortcomings related to its products' compliance with the BAP standards.

Standards

18.1: The facility shall operate an effective record-keeping system that provides timely, organized, accurate entries, performed and overseen by a designated trained person or team responsible for collecting the data, ensuring it is complete and accurate, and that traceability requirements are met.

18.2: The facility shall keep complete and accurate records for each culture unit and production cycle, including the culture unit identification number, unit area and volume, species stocked and, if applicable, species specifications such as triploid or GMO.

18.3: The facility shall keep complete and accurate records concerning any antibiotic or other drug use at both the hatchery and the farm.

18.4: Complete and accurate records shall be maintained on the use of sulfites or other approved food-processing aids/additives in shrimp, as well as the use of herbicides, algicides and other pesticides.

18.5: Complete and accurate records regarding manufacturer and lot numbers for each feed used shall be maintained.
18.6: The facility shall maintain complete and accurate records of the sources and numbers of postlarvae or fingerlings stocked, stocking dates and all feeds used for each culture unit.
18.7: Complete and accurate records regarding the harvest date, harvest quantity, movement document number (if applicable) and processing plant(s) or purchaser(s) shall be maintained. If product lots are destined to more than one plant or purchaser, each lot shall be separately identified.
18.8: In order to use the BAP logo, facilities shall have such use approved and registered in advance with BAP Management.
18.9: The facility shall keep records of any customer complaints related to its products' compliance with the BAP standards.
18.10: The facility shall keep records of investigations of such complaints and actions taken to address/correct them.

19. Shrimp-Specific Standards

Environment

Effluent Management

Water exchange shall be limited to reduce overall environmental impacts.

Food Safety

Harvest and Transport

Sulfites shall be handled responsibly to control risks to consumers and the environment.
If shrimp are treated on farm at harvest with sulfites, the protocol for this practice shall be provided. Because used sulfite solutions can cause localized dissolved-oxygen depletion in discharge water bodies, these solutions shall be held in a tank or small pond until the sulfites have oxidized completely, typically for at least 48 hours. Mechanical aeration accelerates the oxidation.

When the dissolved-oxygen concentration of the solution reaches 4 or 5 mg/L, the sulfite has been completely converted to sulfate. Example: Sulfite solution can be treated with 0.4 kg lime/L to neutralize acidity before final release into natural waters.

Standards

19.1: The mean water exchange rate shall not exceed 10% per day (i.e., on an annual basis, 36 x total pond volume). This limit does not apply to shrimp ponds in deserts.
19.2: If used, sulfites shall be applied in a manner that will yield a tissue concentration within regulatory limits.
19.3: Sulfite solutions shall be deactivated or neutralized, for example by 48-hour retention, prior to release into natural water bodies.

20. Tilapia-Specific Standards

Environment

Use of Hormones for Producing All-Male Fry
When hormones are used to produce all-male fry, records of hormone applications shall be maintained. Employees who work with methyl testosterone shall be instructed to wear protective clothing and masks with air filters. The facility shall avoid releasing methyl testosterone-treated water directly into the environment.

Implementation

Analyses of tilapia fillets have shown that the use of methyl testosterone or related hormones for producing all-male fry has not resulted in residues of testosterone higher than those naturally found in control fish. Nevertheless, producers are encouraged to use other methods of obtaining all-male fry. To minimize any environmental impacts, onsite biofiltration/bioremediation, such as a trickling filter or constructed wetlands, can be used.

Standard

20.1: If hormones are used during fry production, workers shall be trained in the handling of hormones and wear protective clothing and masks with air filters.

20.2: The facility shall avoid releasing methyl testosterone-treated water directly into the environment, for example by retaining for a minimum of 48 hours.

20.3: Any antibiotic usage shall not exceed 3 treatments per on-growing cycle, where a treatment comprises a single course of antibiotics given to address a specific disease issue over a prescribed period.

20.4: Antimicrobials that are critically important for human medicine* shall not be used.

20.5: In watersheds where Tilapia species are not indigenous and not established**, tilapia farms shall have at least two independent containment systems to prevent escapes. Additionally, they shall only stock monosex juveniles (minimum 99% phenotypically monosex).

*Critically Important Antimicrobials for Human Medicine, 3rd Revision World Health Organization, 2011 http://www/who.int/foodsafety/publications/antimicrobials-third/en

** A non-indigenous species is considered established if it has a reproducing population within the watershed, as inferred from multiple discoveries of adult and juvenile life stages over at least two consecutive years. Given that successful establishment may require multiple introductions, species are not considered established if their records of discoveries are based on only one or a few non-reproducing individuals whose occurrence may reflect merely transient species or unsuccessful invasions. (adapted from National Oceanic and Atmospheric Administration).

Appendix A

BAP Effluent Water Quality Criteria – All Pond Farms

Variable (units)	Initial Value	Final (after 5 years)	Collection Frequency
pH (standard pH units)	6.0-9.5	6.0-9.0	Monthly
Total suspended solids (mg/L)	50 or less	25 or less	Quarterly
Soluble phosphorus (mg/L)	0.5 or less	0.3 or less	Monthly
Total ammonia nitrogen (mg/L)	5 or less	3 or less	Monthly
5-day biochemical oxygen demand (mg/L)	50 or less	30 or less	Quarterly
Dissolved oxygen (mg/L)	4 or more	5 or more	Monthly
Chloride Water with less than 1 ppt salinity, specific conductance below 1,500 mmhos/cm or chloride less than 550 mg/L is considered fresh.	No discharge above 800 mg/L chloride into freshwater	No discharge above 550 mg/L chloride into freshwater	Monthly

Appendix B

Sample Effluent Monitoring Form – pH and Dissolved Oxygen

Date (day/month/ year)	pH (standard units) Morning	Evening	Average	Dissolved Oxygen (mg/L) Morning	Evening	Average	No. Units Harvested
____/01/____							
____/02/____							
____/03/____							
____/04/____							
____/05/____							
____/06/____							
____/07/____							
____/08/____							
____/09/____							
____/10/____							
____/11/____							
____/12/____							
Annual Average							

Sample Effluent Monitoring Form – Soluble Phosphorus, Total Ammonia Nitrogen, Chloride

Date (day/month/year)	Soluble Phosphorus (mg/L)	Total Ammonia Nitrogen (mg/L)	Chloride (mg/L)	Number of Units Harvested
____/01/____				
____/02/____				
____/03/____				
____/04/____				
____/05/____				
____/06/____				
____/07/____				
____/08/____				
____/09/____				
____/10/____				
____/11/____				
____/12/____				
Annual Average				

Sample Effluent Monitoring Form – Total Suspended Solids, 5-Day Biochemical Oxygen Demand

Quarter	Date (day/month/ year)	Total Suspended Solids (mg/L)	5-Day Biochemical Oxygen Demand (mg/L)	Number of Units Harvested
1				
2				
3				
4				
Annual Average				

Appendix C

Calculation of Annual Effluent Volume

An estimation of annual effluent volume shall be determined using one of the following equations.

Farm Discharge Calculation

Equation 1 – Pump Discharge Method

Farm discharge (m^3/yr) = Pump discharge (m^3/min) x
Average time of pump operation (hr/day) x
60 min/hr x 365 days/yr

Equation 2 – Water Exchange Method

Farm discharge in m^3/yr =
[Volume of ponds in m^3 x Number of crops/yr] +
[Volume of ponds in m^3 x Average daily water exchange rate as fraction of pond volume x Crop in days x Number of crops/yr]

Equation 3 – Watershed Method

Effluent = (Water added + Precipitation + Runoff) –
(Seepage + Evaporation) + (Farm volume, day 1 –
Farm volume, day 365)

The terms of this equation can be estimated as follows:

Water added (m^3) = Pump capacity (m^3/hr) x
Pump operation (hr/yr) or other appropriate method

Precipitation (m^3) = Annual precipitation (m) x
Farm water surface area (m^2)

Runoff (m^3) = Annual precipitation (m) x
Watershed area (m^2) × 0.25

Seepage (m^3) = Farm water surface area (m^2) x 0.55 m/yr

Evaporation (m^3) = Class A pan evaporation (m/yr) x
0.8 x Farm water surface area (m^2)

Farm volume = [Average depth of ponds (m) –
Average distance of water level below overflow structure (m)] x Farm water surface area (m^2)

Additional Data

The BAP program will use data provided by facilities' application forms to calculate:

- an annual water use index, determined as described below
- annual load indices for total suspended solids, soluble phosphorus, total ammonia nitrogen and five-day biochemical oxygen demand, determined as described below.

Pooled, anonymous data for loads and indices will be used as the basis for setting metric standards by June 2015.

Annual Effluent Loads

Loads of water quality variables are more indicative of the pollution potential of farm effluents than separate measurements of concentrations of these variables and effluent volume. After the first year of effluent monitoring, annual loads for total suspended solids, soluble phosphorus, total ammonia nitrogen and five-day biochemical oxygen demand shall be calculated as follows:

Equation 4

Load of variable (kg/yr) = Farm discharge (m^3/yr) x
[Mean annual variable concentration in effluent –
mean annual variable concentration in source water
(mg/L, same as g/m^3)] x 10^{-3} kg/g

Water Use and Load Indices

While not a recommended practice, it is possible to comply with numerical water quality criteria by increasing the amount of water passing through a farm to dilute the concentrations of tested variables. Compliance with the water use index assures that farms meet water quality criteria through good management rather than diluting effluents before they are released into natural waters.

After the first year of effluent monitoring, water use and load indices shall be estimated using the following equations.

Equation 5

Water use index (m^3/kg fish or shrimp) =
Annual effluent volume (m^3) ÷ Annual fish production (kg)

Equation 6

Load index (kg variable/MT fish or shrimp) =
Annual load of variable (kg/yr) ÷ Annual fish production (MT/yr)

Example: Water Use, Load Indices
For Annual Effluent Estimated
By Pond Volume-Water Exchange Method

A farm has 100 ha of ponds that average 1 m deep, with average water exchange of 2.5% pond volume/day. There are 2.3 crops/year, and the average length of each crop is 120 days. The source water of the farm contains an average of 10 mg/L total suspended solids (TSS), 0.03 mg/L soluble phosphorus (S.P.), 0.15 mg/L total ammonia nitrogen (TAN) and 1.5 mg/L biochemical oxygen demand (BOD).

The farm effluent contains an average of 45 mg/L TSS, 0.19 mg/L S.P., 0.87 mg/L TAN and 9.6 mg/L BOD. Shrimp/ fish production for the past year was 230,000 kg (230 MT).

Calculations

Pond volume = 100 ha x 10,000 m^2/ha x 1 m =
1,000,000 m^3

Annual effluent volume = [1,000,000 m^3/crop x
2.3 crops/yr] + [1,000,000 m^3 x 0.025 pond volume/day x
120 days/crop x 2.3 crops/yr] = 9,200,000 m^3/yr

TSS load = (45 – 10 g/m^3)(9,200,000 m^3/yr)10^{-3} = 322,000 kg/yr

S.P. load = (0.19 – 0.03 g/m^3)(9,200,000 m^3/yr)10^{-3} = 1,472 kg/yr

TAN load = (0.87 – 0.15 g/m^3)(9,200,000 m^3/yr)10^{-3} = 6,624 kg/yr

BOD load = (9.6 – 1.5 g/m^3)(9,200,000 m^3/yr)10^{-3} = 74,520 kg/yr

Water use index = (9,2000,000 m^3/yr) /
(230,000 kg shrimp or fish/yr) = 40 m^3/kg shrimp/fish

TSS index = (322,000 kg/yr) / (230 MT shrimp or fish) = 1,400 kg TSS/MT shrimp/fish

S.P. index = (1,472 kg/yr) / (230 MT shrimp or fish) =
6.4 kg S.P./MT shrimp/fish

TAN index = (6,624 kg/yr) / (230 MT shrimp or fish) = 28.8 kg TAN/MT shrimp/fish

BOD index = (74,520 kg/yr) / (230 MT shrimp or fish)= 324 kg BOD/MT shrimp/fish

Example: Water Use, Load Indices
For Annual Effluent Estimated
By Pump Operation Method

A farm has two pumps that discharge a combined volume
of 136 m^3/min. The pumps operate an average of 8 hr/day. The source water of the farm contains an average 10 mg/L total suspended solids (TSS), 0.03 mg/L soluble phosphorus (S.P.), 0.15 mg/L total ammonia nitrogen (TAN) and 1.5 mg/L biochemical oxygen demand (BOD). The farm effluent contains 91 mg/L total suspended solids, 0.23 mg/L soluble phosphorus, 1.20 mg/L total ammonia nitrogen and 12.7 mg/L biochemical oxygen demand. Fish production during the past year was 378,000 kg (378 MT).

Calculations
Annual effluent volume = 136 m^3/min x 60 min/hr x
8 hr/day x 365 days/yr = 23,827,200 m^3/yr

TSS load = (23,827,200 m^3/yr)(91 – 10g/m^3)10^{-3} = 1,930,000 kg/yr

S.P. load = (23,827,200 m^3/yr)(0.23 – 0.03 g/m^3)10^{-3} = 4,765 kg/yr

TAN load = (23,827,200 m^3/yr)(1.20 – 0.15 g/m^3)10^{-3} = 25,018 kg/yr

BOD load = (23,827,200 m^3/yr)(12.7 – 1.5 g/m^3)10^{-3} = 266,865 kg/yr

Water use index = (23,827.200 m^3/yr) /
(378,000 kg shrimp or fish/yr) = 63.0 m^3/kg shrimp/fish

TSS index = (1,930,000 kg/yr) / 378 MT shrimp or fish) = 5,106 kg TSS/MT shrimp/fish

S.P. index = (4,765 kg/yr) / (378 MT shrimp or fish) =
12.6 kg S.P./MT shrimp/fish

TAN index = (25,018 kg/yr) / (378 MT shrimp or fish) = 66.2 kg TAN/MT shrimp/fish

BOD index = (266,865 kg/yr) / (378 MT shrimp or fish) = 706 kg BOD/MT shrimp/fish

TAN index = (6,624 kg/yr) / (230 MT shrimp or fish) =
28.8 kg TAN/MT shrimp/fish

BOD index = (74,520 kg/yr) / (230 MT shrimp or fish) =
324 kg BOD/MT shrimp/fish

Appendix D

BAP Water Quality Monitoring
Cages and Net Pens in Lakes and Reservoirs

Variable	Sample Depth	Collection Frequency
Temperature	Vertical profile, 2-m	Monthly
Dissolved oxygen	intervals	Monthly
pH	Vertical profile, 2-m	Quarterly
Chlorophyll a	intervals	Quarterly
5-day biochemical oxygen demand	Equal to cage mid-depth	Quarterly
Secchi disk visibility	Equal to cage mid-depth	Weekly
Soluble phosphorus	Equal to cage mid-depth	Quarterly
Total ammonia nitrogen	Not applicable	Quarterly
Phytoplankton abundance and	Equal to cage mid-depth	Quarterly
species	Equal to cage mid-depth	
	Equal to cage mid-depth	

Appendix E

Load Indices for Cages, Net Pens

Water use indices cannot be applied to cages and pens. The loads of nitrogen and phosphorus imposed by cages and net pens on receiving water bodies can be estimated as follows:

Equation 1

Nitrogen load (kg/yr) = [Total feed (kg) x
Nitrogen (% in feed) ÷ 100] –
[Harvested fish* (kg) x Nitrogen (% in fish) ÷ 100]

Equation 2

Phosphorus load (kg/yr) = [Total feed (kg) x
Nitrogen (% in feed) ÷ 100] –
[Harvested fish* (kg) x Nitrogen (% in fish) ÷ 100]

*In Equations 1 and 2, the mass of harvested fish can also include the mass of any dead fish removed from the cages before harvest.

Equation 3

Nitrogen load index (kg/MT fish) = Nitrogen load (kg/yr) ÷
Fish production (MT/yr)

Equation 4

Phosphorus load index (kg/MT fish) = Phosphorus load (kg/yr) ÷ Fish production (MT/yr)

The percentage nitrogen in feed is percentage crude protein divided by 6.25. The phosphorus content in tilapia feed is about 1%, but the exact value should be measured or obtained from the feed manufacturer. For example, live tilapia typically contain 2.2% nitrogen and 0.72% phosphorus.

Appendix F

Sample Product Traceability Form

Farm Name	Pond or Cage Number Pond Area (ha)
POSTLARVAE OR FINGERLINGS Stocking Date	**FEED** Feed Type
Stocking Quantity Species	Manufacturer
Any Species Specifications (e.g., triploid, G.M.)	Lot Number(s)
Hatchery BAP No.	
Confirmation: No Use of Proactively Prohibited Chemicals Yes No	Confirmation: No Use of Proactively Prohibited Chemicals Yes No
THERAPEUTIC DRUG USE Compound 1	**PESTICIDE USE** Compound 1
Disease Treated	Condition Treated
Application Rate	Application Rate
Application Period	Application Period
Compound 2	Compound 2
Disease Treated	Condition Treated
Application Rate	Application Rate
Application Period	Application Period
HARVEST Harvest Date	Harvest Purchaser Name/ Address
Harvest Quantity (kg)	

BAP FCFS Standard - Issue 2.4 Change-Log (23-May-2017)

Approved (SOC May 2017)

20.5 In watersheds where Tilapia species are not indigenous and not established, tilapia farms shall have at least two independent containment systems to prevent escapes. Additionally, they shall only stock monosex juveniles(minimum 99% phenotypically monosex).

Added social accountability to descriptions of Critical and major NC's.

ROBIN STUART (Manager of Aquaculture Operations)

[redacted], Canada

Fax [redacted]
Home Phone [redacted] Cell [redacted]
Email: [redacted]

P E R S O N A L

Mr. Stuart is one of the aquaculture industry pioneers in Canada with a wealth of experience in many aspects of the industry including management, research and development, technical assistance, environmental management, and practical hands on experience in all aspects of aquaculture activities. He has managed and operated aquaculture-processing facilities for both finfish and shellfish. As an entrepreneur businessman he is well versed in all aspects of farm management including marketing and business farm management.

A wide range of experience in both finfish and shellfish culture brings a multiplicity of experiences useful for aquaculture development elsewhere.

Mr. Stuart has worked for both the industry and the Provincial and Federal Fisheries departments. He is well versed in the regulatory environment and has chaired committees involving all the government regulators on aspects of environmental management for aquaculture.

He is one of the founders of the Aquaculture Association of Nova Scotia and a past President on three occasions. This has kept him in touch of the industry across the country and has been asked to represent industry at several National and International conferences.

As a professional diver with over 8000 logged dive hours Mr. Stuart engages working with a passion that only comes from a sincere love and respect for the ocean and its inhabitants.

A down to earth approach with a real sense of the practical combined with good communication skills enables Mr. Stuart to get things done by utilizing the skills of those around him combined with an indomitable spirit and persistence.

E D U C A T I O N

Dalhousie University, B.Sc.(Marine Biology)

E M P L O Y M E N T

Robin Stuart Consulting

Do Environmental Management Plan for mussel farms in St Ann's Harbour since 2002(17 years) as required by federal and provincial governments.

Cape Breton University

Work on oyster growout project to determine environmental effects on MSX parasite in oysters.

Waycobah First Nation, Aug.2015 til present

Operations manager for trout farm in Whycocomagh Bay.

Paqtnkek First Nations, 2013,2014,2015,til present

Do stock assessment of Pomquet Harbour for oysters. Provide training for oyster seed collection both classroom and field. Oversee oyster grow-out operation and provide technical assistance

Coldwater Fisheries Inc. May/11 to August/14
Operations Manager for Cold Water Fisheries Incorporated -Cape Breton Operations for trout cultivation at several sites including St Peters Hatchery, Atoqwa'su Farms a joint venture with Waycobah First Nations, and several other sites.

5M Aqua Farms Ltd. October/10 to May/11
Conduct hydrographic data collection and mussel performance compared to other locations and assist to restructure company to be more competitive

5M Aqua Farms Ltd. October/09 to October/10
Hired as a consultant to organize and oversee a project with a team of scientist from 3 universities to study environmental impact of a mussel farm on St Ann's Harbour, the largest farm in Eastern Canada..Topics such as develop a working carrying capacity model, assess the impact on benthic invertebrates, and migratory wild pelagic. Identify the mortality problem encountered with farm mussel stocks with solution. Identify performance of mussels both meat and shell growth year round at different locations in the harbour to improve farm management.

Cape Breton University, June/09 to October/09
Conducted detailed study of Sydney Harbour under the direction of Dr. Bruce Hatcher to map the marine benthic communities in Sydney Harbour to provide an aid for DFO to determine the compensation package (HADD) for the dredging of the harbour and construction of the new container pier in Point Edward. The study involved underwater video transects and taxonomic identification of all species by both number and distribution.

PEI Mussel Farms Ltd., May/06 to March/09
Hired under contract develop and implement an environmental monitoring program for the companies operations in both PEI and Nova Scotia. The development of a web site as a tool to provide both up-to-date environmental data but also production performance data for all leases. Due to challenging economic environment due to lower profit margins and an increasingly competitive global market employment ended on an employee basis.

Cape Breton University, February /06 to present
Research Associate. Preparing historical science studies on Bras d' Or Lakes in a usable electronic format to enable application in future research on the development of the oyster industry of Cape Breton.

Ocean Stuarts Consulting Services October/01 to January/06
Sole proprietor. Design Environmental Management Plan for one of the largest mussel farm in Canada. Conduct MSX R&D program winter 2003. Design Environmental Monitoring Program for NS finfish & shellfish aquaculture industry. Stock assessment survey for public oyster beds in Bras d' Or Lakes and to enable a relay fishery. Teach shellfish spat prediction technology to group of shellfish farms to enable them self-sufficiency. Perform various liaison functions with fed and provincial government levels for aquaculture companies.

Apaqtukewaq Fisheries, Chapel Island May-June 2001
Identify oyster leases and submit applications including business plans for each. May 2001

Teaching Shellfish Culture January-May 2001
Teach shellfish culture to 42 Native students from Eskasoni First Nation. Designed the curriculum, which covered a 16-week time frame. Job ended April 13.

Contract Diving Services
Provide diving services for three fish farms for a four-month period. Diving involved underwater log hours of over 500 hours in this period. Performed diving environmental assessment work for large mussel farm. Has logged over 7500 over dive hours.

Nova Scotia Dept. Fisheries & Aquaculture, Biologist May 2000
Undertook a contract to work in close liaison with all regulatory agencies and industry to design environmental assessment guidelines to meet the CEA process for both finfish and shellfish industries. The job involved chairing a committee of all federal and provincial departments with an input on environmental assessments. The job ended in September 2000.

Biologist-Manager, Saddle Island Fisheries Ltd. 1995 to Nov, 1999
Identified and set up year round salmonid net pen farm. Responsible for all aspects from site selection to installation, hiring, operations including growing to harvesting, processing over one million pounds H&G salmon. The farm was purchased by another company & still operates today

Senior Manager-Biologist Eskasoni Fisheries Ltd. 1993-95
Involved in all aspects of management from site selection, operating plan development, hiring, and operations of three net pen sites in Bras d' Or Lakes, C.B Triploid trout and Atlantic salmon were grown . This was the largest salmon farm in Nova Scotia at the time.

Manager & Co-Founder Golden Eagle Fisheries Ltd. **1990-93**
Managed cage operations of several sites growing trout and Atlantic salmon.

Teacher Aquaculture Training Course **1990**
Designed the modules and taught 24 Native students in all aspects of salmonid aquaculture in conjunction with the NS Fisheries Training School over nine months.

Consultant Aboriginal Fisheries Development **1989**
Assisted in the creation of an Aboriginal Fisheries development plan for Atlantic Canada under the direction of the Eskasoni Band.

Consultant **1988-89**
Identified salmonid overwintering sites Cape Breton.
Environmental Impact study with CEF Consultants involving diving, electro-seining, etc.
Consultant for Nova Aqua to discover reason for high salmonid mortalities on land based marine tank farm. Report enabled insurance coverage.
Reports on sea lice life history and control methods in conjunction with Atlantic Vet College and National Research Council
Organized International Workshop on Sea Lice at Gaelic College, St. Anne's, CB.

President -Stuart Salmon Farms Ltd**. 1986-90**
Formed company complete with shareholders and operated until sea lice infestation rendered continuing uneconomic**.**

Research Director, Cape Breton Marine Farming Ltd**. 1985-86**
Directed a crew of technicians and biologists on studies on Atlantic salmon, speckled trout reared in seawater, rainbow trout, and striped bass at several locations on Cape Breton Island. First to rear large rainbows in seawater in Canada
Vaccination techniques, feed trials, density studies, etc. First to inject Vibrio vaccine on commercial scale in Canada**.**

PROFESSIONAL AFFILIATIONS

1. Founding member Aquaculture Association of Nova Scotia,
2. President Cape Breton Oystermen's Association,
3. Writer Atlantic Fish Farming
4. Maritime Oyster Development Committee
5. President Aquaculture Association of Nova Scotia, 1986,1994,1995
6. Member Aquaculture Association of Canada

7. Member World Aquaculture Association
8. Executive & Board member Aquaculture Association of Nova Scotia 1996,1997,2002 to 2018
9. Member Regional Aquaculture Development Committee East St. Margaret's Bay, 1999
10. Board Member, Eastern Nova Scotia Oyster Management Board, 2004-2009
11. CEPI advisor on aquaculture

SPECIALIZED TRAINING

Professional Scuba Diver (RCN Clearance Diver, NASDS),1969, 8300 logged dive hrs
Small Business Management, University College of Cape Breton
Christopher Leadership Course
Lotus 123,Computer Tutor,
Marine Emergency Duties A1
St.John's Ambulance First Aid
Small boat safety course
Revised Quality Management Program, HACCP,1998

CASUAL INTERESTS

Long distance running, President Baddeck Runners Club 2005-2019
Scuba Diver
Rugby, Soccer Coach
Hiking
Community Volunteer Services, several awards

Winston Patles

(Finfish Aquaculture Manager)

[redacted]
B0E 3M0
Address
[redacted]

Experience

We'koqma'q First Nation
2016-2019 Manager, Finfish Aquaculture Operation
2015-2016 Supervisor, Finfish Aquaculture Operation

Cold Water Fisheries Inc.
2011-2014 Labourer, Supervisor, Finfish Aquaculture Operation

Leon Silliboy
2009-2011 Plumber

Georgia Pacific
2005-2007 Truck Driver

Bras D'Or Fisheries
2000-2001 Finfish cage technician for marine finfish farm

Scotia Rainbow
1995-2000 Maintenance, diving, feeder for marine finfish farm

Eskasoni Fisheries
1993-1995 Maintenance, equipment mechanic, diving, feeder for marine finfish farm

Golden Eagle Fisheries Ltd.
1990-1993 Night watchman, cleaner, maintenance, diving for marine finfish farm

Education

2008-2009 Plumbing (NSCC)
2007 GED Diploma

Gordon MacLean

(Maintenance Manager)



Experience

Maintenance Manager (2018-present)

We'koqma'q First Nation

- Maintaining, inspecting and repairing equipment for processing finfish
- Maintaining, inspecting and repairing mechanical and hydraulic equipment for marine finfish farm

Journeyman Millwright - Field mechanic (2015-2018)

Ceda - DFM

- Maintaining and repairing diesel engines and centrifugal pumps
- Welding,
- pipe fitting
- Oil sampling analysis
- Laser alignments
- Preventative Maintenance
- Troubleshooting , analysis of pump failure
- Using past experiences to repair pumps in a professional and timely manner.

Journeyman Millwright; Relief Maintenance Supervisor (2010-2011; 2015)

New Page/Port Hawkesbury Paper Port Hawkesbury, NS

- Maintaining and repairing paper machines
- Executing laser alignments
- Welding, cutting and pipe-fitting on a variety of machinery and equipment
- Troubleshooting paper machines, pulp refiners, motors, pumps etc.
- Installing and removing of all bearings and mechanical seals
- Performing preventative and reactive maintenance on all machinery

Journeyman Millwright (2014)

NewStar Terminals Port Hawkesbury, NS

- Centrifugal pump repairs
- Repairs, overhauls and preventative maintenance
- Oil and gas ship loading arms repair and maintenance
- Valve repair and hydro testing
- Pipefitting and hy-torquing

Journeyman Millwright (2012-2014)

CEDA, Environmental Fluid Solutions Fort McMurray, AB

- Maintaining and repairing Diesel engines and many types of pumps
- Executing laser alignments
- Troubleshooting mechanical, electrical, hydraulic, pneumatic systems
- Welding, fabricating, pipe fitting
- Planning jobs, looking at prints, pre-job assessment and final job documentation
- Keeping all dewatering equipment running or in running order for Shell
- Building and maintaining Dredges and Barges

Journeyman Millwright (2011)

J.V Driver, MNU Suncor Fort McMurray, AB

- Pipefitting along with a pipefitter
- Carry out walk-downs
- Performed hydro-prep piping for hydro-testing
- Reading blueprints

Journeyman Millwright (2008-2010; 2012)

Ocean Nutrition Canada Mulgrave, NS

- Maintained and installed various vacuum pumps
- Welded, pipe-fitted and performed vibration analysis on vacuum and pumping equipment
- Dismantled and rebuilt many types of pumps
- Troubleshooting vacuum systems and multiple tank agitators/gearboxes

Millwright (2003-2008)
J.D. Irving Ltd. Sproule Lumber Bible Hill, NS

- Maintained/repaired all machines and equipment in a modern high production sawmill
- Welded, cut and fabricated components
- Removed and installed equipment and troubleshoot as required
  - Operated industrial equipment like forklift **s** , zoom booms and scissor lifts and ran mill equipment for testing

Education

UNIVERSITY OF CAPE BRETON – Apprenticeship Training
Sydney, Nova Scotia (Graduated in 2005)

NSCC-PICTOU CAMPUS – Heavy Duty Equipment Repair Certificate
Stellarton, Nova Scotia (Graduated in 1999)

INVERNESS JUNIOR/SENIOR HIGHSCHOOL- Academic Diploma
Inverness, Nova Scotia (Graduated in 1997)

Additional Courses and Training

CSTS, OSSA, WHIMIS, OH& S, F4 Welding Certificate, Zoom Boom Lift, Scissor Lift, Confined Space Entry, Heat Stress, Indoor Cranes, Fall Protection, Hotwork, Lockout, Scaffold Training

Appendix D: MEOPAR- Funded Sediment Modelling for Whycocomagh Bay

The below was extracted from the proposal by C. Algar et al., with permission:

Objective 1: Modelling and Field studies: The goal of this phase of the proposal is to develop and parameterize a numerical diagenetic model that can capture carbon, oxygen, and sulfur dynamics in the sediments of Whycocomagh Bay, both with and without the influence of fish cages. The model will be used to assess the impact of aquaculture upon the biogeochemical processes of the Whycocomagh Bay benthic ecosystem and investigate how changes in fish-rearing practices, such as increased stocking levels, may alter this biogeochemistry.

The model will be based on a previous model that was developed by an undergraduate honours student (A. Chan) in my research group. It is a multicomponent diagenetic reactive-transport model (*10–12*). The model describes the entire suit of metabolic processes observed in the sediment redox cascade (*13*) (aerobic metabolism, nitrate reduction, iron and manganese oxide reduction, sulfate reduction and methanogenesis), along with the corresponding secondary metabolisms (e.g. nitrification, sulfide oxidation, methane oxidation), abiotic reactions such as sulfide mineral formation, and key transport processes (sedimentation, diffusion, bioturbation, and bioirrigation).

To parameterize and ground-truth the model, a 2 year field study will be carried out aimed at quantifying porewater chemistry and fluxes across the sediment-water interface. To do this, sediment cores will be collected seasonally (minimum of three times per year), from immediately after ice break up in the spring (~April) until freeze up in the fall (~December/January). Sediment cores will be collected immediately under fish cages, and at similar water depths in a "pristine" sediment far from the influence of the aquaculture cage (the location of the pristine site will be based on the guidelines outlined Nova Scotia's aquaculture EMP (*14*)), and at the deepest depth (~48 m) in the anoxic zone in the center of the Bay. At each location six sediment cores will be collected. Three will be used to conduct flux incubations to determine oxygen (when O_2 is present in the bottom water), sulfide, and nutrient fluxes across the sediment water interface. The overlying water in each core will be spiked with bromide to determine bioirrigation rates. The remaining three cores will be used to determine porewater and solid phase chemistry (CHN and organic mater content). Porewaters will be extracted using Rhizon samplers and analysis for nutrients (NO_3^-, NH_4^+, and PO_4^{2-}) and free sulfide. Microprofiling (UNISENSE microsensors) for O_2, pH, and H_2S will be conducted to determine their concentration across the sediment water interphase at sub-millimeter resolution.

Results from the field campaign and diagenetic modeling will be combined with data collected by collaborator Hatcher, and partners NS-DFA and CMAR who have been monitoring physical (T,S, current velocities) and chemical (O_2, nutrients) conditions in the waters of Whycocomagh Bay, to produce carrying capacity estimates for the bay that predict what level of fish farming it can sustainably support. Carrying capacity estimates will be developed with collaborator Filgueira, who has used this approach for shellfish aquaculture sites (*15–17*).

DATA REPORT 6336: Whycocomagh Bay, NS

Prepared 14 February 2019
by J. Churchill, Data Manager

CONTENTS OF REPORT

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- 1.1 Data List
- 1.2 Restrictions
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- 4.1 Fauna
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5.0 Rare Species within 100 km
- 5.1 Source Bibliography



Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) 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
WhycocomaghBNS_6336ob xls	All Rare and legally protected *Flora and Fauna* in your study area
WhycocomaghBNS_6336ob100km xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
WhycocomaghBNS_6336ma xls	All *Managed Areas* in your study area
WhycocomaghBNS_6336sa.xls	All *Significant Natural Areas* in your study area
WhycocomaghBNS_6336ff xls	Rare and common *Freshwater Fish* in your study area (DFO database)

1.2 RESTRICTIONS

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

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

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

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

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney, Senior Scientist, Executive Director
Tel: (506) 364-2658
sean.blaney@accdc.ca

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

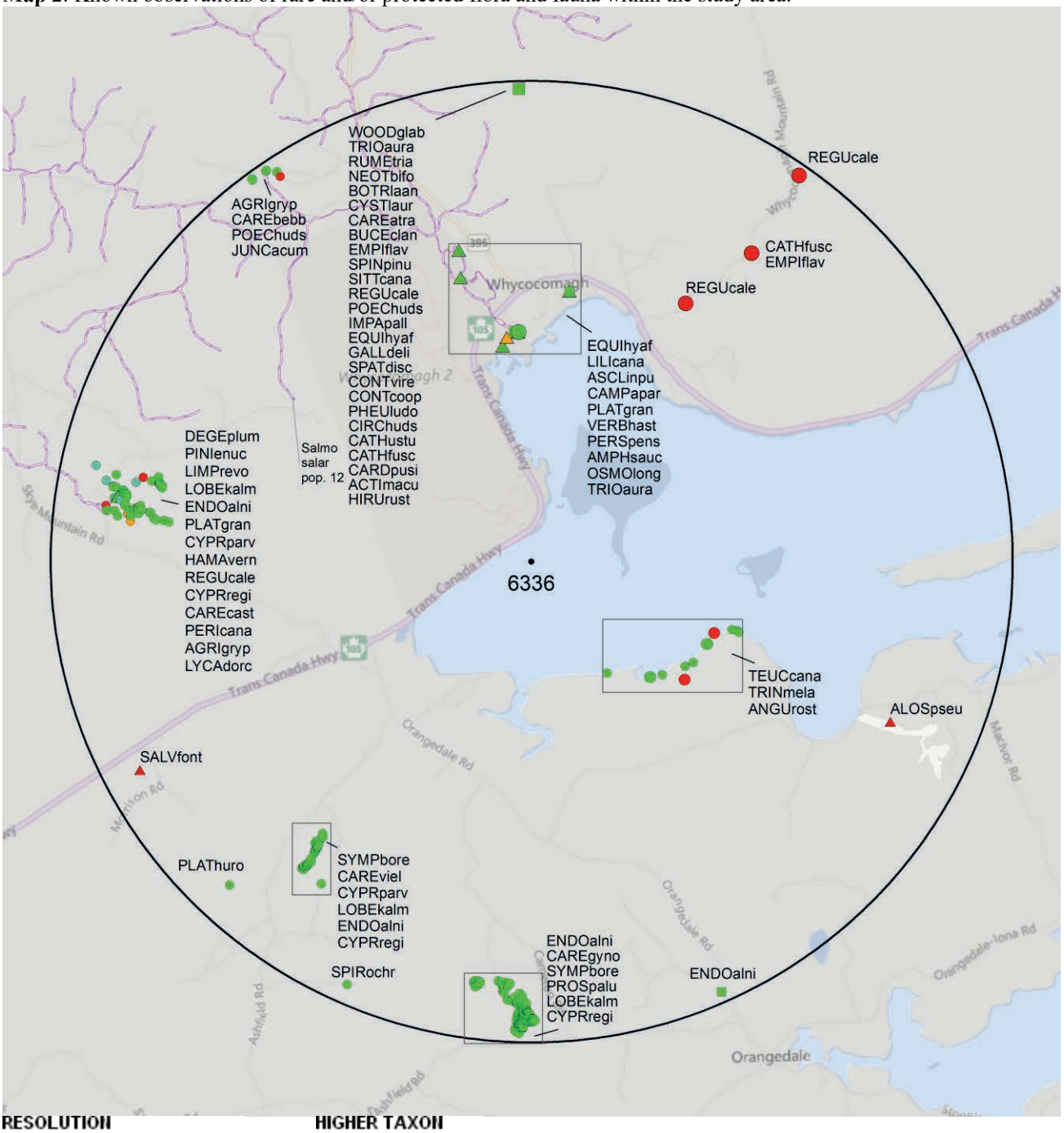
2.1 FLORA

The study area contains 257 records of 31 vascular, 6 records of 3 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 39 records of 23 vertebrate, 3 records of 2 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

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



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

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

3.0 SPECIAL AREAS

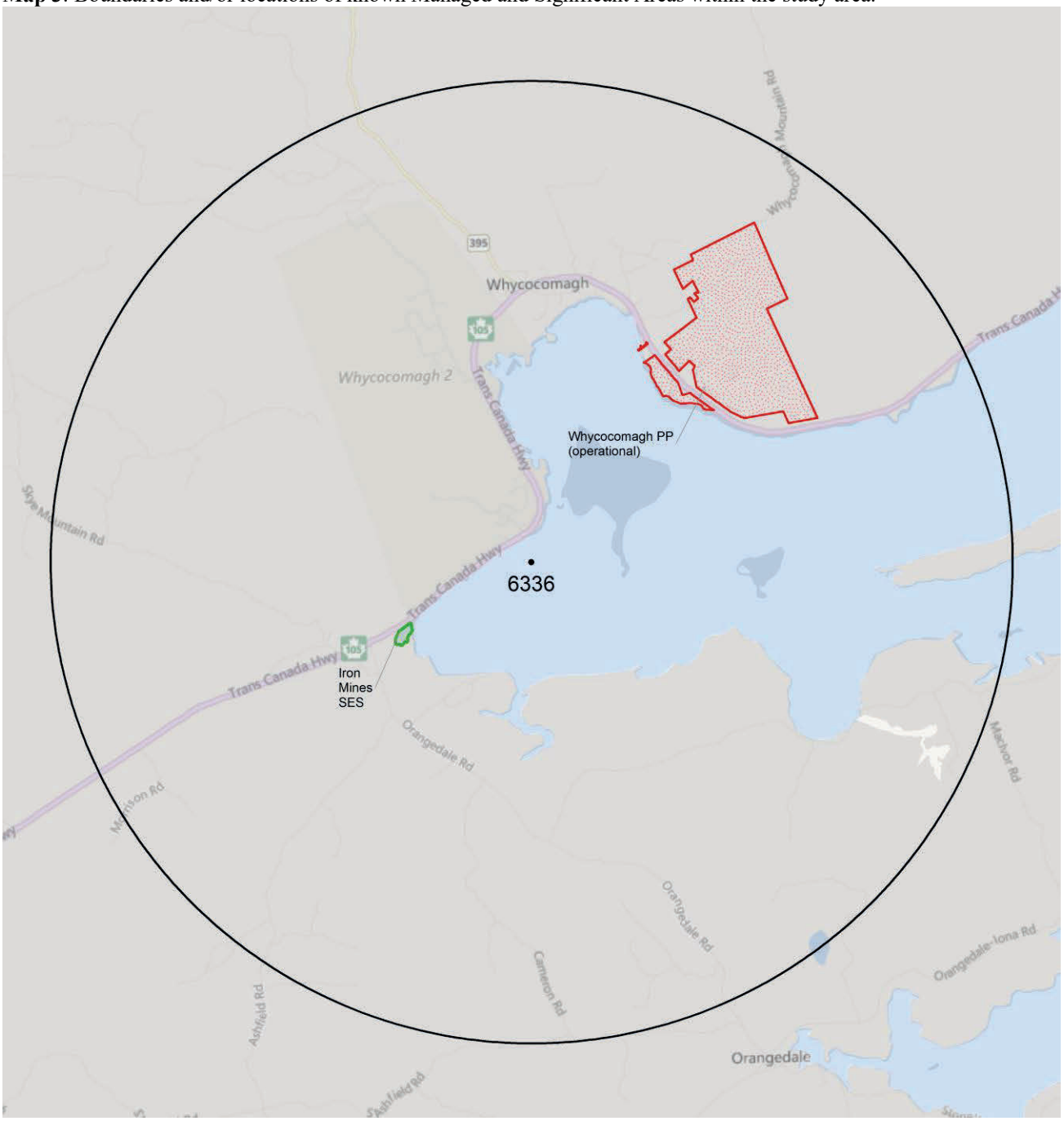
3.1 MANAGED AREAS

The GIS scan identified 1 managed area 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)
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	2	4.6 ± 0.0
N	*Hamatocaulis vernicosus*	a Moss				S1S2	3 Sensitive	1	4.4 ± 0.0
N	*Limprichtia revolvens*	a Moss				S2S3	3 Sensitive	3	4.2 ± 0.0
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	2	4.4 ± 0.0
P	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	12	3.6 ± 0.0
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	5 Undetermined	1	4.6 ± 0.0
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	2 May Be At Risk	1	2.4 ± 10.0
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	2	4.9 ± 7.0
P	*Lobelia kalmii*	Brook Lobelia				S2	2 May Be At Risk	26	3.7 ± 0.0
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2	3 Sensitive	1	4.9 ± 7.0
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	1	4.9 ± 0.0
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	6	3.9 ± 0.0
P	*Carex atratiformis*	Scabrous Black Sedge				S2	3 Sensitive	1	4.9 ± 7.0
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	1	3.0 ± 1.0
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	54	3.6 ± 0.0
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S2	2 May Be At Risk	1	4.9 ± 10.0
P	*Woodsia glabella*	Smooth Cliff Fern				S2	3 Sensitive	1	4.9 ± 7.0
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	15	3.7 ± 0.0
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	2	2.3 ± 1.0
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	5	3.8 ± 0.0
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	3 Sensitive	1	4.9 ± 7.0
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	1	2.8 ± 5.0
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	1	4.4 ± 0.0
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	9	1.4 ± 0.0
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3	4 Secure	1	2.4 ± 3.0
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3	4 Secure	97	3.6 ± 0.0
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	3	3.8 ± 0.0
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	1	2.4 ± 0.0
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	1	4.9 ± 7.0
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	3	2.8 ± 5.0
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	1	4.8 ± 0.0
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	2	2.8 ± 1.0
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	2	4.9 ± 0.0
P	*Equisetum hyemale ssp. affine*	common scouring-rush				S3S4	4 Secure	2	3.3 ± 3.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	1	2.0 ± 0.0
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	1	4.9 ± 7.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	2	4.9 ± 7.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	3	4.9 ± 7.0
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	1	4.9 ± 7.0
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	1	4.9 ± 7.0
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	2	4.9 ± 7.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	2	4.9 ± 7.0
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	1	4.1 ± 0.0
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	1	4.1 ± 0.0
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	2	4.8 ± 0.0
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	1	4.9 ± 7.0
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	1	4.1 ± 0.0
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	1	4.6 ± 0.0
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	3	4.9 ± 7.0
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	1	4.9 ± 7.0
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	1	2.0 ± 0.0
A	*Spatula discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	2	4.9 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	2	4.9 ± 7.0
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	2	3.9 ± 0.0
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	5	3.1 ± 0.0
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	2	3.9 ± 0.0
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	1	4.9 ± 7.0
I	*Lycaena dorcas*	Dorcas Copper				S1?	6 Not Assessed	2	4.2 ± 0.0
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	1	2.3 ± 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”.

ova 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**	**YES**
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.

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5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 17742 records of 133 vertebrate and 472 records of 48 invertebrate fauna; 6212 records of 278 vascular, 1170 records of 99 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	36	21.4 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	7	90.5 ± 0.0	PE
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	632	26.2 ± 0.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	36	75.8 ± 7.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered	Endangered	Endangered	S2M	1 At Risk	135	40.9 ± 0.0	NS
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	1	96.5 ± 0.0	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	3	32.8 ± 0.0	NS
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Endangered	S1S2B	1 At Risk	211	30.3 ± 7.0	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	70	2.5 ± 0.0	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2	2 May Be At Risk	1	64.8 ± 0.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	2	2.0 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	68	24.9 ± 0.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	236	11.0 ± 7.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	414	4.9 ± 7.0	NS
A	*Cardellina canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	253	10.0 ± 0.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	218	11.0 ± 7.0	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	3 Sensitive	2	75.8 ± 7.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	7	68.2 ± 7.0	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	2	40.4 ± 7.0	NS
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	77.9 ± 16.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	6	32.2 ± 0.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	171	11.1 ± 7.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	89	5.1 ± 7.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	561	4.9 ± 7.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	10	55.8 ± 7.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S2S3M	3 Sensitive	1	97.8 ± 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	70.8 ± 1.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	8	50.1 ± 10.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	185	4.9 ± 7.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	212	8.3 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern			S4S5	4 Secure	1	88.8 ± 1.0	NS
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S1	1 At Risk	139	15.0 ± 1.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B	5 Undetermined	1	71.4 ± 7.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	2	88.9 ± 0.0	PE
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	17	10.1 ± 0.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B	5 Undetermined	11	38.9 ± 7.0	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		6	76.5 ± 1.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	18	24.8 ± 0.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	411	5.1 ± 7.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	12	33.5 ± 7.0	NS
A	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	4 Secure	2	64.5 ± 4.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	75	11.0 ± 0.0	NS
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	229	4.9 ± 7.0	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	82	11.0 ± 7.0	NS
A	*Morone saxatilis*	Striped Bass	E,E,SC			S2S3	2 May Be At Risk	4	54.6 ± 0.0	NS
A	*Martes americana*	American Marten			Endangered	S1	1 At Risk	28	13.5 ± 1.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	13	26.3 ± 0.0	NS
A	*Salmo salar*	Atlantic Salmon				S1	2 May Be At Risk	91	7.0 ± 0.0	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1?	5 Undetermined	7	10.7 ± 0.0	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	3	60.3 ± 7.0	NS
A	*Uria aalge*	Common Murre				S1?B,S5N	4 Secure	3	75.5 ± 0.0	NS
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	2 May Be At Risk	1	65.2 ± 7.0	NS
A	*Anas acuta*	Northern Pintail				S1B	2 May Be At Risk	7	68.5 ± 1.0	NS
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	4 Secure	2	80.5 ± 0.0	NS
A	*Haematopus palliatus*	American Oystercatcher				S1B	5 Undetermined	7	65.8 ± 7.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	18	25.1 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	5 Undetermined	3	59.6 ± 0.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B	5 Undetermined	7	27.1 ± 7.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	209	40.9 ± 0.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	321	34.7 ± 0.0	NS
A	*Pluvialis dominica*	American Golden-Plover				S1S2M	3 Sensitive	79	53.8 ± 0.0	NS
A	*Limosa haemastica*	Hudsonian Godwit				S1S2M	3 Sensitive	95	53.8 ± 0.0	NS
A	*Microtus chrotorrhinus*	Rock Vole				S2	4 Secure	20	10.1 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	9	52.1 ± 7.0	NS
A	*Spatula clypeata*	Northern Shoveler				S2B	2 May Be At Risk	5	74.7 ± 0.0	NS
A	*Mareca strepera*	Gadwall				S2B	2 May Be At Risk	7	61.2 ± 7.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	5	65.6 ± 0.0	NS
A	*Setophaga tigrina*	Cape May Warbler				S2B	3 Sensitive	62	17.6 ± 0.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	7	11.1 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	11	27.1 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	30	32.0 ± 7.0	NS
A	*Alca torda*	Razorbill				S2B,S4N	3 Sensitive	43	46.3 ± 7.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	99	4.9 ± 7.0	NS
A	*Branta bernicla*	Brant				S2M	3 Sensitive	1	64.3 ± 16.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3	3 Sensitive	286	30.5 ± 7.0	NS
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	21	38.9 ± 7.0	NS
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	263	4.9 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	2	89.1 ± 7.0	PE
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	6	44.9 ± 7.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	509	11.1 ± 7.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	115	5.1 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	147	4.9 ± 7.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	6	40.4 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	161	4.1 ± 0.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	92	34.7 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	73	53.8 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	1	77.6 ± 0.0	NS
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	337	4.1 ± 0.0	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	679	4.8 ± 0.0	NS
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	499	4.9 ± 7.0	NS
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	43	4.1 ± 0.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	60	4.6 ± 0.0	NS
A	*Synaptomys cooperi*	Southern Bog Lemming				S3	4 Secure	10	10.1 ± 0.0	NS
A	*Pekania pennanti*	Fisher				S3	3 Sensitive	1	39.6 ± 0.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	25	41.5 ± 10.0	NS
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	232	5.1 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	176	5.1 ± 7.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	368	4.9 ± 7.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	101	23.9 ± 0.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	21	11.3 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	71	11.0 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	130	11.0 ± 7.0	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	87	4.9 ± 7.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	462	2.0 ± 0.0	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S3B,S5N	3 Sensitive	49	72.1 ± 7.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S3B,S5N	3 Sensitive	34	72.3 ± 0.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	344	34.7 ± 0.0	NS
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	232	51.2 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	153	40.9 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	272	34.7 ± 0.0	NS
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	157	40.9 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	162	53.8 ± 0.0	NS
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	175	40.9 ± 0.0	NS
A	*Somateria mollissima*	Common Eider				S3S4	4 Secure	267	36.4 ± 7.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	66	20.7 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	29	31.0 ± 0.0	NS
A	*Sorex palustris*	American Water Shrew				S3S4	4 Secure	3	81.0 ± 1.0	NS
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	111	18.2 ± 7.0	NS
A	*Spatula discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	96	4.9 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	605	4.9 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	600	3.9 ± 0.0	NS
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	1484	3.1 ± 0.0	NS
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	171	3.9 ± 0.0	NS
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	992	4.9 ± 7.0	NS
A	*Oreothlypis peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	144	8.3 ± 0.0	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	189	11.3 ± 7.0	NS
A	*Setophaga striata*	Blackpoll Warbler				S3S4B	3 Sensitive	185	11.3 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	261	11.3 ± 7.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	138	11.1 ± 7.0	NS
A	*Bucephala albeola*	Bufflehead				S3S4N	4 Secure	19	59.3 ± 11.0	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N	4 Secure	2	83.7 ± 7.0	NS
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	35	31.1 ± 0.0	NS
A	*Aythya americana*	Redhead				SHB,SNAM	4 Secure	1	95.9 ± 15.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	17	14.2 ± 0.0	NS
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Threatened	S1	1 At Risk	37	64.1 ± 0.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	4	71.4 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern		Vulnerable	S3	3 Sensitive	3	44.5 ± 0.0	NS
I	*Quedius spelaeus*	Spelean Rove Beetle				S1		1	68.7 ± 1.0	NS
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S1	1 At Risk	15	33.7 ± 1.0	NS
I	*Somatochlora albicincta*	Ringed Emerald				S1	2 May Be At Risk	7	70.4 ± 0.0	NS
I	*Leucorrhinia patricia*	Canada Whiteface				S1	2 May Be At Risk	1	73.7 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
I	*Coenagrion interrogatum*	Subarctic Bluet				S1	2 May Be At Risk	2	51.1 ± 0.0	NS
I	*Leptodea ochracea*	Tidewater Mucket				S1	3 Sensitive	17	62.8 ± 1.0	NS
I	*Lycaena dorcas*	Dorcas Copper				S1?	6 Not Assessed	24	4.2 ± 0.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	1	76.4 ± 1.0	NS
I	*Strymon melinus*	Grey Hairstreak				S1S2	4 Secure	1	37.7 ± 0.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	1	37.6 ± 1.0	NS
I	*Coenagrion resolutum*	Taiga Bluet				S1S2	2 May Be At Risk	1	97.2 ± 1.0	PE
I	*Haematopota rara*	Shy Cleg				S1S3	5 Undetermined	2	51.9 ± 0.0	NS
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	1	25.8 ± 0.0	NS
I	*Boloria chariclea grandis*	Purple Lesser Fritillary				S2	3 Sensitive	4	38.8 ± 0.0	NS
I	*Aglais milberti milberti*	Milbert's Tortoise Shell				S2	4 Secure	1	33.7 ± 1.0	NS
I	*Somatochlora septentrionalis*	Muskeg Emerald				S2	3 Sensitive	21	32.7 ± 0.0	NS
I	*Somatochlora williamsoni*	Williamson's Emerald				S2	2 May Be At Risk	10	36.5 ± 0.0	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	3 Sensitive	98	12.4 ± 0.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	2	37.9 ± 0.0	NS
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	6	27.8 ± 0.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	9	25.5 ± 1.0	NS
I	*Gomphus descriptus*	Harpoon Clubtail				S2S3	3 Sensitive	16	7.0 ± 0.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	5	13.6 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	1	89.6 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	7	26.0 ± 1.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	5	47.5 ± 0.0	NS
I	*Iphthiminus opacus*	a Darkling Beetle				S3		1	6.6 ± 0.0	NS
I	*Callophrys henrici*	Henry's Elfin				S3	4 Secure	1	98.2 ± 0.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	2	66.1 ± 1.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	13	13.2 ± 0.0	NS
I	*Oeneis jutta*	Jutta Arctic				S3	2 May Be At Risk	10	12.3 ± 0.0	NS
I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	1	36.3 ± 0.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	1	75.6 ± 1.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	3	7.0 ± 0.0	NS
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	2	46.7 ± 0.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	3	28.5 ± 0.0	NS
I	*Sympetrum danae*	Black Meadowhawk				S3	3 Sensitive	16	25.4 ± 1.0	NS
I	*Enallagma vernale*	Vernal Bluet				S3	5 Undetermined	8	7.0 ± 0.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	20	2.3 ± 1.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	17	33.7 ± 1.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	1	75.7 ± 1.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	16	26.0 ± 0.0	NS
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3S4	4 Secure	22	26.0 ± 1.0	NS
I	*Lampsilis radiata*	Eastern Lampmussel				S3S4	3 Sensitive	15	20.1 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	280	10.7 ± 0.0	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened		Threatened	S1S2	2 May Be At Risk	1	46.7 ± 0.0	NS
N	*Sclerophora peronella (Nova Scotia pop)*	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		5	53.2 ± 0.0	NS
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	74	4.6 ± 0.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	1	100.0 ± 0.0	NS
N	*Cladonia brevis*	Short Peg Lichen				S1		1	52.9 ± 0.0	NS
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S1	2 May Be At Risk	2	20.4 ± 0.0	NS
N	*Gowardia nigricans*	Gray Witch's Beard Lichen				S1	6 Not Assessed	1	88.5 ± 1.0	NS
N	*Metacalypogeia schusterana*	Schuster's Pouchwort				S1?	5 Undetermined	1	40.0 ± 0.0	NS
N	*Moerckia hibernica*	Irish Ruffwort				S1?		1	40.0 ± 0.0	NS
N	*Brachythecium erythrorrhizon*	Taiga Ragged Moss				S1?		2	39.8 ± 0.0	NS
N	*Calliergon richardsonii*	Richardson's Spear Moss				S1?		1	92.5 ± 0.0	NS
N	*Conardia compacta*	Coast Creeping Moss				S1?	3 Sensitive	2	20.3 ± 2.0	NS
N	*Entodon concinnus*	Lime Entodon Moss				S1?	3 Sensitive	2	87.2 ± 0.0	NS
N	*Grimmia laevigata*	a Moss				S1?	3 Sensitive	2	81.7 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Grimmia pilifera*	a Moss				S1?	3 Sensitive	2	87.2 ± 0.0	NS
N	*Hygrohypnum smithii*	Smith's Brook Moss				S1?	3 Sensitive	1	87.4 ± 0.0	NS
N	*Orthothecium strictum*	Shiny Erect-capsule Moss				S1?	3 Sensitive	2	87.2 ± 0.0	NS
N	*Paludella squarrosa*	Tufted Fen Moss				S1?	3 Sensitive	1	33.3 ± 5.0	NS
N	*Timmia norvegica*	a moss				S1?	3 Sensitive	1	95.1 ± 50.0	NS
N	*Syntrichia ruralis*	a Moss				S1?	3 Sensitive	1	62.3 ± 1.0	NS
N	*Ulota curvifolia*	a Moss				S1?	3 Sensitive	1	81.7 ± 0.0	NS
N	*Plagiomnium ellipticum*	Marsh Leafy Moss				S1?	2 May Be At Risk	1	87.0 ± 2.0	NS
N	*Flavocetraria nivalis*	Crinkled Snow Lichen				S1?	3 Sensitive	1	70.0 ± 0.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	6	55.1 ± 0.0	NS
N	*Buxbaumia minakatae*	Hump-Backed Elves				S1S2	3 Sensitive	1	38.0 ± 100 0	NS
N	*Ctenidium molluscum*	Mollusc Ctenidium moss				S1S2		1	79.8 ± 1.0	NS
N	*Dicranodontium denudatum*	Beaked Bow Moss				S1S2	3 Sensitive	2	87.2 ± 0.0	NS
N	*Dicranoweisia crispula*	Mountain Thatch Moss				S1S2	3 Sensitive	1	78.3 ± 0.0	NS
N	*Didymodon ferrugineus*	a moss				S1S2	3 Sensitive	1	99.7 ± 0.0	NS
N	*Mnium thomsonii*	Thomson's Leafy Moss				S1S2	3 Sensitive	2	99.7 ± 0.0	NS
N	*Plagiobryum zieri*	a Moss				S1S2	3 Sensitive	6	87.2 ± 0.0	NS
N	*Platydictya confervoides*	a Moss				S1S2	3 Sensitive	1	64.2 ± 3.0	NS
N	*Seligeria calcarea*	Chalk Brit le Moss				S1S2	3 Sensitive	2	99.7 ± 0.0	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2		2	14.4 ± 0.0	NS
N	*Hamatocaulis vernicosus*	a Moss				S1S2	3 Sensitive	2	4.4 ± 0.0	NS
N	*Schistidium trichodon*	a Moss				S1S2	3 Sensitive	1	99.7 ± 0.0	NS
N	*Anomodon viticulosus*	a Moss				S2?	3 Sensitive	4	99.7 ± 0.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	3	43.7 ± 30.0	NS
N	*Campylium polygamum*	a Moss				S2?	5 Undetermined	1	98.2 ± 2.0	NS
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S2?	5 Undetermined	1	8.8 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	5 Undetermined	1	90.4 ± 0.0	PE
N	*Fontinalis hypnoides*	a moss				S2?	5 Undetermined	2	88.9 ± 1.0	NS
N	*Fontinalis sullivantii*	a Moss				S2?	3 Sensitive	1	38.0 ± 100 0	NS
N	*Grimmia anomala*	Mountain Forest Grimmia				S2?	3 Sensitive	3	55.6 ± 0.0	NS
N	*Orthotrichum anomalum*	Anomalous Bristle Moss				S2?	3 Sensitive	1	81.7 ± 0.0	NS
N	*Philonotis marchica*	a Moss				S2?	5 Undetermined	1	99.9 ± 5.0	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	3 Sensitive	2	23.2 ± 0.0	NS
N	*Pseudoleskea patens*	Patent Leskea Moss				S2?	3 Sensitive	2	96.5 ± 0.0	NS
N	*Pseudoleskea stenophylla*	Narrow-leaved Leskea Moss				S2?	3 Sensitive	2	96.6 ± 1.0	NS
N	*Rhytidium rugosum*	Wrinkle-leaved Moss				S2?	3 Sensitive	4	86.2 ± 0.0	NS
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2?	3 Sensitive	9	8.9 ± 0.0	NS
N	*Seligeria donniana*	Donian Beardless Moss				S2?	3 Sensitive	3	98.2 ± 2.0	NS
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	4	87.0 ± 0.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2?	3 Sensitive	2	91.8 ± 0.0	NS
N	*Tortella fragilis*	Fragile Twisted Moss				S2?	3 Sensitive	6	39.6 ± 0.0	NS
N	*Anomobryum filiforme*	a moss				S2?		5	86.2 ± 0.0	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	6	39.2 ± 0.0	NS
N	*Platylomella lescurii*	a Moss				S2?	3 Sensitive	1	87.0 ± 1.0	NS
N	*Nephroma arcticum*	Arctic Kidney Lichen				S2?	2 May Be At Risk	1	38.5 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2?	3 Sensitive	17	14.5 ± 0.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3 Sensitive	1	96.5 ± 0.0	NS
N	*Tetraplodon mnioides*	Entire-leaved Nitrogen Moss				S2S3	4 Secure	9	87.0 ± 0.0	NS
N	*Limprichtia revolvens*	a Moss				S2S3	3 Sensitive	6	4.2 ± 0.0	NS
N	*Cetraria muricata*	Spiny Heath Lichen				S2S3	5 Undetermined	2	88.5 ± 1.0	NS
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S2S3	2 May Be At Risk	1	60.7 ± 0.0	NS
N	*Leptogium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	2	20.4 ± 0.0	NS
N	*Racodium rupestre*	Rockhair Lichen				S2S3	5 Undetermined	1	96.0 ± 0.0	NS
N	*Usnea mutabilis*	Bloody Beard Lichen				S2S3	3 Sensitive	1	11.1 ± 0.0	NS

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N	*Collema tenax*	Soil Tarpaper Lichen				S3		2	20.3 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	3	50.7 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	4 Secure	36	15.2 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3	4 Secure	1	56.8 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3	3 Sensitive	1	54.9 ± 0.0	NS
N	*Leptogium lichenoides*	Tattered Jellyskin Lichen				S3	2 May Be At Risk	2	20.4 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	1	38.5 ± 0.0	NS
N	*Platismatia norvegica*	Oldgrowth Rag Lichen				S3	4 Secure	128	49.8 ± 0.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	10	46.9 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S3?	3 Sensitive	1	14.7 ± 0.0	NS
N	*Drummondia prorepens*	a Moss				S3?	3 Sensitive	5	77.4 ± 2.0	NS
N	*Anomodon tristis*	a Moss				S3?	3 Sensitive	2	77.7 ± 0.0	NS
N	*Mnium stellare*	Star Leafy Moss				S3?	5 Undetermined	2	39.8 ± 0.0	NS
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	1	99.6 ± 0.0	NS
N	*Dicranella varia*	a Moss				S3S4	5 Undetermined	2	15.7 ± 0.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	7	87.0 ± 0.0	NS
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	4 Secure	5	37.9 ± 0.0	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	3 Sensitive	2	87.2 ± 0.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3S4	4 Secure	1	97.7 ± 0.0	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	4 Secure	2	91.8 ± 0.0	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	3 Sensitive	3	79.8 ± 1.0	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	4 Secure	4	78.3 ± 0.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	3 Sensitive	1	25.7 ± 3.0	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	4 Secure	3	88.5 ± 1.0	NS
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	4 Secure	92	49.1 ± 0.0	NS
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	5 Undetermined	3	56.6 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4		1	52.3 ± 0.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	316	38.4 ± 0.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	4 Secure	5	79.6 ± 0.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	8	13.7 ± 2.0	NS
P	*Juncus caesariensis*	New Jersey Rush	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	239	49.5 ± 5.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	13	67.7 ± 0.0	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	21	18.7 ± 1.0	NS
P	*Salix candida*	Sage Willow			Endangered	S1	2 May Be At Risk	42	24.6 ± 0.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	5	78.4 ± 7.0	NS
P	*Acer saccharinum*	Silver Maple				S1	5 Undetermined	1	73.3 ± 0.0	NS
P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	6	20.8 ± 3.0	NS
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	7	68.7 ± 1.0	NS
P	*Arnica lonchophylla*	Northern Arnica				S1	2 May Be At Risk	10	36.4 ± 7.0	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S1	2 May Be At Risk	3	44.9 ± 7.0	NS
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S1	2 May Be At Risk	1	77.1 ± 3.0	NS
P	*Ageratina altissima*	White Snakeroot				S1	2 May Be At Risk	2	67.8 ± 1.0	NS
P	*Betula glandulosa*	Glandular Birch				S1	2 May Be At Risk	5	84.9 ± 7.0	NS
P	*Cardamine dentata*	Toothed Bittercress				S1	2 May Be At Risk	5	12.1 ± 0.0	NS
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	2 May Be At Risk	4	80.5 ± 0.0	NS
P	*Draba glabella*	Rock Whi low-Grass				S1	2 May Be At Risk	3	81.7 ± 0.0	NS
P	*Draba norvegica*	Norwegian Whitlow-Grass				S1	2 May Be At Risk	7	55.3 ± 2.0	NS
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	2	5.7 ± 2.0	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	2 May Be At Risk	7	62.7 ± 1.0	NS
P	*Diapensia lapponica*	Diapensia				S1	2 May Be At Risk	1	79.8 ± 0.0	NS
P	*Pinguicula vulgaris*	Common Butterwort				S1	2 May Be At Risk	6	79.8 ± 0.0	NS
P	*Utricularia ochroleuca*	Yellowish-white Bladderwort				S1	5 Undetermined	1	64.5 ± 1.0	NS
P	*Oxyria digyna*	Mountain Sorrel				S1	2 May Be At Risk	8	96.8 ± 0.0	NS
P	*Bistorta vivipara*	Alpine Bistort				S1	2 May Be At Risk	1	37.9 ± 1.0	NS
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	2	41.2 ± 1.0	NS
P	*Anemone multifida*	Cut-leaved Anemone				S1	2 May Be At Risk	4	80.9 ± 1.0	NS

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P	*Potentilla litoralis*	Coastal Cinquefoil				S1	0.1 Extirpated	4	86.0 ± 1.0	NS
P	*Salix vestita*	Hairy Willow				S1	2 May Be At Risk	1	87.4 ± 0.0	NS
P	*Saxifraga aizoides*	Yellow Mountain Saxifrage				S1	2 May Be At Risk	8	87.4 ± 0.0	NS
P	*Saxifraga oppositifolia*	Purple Mountain Saxifrage				S1	2 May Be At Risk	2	86.7 ± 1.0	NS
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S1		1	9.0 ± 0.0	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	5 Undetermined	2	38.7 ± 1.0	NS
P	*Carex alopecoidea*	Foxtail Sedge				S1	2 May Be At Risk	2	61.8 ± 0.0	NS
P	*Carex granularis*	Limestone Meadow Sedge				S1	2 May Be At Risk	21	8.6 ± 0.0	NS
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	16	4.4 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	3	7.7 ± 0.0	NS
P	*Carex rariflora*	Loose-flowered Alpine Sedge				S1	2 May Be At Risk	1	89.9 ± 5.0	NS
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S1	2 May Be At Risk	3	51.3 ± 0.0	NS
P	*Carex tincta*	Tinged Sedge				S1	2 May Be At Risk	1	61.8 ± 1.0	NS
P	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	54	3.6 ± 0.0	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	6	72.3 ± 0.0	NS
P	*Carex saxatilis*	Russet Sedge				S1	2 May Be At Risk	1	98.5 ± 7.0	NS
P	*Cyperus lupulinus*	Hop Flatsedge				S1	2 May Be At Risk	5	62.0 ± 0.0	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	8	62.7 ± 1.0	NS
P	*Eleocharis erythropoda*	Red-stemmed Spikerush				S1	2 May Be At Risk	6	7.3 ± 0.0	NS
P	*Rhynchospora capillacea*	Slender Beakrush				S1	2 May Be At Risk	8	11.1 ± 10.0	NS
P	*Blysmopsis rufa*	Red Bulrush				S1	2 May Be At Risk	1	73.0 ± 1.0	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	2	28.7 ± 0.0	NS
P	*Triantha glutinosa*	Sticky False-Asphodel				S1	2 May Be At Risk	15	24.5 ± 0.0	NS
P	*Malaxis monophyllos*	White Adder's-mouth				S1	2 May Be At Risk	1	54.2 ± 7.0	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	11	27.7 ± 0.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	9	28.0 ± 0.0	NS
P	*Elymus hystrix*	Spreading Wild Rye				S1	2 May Be At Risk	1	96.4 ± 4.0	NS
P	*Hordeum brachyantherum*	Meadow Barley				S1	2 May Be At Risk	1	61.9 ± 0.0	NS
P	*Phleum alpinum*	Alpine Timothy				S1	2 May Be At Risk	7	60.3 ± 0.0	NS
P	*Torreyochloa pallida var. pallida*	Pale False Manna Grass				S1	0.1 Extirpated	2	74.0 ± 1.0	NS
P	*Graphephorum melicoides*	Purple False Oats				S1	2 May Be At Risk	4	49.1 ± 0.0	NS
P	*Sparganium androcladum*	Branching Bur-Reed				S1	2 May Be At Risk	2	22.5 ± 0.0	NS
P	*Equisetum palustre*	Marsh Horsetail				S1	2 May Be At Risk	8	26.3 ± 0.0	NS
P	*Botrychium lunaria*	Common Moonwort				S1	2 May Be At Risk	2	65.7 ± 1.0	NS
P	*Epilobium lactiflorum*	White-flowered Willowherb				S1?	2 May Be At Risk	1	96.0 ± 5.0	NS
P	*Bolboschoenus robustus*	Sturdy Bulrush				S1?	5 Undetermined	2	33.1 ± 5.0	NS
P	*Dichanthelium lindheimeri*	Lindheimer's Panicgrass				S1?	5 Undetermined	1	97.4 ± 1.0	NS
P	*Huperzia selago*	Northern Firmoss				S1?	2 May Be At Risk	1	72.0 ± 2.0	NS
P	*Fraxinus nigra*	Black Ash			Threatened	S1S2	1 At Risk	95	2.4 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	1	69.6 ± 7.0	NS
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S1S2	2 May Be At Risk	7	65.7 ± 4.0	NS
P	*Cornus suecica*	Swedish Bunchberry				S1S2	3 Sensitive	21	70.3 ± 6.0	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	8	14.2 ± 1.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	3	34.9 ± 7.0	NS
P	*Parnassia parviflora*	Small-flowered Grass-of-Parnassus				S1S2	2 May Be At Risk	16	29.9 ± 1.0	NS
P	*Carex livida*	Livid Sedge				S1S2	2 May Be At Risk	27	42.3 ± 5.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	1	62.7 ± 1.0	NS
P	*Juncus alpinoarticulatus ssp. Rariflorus*					S1S2	2 May Be At Risk	13	13.3 ± 5.0	NS
P	*Juncus bulbosus*	Bulbous Rush				S1S2	5 Undetermined	12	82.5 ± 0.0	NS
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	5 Undetermined	5	4.6 ± 0.0	NS
P	*Calamagrostis stricta ssp.*	Slim-stemmed Reed Grass				S1S2	3 Sensitive	2	33.5 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	stricta									
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	24	25.7 ± 0.0	NS
P	*Festuca prolifera*	Proliferous Fescue				S1S2	3 Sensitive	6	78.3 ± 1.0	NS
P	*Sparganium hyperboreum*	Northern Burreed				S1S2	3 Sensitive	13	24.7 ± 1.0	NS
P	*Cryptogramma stelleri*	Steller's Rockbrake				S1S2	2 May Be At Risk	17	5.6 ± 0.0	NS
P	*Woodsia alpina*	Alpine Cliff Fern				S1S2	2 May Be At Risk	8	67.3 ± 2.0	NS
P	*Selaginella selaginoides*	Low Spikemoss				S1S2	2 May Be At Risk	5	45.8 ± 0.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	2	61.8 ± 0.0	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	2	87.0 ± 0.0	NS
P	*Osmorhiza longistylis*	Smoo h Sweet Cicely				S2	2 May Be At Risk	21	2.4 ± 10.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	8	11.1 ± 7.0	NS
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S2	2 May Be At Risk	10	70.9 ± 2.0	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2	3 Sensitive	2	55.8 ± 7.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	10	4.9 ± 7.0	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	19	12.8 ± 0.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2	3 Sensitive	6	57.2 ± 0.0	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S2	3 Sensitive	9	67.0 ± 1.0	NS
P	*Draba arabisans*	Rock Whi low-Grass				S2	3 Sensitive	14	10.2 ± 1.0	NS
P	*Lobelia kalmii*	Brook Lobelia				S2	2 May Be At Risk	95	3.7 ± 0.0	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	4	88.9 ± 1.0	PE
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	27.7 ± 0.0	NS
P	*Oxybasis rubra*	Red Goosefoot				S2	2 May Be At Risk	3	48.6 ± 2.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	11	87.2 ± 0.0	PE
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	2	21.5 ± 1.0	NS
P	*Crassula aquatica*	Water Pygmyweed				S2	3 Sensitive	6	40.3 ± 7.0	NS
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	2 May Be At Risk	5	81.7 ± 0.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	2	46.2 ± 7.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	6	13.9 ± 0.0	NS
P	*Utricularia resupinata*	Inverted Bladderwort				S2	3 Sensitive	1	49.8 ± 0.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2	5 Undetermined	1	28.8 ± 1.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2	3 Sensitive	10	4.9 ± 7.0	NS
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	10	78.2 ± 1.0	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	2 May Be At Risk	10	43.2 ± 3.0	NS
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	4	28.9 ± 1.0	NS
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	23	19.0 ± 0.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	33	27.4 ± 0.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	93	6.0 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	12	10.0 ± 0.0	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	2 May Be At Risk	28	20.5 ± 7.0	NS
P	*Saxifraga paniculata ssp. Laestadii*	Laestadius' Saxifrage				S2	3 Sensitive	16	11.3 ± 7.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	11	7.9 ± 0.0	NS
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	30	4.9 ± 0.0	NS
P	*Carex capillaris*	Hairlike Sedge				S2	3 Sensitive	14	79.6 ± 1.0	NS
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	24	3.9 ± 0.0	NS
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	1	37.1 ± 1.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	37	11.3 ± 5.0	NS
P	*Carex scirpoidea*	Scirpuslike Sedge				S2	3 Sensitive	13	57.8 ± 4.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	3	47.9 ± 1.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S2	3 Sensitive	2	36.7 ± 0.0	NS
P	*Carex atratiformis*	Scabrous Black Sedge				S2	3 Sensitive	18	4.9 ± 7.0	NS
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S2	3 Sensitive	30	7.7 ± 0.0	NS
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	2	63.7 ± 10.0	NS
P	*Juncus stygius ssp. americanus*	Moor Rush				S2	3 Sensitive	35	36.4 ± 7.0	NS

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P	*Allium schoenoprasum*	Wild Chives				S2	2 May Be At Risk	1	73.5 ± 0.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	8	46.1 ± 7.0	NS
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	21	3.0 ± 1.0	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	11	8.1 ± 0.0	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	3 Sensitive	18	13.3 ± 0.0	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	360	3.6 ± 0.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	26	18.9 ± 0.0	NS
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S2	3 Sensitive	5	88.7 ± 0.0	PE
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2	3 Sensitive	1	73.7 ± 0.0	NS
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	3 Sensitive	1	90.2 ± 10.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	8	25.1 ± 7.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	9	11.5 ± 0.0	NS
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S2	2 May Be At Risk	23	4.9 ± 10.0	NS
P	*Dryopteris fragrans*	Fragrant Wood Fern				S2	3 Sensitive	11	49.4 ± 7.0	NS
P	*Polystichum lonchitis*	Northern Holly Fern				S2	3 Sensitive	16	6.2 ± 1.0	NS
P	*Woodsia glabella*	Smoo h Cliff Fern				S2	3 Sensitive	20	4.9 ± 7.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	59	3.7 ± 0.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	3	61.2 ± 7.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	2	68.2 ± 0.0	NS
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	2 May Be At Risk	1	22.5 ± 0.0	NS
P	*Crataegus submollis*	Quebec Hawthorn				S2?	5 Undetermined	2	87.5 ± 7.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	2	71.2 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	4	27.1 ± 0.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2S3	3 Sensitive	38	54.5 ± 1.0	NS
P	*Iva frutescens*	Big-leaved Marsh-elder				S2S3	3 Sensitive	1	95.8 ± 4.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2S3	3 Sensitive	14	39.4 ± 0.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2S3	3 Sensitive	3	92.0 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	1	68.8 ± 5.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	1	89.1 ± 5.0	PE
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	3 Sensitive	2	53.9 ± 2.0	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	123	2.3 ± 1.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	139	26.8 ± 0.0	NS
P	*Empetrum atropurpureum*	Purple Crowberry				S2S3	3 Sensitive	7	69.0 ± 3.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	13	24.7 ± 1.0	NS
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	38	12.1 ± 0.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	2	73.5 ± 1.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	5 Undetermined	1	54.9 ± 7.0	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	16	11.4 ± 5.0	NS
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	5 Undetermined	7	29.2 ± 1.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	1	46.1 ± 2.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	1	72.4 ± 0.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3 Sensitive	5	19.6 ± 2.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	1	98.5 ± 7.0	NS
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	9	23.6 ± 0.0	NS
P	*Eleocharis flavescens*	Pale Spikerush				S2S3	3 Sensitive	3	76.1 ± 5.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2S3	3 Sensitive	8	9.7 ± 0.0	NS
P	*Oreojuncus trifidus*	Highland Rush				S2S3	3 Sensitive	16	15.2 ± 0.0	NS
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	6	96.8 ± 1.0	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	97	3.8 ± 0.0	NS
P	*Poa glauca*	Glaucous Blue Grass				S2S3	3 Sensitive	19	5.6 ± 0.0	NS
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	46	11.0 ± 7.0	NS

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P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	3 Sensitive	9	4.9 ± 7.0	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	6	16.9 ± 5.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	1	60.9 ± 5.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	4 Secure	29	25.4 ± 0.0	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	95	13.3 ± 0.0	NS
P	*Bidens beckii*	Water Beggarticks				S3	4 Secure	9	19.8 ± 0.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	142	13.3 ± 0.0	NS
P	*Betula pumila var. pumila*	Bog Birch				S3	3 Sensitive	12	18.0 ± 7.0	NS
P	*Betula pumila*	Bog Birch				S3	3 Sensitive	25	9.4 ± 0.0	NS
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	4	2.8 ± 5.0	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	3 Sensitive	1	86.9 ± 0.0	NS
P	*Viburnum edule*	Squashberry				S3	3 Sensitive	59	55.8 ± 7.0	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	16	46.6 ± 0.0	NS
P	*Vaccinium boreale*	Northern Blueberry				S3	3 Sensitive	44	11.3 ± 7.0	NS
P	*Vaccinium cespitosum*	dwarf bilberry				S3	4 Secure	28	45.9 ± 7.0	NS
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3 Sensitive	16	67.4 ± 0.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	1	37.4 ± 0.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	49	4.4 ± 0.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	55	1.4 ± 0.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3	4 Secure	4	14.9 ± 7.0	NS
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4 Secure	24	37.5 ± 2.0	NS
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	20	6.0 ± 0.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	3 Sensitive	1	67.9 ± 7.0	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3	4 Secure	10	2.4 ± 3.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3	3 Sensitive	12	26.3 ± 0.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	1	8.4 ± 0.0	NS
P	*Primula laurentiana*	Laurentian Primrose				S3	4 Secure	1	49.1 ± 7.0	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	16	11.4 ± 0.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	28	11.0 ± 0.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	18	6.0 ± 2.0	NS
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	96	6.1 ± 0.0	NS
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3	4 Secure	459	3.6 ± 0.0	NS
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	220	3.8 ± 0.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3	4 Secure	6	44.3 ± 0.0	NS
P	*Galium kamtschaticum*	Northern Wild Licorice				S3	4 Secure	46	10.8 ± 1.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	18	44.7 ± 2.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	9	46.9 ± 5.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	2	28.0 ± 0.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	17	20.9 ± 2.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	20	2.4 ± 0.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	4 Secure	17	10.0 ± 5.0	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	164	12.7 ± 0.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	7	68.2 ± 0.0	NS
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	4	28.7 ± 2.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	4 Secure	9	25.2 ± 0.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	47	11.6 ± 0.0	NS
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	4	93.3 ± 0.0	NS
P	*Elodea canadensis*	Canada Waterweed				S3	4 Secure	8	24.2 ± 0.0	NS
P	*Juncus subcaudatus*	Woods-Rush				S3	3 Sensitive	9	50.0 ± 0.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	63	7.9 ± 0.0	NS
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S3	3 Sensitive	24	34.9 ± 7.0	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	32	8.7 ± 0.0	NS
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	51	4.9 ± 7.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	23	2.8 ± 5.0	NS

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P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	3	7.8 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	14	12.4 ± 0.0	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	6	4.8 ± 0.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3	4 Secure	19	26.3 ± 0.0	NS
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	23	12.3 ± 1.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	3 Sensitive	17	14.2 ± 0.0	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	3 Sensitive	12	14.9 ± 7.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	18	6.0 ± 0.0	NS
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	4 Secure	25	11.0 ± 0.0	NS
P	*Asplenium viride*	Green Spleenwort				S3	3 Sensitive	35	5.6 ± 0.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3	3 Sensitive	22	13.7 ± 0.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	38	10.0 ± 0.0	NS
P	*Isoetes acadiensis*	Acadian Quillwort				S3	3 Sensitive	9	66.0 ± 1.0	NS
P	*Diphasiastrum sitchense*	Si ka Ground-cedar				S3	4 Secure	10	31.9 ± 5.0	NS
P	*Huperzia appressa*	Mountain Firmoss				S3	3 Sensitive	22	20.2 ± 1.0	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	4 Secure	4	60.9 ± 5.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	5 Undetermined	5	7.4 ± 0.0	NS
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	57	2.8 ± 1.0	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	4 Secure	10	10.3 ± 1.0	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	4 Secure	9	29.4 ± 2.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	4	49.2 ± 1.0	NS
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	17	14.2 ± 0.0	NS
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	148	7.6 ± 0.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	1	69.1 ± 0.0	NS
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	2	89.0 ± 0.0	PE
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	72	5.6 ± 0.0	NS
P	*Salix petiolaris*	Meadow Willow				S3S4	4 Secure	8	10.0 ± 0.0	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	4 Secure	3	23.9 ± 0.0	NS
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	5	15.2 ± 0.0	NS
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	5 Undetermined	9	24.2 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	4	4.9 ± 0.0	NS
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	37	33.0 ± 5.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	16	14.4 ± 5.0	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	4 Secure	1	18.0 ± 0.0	NS
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	20	15.3 ± 0.0	NS
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	417	5.9 ± 0.0	NS
P	*Equisetum hyemale ssp. affine*	common scouring-rush				S3S4	4 Secure	36	3.3 ± 3.0	NS
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	75	12.9 ± 0.0	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	4 Secure	6	14.9 ± 5.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	34	25.3 ± 0.0	NS
P	*Viola canadensis*	Canada Violet				SH	0.1 Extirpated	1	19.6 ± 0.0	NS
P	*Poa alpina*	Alpine Blue Grass				SH	0.1 Extirpated	2	72.3 ± 0.0	NS
P	*Botrychium minganense*	Mingan Moonwort				SH	0.1 Extirpated	1	66.9 ± 1.0	NS
P	*Solidago randii*	Rand's Goldenrod				SNA		1	68.7 ± 5.0	NS

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Prepared 8 February 2019
by J. Churchill, Data Manager

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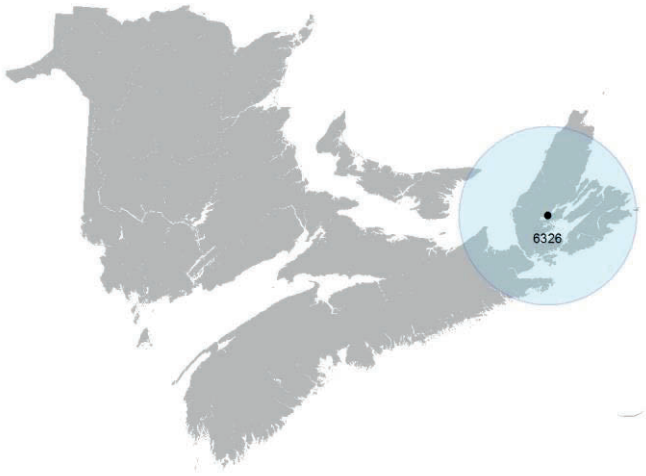
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Map 1. A 100 km buffer around the study area

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
WhycocomaghBNS_6326ob xls	All Rare and legally protected *Flora and Fauna* in your study area
WhycocomaghBNS_6326ob100km xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
WhycocomaghBNS_6326sa.xls	All *Significant Natural Areas* in your study area
WhycocomaghBNS_6326ff xls	Rare and common *Freshwater Fish* in your study area (DFO database)

1.2 RESTRICTIONS

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

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

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

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

Plants, Lichens, Ranking Methods, All other Inquiries
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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
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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

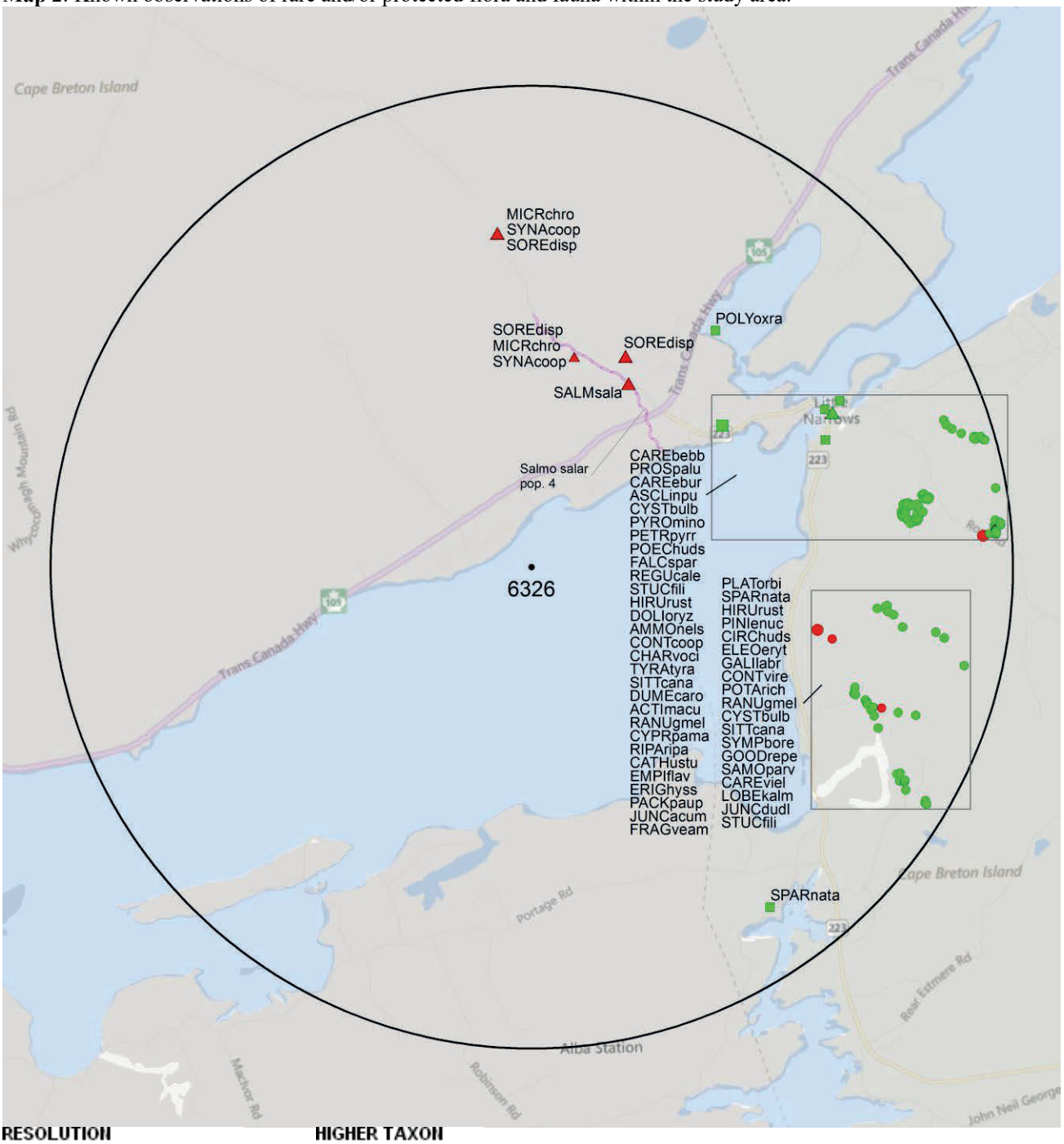
2.1 FLORA

The study area contains 107 records of 25 vascular, no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 43 records of 23 vertebrate, no records of invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

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



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

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

3.0 SPECIAL AREAS

3.1 MANAGED AREAS

The GIS scan identified no managed areas in the vicinity of the study area (Map 3).

3.2 SIGNIFICANT AREAS

The GIS scan identified 1 biologically significant site 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	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	3	4.4 ± 0.0
P	*Eleocharis erythropoda*	Red-stemmed Spikerush				S1	2 May Be At Risk	1	4.6 ± 0.0
P	*Lobelia kalmii*	Brook Lobelia				S2	2 May Be At Risk	2	4.4 ± 0.0
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	4	3.6 ± 0.0
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	2	4.5 ± 0.0
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	3 Sensitive	6	4.8 ± 0.0
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	1	3.8 ± 0.0
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	8	3.6 ± 0.0
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	1	3.1 ± 5.0
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	3	2.5 ± 7.0
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	2	4.8 ± 0.0
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	2	4.8 ± 0.0
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	4	3.5 ± 5.0
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	1	4.0 ± 0.0
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	1	4.0 ± 0.0
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	20	3.3 ± 5.0
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	5	4.1 ± 0.0
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	1	4.5 ± 0.0
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	1	4.3 ± 0.0
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	1	4.3 ± 0.0
P	*Sparganium natans*	Small Burreed				S3	4 Secure	2	4.3 ± 0.0
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	2	3.5 ± 2.0
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	8	3.9 ± 0.0
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	1	3.6 ± 4.0
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	25	3.9 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	1	2.5 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	3	2.5 ± 7.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	1	2.5 ± 7.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	1	2.5 ± 7.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	1	3.9 ± 0.0
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	3	2.2 ± 0.0
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	1	3.2 ± 0.0
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	1	2.5 ± 7.0
A	*Salmo salar*	Atlantic Salmon				S1	2 May Be At Risk	1	2.2 ± 1.0
A	*Microtus chrotorrhinus*	Rock Vole				S2	4 Secure	10	2.2 ± 0.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	2	2.5 ± 7.0
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	1	4.3 ± 0.0
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	1	2.5 ± 7.0
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	2	2.5 ± 7.0
A	*Synaptomys cooperi*	Southern Bog Lemming				S3	4 Secure	4	2.2 ± 0.0
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	1	2.5 ± 7.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	1	2.5 ± 7.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	2	2.5 ± 7.0
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	1	2.5 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	1	2.5 ± 7.0
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	1	4.8 ± 0.0
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	2	2.5 ± 7.0
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	1	4.7 ± 0.0

4.3 LOCATION SENSITIVE SPECIES

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

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
81	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2015. Atlantic Canada Conservation Data Centre Fieldwork 2015. Atlantic Canada Conservation Data Centre, # recs.
24	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2014. Atlantic Canada Conservation Data Centre Fieldwork 2014. Atlantic Canada Conservation Data Centre, # recs.
17	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
8	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
8	Benjamin, L.K. (compiler). 2012. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 4965 recs.
4	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.
2	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
2	Newell, R.E. 2000. E.C. Smith Herbarium Database. Acadia University, Wolfville NS, 7139 recs.
1	Benjamin, L.K. (compiler) 2012. Significant Habitat & Species Database. NS Dept of Natural Resources.
1	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
1	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
1	Pronych, G. & Wilson, A. 1993. Atlas of Rare Vascular Plants in Nova Scotia. Nova Scotia Museum, Halifax NS, I:1-168, II:169-331. 1446 recs.
1	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
1	Scott, F.W. 1988. Status Report on the Gaspé Shrew (Sorex gaspensis) in Canada. Committee on the Status of Endangered Wildlife in Canada, 12 recs.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 17445 records of 133 vertebrate and 479 records of 47 invertebrate fauna; 6395 records of 282 vascular, 1177 records of 108 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	36	27.4 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	5	95.3 ± 0.0	PE
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	591	32.3 ± 0.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	12	80.6 ± 7.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered	Endangered	Endangered	S2M	1 At Risk	135	43.5 ± 0.0	NS
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	1	89.3 ± 0.0	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	3	37.4 ± 0.0	NS
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Endangered	S1S2B	1 At Risk	223	23.6 ± 7.0	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	71	8.4 ± 0.0	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2	2 May Be At Risk	1	57.4 ± 0.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	2	7.8 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	63	19.6 ± 0.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	226	2.5 ± 7.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	400	2.5 ± 7.0	NS
A	*Cardellina canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	211	7.3 ± 0.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	207	2.5 ± 7.0	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	3 Sensitive	2	80.6 ± 7.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	7	75.7 ± 7.0	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	4	47.6 ± 7.0	NS
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	69.3 ± 16.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	6	24.2 ± 0.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	154	6.8 ± 0.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	74	5.8 ± 0.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	531	2.5 ± 7.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	11	51.5 ± 7.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S2S3M	3 Sensitive	1	89.4 ± 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	79.4 ± 1.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	8	42.0 ± 10.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	173	3.9 ± 0.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	202	7.6 ± 0.0	NS
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern			S4S5	4 Secure	1	97.2 ± 1.0	NS
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S1	1 At Risk	157	18.3 ± 1.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B	5 Undetermined	1	63.0 ± 7.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	2	93.2 ± 0.0	PE
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	18	2.2 ± 0.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B	5 Undetermined	14	30.7 ± 7.0	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		6	72.8 ± 1.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	18	30.2 ± 1.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	408	8.8 ± 7.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	12	28.7 ± 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	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	4 Secure	2	71.6 ± 4.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	76	12.1 ± 7.0	NS
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	220	3.2 ± 0.0	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	79	2.5 ± 7.0	NS
A	*Morone saxatilis*	Striped Bass	E,E,SC			S2S3	2 May Be At Risk	4	47.3 ± 0.0	NS
A	*Martes americana*	American Marten			Endangered	S1	1 At Risk	30	11.5 ± 1.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	13	27.2 ± 0.0	NS
A	*Salmo salar*	Atlantic Salmon				S1	2 May Be At Risk	87	2.2 ± 1.0	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1?	5 Undetermined	7	9.5 ± 0.0	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	3	68.6 ± 7.0	NS
A	*Uria aalge*	Common Murre				S1?B,S5N	4 Secure	3	67.4 ± 0.0	NS
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	2 May Be At Risk	1	73.8 ± 7.0	NS
A	*Anas acuta*	Northern Pintail				S1B	2 May Be At Risk	7	63.8 ± 0.0	NS
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	4 Secure	2	89.1 ± 0.0	NS
A	*Haematopus palliatus*	American Oystercatcher				S1B	5 Undetermined	7	68.6 ± 7.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	17	24.8 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	5 Undetermined	3	68.0 ± 0.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B	5 Undetermined	7	33.7 ± 7.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	224	43.5 ± 0.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	334	36.2 ± 0.0	NS
A	*Pluvialis dominica*	American Golden-Plover				S1S2M	3 Sensitive	80	51.9 ± 0.0	NS
A	*Limosa haemastica*	Hudsonian Godwit				S1S2M	3 Sensitive	95	51.9 ± 0.0	NS
A	*Microtus chrotorrhinus*	Rock Vole				S2	4 Secure	26	2.2 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	10	43.5 ± 7.0	NS
A	*Spatula clypeata*	Northern Shoveler				S2B	2 May Be At Risk	5	66.1 ± 0.0	NS
A	*Mareca strepera*	Gadwall				S2B	2 May Be At Risk	7	66.6 ± 0.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	4	58.7 ± 0.0	NS
A	*Setophaga tigrina*	Cape May Warbler				S2B	3 Sensitive	58	21.4 ± 7.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	4	8.8 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	11	33.7 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	30	35.3 ± 7.0	NS
A	*Alca torda*	Razorbill				S2B,S4N	3 Sensitive	50	45.6 ± 7.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	90	8.2 ± 7.0	NS
A	*Branta bernicla*	Brant				S2M	3 Sensitive	1	69.1 ± 16.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3	3 Sensitive	322	31.2 ± 0.0	NS
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	19	30.7 ± 7.0	NS
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	251	8.2 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	2	93.5 ± 7.0	PE
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	6	42.2 ± 7.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	510	8.8 ± 7.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	110	2.5 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	130	6.5 ± 0.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	4	47.6 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	161	4.3 ± 0.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	155	36.2 ± 0.0	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	75	51.9 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	1	69.0 ± 0.0	NS
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	332	6.0 ± 0.0	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	659	2.5 ± 7.0	NS
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	480	2.5 ± 7.0	NS
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	44	5.3 ± 0.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	60	11.6 ± 0.0	NS
A	*Synaptomys cooperi*	Southern Bog Lemming				S3	4 Secure	10	2.2 ± 0.0	NS
A	*Pekania pennanti*	Fisher				S3	3 Sensitive	1	35.7 ± 0.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	26	47.8 ± 10.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	221	2.5 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	185	2.5 ± 7.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	364	5.4 ± 0.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	92	24.0 ± 0.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	18	19.9 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	68	2.5 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	124	2.5 ± 7.0	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	87	8.2 ± 7.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	477	7.3 ± 0.0	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S3B,S5N	3 Sensitive	76	64.0 ± 7.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S3B,S5N	3 Sensitive	34	64.2 ± 0.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	344	36.2 ± 0.0	NS
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	233	51.9 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	156	43.5 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	282	36.2 ± 0.0	NS
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	160	43.5 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	162	51.9 ± 0.0	NS
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	180	43.5 ± 0.0	NS
A	*Somateria mollissima*	Common Eider				S3S4	4 Secure	248	38.6 ± 7.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	61	28.1 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	31	22.5 ± 0.0	NS
A	*Sorex palustris*	American Water Shrew				S3S4	4 Secure	7	76.8 ± 1.0	NS
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	107	22.9 ± 7.0	NS
A	*Spatula discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	89	8.2 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	607	2.5 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	579	4.8 ± 0.0	NS
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	1443	2.5 ± 7.0	NS
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	148	5.6 ± 0.0	NS
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	950	4.7 ± 0.0	NS
A	*Oreothlypis peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	136	16.7 ± 0.0	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	174	11.6 ± 7.0	NS
A	*Setophaga striata*	Blackpoll Warbler				S3S4B	3 Sensitive	191	16.6 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	263	11.6 ± 7.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	136	8.8 ± 7.0	NS
A	*Bucephala albeola*	Bufflehead				S3S4N	4 Secure	16	64.9 ± 11.0	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N	4 Secure	2	75.1 ± 7.0	NS
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	38	38.6 ± 0.0	NS
A	*Aythya americana*	Redhead				SHB,SNAM	4 Secure	2	87.3 ± 15.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	15	5.9 ± 0.0	NS
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Threatened	S1	1 At Risk	37	55.7 ± 0.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	3	78.1 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern		Vulnerable	S3	3 Sensitive	3	36.0 ± 0.0	NS
I	*Quedius spelaeus*	Spelean Rove Beetle				S1		1	60.6 ± 1.0	NS
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S1	1 At Risk	15	25.2 ± 1.0	NS
I	*Somatochlora albicincta*	Ringed Emerald				S1	2 May Be At Risk	7	64.4 ± 0.0	NS
I	*Somatochlora brevicincta*	Quebec Emerald				S1	2 May Be At Risk	7	95.5 ± 0.0	NS
I	*Leucorrhinia patricia*	Canada Whiteface				S1	2 May Be At Risk	1	67.8 ± 0.0	NS
I	*Coenagrion interrogatum*	Subarctic Bluet				S1	2 May Be At Risk	2	43.8 ± 0.0	NS
I	*Leptodea ochracea*	Tidewater Mucket				S1	3 Sensitive	17	54.5 ± 1.0	NS
I	*Lycaena dorcas*	Dorcas Copper				S1?	6 Not Assessed	24	12.4 ± 0.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	1	67.8 ± 1.0	NS
I	*Strymon melinus*	Grey Hairstreak				S1S2	4 Secure	1	39.0 ± 0.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	1	35.5 ± 1.0	NS
I	*Haematopota rara*	Shy Cleg				S1S3	5 Undetermined	2	49.9 ± 0.0	NS
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	1	31.9 ± 0.0	NS
I	*Boloria chariclea grandis*	Purple Lesser Fritillary				S2	3 Sensitive	7	31.5 ± 0.0	NS

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I	*Aglais milberti milberti*	Milbert's Tortoise Shell				S2	4 Secure	1	25.2 ± 1.0	NS
I	*Somatochlora septentrionalis*	Muskeg Emerald				S2	3 Sensitive	28	28.4 ± 0.0	NS
I	*Somatochlora williamsoni*	Williamson's Emerald				S2	2 May Be At Risk	10	28.7 ± 0.0	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	3 Sensitive	97	20.1 ± 0.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	2	31.5 ± 0.0	NS
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	4	20.9 ± 0.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	9	17.5 ± 1.0	NS
I	*Gomphus descriptus*	Harpoon Clubtail				S2S3	3 Sensitive	16	14.4 ± 0.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	5	21.6 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	1	98.2 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	9	17.6 ± 1.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	5	49.9 ± 0.0	NS
I	*Iphthiminus opacus*	a Darkling Beetle				S3		1	14.8 ± 0.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	2	74.7 ± 1.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	13	21.7 ± 0.0	NS
I	*Oeneis jutta*	Jutta Arctic				S3	2 May Be At Risk	10	17.2 ± 0.0	NS
I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	1	43.7 ± 0.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	1	67.5 ± 1.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	3	14.4 ± 0.0	NS
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	2	38.7 ± 0.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	3	36.1 ± 0.0	NS
I	*Sympetrum danae*	Black Meadowhawk				S3	3 Sensitive	15	33.1 ± 1.0	NS
I	*Enallagma vernale*	Vernal Bluet				S3	5 Undetermined	8	14.4 ± 0.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	23	8.2 ± 1.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	16	25.2 ± 1.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	1	84.3 ± 1.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	15	17.7 ± 0.0	NS
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3S4	4 Secure	20	17.6 ± 1.0	NS
I	*Lampsilis radiata*	Eastern Lampmussel				S3S4	3 Sensitive	13	21.7 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	280	10.9 ± 0.0	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened		Threatened	S1S2	2 May Be At Risk	1	42.4 ± 0.0	NS
N	*Sclerophora peronella (Nova Scotia pop)*	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		5	47.2 ± 0.0	NS
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	73	6.5 ± 0.0	NS
N	*Cladonia brevis*	Short Peg Lichen				S1		1	51.0 ± 0.0	NS
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S1	2 May Be At Risk	2	13.0 ± 0.0	NS
N	*Gowardia nigricans*	Gray Witch's Beard Lichen				S1	6 Not Assessed	1	82.0 ± 1.0	NS
N	*Cavernularia hultenii*	Powdered Honeycomb Lichen				S1	2 May Be At Risk	1	94.1 ± 1.0	NS
N	*Metacalypogeia schusterana*	Schuster's Pouchwort				S1?	5 Undetermined	1	31.4 ± 0.0	NS
N	*Moerckia hibernica*	Irish Ruffwort				S1?		1	31.4 ± 0.0	NS
N	*Brachythecium erythrorrhizon*	Taiga Ragged Moss				S1?		2	31.3 ± 0.0	NS
N	*Calliergon richardsonii*	Richardson's Spear Moss				S1?		1	87.7 ± 0.0	NS
N	*Conardia compacta*	Coast Creeping Moss				S1?	3 Sensitive	2	25.3 ± 2.0	NS
N	*Dicranum elongatum*	Long-forked Broom Moss				S1?	3 Sensitive	3	99.4 ± 0.0	NS
N	*Dicranum groenlandicum*	Mountain Broom Moss				S1?	3 Sensitive	1	99.4 ± 0.0	NS
N	*Entodon concinnus*	Lime Entodon Moss				S1?	3 Sensitive	2	82.6 ± 0.0	NS
N	*Grimmia laevigata*	a Moss				S1?	3 Sensitive	2	77.5 ± 0.0	NS
N	*Grimmia pilifera*	a Moss				S1?	3 Sensitive	2	82.6 ± 0.0	NS
N	*Hygrohypnum smithii*	Smith's Brook Moss				S1?	3 Sensitive	1	82.9 ± 0.0	NS
N	*Orthothecium strictum*	Shiny Erect-capsule Moss				S1?	3 Sensitive	2	82.6 ± 0.0	NS
N	*Paludella squarrosa*	Tufted Fen Moss				S1?	3 Sensitive	1	25.3 ± 5.0	NS
N	*Seligeria recurvata*	a Moss				S1?	3 Sensitive	1	96.1 ± 1.0	NS
N	*Seligeria tristichoides*	a Moss				S1?	3 Sensitive	1	96.1 ± 1.0	NS
N	*Timmia norvegica*	a moss				S1?	3 Sensitive	1	89.2 ± 50.0	NS
N	*Syntrichia ruralis*	a Moss				S1?	3 Sensitive	1	54.6 ± 1.0	NS

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N	*Ulota curvifolia*	a Moss				S1?	3 Sensitive	1	77.5 ± 0.0	NS
N	*Plagiomnium ellipticum*	Marsh Leafy Moss				S1?	2 May Be At Risk	1	82.6 ± 2.0	NS
N	*Flavocetraria nivalis*	Crinkled Snow Lichen				S1?	3 Sensitive	1	65.1 ± 0.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	6	50.1 ± 0.0	NS
N	*Buxbaumia minakatae*	Hump-Backed Elves				S1S2	3 Sensitive	1	29.9 ± 100 0	NS
N	*Ctenidium molluscum*	Mollusc Ctenidium moss				S1S2		1	75.5 ± 1.0	NS
N	*Dicranodontium denudatum*	Beaked Bow Moss				S1S2	3 Sensitive	3	82.6 ± 0.0	NS
N	*Dicranoweisia crispula*	Mountain Thatch Moss				S1S2	3 Sensitive	1	73.6 ± 0.0	NS
N	*Didymodon ferrugineus*	a moss				S1S2	3 Sensitive	2	94.4 ± 0.0	NS
N	*Hypnum pratense*	Meadow Plait Moss				S1S2	3 Sensitive	1	99.8 ± 1.0	NS
N	*Mnium thomsonii*	Thomson's Leafy Moss				S1S2	3 Sensitive	2	94.4 ± 0.0	NS
N	*Plagiobryum zieri*	a Moss				S1S2	3 Sensitive	6	82.6 ± 0.0	NS
N	*Platydictya confervoides*	a Moss				S1S2	3 Sensitive	1	55.6 ± 3.0	NS
N	*Seligeria calcarea*	Chalk Brit le Moss				S1S2	3 Sensitive	2	94.4 ± 0.0	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2		2	17.4 ± 0.0	NS
N	*Hamatocaulis vernicosus*	a Moss				S1S2	3 Sensitive	2	12.5 ± 0.0	NS
N	*Schistidium trichodon*	a Moss				S1S2	3 Sensitive	2	94.4 ± 0.0	NS
N	*Anacamptodon splachnoides*	a Moss				S2?	3 Sensitive	1	95.2 ± 1.0	NS
N	*Anomodon viticulosus*	a Moss				S2?	3 Sensitive	7	94.4 ± 0.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	3	35.2 ± 30.0	NS
N	*Campylium polygamum*	a Moss				S2?	5 Undetermined	1	93.1 ± 2.0	NS
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S2?	5 Undetermined	1	16.7 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	5 Undetermined	1	95.5 ± 0.0	PE
N	*Fontinalis hypnoides*	a moss				S2?	5 Undetermined	2	84.2 ± 1.0	NS
N	*Fontinalis sullivantii*	a Moss				S2?	3 Sensitive	1	29.9 ± 100 0	NS
N	*Grimmia anomala*	Mountain Forest Grimmia				S2?	3 Sensitive	3	50.9 ± 0.0	NS
N	*Hygrohypnum bestii*	Best's Brook Moss				S2?	3 Sensitive	2	97.7 ± 0.0	NS
N	*Kiaeria starkei*	Starke's Fork Moss				S2?	3 Sensitive	1	96.1 ± 1.0	NS
N	*Orthotrichum anomalum*	Anomalous Bristle Moss				S2?	3 Sensitive	1	77.5 ± 0.0	NS
N	*Philonotis marchica*	a Moss				S2?	5 Undetermined	2	94.8 ± 5.0	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	3 Sensitive	4	30.9 ± 0.0	NS
N	*Pseudoleskea patens*	Patent Leskea Moss				S2?	3 Sensitive	5	89.4 ± 0.0	NS
N	*Pseudoleskea stenophylla*	Narrow-leaved Leskea Moss				S2?	3 Sensitive	7	92.0 ± 1.0	NS
N	*Rhytidium rugosum*	Wrinkle-leaved Moss				S2?	3 Sensitive	4	81.8 ± 0.0	NS
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2?	3 Sensitive	9	6.4 ± 0.0	NS
N	*Seligeria donniana*	Donian Beardless Moss				S2?	3 Sensitive	3	93.1 ± 2.0	NS
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	4	82.6 ± 0.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2?	3 Sensitive	1	98.1 ± 5.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2?	3 Sensitive	2	86.8 ± 0.0	NS
N	*Tortella fragilis*	Fragile Twisted Moss				S2?	3 Sensitive	6	31.1 ± 0.0	NS
N	*Anomobryum filiforme*	a moss				S2?		5	81.8 ± 0.0	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	6	31.7 ± 0.0	NS
N	*Platylomella lescurii*	a Moss				S2?	3 Sensitive	2	82.6 ± 1.0	NS
N	*Nephroma arcticum*	Arctic Kidney Lichen				S2?	2 May Be At Risk	1	33.0 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2?	3 Sensitive	16	17.8 ± 0.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3 Sensitive	1	89.4 ± 0.0	NS
N	*Tetraplodon mnioides*	Entire-leaved Nitrogen Moss				S2S3	4 Secure	9	82.6 ± 0.0	NS
N	*Limprichtia revolvens*	a Moss				S2S3	3 Sensitive	6	12.3 ± 0.0	NS
N	*Cetraria muricata*	Spiny Heath Lichen				S2S3	5 Undetermined	4	82.0 ± 1.0	NS
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S2S3	2 May Be At Risk	1	52.1 ± 0.0	NS
N	*Leptogium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	2	13.0 ± 0.0	NS
N	*Racodium rupestre*	Rockhair Lichen				S2S3	5 Undetermined	1	88.1 ± 0.0	NS
N	*Usnea mutabilis*	Bloody Beard Lichen				S2S3	3 Sensitive	1	19.6 ± 0.0	NS
N	*Collema tenax*	Soil Tarpaper Lichen				S3		2	12.9 ± 0.0	NS

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N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	3	46.2 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	4 Secure	36	18.7 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3	4 Secure	1	51.8 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3	3 Sensitive	1	49.8 ± 0.0	NS
N	*Leptogium lichenoides*	Tattered Jellyskin Lichen				S3	2 May Be At Risk	2	13.0 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	1	33.0 ± 0.0	NS
N	*Platismatia norvegica*	Oldgrowth Rag Lichen				S3	4 Secure	128	43.7 ± 0.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	10	41.3 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S3?	3 Sensitive	1	6.6 ± 0.0	NS
N	*Drummondia prorepens*	a Moss				S3?	3 Sensitive	5	72.9 ± 2.0	NS
N	*Anomodon tristis*	a Moss				S3?	3 Sensitive	2	73.3 ± 0.0	NS
N	*Mnium stellare*	Star Leafy Moss				S3?	5 Undetermined	2	31.3 ± 0.0	NS
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	1	94.5 ± 0.0	NS
N	*Dicranella varia*	a Moss				S3S4	5 Undetermined	2	17.7 ± 0.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	10	82.6 ± 0.0	NS
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	4 Secure	5	30.0 ± 0.0	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	3 Sensitive	2	82.6 ± 0.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3S4	4 Secure	1	89.8 ± 0.0	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	4 Secure	2	86.8 ± 0.0	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	3 Sensitive	6	75.5 ± 1.0	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	4 Secure	4	73.6 ± 0.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	3 Sensitive	1	24.4 ± 3.0	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	4 Secure	3	82.0 ± 1.0	NS
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	4 Secure	72	45.4 ± 0.0	NS
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	5 Undetermined	3	48.2 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4		1	44.4 ± 0.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	309	33.4 ± 0.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	4 Secure	5	86.0 ± 0.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	6	14.6 ± 2.0	NS
P	*Juncus caesariensis*	New Jersey Rush	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	239	46.3 ± 0.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	13	59.1 ± 0.0	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	21	27.1 ± 1.0	NS
P	*Salix candida*	Sage Willow			Endangered	S1	2 May Be At Risk	42	27.2 ± 0.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	3	87.0 ± 7.0	NS
P	*Acer saccharinum*	Silver Maple				S1	5 Undetermined	1	64.8 ± 0.0	NS
P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	6	24.9 ± 1.0	NS
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	7	77.0 ± 1.0	NS
P	*Arnica lonchophylla*	Northern Arnica				S1	2 May Be At Risk	11	38.6 ± 7.0	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S1	2 May Be At Risk	3	42.2 ± 7.0	NS
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S1	2 May Be At Risk	1	68.5 ± 3.0	NS
P	*Ageratina altissima*	White Snakeroot				S1	2 May Be At Risk	2	76.4 ± 1.0	NS
P	*Betula glandulosa*	Glandular Birch				S1	2 May Be At Risk	5	78.3 ± 7.0	NS
P	*Cardamine dentata*	Toothed Bittercress				S1	2 May Be At Risk	5	18.0 ± 0.0	NS
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	2 May Be At Risk	4	83.6 ± 0.0	NS
P	*Draba glabella*	Rock Whi low-Grass				S1	2 May Be At Risk	3	77.6 ± 0.0	NS
P	*Draba norvegica*	Norwegian Whitlow-Grass				S1	2 May Be At Risk	8	50.5 ± 2.0	NS
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	2	10.1 ± 2.0	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	2 May Be At Risk	7	71.2 ± 1.0	NS
P	*Diapensia lapponica*	Diapensia				S1	2 May Be At Risk	1	74.3 ± 0.0	NS
P	*Kalmia procumbens*	Alpine Azalea				S1	2 May Be At Risk	1	98.9 ± 0.0	NS
P	*Pinguicula vulgaris*	Common Butterwort				S1	2 May Be At Risk	6	74.3 ± 1.0	NS
P	*Utricularia ochroleuca*	Yellowish-white Bladderwort				S1	5 Undetermined	1	57.9 ± 1.0	NS
P	*Oxyria digyna*	Mountain Sorrel				S1	2 May Be At Risk	8	91.1 ± 0.0	NS
P	*Bistorta vivipara*	Alpine Bistort				S1	2 May Be At Risk	1	37.8 ± 1.0	NS
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	2	48.0 ± 1.0	NS
P	*Anemone multifida*	Cut-leaved Anemone				S1	2 May Be At Risk	4	76.7 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Potentilla litoralis*	Coastal Cinquefoil				S1	0.1 Extirpated	4	81.8 ± 1.0	NS
P	*Salix vestita*	Hairy Willow				S1	2 May Be At Risk	1	82.8 ± 0.0	NS
P	*Saxifraga aizoides*	Yellow Mountain Saxifrage				S1	2 May Be At Risk	8	82.8 ± 0.0	NS
P	*Saxifraga oppositifolia*	Purple Mountain Saxifrage				S1	2 May Be At Risk	2	82.3 ± 1.0	NS
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S1		1	16.3 ± 0.0	NS
P	*Pedicularis palustris*	Marsh Lousewort				S1	2 May Be At Risk	3	93.0 ± 0.0	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	5 Undetermined	2	30.3 ± 1.0	NS
P	*Carex alopecoidea*	Foxtail Sedge				S1	2 May Be At Risk	2	70.3 ± 0.0	NS
P	*Carex granularis*	Limestone Meadow Sedge				S1	2 May Be At Risk	21	5.9 ± 0.0	NS
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	16	6.5 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	2	16.2 ± 0.0	NS
P	*Carex rariflora*	Loose-flowered Alpine Sedge				S1	2 May Be At Risk	10	82.1 ± 5.0	NS
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S1	2 May Be At Risk	3	49.6 ± 0.0	NS
P	*Carex tincta*	Tinged Sedge				S1	2 May Be At Risk	1	70.3 ± 1.0	NS
P	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	54	4.4 ± 0.0	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	6	80.8 ± 0.0	NS
P	*Carex saxatilis*	Russet Sedge				S1	2 May Be At Risk	7	91.7 ± 7.0	NS
P	*Cyperus lupulinus*	Hop Flatsedge				S1	2 May Be At Risk	5	70.5 ± 0.0	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	8	71.1 ± 1.0	NS
P	*Eleocharis erythropoda*	Red-stemmed Spikerush				S1	2 May Be At Risk	6	4.6 ± 0.0	NS
P	*Rhynchospora capillacea*	Slender Beakrush				S1	2 May Be At Risk	8	10.8 ± 10.0	NS
P	*Blysmopsis rufa*	Red Bulrush				S1	2 May Be At Risk	1	69.2 ± 1.0	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	2	30.0 ± 0.0	NS
P	*Triantha glutinosa*	Sticky False-Asphodel				S1	2 May Be At Risk	15	27.2 ± 0.0	NS
P	*Malaxis monophyllos*	White Adder's-mouth				S1	2 May Be At Risk	1	61.6 ± 7.0	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	11	34.6 ± 0.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	9	34.9 ± 0.0	NS
P	*Elymus hystrix*	Spreading Wild Rye				S1	2 May Be At Risk	1	88.0 ± 4.0	NS
P	*Hordeum brachyantherum*	Meadow Barley				S1	2 May Be At Risk	1	56.9 ± 0.0	NS
P	*Phleum alpinum*	Alpine Timothy				S1	2 May Be At Risk	7	55.3 ± 0.0	NS
P	*Torreyochloa pallida var. pallida*	Pale False Manna Grass				S1	0.1 Extirpated	2	67.7 ± 1.0	NS
P	*Graphephorum melicoides*	Purple False Oats				S1	2 May Be At Risk	4	44.6 ± 0.0	NS
P	*Sparganium androcladum*	Branching Bur-Reed				S1	2 May Be At Risk	2	14.0 ± 0.0	NS
P	*Equisetum palustre*	Marsh Horsetail				S1	2 May Be At Risk	8	32.7 ± 0.0	NS
P	*Botrychium lunaria*	Common Moonwort				S1	2 May Be At Risk	2	57.9 ± 1.0	NS
P	*Epilobium lactiflorum*	White-flowered Willowherb				S1?	2 May Be At Risk	1	90.4 ± 5.0	NS
P	*Bolboschoenus robustus*	Sturdy Bulrush				S1?	5 Undetermined	2	24.7 ± 5.0	NS
P	*Dichanthelium lindheimeri*	Lindheimer's Panicgrass				S1?	5 Undetermined	1	90.9 ± 1.0	NS
P	*Huperzia selago*	Northern Firmoss				S1?	2 May Be At Risk	2	64.5 ± 2.0	NS
P	*Fraxinus nigra*	Black Ash			Threatened	S1S2	1 At Risk	98	4.5 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	1	78.2 ± 7.0	NS
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S1S2	2 May Be At Risk	7	57.3 ± 0.0	NS
P	*Cornus suecica*	Swedish Bunchberry				S1S2	3 Sensitive	23	72.6 ± 6.0	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	8	7.7 ± 1.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	6	32.5 ± 7.0	NS
P	*Parnassia parviflora*	Small-flowered Grass-of-Parnassus				S1S2	2 May Be At Risk	17	33.3 ± 3.0	NS
P	*Carex livida*	Livid Sedge				S1S2	2 May Be At Risk	27	41.8 ± 5.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	1	71.2 ± 1.0	NS
P	*Juncus alpinoarticulatus ssp. Rariflorus*					S1S2	2 May Be At Risk	13	16.0 ± 0.0	NS
P	*Juncus bulbosus*	Bulbous Rush				S1S2	5 Undetermined	12	73.9 ± 0.0	NS
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	5 Undetermined	4	13.0 ± 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	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	3 Sensitive	2	25.4 ± 1.0	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	24	33.0 ± 0.0	NS
P	*Festuca prolifera*	Proliferous Fescue				S1S2	3 Sensitive	6	73.2 ± 1.0	NS
P	*Sparganium hyperboreum*	Northern Burreed				S1S2	3 Sensitive	13	30.3 ± 1.0	NS
P	*Cryptogramma stelleri*	Steller's Rockbrake				S1S2	2 May Be At Risk	17	8.5 ± 0.0	NS
P	*Woodsia alpina*	Alpine Cliff Fern				S1S2	2 May Be At Risk	10	59.6 ± 2.0	NS
P	*Selaginella selaginoides*	Low Spikemoss				S1S2	2 May Be At Risk	5	44.5 ± 0.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	2	70.3 ± 0.0	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	3	82.6 ± 0.0	NS
P	*Osmorhiza longistylis*	Smoo h Sweet Cicely				S2	2 May Be At Risk	21	8.1 ± 10.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	8	7.6 ± 0.0	NS
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S2	2 May Be At Risk	11	66.1 ± 2.0	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2	3 Sensitive	1	51.5 ± 7.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	10	8.2 ± 7.0	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	19	21.1 ± 0.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2	3 Sensitive	6	52.5 ± 0.0	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S2	3 Sensitive	9	62.0 ± 1.0	NS
P	*Draba arabisans*	Rock Whi low-Grass				S2	3 Sensitive	14	14.6 ± 1.0	NS
P	*Lobelia kalmii*	Brook Lobelia				S2	2 May Be At Risk	95	4.4 ± 0.0	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	5	82.6 ± 0.0	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	34.6 ± 0.0	NS
P	*Oxybasis rubra*	Red Goosefoot				S2	2 May Be At Risk	4	40.0 ± 2.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	11	83.9 ± 1.0	NS
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	2	13.1 ± 1.0	NS
P	*Crassula aquatica*	Water Pygmyweed				S2	3 Sensitive	6	40.3 ± 7.0	NS
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	2 May Be At Risk	5	77.6 ± 0.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	1	54.1 ± 7.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	6	5.4 ± 0.0	NS
P	*Utricularia resupinata*	Inverted Bladderwort				S2	3 Sensitive	1	45.4 ± 0.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2	5 Undetermined	1	27.2 ± 1.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2	3 Sensitive	10	8.2 ± 7.0	NS
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	10	73.6 ± 1.0	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	2 May Be At Risk	10	51.3 ± 3.0	NS
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	4	22.8 ± 1.0	NS
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	23	24.8 ± 0.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	35	20.3 ± 0.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	93	3.6 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	12	18.1 ± 0.0	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	2 May Be At Risk	28	12.1 ± 7.0	NS
P	*Saxifraga paniculata ssp. Laestadii*	Laestadius' Saxifrage				S2	3 Sensitive	16	18.1 ± 7.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	11	15.0 ± 0.0	NS
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	30	4.5 ± 0.0	NS
P	*Carex capillaris*	Hairlike Sedge				S2	3 Sensitive	14	74.6 ± 1.0	NS
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	24	12.0 ± 0.0	NS
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	1	37.3 ± 1.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	37	10.7 ± 5.0	NS
P	*Carex scirpoidea*	Scirpuslike Sedge				S2	3 Sensitive	13	53.0 ± 4.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	3	56.0 ± 1.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S2	3 Sensitive	2	28.9 ± 0.0	NS
P	*Carex atratiformis*	Scabrous Black Sedge				S2	3 Sensitive	19	8.2 ± 7.0	NS
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S2	3 Sensitive	30	6.4 ± 0.0	NS
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	2	60.3 ± 10.0	NS
P	*Juncus stygius ssp.*	Moor Rush				S2	3 Sensitive	38	36.3 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	americanus									
P	*Allium schoenoprasum*	Wild Chives				S2	2 May Be At Risk	1	65.0 ± 0.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	8	48.6 ± 7.0	NS
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	20	8.6 ± 1.0	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	12	6.7 ± 0.0	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	3 Sensitive	18	4.8 ± 0.0	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	360	6.5 ± 0.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	1	96.5 ± 0.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	26	24.7 ± 0.0	NS
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S2	3 Sensitive	5	93.1 ± 0.0	PE
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2	3 Sensitive	1	67.8 ± 0.0	NS
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	3 Sensitive	1	81.9 ± 10.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	8	28.6 ± 0.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	9	3.8 ± 0.0	NS
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S2	2 May Be At Risk	23	8.2 ± 10.0	NS
P	*Dryopteris fragrans*	Fragrant Wood Fern				S2	3 Sensitive	11	46.9 ± 7.0	NS
P	*Polystichum lonchitis*	Northern Holly Fern				S2	3 Sensitive	21	8.8 ± 7.0	NS
P	*Woodsia glabella*	Smoo h Cliff Fern				S2	3 Sensitive	24	8.2 ± 7.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	59	3.6 ± 0.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	3	69.6 ± 7.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	2	76.7 ± 0.0	NS
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	2 May Be At Risk	1	14.0 ± 0.0	NS
P	*Crataegus submollis*	Quebec Hawthorn				S2?	5 Undetermined	1	96.1 ± 7.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	2	62.6 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	4	34.1 ± 0.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2S3	3 Sensitive	41	47.0 ± 1.0	NS
P	*Iva frutescens*	Big-leaved Marsh-elder				S2S3	3 Sensitive	1	87.3 ± 4.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2S3	3 Sensitive	13	30.8 ± 0.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2S3	3 Sensitive	10	86.2 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	1	71.4 ± 5.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	1	94.0 ± 5.0	PE
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	3 Sensitive	2	45.5 ± 2.0	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	123	8.2 ± 7.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	140	28.8 ± 0.0	NS
P	*Empetrum atropurpureum*	Purple Crowberry				S2S3	3 Sensitive	9	71.5 ± 3.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	13	16.8 ± 1.0	NS
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	46	20.7 ± 0.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	2	65.0 ± 1.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	5 Undetermined	1	52.1 ± 7.0	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	16	3.1 ± 5.0	NS
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	5 Undetermined	7	23.0 ± 1.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	2	50.5 ± 2.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	1	80.9 ± 0.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3 Sensitive	5	18.5 ± 2.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	3	91.7 ± 7.0	NS
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	9	16.4 ± 0.0	NS
P	*Eleocharis flavescens*	Pale Spikerush				S2S3	3 Sensitive	3	84.7 ± 5.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2S3	3 Sensitive	8	18.0 ± 0.0	NS
P	*Oreojuncus trifidus*	Highland Rush				S2S3	3 Sensitive	16	7.4 ± 0.0	NS
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	16	91.2 ± 1.0	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	99	5.8 ± 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	*Poa glauca*	Glaucous Blue Grass				S2S3	3 Sensitive	19	8.5 ± 0.0	NS
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	46	2.5 ± 7.0	NS
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	3 Sensitive	9	8.2 ± 7.0	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	8	25.3 ± 5.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	1	52.3 ± 5.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	4 Secure	33	26.2 ± 0.0	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	100	4.8 ± 0.0	NS
P	*Bidens beckii*	Water Beggarticks				S3	4 Secure	7	21.6 ± 0.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	142	4.8 ± 0.0	NS
P	*Betula pumila var. pumila*	Bog Birch				S3	3 Sensitive	14	21.4 ± 7.0	NS
P	*Betula pumila*	Bog Birch				S3	3 Sensitive	41	17.4 ± 0.0	NS
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	2	7.5 ± 5.0	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	3 Sensitive	1	82.5 ± 0.0	NS
P	*Viburnum edule*	Squashberry				S3	3 Sensitive	64	51.5 ± 7.0	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	20	46.0 ± 0.0	NS
P	*Vaccinium boreale*	Northern Blueberry				S3	3 Sensitive	48	18.1 ± 7.0	NS
P	*Vaccinium cespitosum*	dwarf bilberry				S3	4 Secure	28	38.4 ± 7.0	NS
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3 Sensitive	23	61.8 ± 0.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	1	37.0 ± 0.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	49	3.5 ± 5.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	55	7.1 ± 0.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3	4 Secure	4	17.3 ± 7.0	NS
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4 Secure	27	32.2 ± 2.0	NS
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	20	7.0 ± 0.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	3 Sensitive	1	60.6 ± 7.0	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3	4 Secure	11	8.1 ± 3.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3	3 Sensitive	12	33.5 ± 0.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	1	5.9 ± 0.0	NS
P	*Primula laurentiana*	Laurentian Primrose				S3	4 Secure	1	43.2 ± 7.0	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	16	4.0 ± 0.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	34	19.6 ± 0.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	21	4.0 ± 0.0	NS
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	96	3.3 ± 5.0	NS
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3	4 Secure	459	5.1 ± 0.0	NS
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	220	5.9 ± 0.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3	4 Secure	7	40.3 ± 0.0	NS
P	*Galium kamtschaticum*	Northern Wild Licorice				S3	4 Secure	54	13.8 ± 1.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	21	51.3 ± 0.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	9	45.5 ± 5.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	2	34.9 ± 0.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	17	26.3 ± 2.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	20	8.1 ± 0.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	4 Secure	17	6.4 ± 0.0	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	164	4.1 ± 0.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	6	76.8 ± 0.0	NS
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	4	25.6 ± 5.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	4 Secure	9	29.6 ± 0.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	63	18.9 ± 0.0	NS
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	3	87.3 ± 0.0	NS
P	*Eleocharis nitida*	Quill Spikerush				S3	4 Secure	2	99.3 ± 0.0	NS
P	*Elodea canadensis*	Canada Waterweed				S3	4 Secure	8	24.6 ± 0.0	NS
P	*Juncus subcaudatus*	Woods-Rush				S3	3 Sensitive	10	45.6 ± 0.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	63	4.5 ± 0.0	NS
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S3	3 Sensitive	27	32.2 ± 3.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	31	4.3 ± 0.0	NS
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	51	8.2 ± 7.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	23	7.5 ± 5.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	6	5.9 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	13	4.3 ± 0.0	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	6	12.6 ± 0.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3	4 Secure	19	28.1 ± 0.0	NS
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	22	20.1 ± 1.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	3 Sensitive	17	15.6 ± 0.0	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	3 Sensitive	12	14.0 ± 7.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	18	4.3 ± 5.0	NS
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	4 Secure	27	19.6 ± 0.0	NS
P	*Asplenium viride*	Green Spleenwort				S3	3 Sensitive	35	8.5 ± 0.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3	3 Sensitive	23	15.4 ± 0.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	38	17.8 ± 0.0	NS
P	*Isoetes acadiensis*	Acadian Quillwort				S3	3 Sensitive	10	58.2 ± 1.0	NS
P	*Diphasiastrum sitchense*	Si ka Ground-cedar				S3	4 Secure	10	24.6 ± 5.0	NS
P	*Huperzia appressa*	Mountain Firmoss				S3	3 Sensitive	23	27.1 ± 1.0	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	4 Secure	3	52.3 ± 5.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	5 Undetermined	5	5.1 ± 0.0	NS
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	57	3.5 ± 2.0	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	4 Secure	8	14.4 ± 1.0	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	4 Secure	9	21.9 ± 2.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	5	41.0 ± 1.0	NS
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	17	5.7 ± 0.0	NS
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	148	15.0 ± 0.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	1	77.7 ± 0.0	NS
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	2	93.4 ± 0.0	PE
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	72	3.9 ± 0.0	NS
P	*Salix petiolaris*	Meadow Willow				S3S4	4 Secure	8	18.0 ± 0.0	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	4 Secure	3	16.8 ± 0.0	NS
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	4	17.9 ± 0.0	NS
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	5 Undetermined	8	15.6 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	4	3.6 ± 4.0	NS
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	44	25.4 ± 5.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	16	9.7 ± 1.0	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	4 Secure	1	22.2 ± 0.0	NS
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	20	7.4 ± 0.0	NS
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	418	3.9 ± 0.0	NS
P	*Equisetum hyemale ssp. affine*	common scouring-rush				S3S4	4 Secure	36	8.2 ± 10.0	NS
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	76	6.2 ± 0.0	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	4 Secure	6	17.3 ± 5.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	36	32.8 ± 0.0	NS
P	*Viola canadensis*	Canada Violet				SH	0.1 Extirpated	1	25.3 ± 0.0	NS
P	*Poa alpina*	Alpine Blue Grass				SH	0.1 Extirpated	2	64.2 ± 0.0	NS
P	*Botrychium minganense*	Mingan Moonwort				SH	0.1 Extirpated	1	58.7 ± 1.0	NS
P	*Solidago randii*	Rand's Goldenrod				SNA		1	75.2 ± 5.0	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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DATA REPORT 6327: Whycocomagh Bay 2, NS

Prepared 8 February 2019
by J. Churchill, Data Manager

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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
WhycocomaghBNS 6327ob xls	All Rare and legally protected *Flora and Fauna* in your study area
WhycocomaghBNS 6327ob100km xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
WhycocomaghBNS 6327ma xls	All *Managed Areas* in your study area
WhycocomaghBNS 6327sa.xls	All *Significant Natural Areas* in your study area
WhycocomaghBNS 6327ff xls	Rare and common *Freshwater Fish* in your study area (DFO database)

1.2 RESTRICTIONS

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

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

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

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

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney, Senior Scientist, Executive Director
Tel: (506) 364-2658
sean.blaney@accdc.ca

Animals (Fauna)
John Klymko, Zoologist
Tel: (506) 364-2660
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Plant Communities
Sarah Robinson, Community Ecologist
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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
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Eastern: Terry Power
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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

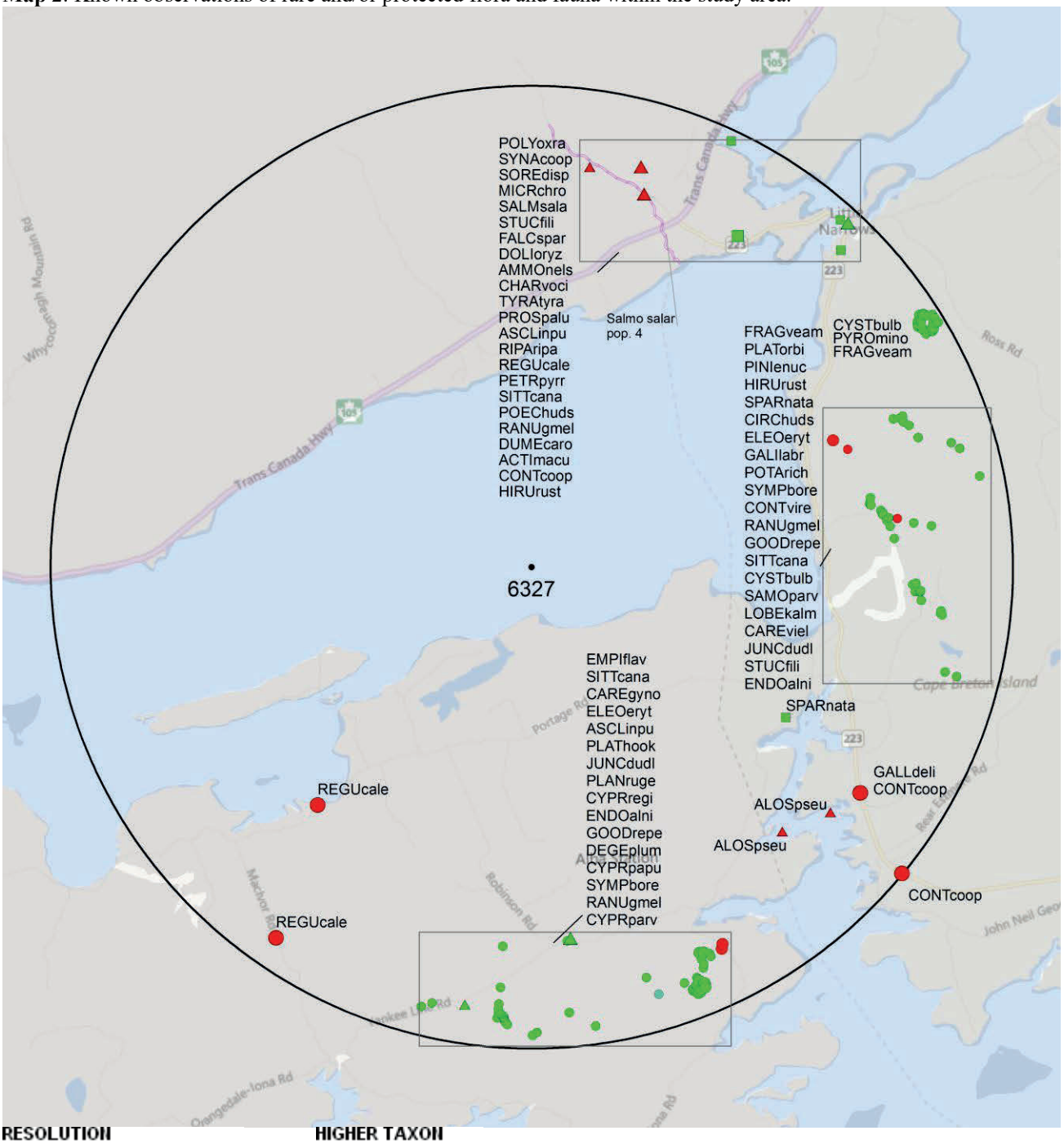
2.1 FLORA

The study area contains 122 records of 26 vascular, 2 records of 1 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 43 records of 24 vertebrate, no records of invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

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



3.0 SPECIAL AREAS

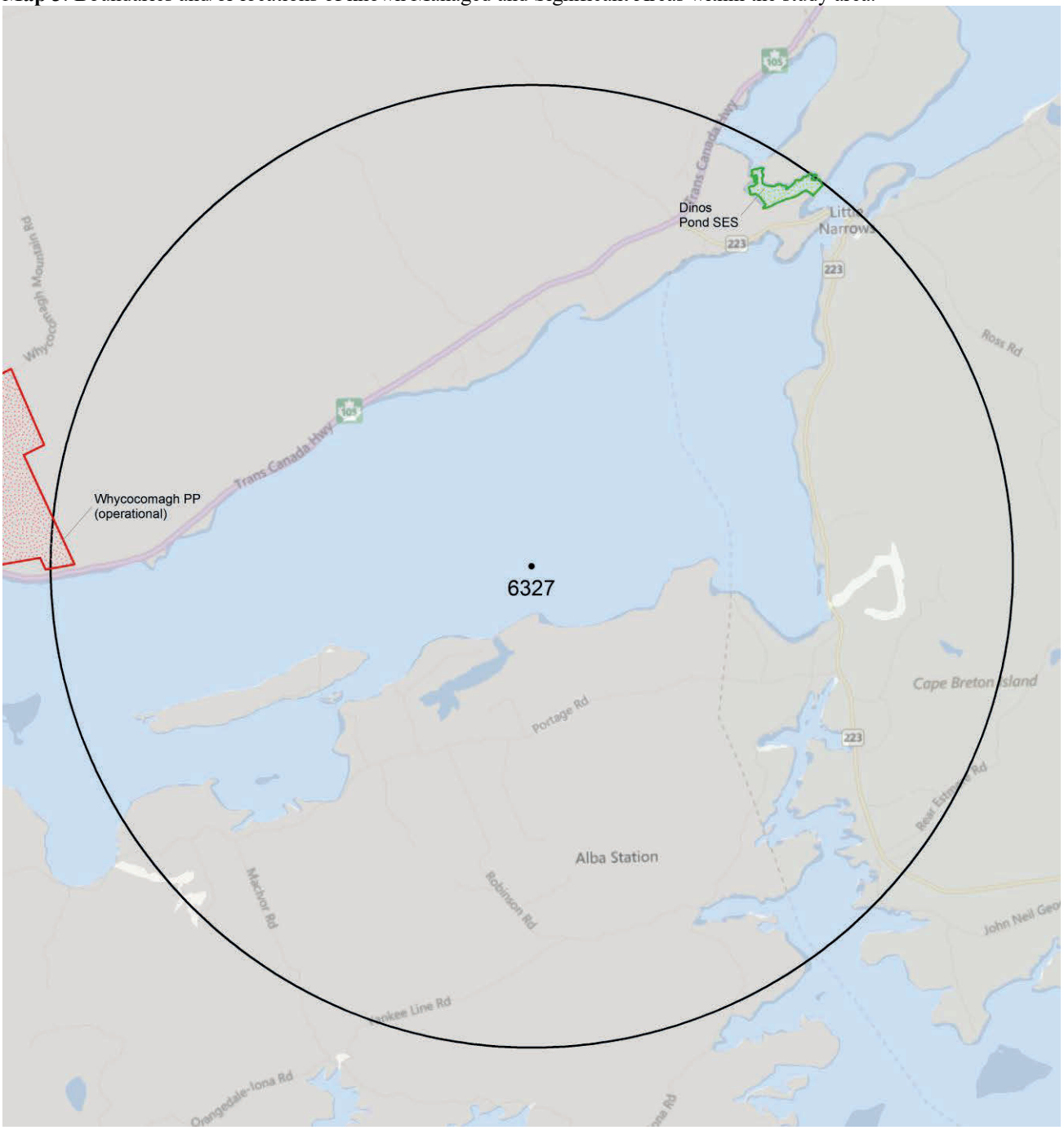
3.1 MANAGED AREAS

The GIS scan identified 1 managed area in the vicinity of the study area (Map 3 and attached file: *ma*.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified 1 biologically significant site 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)
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	2	4.6 ± 0.0
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	6	4.7 ± 0.0
P	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	3	4.0 ± 0.0
P	*Eleocharis erythropoda*	Red-stemmed Spikerush				S1	2 May Be At Risk	2	4.7 ± 0.0
P	*Lobelia kalmii*	Brook Lobelia				S2	2 May Be At Risk	2	4.0 ± 0.0
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	4	3.6 ± 0.0
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	1	4.7 ± 0.0
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	2	4.6 ± 0.0
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	1	3.7 ± 0.0
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	10	3.6 ± 0.0
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	1	4.9 ± 5.0
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	2	4.6 ± 0.0
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	3	4.1 ± 7.0
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	1	4.8 ± 5.0
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	1	3.9 ± 0.0
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	1	3.8 ± 0.0
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	1	4.8 ± 0.0
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	15	3.7 ± 0.0
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3	4 Secure	31	4.4 ± 0.0
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	2	4.1 ± 0.0
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	2	4.2 ± 0.0
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	1	3.9 ± 0.0
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	1	4.5 ± 0.0
P	*Sparganium natans*	Small Burreed				S3	4 Secure	2	3.1 ± 5.0
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	2	3.9 ± 1.0
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	5	4.2 ± 0.0
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	20	4.0 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	1	4.1 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	3	3.4 ± 0.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	1	4.1 ± 7.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	4	4.1 ± 0.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	1	3.8 ± 0.0
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	2	4.2 ± 0.0
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	1	3.5 ± 0.0
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	1	4.1 ± 7.0
A	*Salmo salar*	Atlantic Salmon				S1	2 May Be At Risk	1	4.0 ± 1.0
A	*Microtus chrotorrhinus*	Rock Vole				S2	4 Secure	5	4.2 ± 0.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	2	4.1 ± 7.0
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	1	4.6 ± 0.0
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	1	4.1 ± 7.0
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	3	3.7 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	2	3.8 ± 0.0
A	*Synaptomys cooperi*	Southern Bog Lemming				S3	4 Secure	2	4.2 ± 0.0
A	*Falco sparverius*	American Kestrel				S3B	4 Secure	1	4.1 ± 7.0
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	1	4.1 ± 7.0
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	1	4.1 ± 0.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	2	4.1 ± 7.0
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	1	4.1 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	1	4.1 ± 7.0
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	1	4.4 ± 0.0
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	4	3.3 ± 0.0

4.3 LOCATION SENSITIVE SPECIES

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

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
75	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2015. Atlantic Canada Conservation Data Centre Fieldwork 2015. Atlantic Canada Conservation Data Centre, # recs.
26	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2014. Atlantic Canada Conservation Data Centre Fieldwork 2014. Atlantic Canada Conservation Data Centre, # recs.
23	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
14	Belliveau, A.G. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre, 10695 recs.
8	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
6	Blaney, C.S.; Mazerolle, D.M. 2012. Fieldwork 2012. Atlantic Canada Conservation Data Centre, 13,278 recs.
5	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
3	Newell, R.E. 2000. E.C. Smith Herbarium Database. Acadia University, Wolfville NS, 7139 recs.
3	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.
1	Benjamin, L.K. (compiler) 2012. Significant Habitat & Species Database. NS Dept of Natural Resources.
1	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
1	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
1	Pronych, G. & Wilson, A. 1993. Atlas of Rare Vascular Plants in Nova Scotia. Nova Scotia Museum, Halifax NS, I:1-168, II:169-331. 1446 recs.
1	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
1	Scott, F.W. 1988. Status Report on the Gaspé Shrew (Sorex gaspensis) in Canada. Committee on the Status of Endangered Wildlife in Canada, 12 recs.
1	Staff, DNR 2007. Restricted & Limited Use Land Database (RLUL).

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 17566 records of 133 vertebrate and 480 records of 47 invertebrate fauna; 6337 records of 281 vascular, 1170 records of 104 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	36	27.8 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	5	96.2 ± 0.0	PE
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	589	32.7 ± 0.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	12	78.6 ± 7.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered	Endangered	Endangered	S2M	1 At Risk	135	41.5 ± 0.0	NS
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	1	91.1 ± 0.0	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	3	38.3 ± 0.0	NS
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Endangered	S1S2B	1 At Risk	223	23.1 ± 7.0	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	71	8.2 ± 0.0	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2	2 May Be At Risk	1	57.3 ± 0.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S2	4 Secure	2	6.7 ± 0.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	64	21.4 ± 0.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	227	4.1 ± 7.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	402	3.4 ± 0.0	NS
A	*Cardellina canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	214	6.9 ± 7.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	210	4.1 ± 7.0	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	3 Sensitive	2	78.6 ± 7.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	7	74.1 ± 7.0	NS
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	4	46.0 ± 7.0	NS
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	70.4 ± 16.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	7	25.8 ± 0.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	156	6.7 ± 0.0	NS
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	77	6.6 ± 0.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	535	4.1 ± 7.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	11	53.5 ± 7.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S2S3M	3 Sensitive	1	90.0 ± 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	78.3 ± 1.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	8	42.3 ± 10.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	175	3.8 ± 0.0	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	206	6.9 ± 7.0	NS
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern			S4S5	4 Secure	1	95.9 ± 1.0	NS
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S1	1 At Risk	153	20.2 ± 1.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B	5 Undetermined	1	63.6 ± 7.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	2	94.1 ± 0.0	PE
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	18	4.2 ± 0.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B	5 Undetermined	14	32.2 ± 7.0	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		6	74.8 ± 1.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	18	31.4 ± 1.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	408	6.9 ± 7.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	12	27.7 ± 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	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	4 Secure	2	69.9 ± 4.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	76	12.6 ± 7.0	NS
A	*Circus hudsonius*	Northern Harrier	Not At Risk			S3S4B	4 Secure	220	3.5 ± 0.0	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	79	4.1 ± 7.0	NS
A	*Morone saxatilis*	Striped Bass	E,E,SC			S2S3	2 May Be At Risk	4	49.1 ± 0.0	NS
A	*Martes americana*	American Marten			Endangered	S1	1 At Risk	29	13.2 ± 1.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	13	28.7 ± 0.0	NS
A	*Salmo salar*	Atlantic Salmon				S1	2 May Be At Risk	88	4.0 ± 1.0	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1?	5 Undetermined	7	11.0 ± 0.0	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B	5 Undetermined	3	68.2 ± 7.0	NS
A	*Uria aalge*	Common Murre				S1?B,S5N	4 Secure	3	68.9 ± 0.0	NS
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	2 May Be At Risk	1	72.9 ± 7.0	NS
A	*Anas acuta*	Northern Pintail				S1B	2 May Be At Risk	7	63.1 ± 0.0	NS
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	4 Secure	2	88.0 ± 0.0	NS
A	*Haematopus palliatus*	American Oystercatcher				S1B	5 Undetermined	7	66.6 ± 7.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	4 Secure	17	25.9 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	5 Undetermined	3	66.7 ± 0.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1B	5 Undetermined	7	32.0 ± 7.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S3M	4 Secure	224	41.5 ± 0.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S3S4M	4 Secure	334	37.6 ± 0.0	NS
A	*Pluvialis dominica*	American Golden-Plover				S1S2M	3 Sensitive	80	50.3 ± 0.0	NS
A	*Limosa haemastica*	Hudsonian Godwit				S1S2M	3 Sensitive	95	50.3 ± 0.0	NS
A	*Microtus chrotorrhinus*	Rock Vole				S2	4 Secure	26	4.2 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	9	44.2 ± 7.0	NS
A	*Spatula clypeata*	Northern Shoveler				S2B	2 May Be At Risk	5	67.2 ± 0.0	NS
A	*Mareca strepera*	Gadwall				S2B	2 May Be At Risk	7	67.7 ± 0.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	4	60.6 ± 0.0	NS
A	*Setophaga tigrina*	Cape May Warbler				S2B	3 Sensitive	59	22.3 ± 7.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	4	6.9 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	11	32.0 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	4 Secure	30	36.4 ± 7.0	NS
A	*Alca torda*	Razorbill				S2B,S4N	3 Sensitive	50	47.4 ± 7.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	95	8.6 ± 7.0	NS
A	*Branta bernicla*	Brant				S2M	3 Sensitive	1	67.2 ± 16.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S2S3	3 Sensitive	322	30.0 ± 0.0	NS
A	*Asio otus*	Long-eared Owl				S2S3	2 May Be At Risk	21	32.2 ± 7.0	NS
A	*Spinus pinus*	Pine Siskin				S2S3	3 Sensitive	254	8.6 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	2	94.4 ± 7.0	PE
A	*Rallus limicola*	Virginia Rail				S2S3B	5 Undetermined	6	44.1 ± 7.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	510	6.9 ± 7.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	2 May Be At Risk	112	4.1 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S2S3B	3 Sensitive	132	6.9 ± 7.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	4	46.0 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	162	4.6 ± 0.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S2S3M	3 Sensitive	155	37.6 ± 0.0	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S2S3M	4 Secure	75	50.3 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	1	70.0 ± 0.0	NS
A	*Perisoreus canadensis*	Canada Jay				S3	3 Sensitive	334	5.4 ± 0.0	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	3 Sensitive	668	4.1 ± 7.0	NS
A	*Sitta canadensis*	Red-breasted Nuthatch				S3	4 Secure	485	3.7 ± 0.0	NS
A	*Alosa pseudoharengus*	Alewife				S3	3 Sensitive	44	3.8 ± 0.0	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	3 Sensitive	61	12.3 ± 0.0	NS
A	*Synaptomys cooperi*	Southern Bog Lemming				S3	4 Secure	10	4.2 ± 0.0	NS
A	*Pekania pennanti*	Fisher				S3	3 Sensitive	1	37.7 ± 0.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3?N	3 Sensitive	26	45.9 ± 10.0	NS

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A	*Falco sparverius*	American Kestrel				S3B	4 Secure	221	4.1 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	185	4.1 ± 7.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B	3 Sensitive	366	4.1 ± 0.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	92	22.1 ± 0.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	2 May Be At Risk	19	19.0 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	3 Sensitive	69	4.1 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	125	4.1 ± 7.0	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B	3 Sensitive	89	8.6 ± 7.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	476	6.2 ± 0.0	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S3B,S5N	3 Sensitive	76	65.5 ± 7.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S3B,S5N	3 Sensitive	34	65.7 ± 0.0	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	4 Secure	344	37.6 ± 0.0	NS
A	*Tringa flavipes*	Lesser Yellowlegs				S3M	4 Secure	233	50.3 ± 0.0	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	156	41.5 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	282	37.6 ± 0.0	NS
A	*Calidris fuscicollis*	White-rumped Sandpiper				S3M	4 Secure	160	41.5 ± 0.0	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	4 Secure	162	50.3 ± 0.0	NS
A	*Calidris alba*	Sanderling				S3M,S2N	4 Secure	180	41.5 ± 0.0	NS
A	*Somateria mollissima*	Common Eider				S3S4	4 Secure	257	36.6 ± 7.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	61	28.1 ± 7.0	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	4 Secure	31	23.7 ± 0.0	NS
A	*Sorex palustris*	American Water Shrew				S3S4	4 Secure	7	78.7 ± 1.0	NS
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	108	24.4 ± 7.0	NS
A	*Spatula discors*	Blue-winged Teal				S3S4B	2 May Be At Risk	89	8.6 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	612	4.1 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	584	4.4 ± 0.0	NS
A	*Regulus calendula*	Ruby-crowned Kinglet				S3S4B	3 Sensitive	1457	3.3 ± 0.0	NS
A	*Catharus fuscescens*	Veery				S3S4B	4 Secure	152	5.7 ± 0.0	NS
A	*Catharus ustulatus*	Swainson's Thrush				S3S4B	4 Secure	960	5.4 ± 0.0	NS
A	*Oreothlypis peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	139	15.6 ± 0.0	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	177	13.6 ± 7.0	NS
A	*Setophaga striata*	Blackpoll Warbler				S3S4B	3 Sensitive	192	18.1 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	264	13.6 ± 7.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5N	4 Secure	141	6.9 ± 7.0	NS
A	*Bucephala albeola*	Bufflehead				S3S4N	4 Secure	18	63.0 ± 11.0	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N	4 Secure	2	75.9 ± 7.0	NS
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	38	38.9 ± 0.0	NS
A	*Aythya americana*	Redhead				SHB,SNAM	4 Secure	2	88.2 ± 15.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	15	6.3 ± 0.0	NS
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Threatened	S1	1 At Risk	37	56.3 ± 0.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	3	76.4 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern		Vulnerable	S3	3 Sensitive	3	37.1 ± 0.0	NS
I	*Quedius spelaeus*	Spelean Rove Beetle				S1		1	62.0 ± 1.0	NS
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S1	1 At Risk	15	26.5 ± 1.0	NS
I	*Somatochlora albicincta*	Ringed Emerald				S1	2 May Be At Risk	7	66.4 ± 0.0	NS
I	*Somatochlora brevicincta*	Quebec Emerald				S1	2 May Be At Risk	7	97.5 ± 0.0	NS
I	*Leucorrhinia patricia*	Canada Whiteface				S1	2 May Be At Risk	1	69.8 ± 0.0	NS
I	*Coenagrion interrogatum*	Subarctic Bluet				S1	2 May Be At Risk	2	45.6 ± 0.0	NS
I	*Leptodea ochracea*	Tidewater Mucket				S1	3 Sensitive	17	55.0 ± 1.0	NS
I	*Lycaena dorcas*	Dorcas Copper				S1?	6 Not Assessed	24	11.9 ± 0.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	1	68.6 ± 1.0	NS
I	*Strymon melinus*	Grey Hairstreak				S1S2	4 Secure	1	37.0 ± 0.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	1	33.9 ± 1.0	NS
I	*Haematopota rara*	Shy Cleg				S1S3	5 Undetermined	2	48.3 ± 0.0	NS
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	1	32.3 ± 0.0	NS
I	*Boloria chariclea grandis*	Purple Lesser Fritillary				S2	3 Sensitive	7	33.3 ± 0.0	NS

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I	*Aglais milberti milberti*	Milbert's Tortoise Shell				S2	4 Secure	1	26.5 ± 1.0	NS
I	*Somatochlora septentrionalis*	Muskeg Emerald				S2	3 Sensitive	26	30.4 ± 0.0	NS
I	*Somatochlora williamsoni*	Williamson's Emerald				S2	2 May Be At Risk	10	30.3 ± 0.0	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	3 Sensitive	97	18.6 ± 0.0	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	2	33.4 ± 0.0	NS
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	4	22.8 ± 0.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	9	17.6 ± 1.0	NS
I	*Gomphus descriptus*	Harpoon Clubtail				S2S3	3 Sensitive	16	13.0 ± 0.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	5	20.3 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	1	97.2 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	9	18.9 ± 1.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	5	47.9 ± 0.0	NS
I	*Iphthiminus opacus*	a Darkling Beetle				S3		1	13.6 ± 0.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	2	73.7 ± 1.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	13	20.7 ± 0.0	NS
I	*Oeneis jutta*	Jutta Arctic				S3	2 May Be At Risk	10	18.7 ± 0.0	NS
I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	1	42.0 ± 0.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	1	67.7 ± 1.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	3	13.0 ± 0.0	NS
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	2	40.3 ± 0.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	3	34.6 ± 0.0	NS
I	*Sympetrum danae*	Black Meadowhawk				S3	3 Sensitive	15	31.6 ± 1.0	NS
I	*Enallagma vernale*	Vernal Bluet				S3	5 Undetermined	8	13.0 ± 0.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	23	8.0 ± 1.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	16	26.5 ± 1.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	1	83.1 ± 1.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	15	19.2 ± 0.0	NS
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3S4	4 Secure	22	18.9 ± 1.0	NS
I	*Lampsilis radiata*	Eastern Lampmussel				S3S4	3 Sensitive	14	23.0 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	280	8.9 ± 0.0	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened		Threatened	S1S2	2 May Be At Risk	1	41.3 ± 0.0	NS
N	*Sclerophora peronella (Nova Scotia pop)*	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		5	46.6 ± 0.0	NS
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	73	4.6 ± 0.0	NS
N	*Cladonia brevis*	Short Peg Lichen				S1		1	49.4 ± 0.0	NS
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S1	2 May Be At Risk	2	12.8 ± 0.0	NS
N	*Gowardia nigricans*	Gray Witch's Beard Lichen				S1	6 Not Assessed	1	83.9 ± 1.0	NS
N	*Cavernularia hultenii*	Powdered Honeycomb Lichen				S1	2 May Be At Risk	1	94.3 ± 1.0	NS
N	*Metacalypogeia schusterana*	Schuster's Pouchwort				S1?	5 Undetermined	1	32.6 ± 0.0	NS
N	*Moerckia hibernica*	Irish Ruffwort				S1?		1	32.6 ± 0.0	NS
N	*Brachythecium erythrorrhizon*	Taiga Ragged Moss				S1?		2	32.6 ± 0.0	NS
N	*Calliergon richardsonii*	Richardson's Spear Moss				S1?		1	89.7 ± 0.0	NS
N	*Conardia compacta*	Coast Creeping Moss				S1?	3 Sensitive	2	26.0 ± 2.0	NS
N	*Entodon concinnus*	Lime Entodon Moss				S1?	3 Sensitive	2	84.6 ± 0.0	NS
N	*Grimmia laevigata*	a Moss				S1?	3 Sensitive	2	79.5 ± 0.0	NS
N	*Grimmia pilifera*	a Moss				S1?	3 Sensitive	2	84.6 ± 0.0	NS
N	*Hygrohypnum smithii*	Smith's Brook Moss				S1?	3 Sensitive	1	84.8 ± 0.0	NS
N	*Orthothecium strictum*	Shiny Erect-capsule Moss				S1?	3 Sensitive	2	84.6 ± 0.0	NS
N	*Paludella squarrosa*	Tufted Fen Moss				S1?	3 Sensitive	1	26.9 ± 5.0	NS
N	*Seligeria recurvata*	a Moss				S1?	3 Sensitive	1	98.0 ± 1.0	NS
N	*Seligeria tristichoides*	a Moss				S1?	3 Sensitive	1	98.0 ± 1.0	NS
N	*Timmia norvegica*	a moss				S1?	3 Sensitive	1	91.1 ± 50.0	NS
N	*Syntrichia ruralis*	a Moss				S1?	3 Sensitive	1	56.2 ± 1.0	NS
N	*Ulota curvifolia*	a Moss				S1?	3 Sensitive	1	79.5 ± 0.0	NS
N	*Plagiomnium ellipticum*	Marsh Leafy Moss				S1?	2 May Be At Risk	1	84.5 ± 2.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Flavocetraria nivalis*	Crinkled Snow Lichen				S1?	3 Sensitive	1	67.0 ± 0.0	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	6	49.1 ± 0.0	NS
N	*Buxbaumia minakatae*	Hump-Backed Elves				S1S2	3 Sensitive	1	31.4 ± 100 0	NS
N	*Ctenidium molluscum*	Mollusc Ctenidium moss				S1S2		1	77.5 ± 1.0	NS
N	*Dicranodontium denudatum*	Beaked Bow Moss				S1S2	3 Sensitive	2	84.6 ± 0.0	NS
N	*Dicranoweisia crispula*	Mountain Thatch Moss				S1S2	3 Sensitive	1	75.6 ± 0.0	NS
N	*Didymodon ferrugineus*	a moss				S1S2	3 Sensitive	2	96.3 ± 0.0	NS
N	*Mnium thomsonii*	Thomson's Leafy Moss				S1S2	3 Sensitive	2	96.3 ± 0.0	NS
N	*Plagiobryum zieri*	a Moss				S1S2	3 Sensitive	6	84.6 ± 0.0	NS
N	*Platydictya confervoides*	a Moss				S1S2	3 Sensitive	1	56.6 ± 3.0	NS
N	*Seligeria calcarea*	Chalk Brit le Moss				S1S2	3 Sensitive	2	96.3 ± 0.0	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2		2	15.5 ± 0.0	NS
N	*Hamatocaulis vernicosus*	a Moss				S1S2	3 Sensitive	2	12.1 ± 0.0	NS
N	*Schistidium trichodon*	a Moss				S1S2	3 Sensitive	2	96.3 ± 0.0	NS
N	*Anacamptodon splachnoides*	a Moss				S2?	3 Sensitive	1	97.0 ± 1.0	NS
N	*Anomodon viticulosus*	a Moss				S2?	3 Sensitive	7	96.3 ± 0.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	3	36.5 ± 30.0	NS
N	*Campylium polygamum*	a Moss				S2?	5 Undetermined	1	95.1 ± 2.0	NS
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S2?	5 Undetermined	1	15.4 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S2?	5 Undetermined	1	96.3 ± 0.0	PE
N	*Fontinalis hypnoides*	a moss				S2?	5 Undetermined	2	86.2 ± 1.0	NS
N	*Fontinalis sullivantii*	a Moss				S2?	3 Sensitive	1	31.4 ± 100 0	NS
N	*Grimmia anomala*	Mountain Forest Grimmia				S2?	3 Sensitive	3	52.9 ± 0.0	NS
N	*Hygrohypnum bestii*	Best's Brook Moss				S2?	3 Sensitive	2	99.7 ± 0.0	NS
N	*Kiaeria starkei*	Starke's Fork Moss				S2?	3 Sensitive	1	98.0 ± 1.0	NS
N	*Orthotrichum anomalum*	Anomalous Bristle Moss				S2?	3 Sensitive	1	79.5 ± 0.0	NS
N	*Philonotis marchica*	a Moss				S2?	5 Undetermined	2	96.8 ± 5.0	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	3 Sensitive	4	30.8 ± 0.0	NS
N	*Pseudoleskea patens*	Patent Leskea Moss				S2?	3 Sensitive	4	91.2 ± 0.0	NS
N	*Pseudoleskea stenophylla*	Narrow-leaved Leskea Moss				S2?	3 Sensitive	6	94.0 ± 1.0	NS
N	*Rhytidium rugosum*	Wrinkle-leaved Moss				S2?	3 Sensitive	4	83.8 ± 0.0	NS
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2?	3 Sensitive	9	6.7 ± 0.0	NS
N	*Seligeria donniana*	Donian Beardless Moss				S2?	3 Sensitive	3	95.1 ± 2.0	NS
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	4	84.5 ± 0.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2?	3 Sensitive	2	88.8 ± 0.0	NS
N	*Tortella fragilis*	Fragile Twisted Moss				S2?	3 Sensitive	6	32.4 ± 0.0	NS
N	*Anomobryum filiforme*	a moss				S2?		5	83.8 ± 0.0	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	6	33.4 ± 0.0	NS
N	*Platylomella lescurii*	a Moss				S2?	3 Sensitive	2	84.6 ± 1.0	NS
N	*Nephroma arcticum*	Arctic Kidney Lichen				S2?	2 May Be At Risk	1	32.2 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2?	3 Sensitive	17	15.8 ± 0.0	NS
N	*Platydictya subtilis*	Bark Willow Moss				S2S3	3 Sensitive	1	91.2 ± 0.0	NS
N	*Tetraplodon mnioides*	Entire-leaved Nitrogen Moss				S2S3	4 Secure	9	84.5 ± 0.0	NS
N	*Limprichtia revolvens*	a Moss				S2S3	3 Sensitive	6	11.9 ± 0.0	NS
N	*Cetraria muricata*	Spiny Heath Lichen				S2S3	5 Undetermined	4	83.9 ± 1.0	NS
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S2S3	2 May Be At Risk	1	53.1 ± 0.0	NS
N	*Leptogium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	2	12.8 ± 0.0	NS
N	*Racodium rupestre*	Rockhair Lichen				S2S3	5 Undetermined	1	88.3 ± 0.0	NS
N	*Usnea mutabilis*	Bloody Beard Lichen				S2S3	3 Sensitive	1	18.6 ± 0.0	NS
N	*Collema tenax*	Soil Tarpaper Lichen				S3		2	12.7 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3	3 Sensitive	3	45.1 ± 0.0	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	4 Secure	36	16.8 ± 0.0	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3	4 Secure	1	50.8 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3	3 Sensitive	1	48.8 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Leptogium lichenoides*	Tattered Jellyskin Lichen				S3	2 May Be At Risk	2	12.8 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3 Sensitive	1	32.2 ± 0.0	NS
N	*Platismatia norvegica*	Oldgrowth Rag Lichen				S3	4 Secure	128	43.1 ± 0.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S3	4 Secure	10	40.5 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S3?	3 Sensitive	1	6.8 ± 0.0	NS
N	*Drummondia prorepens*	a Moss				S3?	3 Sensitive	5	74.9 ± 2.0	NS
N	*Anomodon tristis*	a Moss				S3?	3 Sensitive	2	75.3 ± 0.0	NS
N	*Mnium stellare*	Star Leafy Moss				S3?	5 Undetermined	2	32.6 ± 0.0	NS
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	1	96.5 ± 0.0	NS
N	*Dicranella varia*	a Moss				S3S4	5 Undetermined	2	15.7 ± 0.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	9	84.5 ± 0.0	NS
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	4 Secure	5	31.7 ± 0.0	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	3 Sensitive	2	84.6 ± 0.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3S4	4 Secure	1	90.0 ± 0.0	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	4 Secure	2	88.8 ± 0.0	NS
N	*Thamnobryum alleghaniense*	a Moss				S3S4	3 Sensitive	6	77.5 ± 1.0	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	4 Secure	4	75.6 ± 0.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	3 Sensitive	1	26.2 ± 3.0	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	4 Secure	3	83.9 ± 1.0	NS
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	4 Secure	72	44.3 ± 0.0	NS
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	5 Undetermined	3	49.5 ± 0.0	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4		1	44.6 ± 0.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	4 Secure	309	32.4 ± 0.0	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	4 Secure	5	84.2 ± 0.0	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	4 Secure	8	12.7 ± 2.0	NS
P	*Juncus caesariensis*	New Jersey Rush	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	239	45.1 ± 5.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	13	60.0 ± 0.0	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	21	25.9 ± 1.0	NS
P	*Salix candida*	Sage Willow			Endangered	S1	2 May Be At Risk	42	28.4 ± 0.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	3	86.0 ± 7.0	NS
P	*Acer saccharinum*	Silver Maple				S1	5 Undetermined	1	65.6 ± 0.0	NS
P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	6	26.4 ± 1.0	NS
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	7	75.7 ± 5.0	NS
P	*Arnica lonchophylla*	Northern Arnica				S1	2 May Be At Risk	11	36.6 ± 7.0	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S1	2 May Be At Risk	3	44.1 ± 7.0	NS
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S1	2 May Be At Risk	1	69.5 ± 3.0	NS
P	*Ageratina altissima*	White Snakeroot				S1	2 May Be At Risk	2	75.4 ± 1.0	NS
P	*Betula glandulosa*	Glandular Birch				S1	2 May Be At Risk	5	80.2 ± 7.0	NS
P	*Cardamine dentata*	Toothed Bittercress				S1	2 May Be At Risk	5	16.3 ± 0.0	NS
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	2 May Be At Risk	4	81.6 ± 0.0	NS
P	*Draba glabella*	Rock Whi low-Grass				S1	2 May Be At Risk	3	79.5 ± 0.0	NS
P	*Draba norvegica*	Norwegian Whitlow-Grass				S1	2 May Be At Risk	8	52.5 ± 2.0	NS
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	2	8.4 ± 2.0	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	2 May Be At Risk	7	70.0 ± 1.0	NS
P	*Diapensia lapponica*	Diapensia				S1	2 May Be At Risk	1	76.3 ± 0.0	NS
P	*Pinguicula vulgaris*	Common Butterwort				S1	2 May Be At Risk	6	76.3 ± 1.0	NS
P	*Utricularia ochroleuca*	Yellowish-white Bladderwort				S1	5 Undetermined	1	59.7 ± 1.0	NS
P	*Oxyria digyna*	Mountain Sorrel				S1	2 May Be At Risk	8	93.0 ± 0.0	NS
P	*Bistorta vivipara*	Alpine Bistort				S1	2 May Be At Risk	1	36.0 ± 1.0	NS
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	2	46.2 ± 1.0	NS
P	*Anemone multifida*	Cut-leaved Anemone				S1	2 May Be At Risk	4	78.7 ± 1.0	NS
P	*Potentilla litoralis*	Coastal Cinquefoil				S1	0.1 Extirpated	4	83.8 ± 1.0	NS
P	*Salix vestita*	Hairy Willow				S1	2 May Be At Risk	1	84.8 ± 0.0	NS
P	*Saxifraga aizoides*	Yellow Mountain Saxifrage				S1	2 May Be At Risk	8	84.8 ± 0.0	NS
P	*Saxifraga oppositifolia*	Purple Mountain Saxifrage				S1	2 May Be At Risk	2	84.2 ± 1.0	NS
P	*Agalinis purpurea var.*	Small-flowered Purple False				S1		1	14.8 ± 0.0	NS

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	parviflora	Foxglove								
P	*Pedicularis palustris*	Marsh Lousewort				S1	2 May Be At Risk	3	93.2 ± 0.0	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	5 Undetermined	2	31.6 ± 1.0	NS
P	*Carex alopecoidea*	Foxtail Sedge				S1	2 May Be At Risk	2	69.1 ± 0.0	NS
P	*Carex granularis*	Limestone Meadow Sedge				S1	2 May Be At Risk	21	5.2 ± 0.0	NS
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	16	4.7 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	2	15.1 ± 0.0	NS
P	*Carex rariflora*	Loose-flowered Alpine Sedge				S1	2 May Be At Risk	9	82.2 ± 5.0	NS
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S1	2 May Be At Risk	3	48.0 ± 0.0	NS
P	*Carex tincta*	Tinged Sedge				S1	2 May Be At Risk	1	69.1 ± 1.0	NS
P	*Carex viridula var. elatior*	Greenish Sedge				S1	2 May Be At Risk	54	4.0 ± 0.0	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	6	79.6 ± 0.0	NS
P	*Carex saxatilis*	Russet Sedge				S1	2 May Be At Risk	7	93.5 ± 7.0	NS
P	*Cyperus lupulinus*	Hop Flatsedge				S1	2 May Be At Risk	5	69.3 ± 0.0	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	8	70.0 ± 1.0	NS
P	*Eleocharis erythropoda*	Red-stemmed Spikerush				S1	2 May Be At Risk	6	4.7 ± 0.0	NS
P	*Rhynchospora capillacea*	Slender Beakrush				S1	2 May Be At Risk	8	12.2 ± 10.0	NS
P	*Blysmopsis rufa*	Red Bulrush				S1	2 May Be At Risk	1	71.2 ± 1.0	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	2	31.4 ± 0.0	NS
P	*Triantha glutinosa*	Sticky False-Asphodel				S1	2 May Be At Risk	15	28.4 ± 0.0	NS
P	*Malaxis monophyllos*	White Adder's-mouth				S1	2 May Be At Risk	1	60.0 ± 7.0	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	11	33.0 ± 0.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	9	33.2 ± 0.0	NS
P	*Elymus hystrix*	Spreading Wild Rye				S1	2 May Be At Risk	1	88.5 ± 4.0	NS
P	*Hordeum brachyantherum*	Meadow Barley				S1	2 May Be At Risk	1	58.8 ± 0.0	NS
P	*Phleum alpinum*	Alpine Timothy				S1	2 May Be At Risk	7	57.3 ± 0.0	NS
P	*Torreyochloa pallida var. pallida*	Pale False Manna Grass				S1	0.1 Extirpated	2	67.2 ± 1.0	NS
P	*Graphephorum melicoides*	Purple False Oats				S1	2 May Be At Risk	4	46.6 ± 0.0	NS
P	*Sparganium androcladum*	Branching Bur-Reed				S1	2 May Be At Risk	2	15.3 ± 0.0	NS
P	*Equisetum palustre*	Marsh Horsetail				S1	2 May Be At Risk	8	33.1 ± 0.0	NS
P	*Botrychium lunaria*	Common Moonwort				S1	2 May Be At Risk	2	59.5 ± 1.0	NS
P	*Epilobium lactiflorum*	White-flowered Willowherb				S1?	2 May Be At Risk	1	92.3 ± 5.0	NS
P	*Bolboschoenus robustus*	Sturdy Bulrush				S1?	5 Undetermined	2	26.0 ± 5.0	NS
P	*Dichanthelium lindheimeri*	Lindheimer's Panicgrass				S1?	5 Undetermined	1	92.8 ± 1.0	NS
P	*Huperzia selago*	Northern Firmoss				S1?	2 May Be At Risk	2	66.2 ± 2.0	NS
P	*Fraxinus nigra*	Black Ash			Threatened	S1S2	1 At Risk	96	4.1 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	1	77.1 ± 7.0	NS
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S1S2	2 May Be At Risk	7	58.4 ± 0.0	NS
P	*Cornus suecica*	Swedish Bunchberry				S1S2	3 Sensitive	22	70.7 ± 6.0	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	8	6.9 ± 1.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	6	34.3 ± 7.0	NS
P	*Parnassia parviflora*	Small-flowered Grass-of-Parnassus				S1S2	2 May Be At Risk	17	34.5 ± 3.0	NS
P	*Carex livida*	Livid Sedge				S1S2	2 May Be At Risk	27	40.0 ± 5.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	1	70.0 ± 1.0	NS
P	*Juncus alpinoarticulatus ssp. Rariflorus*					S1S2	2 May Be At Risk	13	16.3 ± 0.0	NS
P	*Juncus bulbosus*	Bulbous Rush				S1S2	5 Undetermined	12	74.7 ± 0.0	NS
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	5 Undetermined	5	11.9 ± 0.0	NS
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S1S2	3 Sensitive	2	27.0 ± 1.0	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	24	31.4 ± 0.0	NS
P	*Festuca prolifera*	Proliferous Fescue				S1S2	3 Sensitive	6	75.2 ± 1.0	NS
P	*Sparganium hyperboreum*	Northern Burreed				S1S2	3 Sensitive	14	30.9 ± 1.0	NS

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P	*Cryptogramma stelleri*	Steller's Rockbrake				S1S2	2 May Be At Risk	17	9.1 ± 0.0	NS
P	*Woodsia alpina*	Alpine Cliff Fern				S1S2	2 May Be At Risk	10	61.3 ± 2.0	NS
P	*Selaginella selaginoides*	Low Spikemoss				S1S2	2 May Be At Risk	5	42.9 ± 0.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	2	69.1 ± 0.0	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	3	84.6 ± 0.0	NS
P	*Osmorhiza longistylis*	Smoo h Sweet Cicely				S2	2 May Be At Risk	21	7.9 ± 10.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	8	6.9 ± 7.0	NS
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S2	2 May Be At Risk	11	68.1 ± 2.0	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2	3 Sensitive	1	53.5 ± 7.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	10	8.6 ± 7.0	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	19	19.9 ± 0.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2	3 Sensitive	6	53.5 ± 1.0	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S2	3 Sensitive	9	64.0 ± 1.0	NS
P	*Draba arabisans*	Rock Whi low-Grass				S2	3 Sensitive	14	15.3 ± 1.0	NS
P	*Lobelia kalmii*	Brook Lobelia				S2	2 May Be At Risk	95	4.0 ± 0.0	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	5	82.7 ± 0.0	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	33.0 ± 0.0	NS
P	*Oxybasis rubra*	Red Goosefoot				S2	2 May Be At Risk	4	41.0 ± 2.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	11	85.9 ± 1.0	NS
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	2	13.6 ± 1.0	NS
P	*Crassula aquatica*	Water Pygmyweed				S2	3 Sensitive	6	38.5 ± 7.0	NS
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	2 May Be At Risk	5	79.5 ± 0.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	1	52.6 ± 7.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	6	6.2 ± 0.0	NS
P	*Utricularia resupinata*	Inverted Bladderwort				S2	3 Sensitive	1	44.3 ± 0.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2	5 Undetermined	1	28.9 ± 1.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2	3 Sensitive	10	8.6 ± 7.0	NS
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	10	75.5 ± 1.0	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	2 May Be At Risk	10	49.9 ± 3.0	NS
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	4	24.7 ± 1.0	NS
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	23	25.3 ± 0.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	34	22.2 ± 0.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	93	3.6 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	12	16.8 ± 0.0	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	2 May Be At Risk	28	12.6 ± 7.0	NS
P	*Saxifraga paniculata ssp. Laestadii*	Laestadius' Saxifrage				S2	3 Sensitive	16	18.2 ± 7.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	11	13.1 ± 0.0	NS
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	30	5.4 ± 0.0	NS
P	*Carex capillaris*	Hairlike Sedge				S2	3 Sensitive	14	76.5 ± 1.0	NS
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	24	11.6 ± 0.0	NS
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	1	38.9 ± 1.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	37	12.1 ± 5.0	NS
P	*Carex scirpoidea*	Scirpuslike Sedge				S2	3 Sensitive	13	55.0 ± 4.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	3	54.6 ± 1.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S2	3 Sensitive	2	30.5 ± 0.0	NS
P	*Carex atratiformis*	Scabrous Black Sedge				S2	3 Sensitive	19	8.6 ± 7.0	NS
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S2	3 Sensitive	30	6.7 ± 0.0	NS
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	2	62.3 ± 10.0	NS
P	*Juncus stygius ssp. americanus*	Moor Rush				S2	3 Sensitive	37	37.9 ± 7.0	NS
P	*Allium schoenoprasum*	Wild Chives				S2	2 May Be At Risk	1	65.8 ± 0.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	8	46.6 ± 7.0	NS
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	20	8.6 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	12	4.7 ± 0.0	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	3 Sensitive	18	5.5 ± 0.0	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	360	4.6 ± 0.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	1	98.4 ± 0.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	26	25.2 ± 0.0	NS
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S2	3 Sensitive	5	94.0 ± 0.0	PE
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2	3 Sensitive	1	69.7 ± 0.0	NS
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	3 Sensitive	1	82.3 ± 10.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	8	29.8 ± 0.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	9	3.7 ± 0.0	NS
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S2	2 May Be At Risk	23	8.6 ± 10.0	NS
P	*Dryopteris fragrans*	Fragrant Wood Fern				S2	3 Sensitive	11	48.8 ± 7.0	NS
P	*Polystichum lonchitis*	Northern Holly Fern				S2	3 Sensitive	21	6.9 ± 7.0	NS
P	*Woodsia glabella*	Smoo h Cliff Fern				S2	3 Sensitive	24	8.6 ± 7.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	59	3.6 ± 0.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	3	68.4 ± 7.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	2	75.7 ± 0.0	NS
P	*Rumex persicarioides*	Peach-leaved Dock				S2?	2 May Be At Risk	1	15.4 ± 0.0	NS
P	*Crataegus submollis*	Quebec Hawthorn				S2?	5 Undetermined	1	95.2 ± 7.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	2	63.5 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	4	32.4 ± 0.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2S3	3 Sensitive	41	48.7 ± 1.0	NS
P	*Iva frutescens*	Big-leaved Marsh-elder				S2S3	3 Sensitive	1	88.1 ± 4.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2S3	3 Sensitive	13	31.9 ± 0.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2S3	3 Sensitive	10	88.2 ± 0.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	1	69.4 ± 5.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	1	94.8 ± 5.0	PE
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	3 Sensitive	2	46.0 ± 2.0	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	123	8.1 ± 1.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	140	30.0 ± 0.0	NS
P	*Empetrum atropurpureum*	Purple Crowberry				S2S3	3 Sensitive	9	69.6 ± 3.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	13	16.9 ± 1.0	NS
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	43	20.0 ± 0.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	2	65.8 ± 1.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	5 Undetermined	1	54.0 ± 7.0	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	5 Undetermined	16	4.9 ± 5.0	NS
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	5 Undetermined	7	25.0 ± 1.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	2	48.6 ± 2.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	1	79.7 ± 0.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3 Sensitive	5	20.2 ± 2.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	3	93.5 ± 7.0	NS
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	9	18.3 ± 0.0	NS
P	*Eleocharis flavescens*	Pale Spikerush				S2S3	3 Sensitive	3	83.6 ± 5.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2S3	3 Sensitive	8	16.8 ± 0.0	NS
P	*Oreojuncus trifidus*	Highland Rush				S2S3	3 Sensitive	16	7.4 ± 0.0	NS
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	16	93.2 ± 1.0	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	99	4.6 ± 0.0	NS
P	*Poa glauca*	Glaucous Blue Grass				S2S3	3 Sensitive	19	9.1 ± 0.0	NS
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	46	4.1 ± 7.0	NS
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	3 Sensitive	9	8.6 ± 7.0	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	8	24.8 ± 5.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	1	53.4 ± 5.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	4 Secure	30	27.8 ± 0.0	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	100	5.5 ± 0.0	NS
P	*Bidens beckii*	Water Beggarticks				S3	4 Secure	7	22.8 ± 0.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	142	5.5 ± 0.0	NS
P	*Betula pumila var. pumila*	Bog Birch				S3	3 Sensitive	13	22.3 ± 7.0	NS
P	*Betula pumila*	Bog Birch				S3	3 Sensitive	25	16.0 ± 0.0	NS
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	2	7.5 ± 5.0	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	3 Sensitive	1	84.5 ± 0.0	NS
P	*Viburnum edule*	Squashberry				S3	3 Sensitive	63	53.5 ± 7.0	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	19	47.8 ± 0.0	NS
P	*Vaccinium boreale*	Northern Blueberry				S3	3 Sensitive	47	18.2 ± 7.0	NS
P	*Vaccinium cespitosum*	dwarf bilberry				S3	4 Secure	28	40.1 ± 7.0	NS
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3 Sensitive	20	61.0 ± 0.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	1	35.2 ± 0.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	49	4.8 ± 5.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	55	6.0 ± 0.0	NS
P	*Decodon verticillatus*	Swamp Loosestrife				S3	4 Secure	4	15.3 ± 7.0	NS
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4 Secure	27	34.2 ± 2.0	NS
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	20	6.8 ± 0.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	3 Sensitive	1	62.4 ± 7.0	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3	4 Secure	11	7.9 ± 3.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3	3 Sensitive	12	31.9 ± 0.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	4 Secure	1	3.9 ± 0.0	NS
P	*Primula laurentiana*	Laurentian Primrose				S3	4 Secure	1	45.1 ± 7.0	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	3 Sensitive	16	3.8 ± 0.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	32	18.8 ± 0.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	21	4.8 ± 0.0	NS
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	96	3.7 ± 0.0	NS
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3	4 Secure	459	4.4 ± 0.0	NS
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	220	5.3 ± 0.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3	4 Secure	6	42.3 ± 0.0	NS
P	*Galium kamtschaticum*	Northern Wild Licorice				S3	4 Secure	54	14.7 ± 1.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	18	49.5 ± 0.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	9	43.8 ± 5.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	2	33.2 ± 0.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	17	26.9 ± 2.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	20	7.9 ± 0.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	4 Secure	17	6.7 ± 0.0	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	164	5.0 ± 0.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	6	75.8 ± 0.0	NS
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	4	27.4 ± 5.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	4 Secure	9	30.8 ± 0.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	47	17.3 ± 0.0	NS
P	*Carex foenea*	Fernald's Hay Sedge				S3	4 Secure	3	88.0 ± 0.0	NS
P	*Eleocharis nitida*	Quill Spikerush				S3	4 Secure	2	99.6 ± 0.0	NS
P	*Elodea canadensis*	Canada Waterweed				S3	4 Secure	8	26.1 ± 0.0	NS
P	*Juncus subcaudatus*	Woods-Rush				S3	3 Sensitive	10	44.5 ± 0.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	63	4.1 ± 0.0	NS
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S3	3 Sensitive	27	34.2 ± 3.0	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	31	4.2 ± 0.0	NS
P	*Neottia bifolia*	Southern Twayblade				S3	4 Secure	51	8.6 ± 7.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	23	7.5 ± 5.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	6	3.9 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	13	4.5 ± 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	6	11.3 ± 0.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3	4 Secure	19	29.9 ± 0.0	NS
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	22	18.7 ± 1.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	3 Sensitive	17	13.6 ± 0.0	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	3 Sensitive	12	15.6 ± 7.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	18	3.1 ± 5.0	NS
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	4 Secure	27	18.8 ± 0.0	NS
P	*Asplenium viride*	Green Spleenwort				S3	3 Sensitive	35	9.1 ± 0.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3	3 Sensitive	22	17.3 ± 0.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	38	16.4 ± 0.0	NS
P	*Isoetes acadiensis*	Acadian Quillwort				S3	3 Sensitive	10	59.9 ± 1.0	NS
P	*Diphasiastrum sitchense*	Si ka Ground-cedar				S3	4 Secure	10	26.4 ± 5.0	NS
P	*Huperzia appressa*	Mountain Firmoss				S3	3 Sensitive	23	27.2 ± 1.0	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	4 Secure	3	53.4 ± 5.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	5 Undetermined	5	5.9 ± 0.0	NS
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	57	3.9 ± 1.0	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	4 Secure	9	15.1 ± 1.0	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	4 Secure	9	21.8 ± 2.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	5	42.4 ± 1.0	NS
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	17	6.4 ± 0.0	NS
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	148	14.9 ± 0.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	1	76.6 ± 0.0	NS
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	2	94.4 ± 0.0	PE
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	72	4.2 ± 0.0	NS
P	*Salix petiolaris*	Meadow Willow				S3S4	4 Secure	8	16.7 ± 0.0	NS
P	*Carex argyrantha*	Silvery-flowered Sedge				S3S4	4 Secure	3	18.7 ± 0.0	NS
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	4	15.9 ± 0.0	NS
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	5 Undetermined	8	16.7 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	4	5.0 ± 4.0	NS
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	44	27.1 ± 5.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	16	10.9 ± 1.0	NS
P	*Panicum philadelphicum*	Philadelphia Panicgrass				S3S4	4 Secure	1	20.2 ± 0.0	NS
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	20	7.4 ± 0.0	NS
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	418	4.0 ± 0.0	NS
P	*Equisetum hyemale ssp. affine*	common scouring-rush				S3S4	4 Secure	36	8.6 ± 10.0	NS
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	76	7.0 ± 0.0	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	4 Secure	6	15.3 ± 5.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S3S4	4 Secure	34	31.2 ± 0.0	NS
P	*Viola canadensis*	Canada Violet				SH	0.1 Extirpated	1	25.8 ± 0.0	NS
P	*Poa alpina*	Alpine Blue Grass				SH	0.1 Extirpated	2	65.7 ± 0.0	NS
P	*Botrychium minganense*	Mingan Moonwort				SH	0.1 Extirpated	1	60.1 ± 1.0	NS
P	*Solidago randii*	Rand's Goldenrod				SNA		1	73.4 ± 5.0	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

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

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62	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
62	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
61	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
59	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
57	Knapton, R. & Power, T.; Williams, M. 2001. SAR Inventory: Fortress Louisbourg NP. Parks Canada, Atlantic, SARINV01-13. 157 recs.
57	Mazerolle, D.M. 2017. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre.
54	Busby, D.G. 1999. 1997-1999 Bicknell's Thrush data, unpublished files. Canadian Wildlife Service, Sackville, 17 recs.
53	Amirault, D.L. & McKnight, J. 2003. Piping Plover Database 1991-2003. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
50	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.
50	LaPaix, R.W.; Crowell, M J.; MacDonald, M. 2011. Stantec rare plant records, 2010-11. Stantec Consulting, 334 recs.
44	anon. 2001. S.. H.. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 76 recs.
41	Klymko, J.J.D. 2014. Maritimes Butterfly Atlas, 2012 submissions. Atlan ic Canada Conservation Data Centre, 8552 records.
40	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
40	Scott, F.W. 2002. Nova Scotia Herpetofauna Atlas Database. Acadia University, Wolfville NS, 8856 recs.
38	Parker, G.R., Maxwell, J.W., Morton, L.D. & Smith,G.E.J. 1983. The ecology of Lynx , Lynx canadensis, on Cape Breton Island. Canadian Journal of Zoology, 61:770-786. 51 recs.
35	Pulsifer, M.D. 2002. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 369 recs.
33	Neily, T.H. 2010. Erioderma Pedicellatum records 2005-09. Mersey Tobiatic Research Institute, 67 recs.
33	Sollows, M.C,. 2008. NBM Science Collections databases: mammals. New Brunswick Museum, Saint John NB, download Jan. 2008, 4983 recs.
27	Neily, T.H. 2017. Maritmes Lichen and Bryophyte records. Atlantic Canada Conservation Data Centre.

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26	Parks Canada. 2010. Specimens in or near National Parks in Atlantic Canada. Canadian National Museum, 3925 recs.
24	Klymko, J.J.D. 2012. Maritimes Butterfly Atlas, 2010 and 2011 records. Atlantic Canada Conservation Data Centre, 6318 recs.
24	Neily, T.H. 2013. Email communication to Sean Blaney regarding Listera australis observations made from 2007 to 2011 in Nova Scotia. , 50.
22	Benjamin, L.K. 2009. Boreal Felt Lichen, Mountain Avens, Orchid and other recent records. Nova Scotia Dept Natural Resources, 105 recs.
21	Belland, R.J. & W.B. Schofield. 1993. Salix vestita Pursh & Saxifraga oppositifolia L.: arctic-alpine species new to Nova Scotia. Rhodora, 95: 76-78.
21	Blaney, C.S.; Spicer, C.D.; Mazerolle, D.M. 2005. Fieldwork 2005. A lantic Canada Conservation Data Centre. Sackville NB, 2333 recs.
21	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.
20	Cameron, R.P. 2012. Rob Cameron 2012 vascular plant data. NS Department of Environment, 30 recs.
20	Gillis, J. 2015. Rare plant records from Cape Breton gypsum sites. Pers. comm., 25 rare plant records.
20	Klymko, J.J.D. 2016. 2015 field data. Atlantic Canada Conservation Data Centre.
19	Cameron, R.P. 2013. 2013 rare species field data. Nova Scotia Department of Environment, 71 recs.
18	Benjamin, L.K. 2011. NSDNR fieldwork & consultant reports 1997, 2009-10. Nova Scotia Dept Natural Resources, 85 recs.
18	Manthorne, A. 2014. MaritimesSwiftwatch Project database 2013-2014. Bird Studies Canada, Sackville NB, 326 recs.
18	Misc. rare species records gathered by NSDNR staff or communicated to NSDNR and forwared to ACCDC
18	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia. , 181 records.
17	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
17	Whittam, R.M. 2006. Bicknell's Thrush in CBHNP, BSC database. Bird Studies Canada, 21 recs.
16	Basquill, S.P. 2012. 2012 rare vascular plant field data. Nova Scotia Department of Natural Resources, 37 recs.
15	Catling, P M., Erskine, D.S. & MacLaren, R.B. 1985. The Plants of Prince Edward Island with new records, nomenclatural changes & corrections & deletions, 1st Ed. Research Branch, Agriculture Canada, Ottawa, Publication 1798. 22pp.
15	Newell, R.E. 2004. Assessment and update status report on the New Jersey Rush (Juncus caesariensis) in Canada. Committee on the Status of Endangered Wildlife in Canada, 15 recs.
14	Basquill, S.P. 2012. 2012 Bryophyte specimen data. Nova Scotia Department of Natural Resources, 37 recs.
14	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
14	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
12	Robinson, S.L. 2011. 2011 ND dune survey field data. Atlantic Canada Conservation Data Centre, 2715 recs.
11	Burns, L. 2013. Personal communication concerning bat occurrence on PEI. Winter 2013. Pers. comm.
11	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
11	Neily, T.H. 2012. 2012 Erioderma pedicellatum records in Nova Scotia.
10	Murphy, S. 2006. Juncus caesariensis data from Yava Technologies In Situ Leach Mining Environmental Assessment. Jacques Whitford Inc., 10 recs.
10	Porter, K. 2013. 2013 rare and non-rare vascular plant field data. St. Mary's University, 57 recs.
9	Goltz, J.P. & Bishop, G. 2005. Confidential supplement to Status Report on Prototype Quillwort (Isoetes prototypus). Committee on the Status of Endangered Wildlife in Canada, 111 recs.
8	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.
7	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
7	NS DNR. 2017. Black Ash records from NS DNR Permanent Sample Plots (PSPs), 1965-2016. NS Dept of Natural Resources.
7	Robinson, S.L. 2014. 2013 Field Data. Atlan ic Canada Conservation Data Centre.
7	Taylor, B.R., and Tam, J.C. 2012. Local distribution of the rare plant Triosteum aurantiacum in northeastern Nova Scotia, Canada. Rhodora, 114(960): 366-382.
6	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
6	Cameron, R.P. 2009. Nova Sco ia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
6	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
6	Scott, F.W. 1988. Status Report on the Gaspé Shrew (Sorex gaspensis) in Canada. Committee on the Status of Endangered Wildlife in Canada, 12 recs.
5	Blaney, C.S.; Mazerolle, D.M.; Klymko, J; Spicer, C.D. 2006. Fieldwork 2006. Atlantic Canada Conservation Data Centre. Sackville NB, 8399 recs.
5	Cameron, R.P. 2009. Cyanolichen database. Nova Scotia Environment & Labour, 1724 recs.
5	MacDonald, M. 2008. PEI Power Corridor Floral Surveys, 2004-08. Jacques Whitford Ltd, 2238 recs (979 rare).
5	Marshall, L. 1998. Atlantic Salmon: Cape Breton SFA 18 (part) & SFA 19. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-09. 5 recs.
5	Plissner, J.H. & Haig, S.M. 1997. 1996 International piping plover census. US Geological Survey, Corvallis OR, 231 pp.
4	Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
4	Blaney, C.S.; Mazerolle, D.M. 2008. Fieldwork 2008. Atlantic Canada Conservation Data Centre. Sackville NB, 13343 recs.
4	Blaney, C.S.; Mazerolle, D.M. 2011. Fieldwork 2011. Atlantic Canada Conservation Data Centre. Sackville NB.
4	Blaney, C.S.; Mazerolle, D.M.; Oberndorfer, E. 2007. Fieldwork 2007. Atlantic Canada Conservation Data Centre. Sackville NB, 13770 recs.
4	Clayden, S.R. 2007. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, download Mar. 2007, 6914 recs.
4	Erskine, D. 1960. The plants of Prince Edward Island, 1st Ed. Research Branch, Agriculture Canada, Ottawa., Publication 1088. 1238 recs.
4	Neily, T.H. & Pepper, C.; Toms, B. 2015. Nova Scotia lichen location database [as of 2015-02-15]. Mersey Tobeatic Research Institute, 1691 records.
4	Newell, R.E. 2001. Fortress Louisbourg Species at Risk Survey 2001. Parks Canada, 4 recs.
4	Popma, T.M. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 113 recs.
4	Porter, C.J.M. 2014. Field work data 2007-2014. Nova Scotia Nature Trust, 96 recs.
4	Rousseau, J. 1938. Notes Floristiques sur l'est de la Nouvelle-Ecosse in Contributions de l'Institut Botanique de l'Universite de Montreal. Universite de Montreal, 32, 13-62. 11 recs.
3	Baechler, Lynn. 2012. Plant observations & photos, 2012. Pers. comm. to S. Blaney, July 2012, 4 recs.

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3	Gilhen, J. 1984. Amphibians & Reptiles of Nova Scotia, 1st Ed. Nova Scotia Museum, 164pp.
3	Layberry, R.A. 2012. Lepidopteran records for he Maritimes, 1974-2008. Layberry Collection, 1060 recs.
3	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
2	Amirault, D.L. 1997-2000. Unpublished files. Canadian Wildlife Service, Sackville, 470 recs.
2	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
2	Blaney, C.S.; Spicer, C.D.; Rothfels, C. 2004. Fieldwork 2004. Atlantic Canada Conservation Data Centre. Sackville NB, 1343 recs.
2	Chris ie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
2	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
2	Dibblee, R.L. 1999. PEI Cormorant Survey. Prince Edward Island Fisheries, Aquaculture & Environment, 1p. 21 recs.
2	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
2	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
2	Gillis, J. 2007. Botanical observations from bog on Skye Mountain, NS. Pers. comm., 8 recs.
2	Hall, R.A. 2001. S.. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 178 recs.
2	Hill, N. 2003. Floerkea proserpinacoides at Heatherdale, Antigonish Co. 2002. , Pers. comm. to C.S. Blaney. 2 recs.
2	Klymko, J.J.D. 2012. Insect field work & submissions. Atlantic Canada Conservation Data Centre, 852 recs.
2	Lock, A.R., Brown, R.G.B. & Gerriets, S.H. 1994. Gazetteer of Marine Birds in Atlantic Canada. Canadian Wildlife Service, Atlantic Region, 137 pp.
2	Munden, C. 2018. Email communication on Cypripedium parviflorum. Amateur naturalist, 2.
2	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
2	Neily, T.H. & Pepper, C.; Toms, B. 2018. Nova Scotia lichen database Update. Mersey Tobeatic Research Institute.
2	O'Neil, S. 1998. Atlantic Salmon: Northumberland Strait Nova Scotia part of SFA 18. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-08. 9 recs.
2	Quigley, E.J. 2006. Plant records, Mabou & Port Hood. Pers. comm. to S.P. Basquill, Jun. 12. 4 recs, 4 recs.
2	Selva, S.B. 2002. Status Report on frosted glass-whiskers, Sclerophora peronella. Committee on the Status of Endangered Wildlife in Canada, Draft Revision, May 2002. 2 recs.
2	Sollows, M.C,. 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
1	Anderson, D.G. 2011. New site for showy ladyslipper on Cape Breton. Nova Scotia Department of Natural Resources, pers.comm. to R. Lautenschlager, Jul 5, 2011.
1	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
1	Beaulieu-Bouchard, M. 2014. Email to S. Blaney regarding Salix reticulata & vestita in NS. Canadian Museum of Nature, 1 obs.
1	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
1	Crowell, M. 2013. email to Sean Blaney regarding Listera australis at Bear Head and Mill Cove Canadian Forces Station. Jacques Whitford Environmental Ltd., 2.
1	Curley, F.R. 2005. PEF&W Collection 2003-04. PEI Fish & Wildlife Div., 716 recs.
1	Doucet, D.A. 2009. Census of Globally Rare, Endemic Butterflies of Nova Scotia Gulf of St Lawrence Salt Marshes. Nova Scotia Dept of Natural Resources, Species at Risk, 155 recs.
1	Gilman, A.; Testo, W. 2015. Use of Gemma Characters to Identify North American Huperzia (Lycopodiaceae). American Fern Journal, 105(3):145-161.
1	Hinds, H.R. 1984. Additions to the flora of Cape Breton Highlands National Park, Nova Scotia. Rhodora, 86:67-72.
1	Klymko, J.J.D. 2018. 2017 field data. Atlantic Canada Conservation Data Centre.
1	Lautenschlager, R A. 2010. Miscellaneous observa ions reported to ACCDC (zoology). Pers. comm. from various persons, 2 recs.
1	McKendry, Karen. 2016. Rare species observa ions, 2016. Nova Scotia Nature Trust, 19 recs.
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	Schori, M. 2003. Hieracium robinsonii locations in Atlantic Canada. Pers. comm. to C.S. Blaney. Gray Herbarium, Harvard University, 1 rec.
1	Spicer, C.D. 2004. Specimens from CWS Herbarium, Mount Allison Herbarium Database. Mount Allison University, 5939 recs.

NAVIGATION PROTECTION ACT (NPA)
NOTICE OF WORKS FORM

WARNING: Any false or misleading statement with respect to this form and supporting documentation, including the misrepresentation of a material fact, may result in the refusal to authorize or issue Approval, or result in the suspension or cancellation of an Approval obtained through fraudulent means.

PRIOR TO COMPLETING THIS FORM:
1. Determine if your project is on a navigable water listed on the Schedule to the NPA. A *Notice to the Minister* is required for works on scheduled navigable waters. Works on non-scheduled navigable waters may be eligible to opt in; if requesting Opt-in, the Opt-in annex must be included with your *Notice to the Minister*.
2. Self assess your project against the *Minor Works Order* to determine if a *Notice to the Minister* is required. Links to the NPA Schedule, Order and Regulations can be accessed through the Navigation Protection Program (NPP) Website.

PURPOSE

This *Notice of Works* Form and its supporting documentation (as well as other relevant information) which may be required for a review by Transport Canada (TC), once completed and submitted, comprise the *Notice to the Minister* as required under the NPA. For assistance in completing your submission, refer to the guidance provided on the NPP website under "Apply to the NPP" including the *Guide to the Navigation Protection Program's Notification, Application and Review Requirements*.

SUPPORTING DOCUMENTATION REQUIREMENTS

Mandatory Information Checklist (incomplete information will be returned with no action)	Recommended Information (may expedite your review)
☑ Completed and signed "Notice of Works Form" with all mandatory fields completed	☐ Body of water details
☑ Map showing location of project [1]	☐ Land use/Ownership information
☑ Top/Plan drawing with dimensions [1]	☐ Body of water use information
☑ Side/Profile drawing with dimensions [1]	☐ Impacts, obstructions and mitigation plans
	☐ Any environmental review information
[1] If you are submitting a Notice of Works in paper form, please provide two (2) copies of each supporting document. If the Notice of Works is submitted electronically, please ensure to attach all relevant documents (individually scanned).	☐ Operation, maintenance and marking plans
	☐ Photographs of work site and body of water
	☐ Aboriginal consultation results
	☐ Other government agencies involved
	☐ Water lot lease information
	☐ Opt-in request annex (non-scheduled navigable waters only)

When submitting a Notice to the Minister in paper form, owners should note:

- All plans and drawings must be legible when printed on 11" x 17" paper
- Your completed Notice to the Minister should be sent to the appropriate regional office as outlined below

TRANSPORT CANADA NAVIGATION PROTECTION PROGRAM REGIONAL OFFICES

Pacific Region Office
820-800 Burrard Street
Vancouver BC V6Z 2J8
Telephone: 604-775-8867
Email: NPPPAC-PPNPAC@tc.gc.ca

Prairie and Northern Region Office
Canada Place 1100-9700 Jasper Ave
Edmonton AB T5J 4E6
Telephone: 780-495-8215
Email: NPPPNR-PPNRPN@tc.gc.ca

Ontario Region Office
100 South Front Street, 1st Floor
Sarnia ON N7T 2M4
Telephone: 519-383-1863
Email: NPPONT-PPNONT@tc.gc.ca

Headquarters Office
(For info on the NPP and NPA ONLY)
Notices not processed at this office
Tower C, 330 Sparks Street, 18th Floor
Ottawa ON K1A 0N5
Telephone: 613-991-3476
Email: NPPHQ-PPNAC@tc.gc.ca

Quebec Region Office
401-1550 d'Estimauville Avenue, 5th Floor
Quebec QC G1J 0C8
Telephone: 877-646-6420
Email: PPNQUE-NPPQUE@tc.gc.ca

Atlantic Region Office
95 Foundry Street, 6th Floor
P.O. Box 42
Moncton NB E1C 8K6
Telephone: 506-851-3113
Email: NPPATL-PPNATL@tc.gc.ca

NAVIGATION PROTECTION ACT
NOTICE OF WORKS FORM

TC file number (if known):

Are you the riparian property owner? ◯Yes ◯No

GENERAL INFORMATION

Official and/or local name(s) of the body of water (Required)
Whycocomagh Bay, Bras D'Or Lake

Is the body of water listed on the schedule to the NPA?
◉Yes ◯No ◯Unknown

Are you also requesting an Approval, if required?
◉Yes ◯No

Is this an Opt-in request?
◯Yes ◉No

Are you representing an Aboriginal group?
◉Yes ◯No

Is the work near/on First Nations reserve or land claim?
◉Yes ◯No ◯Unknown

Does this project involve throwing or depositing materials in water?
◯Yes ◉No

Does this project involve dewatering a body of water?
◯Yes ◉No

OWNER CONTACT INFORMATION[2]

Individual or company name (Required)
Waycobah First Nation

Contact name (Required)
Donald Davis

Mailing address (Required)
[redacted]
[redacted]Whycocomagh

City/Town (Required)
Whycocomagh

Province/Territory (Required)
NS

Postal code (Required)
B0E3M0

Primary telephone number (999-999-9999) (Required)
[redacted]

Other telephone number (999-999-9999)
[redacted]

E-mail
[redacted]

Owner's agent/mandatary (contractor/consultant/representative/co-proponent, if any)

Company name

Contact name

Mailing address

City/Town

Province/Territory

Postal code

Primary telephone number (999-999-9999) (Required)

Other telephone number (999-999-9999)

E-mail

WORK SITE INFORMATION

Nearest municipality/county/district (Required)
Inverness

Province/Territory (Required)
NS

Site location such as lot, concession, section, township, range, meridian, 911 address, property identification, etc. (Required)
Whycocomagh

Site position Latitude North (Required)
Degrees 45 Minutes 56 Seconds 52.66

Site position Longitude West (Required)
Degrees -61 Minutes 7 Seconds 26.22

Hydro chart number: 4278

Topo map number: 011F14

Body of water details, such as characteristics, bank/bottom features, biological components, flow/tides, etc.

See attached

Potential obstructions, such as natural/man-made, other works, navigation aids, etc.

n/a

Land use/Ownership, such as past/current, private/government, rural/suburban, coastal, environmental, etc.

Waycobah owns some adjoining land. Shore line is a rural area.

BODY OF WATER USE INFORMATION

Navigation types (check all that apply)

☑ Commercial ☑ Recreational

Maximum vessel size

Length 48' Width 20' Draft 8"

Traffic direction

○ One-way ◉ Two-way

Manoeuvrability (check all that apply)

☐ Poor ☑ Good ☐ Excellent

Day/Night

◉ Day ○ Night ○ Both

Volume

◉ Low ○ Medium ○ High

Navigation season(s) (check all that apply)

☐ Winter ☑ Spring ☑ Summer ☑ Fall

Other uses such as cottagers, special events, fishing, etc.

Maximum vessel indicated above is a barge to be used for Waycobah's finfish operations.

OTher users would include recreational small sailing craft, motorboats, small fishing boats.

PROJECT INFORMATION

Name of work such as bridge, dam, marina, etc. (Required)

Finfish aquaculture

Type of work (check all that apply) (Required)

☐ Construct ☑ Place ☐ Alter

☐ Repair ☐ Decommission ☐ Rebuild

☐ Permanent ☐ Temporary ☐ Remove

Brief project description (or attach) such as status, structures, operation, etc. (Required)

See attached.

Method of construction such as temporary works, activities, etc. (Required)

See attached.

Anticipated impacts such as source, severity, mitigation, marking, waste/debris management, use, cumulative, etc.

See attached.

Expected start date (dd-mm-yyyy) (Required)

01-05-2019

Expected completion date (dd-mm-yyyy) (Required)

Ongoing

Canada

ENVIRONMENTAL REVIEW INFORMATION

Is the work located on Federal lands?

◯ Yes ◯ No ◯ Unknown

Is the project a designated project under the *Regulations Designating Physical Activities* under the *Canadian Environmental Assessment Act, 2012*?

◯ Yes ◯ No ◯ Unknown

Is the project subject to Northern Environmental Assessment (EA) Regime(s)?

◯ Yes ◯ No ◯ Unknown

If yes, identify the northern EA regime(s) that apply

- ☐ Inuvialuit Final Agreement (IFA)
- ☐ *Mackenzie Valley Resource Management Act* (MVRMA)
- ☐ Nunavut Land Claims Agreement (NLCA)
- ☐ *Yukon Environmental and Socio-economic Assessment Act* (YESAA)

Other Federal Organizations involved

- ☐ Canadian Environmental Assessment Agency (CEAA)
- ☐ Environment Canada (EC)
- ☐ Fisheries and Oceans Canada (DFO)
- ☐ Natural Resources Canada (NRCan)
- ☐ Major Projects Management Office (MPMO)
- ☐ Northern Projects Management Office (NPMO)
- ☐ Aboriginal Affairs and Northern Development Canada (AANDC)
- ☐ Other: _____

OWNER AUTHORIZATION[2]

I hereby certify that the information contained herein and in any of the supporting documents is complete, true and accurate to the best of my knowledge and belief, and that I am authorized, as the owner, to submit this Notice to the Minister.

[redacted]
Signature (Required)

26/02/2019
Date (dd-mm-yyyy) (Required)

[redacted]
Print Name (Required)

FOR OFFICE USE ONLY

	Date stamped (dd-mm-yyyy)

[2] "Owner", in relation to a work, means the actual or reputed owner of the work or that owner's agent or mandatary. It includes a person who is in possession or claiming ownership of the work and a person who is authorizing or otherwise responsible for the construction, placement, alteration, repair, rebuilding, removal, decommissioning, maintenance, operation, safety or use of the work. It also includes a person who proposes to construct or place a work.

The personal information provided on this Notice to the Minister is collected under the authority of the ***Navigation Protection Act***, sections 4, 5, 6, 9, 21, 22, 23 and 24. This information is required for the purpose of processing applications made under the above-noted sections for proposed, commenced or existing works that are or will be constructed, placed, altered, repaired, rebuilt, removed or decommissioned in, on, over, under, through or across any navigable water in Canada. The personal information collected is described in a personal information bank entitled ***Navigation Protection Program*** (bank number TC PPU 086). Under the provisions of the ***Privacy Act***, individuals have the right of access to, correction of and protection of their personal information. Instructions for obtaining personal information are provided in Info Source, a copy of which is available in major public and academic libraries or online at http://www.infosource.gc.ca

Canada

Navigation Protection Act Notice of Works Form

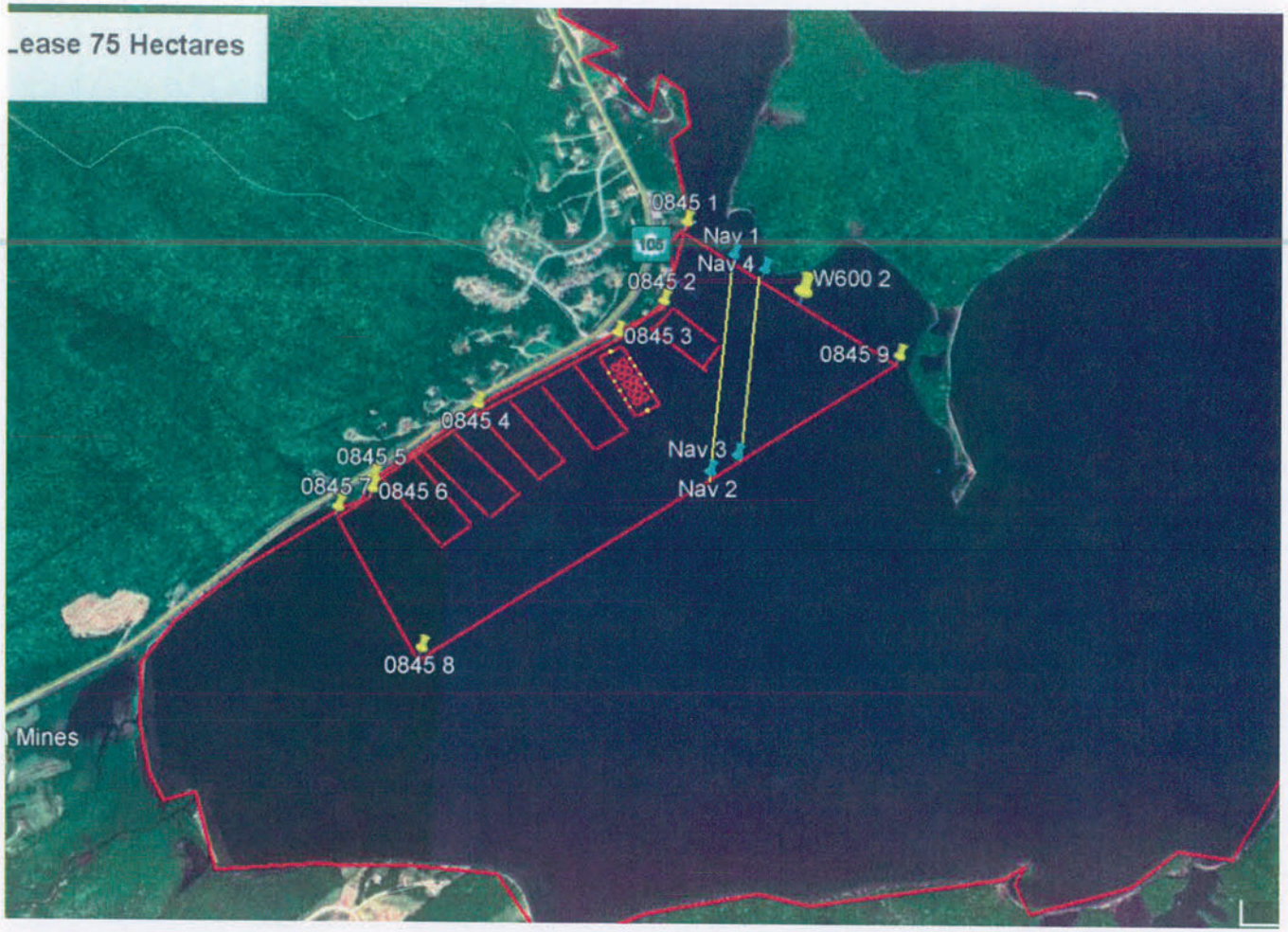
Waycobah First Nation, Whycocomagh Lease Amendment Finfish Aquaculture

Amend leases 814,845, 0600 to new 0845

1	45°57'15.95"N	61° 7'29.08"W
2	45°57'8.35"N	61° 7'32.09"W
3	45°57'5.34"N	61° 7'38.06"W
4	45°56'58.61"N	61° 7'55.83"W
5	45°56'51.98"N	61° 8'8.90"W
6	45°56'50.99"N	61° 8'9.02"W
7	45°56'49.28"N	61° 8'13.20"W
8	45°56'36.92"N	61° 8'2.06"W
9	45°57'3.39"N	61° 7'1.69"W
10 (1)	Same as 1	

Navigation channel through new lease 0845

Nav 1	45°56'52.60"N	61° 7'26.22"W
Nav 2	45°56'52.66"N	61° 7'26.22"W
Nav 3	45°56'54.18"N	61° 7'22.73"W
Nav 4	45°57'11.47"N	61° 7'18.88"W


Lease 75 Hectares
0845 1
Nav 1
Nav 4
W600 2
0845 2
0845 3
0845 9
0845 4
0845 5
0845 7
0845 6
Nav 3
Nav 2
0845 8
Mines

Navigation Protection Act Notice of Works Form Attachments for Waycobah First Nation, Whycocomagh Amendment Finfish Aquaculture

Body of water details:

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomaugh since 2009.
Average wind speed (km/hr) (30m height)	22.5	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease.
Wind speed class rating (10m height)	Low to Moderate	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (Robin Stuart).		
Annual maximum tide (m)			
Depth of water at each corner of the site (m)	Corner 1: 1.8m Corner 2: 7.4m Corner 3: 28m Corner 4: 6.3m Center Lease: 1: 23m, 2: 13.1m, 3: 12.0m, 4: 8.2m	Depths taken during baseline EMP sampling	

Brief project description

We'koqma'q First Nation is requesting a boundary amendment to marine finfish aquaculture Site 0814 which will allow the replacement of three leases with a single lease of larger total area. The three current sites are #0814 (1.39 ha), #0845 (1.57 ha) and #0600 (1.39 ha). They are all licensed for the marine cage cultivation of Atlantic salmon and rainbow trout. The requested amended site overlays all of these sites, is 75 hectares in size and includes a navigational corridor. It is located in Whycocomagh Bay, south of the village of Whycocomagh and Indian Island. This site will house 48 polar circle sea cages which will grow rainbow trout. The cages will be moored in place with steel anchors and concrete blocks. The cage frames are made of HDPE and are self-floating. The mooring systems will permanently remain in place after installation; but the sea cages will be moved into the existing wharves on site each winter, before the area ices over and replaced each spring, after the ice leaves.

Method of construction

Mooring deployment: Moorings are placed on barge. Barge is motored out to the pre-determined waypoint and the mooring is dropped.

Grid system installation: The end moorings and center lines are dropped first. The center line is pulled tight before the cross grids are installed. The grid and scope lines are assembled prior to installation so that all connections and intersections of the lines can be properly secured. The scope of the lines is targeted to be 3:1 at high tide. The types of moorings to be used at each point on the grid are shown on the top view diagram supplied with the application.

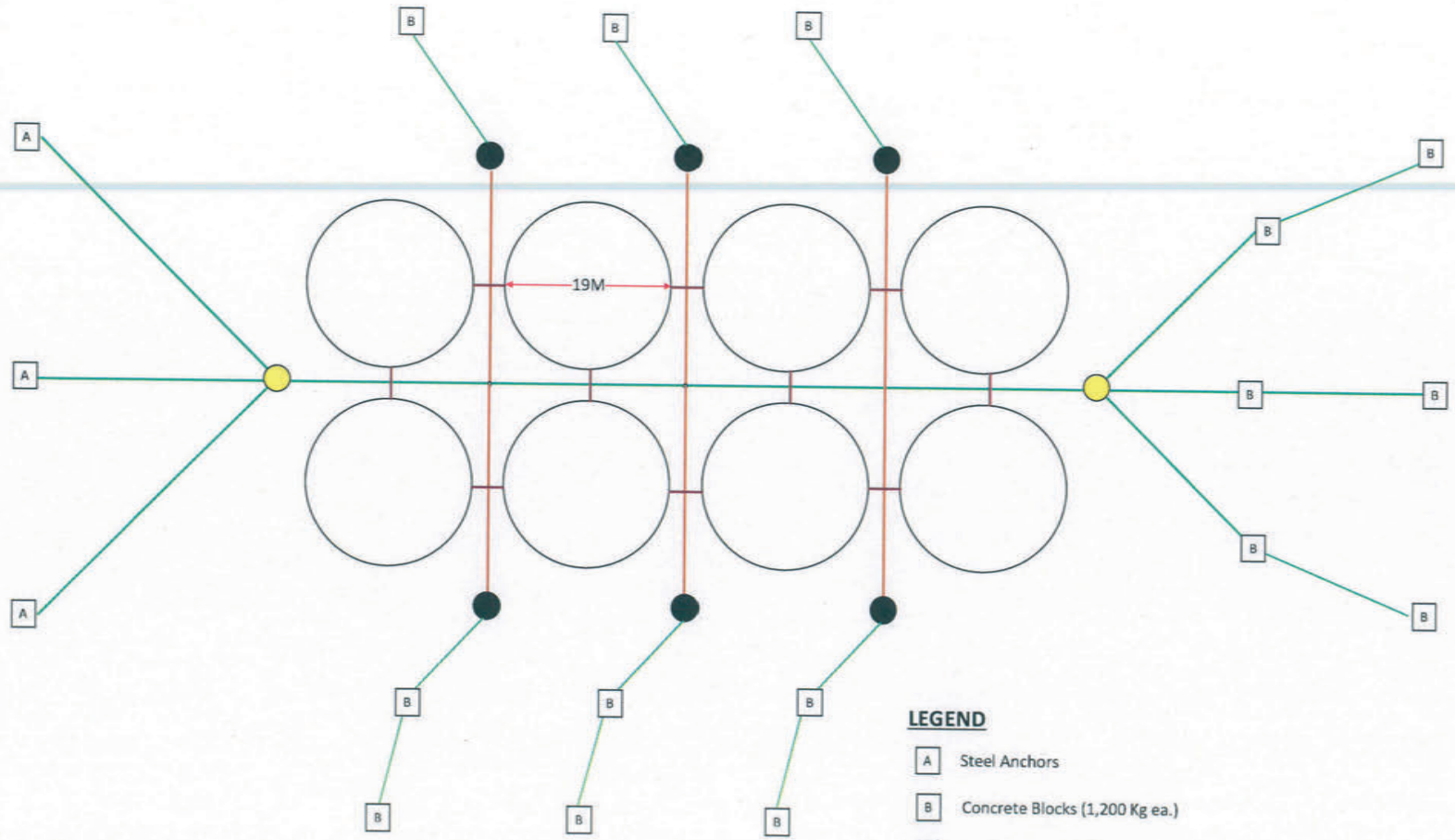
Each cross line is marked with an 18" inflatable yellow buoy. These buoys can stay out all winter and have less of a tendency to be destroyed or move with the ice. Other types of buoys get moved or sheared by winter ice. Although the cages are moved in the winter, the line/grid marker buoys are left year-round.

Cage installation: Cages are assembled on shore, inspected, then pulled into the water then towed to their location where bridles are attached to the cage collars as shown in the diagram.

Anticipated impacts

Site location considerations and mitigation practices have been described in a Development Plan and submitted to NSDFA. These will be reviewed according to the Aquaculture Licencing and Leasing regulations for Nova Scotia. The plan recognizes potential impacts and describes practices intended to reduce impacts to other users of the local waters, including the fishery, wildlife (including Atlantic salmon), local residents, and seasonal visitors. Ongoing environmental monitoring in terms of benthic impacts is part of this plan.

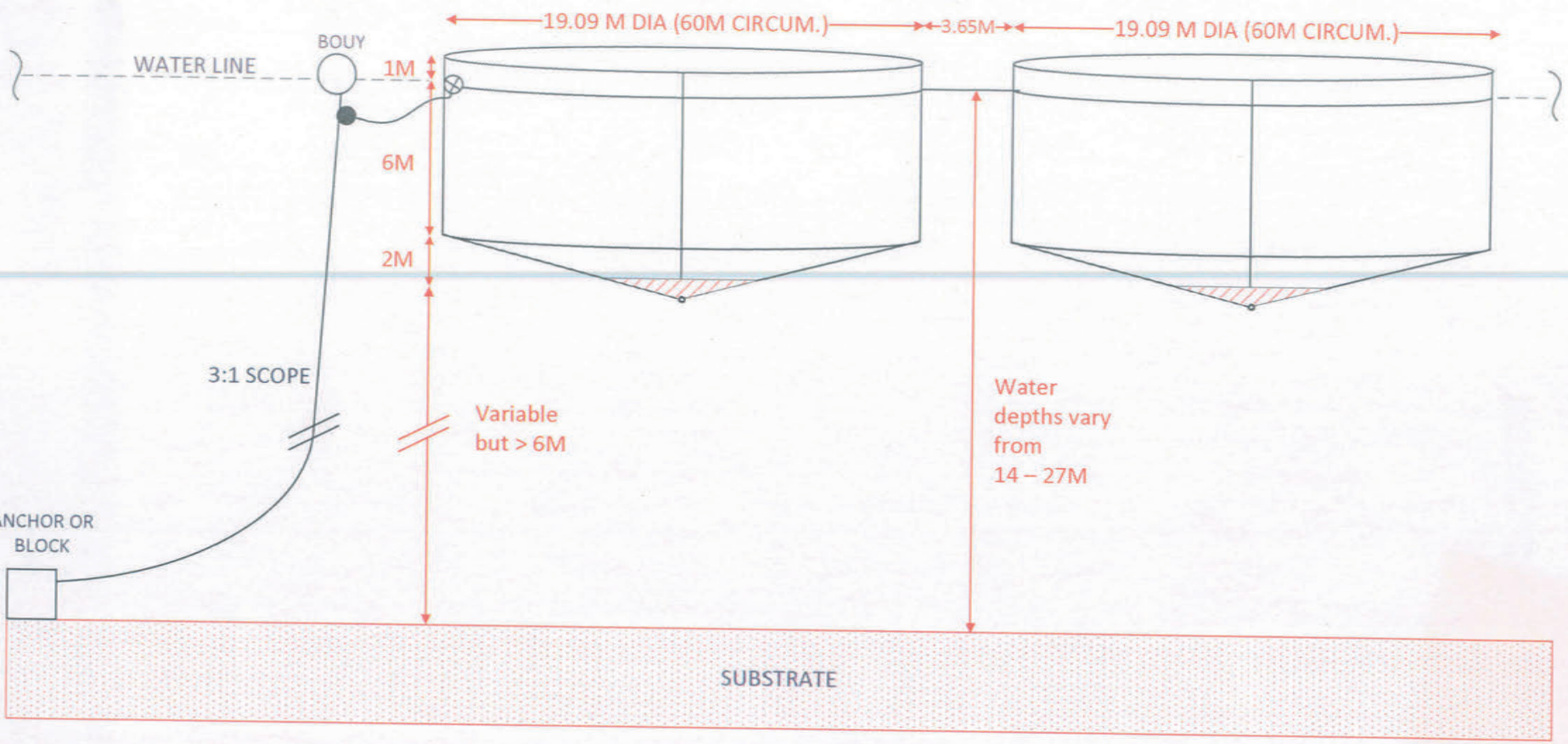
Top view of a single cage array of eight cages.
Six arrays (48 cages) will be deployed at the site.



NOTES

- Red Lines represent distance measurements (m)
- Cages are 60m circumference.
- Double blocks on windward side

Client: We'koqma'q First Nation		
Sheet Title: Whycocomagh Leases – Top View		
Scale: 0.25": 5'	DWN BY: AJD	1 of 1
Date: Feb 20, 2019		



LEGEND

- ● Steel ring with shackles
- ⊗ Tied to cage collar

Client: We'koqma'q First Nation		
Sheet Title: Sea Cage Side View		
Scale: 0.25": 2m	DWN BY: AJD	1 of 1
Date: Feb 20, 2019		

Transport Canada / Transports Canada

PROTECTED A (WHEN COMPLETED)

NAVIGATION PROTECTION ACT (NPA)
NOTICE OF WORKS FORM

WARNING: Any false or misleading statement with respect to this form and supporting documentation, including the misrepresentation of a material fact, may result in the refusal to authorize or issue Approval, or result in the suspension or cancellation of an Approval obtained through fraudulent means.

PRIOR TO COMPLETING THIS FORM:
1. Determine if your project is on a navigable water listed on the Schedule to the NPA. A *Notice to the Minister* is required for works on scheduled navigable waters. Works on non-scheduled navigable waters may be eligible to opt in; if requesting Opt-in, the Opt-in annex must be included with your *Notice to the Minister*.
2. Self assess your project against the *Minor Works Order* to determine if a *Notice to the Minister* is required. Links to the NPA Schedule, Order and Regulations can be accessed through the Navigation Protection Program (NPP) Website.

PURPOSE

This *Notice of Works* Form and its supporting documentation (as well as other relevant information) which may be required for a review by Transport Canada (TC), once completed and submitted, comprise the *Notice to the Minister* as required under the NPA. For assistance in completing your submission, refer to the guidance provided on the NPP website under "Apply to the NPP" including the *Guide to the Navigation Protection Program's Notification, Application and Review Requirements*.

SUPPORTING DOCUMENTATION REQUIREMENTS

Mandatory Information Checklist
(incomplete information will be returned with no action)

- ☑ Completed and signed "Notice of Works Form" with all mandatory fields completed
- ☑ Map showing location of project [1]
- ☑ Top/Plan drawing with dimensions [1]
- ☑ Side/Profile drawing with dimensions [1]

[1] If you are submitting a Notice of Works in paper form, please provide two (2) copies of each supporting document. If the Notice of Works is submitted electronically, please ensure to attach all relevant documents (individually scanned).

Recommended Information
(may expedite your review)

- ☐ Body of water details
- ☐ Land use/Ownership information
- ☐ Body of water use information
- ☐ Impacts, obstructions and mitigation plans
- ☐ Any environmental review information
- ☐ Operation, maintenance and marking plans
- ☐ Photographs of work site and body of water
- ☐ Aboriginal consultation results
- ☐ Other government agencies involved
- ☐ Water lot lease information
- ☐ Opt-in request annex (non-scheduled navigable waters only)

When submitting a Notice to the Minister in paper form, owners should note:

- All plans and drawings must be legible when printed on 11" x 17" paper
- Your completed Notice to the Minister should be sent to the appropriate regional office as outlined below

TRANSPORT CANADA NAVIGATION PROTECTION PROGRAM REGIONAL OFFICES

Pacific Region Office
820-800 Burrard Street
Vancouver BC V6Z 2J8
Telephone: 604-775-8867
Email: NPPPAC-PPNPAC@tc.gc.ca

Prairie and Northern Region Office
Canada Place 1100-9700 Jasper Ave
Edmonton AB T5J 4E6
Telephone: 780-495-8215
Email: NPPPNR-PPNRPN@tc.gc.ca

Ontario Region Office
100 South Front Street, 1st Floor
Sarnia ON N7T 2M4
Telephone: 519-383-1863
Email: NPPONT-PPNONT@tc.gc.ca

Headquarters Office
(For info on the NPP and NPA ONLY)
Notices not processed at this office
Tower C, 330 Sparks Street, 18th Floor
Ottawa ON K1A 0N5
Telephone: 613-991-3476
Email: NPPHQ-PPNAC@tc.gc.ca

Quebec Region Office
401-1550 d'Estimauville Avenue, 5th Floor
Quebec QC G1J 0C8
Telephone: 877-646-6420
Email: PPNQUE-NPPQUE@tc.gc.ca

Atlantic Region Office
95 Foundry Street, 6th Floor
P.O. Box 42
Moncton NB E1C 8K6
Telephone: 506-851-3113
Email: NPPATL-PPNATL@tc.gc.ca

Canada

Transport Canada / Transports Canada

NAVIGATION PROTECTION ACT
NOTICE OF WORKS FORM

TC file number (if known):

Are you the riparian property owner? ◯Yes ◯No

GENERAL INFORMATION

Official and/or local name(s) of the body of water (Required)
Whycocomagh Bay, Bras D'Or Lake

Is the body of water listed on the schedule to the NPA?
◉Yes ◯No ◯Unknown

Are you also requesting an Approval, if required?
◉Yes ◯No

Is this an Opt-in request?
◯Yes ◉No

Are you representing an Aboriginal group?
◉Yes ◯No

Is the work near/on First Nations reserve or land claim?
◉Yes ◯No ◯Unknown

Does this project involve throwing or depositing materials in water?
◯Yes ◉No

Does this project involve dewatering a body of water?
◯Yes ◉No

OWNER CONTACT INFORMATION[2]

Individual or company name (Required)
Waycobah First Nation

Contact name (Required)
Donald Davis

Mailing address (Required)
[redacted]
[redacted], Whycocomagh

City/Town (Required)
Whycocomagh

Province/Territory (Required)
NS

Postal code (Required)
B0E3M0

Primary telephone number (999-999-9999) (Required)
[redacted]

Other telephone number (999-999-9999)
[redacted]

E-mail
[redacted]

Owner's agent/mandatary (contractor/consultant/representative/co-proponent, if any)

Company name

Contact name

Mailing address

City/Town

Province/Territory

Postal code

Primary telephone number (999-999-9999) (Required)

Other telephone number (999-999-9999)

E-mail

WORK SITE INFORMATION

Nearest municipality/county/district (Required)
Inverness

Province/Territory (Required)
NS

Site location such as lot, concession, section, township, range, meridian, 911 address, property identification, etc. (Required)
Aberdeen, NS

Site position Latitude North (Required)
Degrees 45 Minutes 58 Seconds 41.78

Site position Longitude West (Required)
Degrees -61 Minutes 01 Seconds 24.67

Hydro chart number: 4278

Topo map number: 011F14

Canada

Body of water details, such as characteristics, bank/bottom features, biological components, flow/tides, etc.

See attached

Potential obstructions, such as natural/man-made, other works, navigation aids, etc.

n/a

Land use/Ownership, such as past/current, private/government, rural/suburban, coastal, environmental, etc.

Shore line is a rural area. Site location was chosen partly because of limited use of shoreline.

BODY OF WATER USE INFORMATION

Navigation types (check all that apply)
☑ Commercial ☑ Recreational

Maximum vessel size
Length 48' Width 20' Draft 8"

Traffic direction
○ One-way ◉ Two-way

Manoeuvrability (check all that apply)
☐ Poor ☑ Good ☐ Excellent

Day/Night
◉ Day ○ Night ○ Both

Volume
◉ Low ○ Medium ○ High

Navigation season(s) (check all that apply)
☐ Winter ☑ Spring ☑ Summer ☑ Fall

Other uses such as cottagers, special events, fishing, etc.

Maximum vessel indicated above is a barge to be used for Waycobah's finfish operations. Other users would be recreational small sailing craft and small fishing boats.

PROJECT INFORMATION

Name of work such as bridge, dam, marina, etc. (Required)

Finfish aquaculture

Type of work (check all that apply) (Required)
☐ Construct ☑ Place ☐ Alter
☐ Repair ☐ Decommission ☐ Rebuild
☐ Permanent ☐ Temporary ☐ Remove

Brief project description (or attach) such as status, structures, operation, etc. (Required)

See attached

Method of construction such as temporary works, activities, etc. (Required)

See attached

Anticipated impacts such as source, severity, mitigation, marking, waste/debris management, use, cumulative, etc.

See attached

Expected start date (dd-mm-yyyy) (Required)
01-05-2019

Expected completion date (dd-mm-yyyy) (Required)
Ongoing

Canada

ENVIRONMENTAL REVIEW INFORMATION

Is the work located on Federal lands?

◯Yes ◯No ◯Unknown

Is the project a designated project under the *Regulations Designating Physical Activities* under the *Canadian Environmental Assessment Act, 2012*?

◯Yes ◯No ◯Unknown

Is the project subject to Northern Environmental Assessment (EA) Regime(s)?

◯Yes ◯No ◯Unknown

If yes, identify the northern EA regime(s) that apply

- ☐ Inuvialuit Final Agreement (IFA)
- ☐ *Mackenzie Valley Resource Management Act* (MVRMA)
- ☐ Nunavut Land Claims Agreement (NLCA)
- ☐ *Yukon Environmental and Socio-economic Assessment Act* (YESAA)

Other Federal Organizations involved

- ☐ Canadian Environmental Assessment Agency (CEAA)
- ☐ Fisheries and Oceans Canada (DFO)
- ☐ Major Projects Management Office (MPMO)
- ☐ Aboriginal Affairs and Northern Development Canada (AANDC)
- ☐ Environment Canada (EC)
- ☐ Natural Resources Canada (NRCan)
- ☐ Northern Projects Management Office (NPMO)
- ☐ Other: _____

OWNER AUTHORIZATION[2]

I hereby certify that the information contained herein and in any of the supporting documents is complete, true and accurate to the best of my knowledge and belief, and that I am authorized, as the owner, to submit this Notice to the Minister.

[redacted]
Signature (Required)

26/02/2019
Date (dd-mm-yyyy) (Required)

[redacted]
Print Name (Required)

FOR OFFICE USE ONLY

	Date stamped (dd-mm-yyyy)

[2]"Owner", in relation to a work, means the actual or reputed owner of the work or that owner's agent or mandatary. It includes a person who is in possession or claiming ownership of the work and a person who is authorizing or otherwise responsible for the construction, placement, alteration, repair, rebuilding, removal, decommissioning, maintenance, operation, safety or use of the work. It also includes a person who proposes to construct or place a work.

The personal information provided on this Notice to the Minister is collected under the authority of the ***Navigation Protection Act***, sections 4, 5, 6, 9, 21, 22, 23 and 24. This information is required for the purpose of processing applications made under the above-noted sections for proposed, commenced or existing works that are or will be constructed, placed, altered, repaired, rebuilt, removed or decommissioned in, on, over, under, through or across any navigable water in Canada. The personal information collected is described in a personal information bank entitled ***Navigation Protection Program*** (bank number TC PPU 086). Under the provisions of the ***Privacy Act***, individuals have the right of access to, correction of and protection of their personal information. Instructions for obtaining personal information are provided in Info Source, a copy of which is available in major public and academic libraries or online at http://www.infosource.gc.ca

Canada

Navigation Protection Act Notice of Works Form Attachments for Waycobah First Nation, North Aberdeen Finfish Aquaculture

Body of water details:

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomagh since 2009
Average wind speed (km/hr) (30m height)	19.8	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease
Wind speed class rating (10m height)	Low to Moderate	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)[1]	1.08	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the greatest Hmax measured with the ACDP during October 31, 2018 to December 11, 2018 deployment.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (Robin Stuart).		
Annual maximum tide (m)			
Depth of water at each corner of the site (m)	Corner 1: 14.6m Corner 2: 26.6m Corner 3: 26.6m Corner 4: 26.4m Center Lease: 26.4m	Depths taken during benthic sampling	

[1] The oceanographic characteristics of this area were collected over the autumn months and early winter months of 2018 (October 31, 2018 to December 11, 2018) via deployment of an ADCP (Acoustic Doppler Current Profiler) within the proposed site's boundaries. This monitored a number of variables associated with currents and waves at multiple levels in the water column.

Brief project description

We'koqma'q First Nation is requesting a new marine finfish licence/lease in the Bras D'Or Lake in Inverness County, NS. This proposed site is located on the northeast side of Whycocomagh Bay in the Bras D'Or Lake. This will be a seasonal site and will house 24 polar circle sea cages which will grow Rainbow trout from May to December. The cages will be moored in place with steel anchors and concrete blocks. The cage frames are made of HDPE and are self-floating. The mooring system will permanently remain in place after installation; but the sea cages will be removed each winter, before the area ices over and replaced each spring, after the ice leaves.

Method of construction

Mooring deployment: Moorings are placed on barge. Barge is motored out to the pre-determined waypoint and the mooring is dropped.

Grid system installation: The end moorings and center lines are dropped first. The center line is pulled tight before the cross grids are installed. The grid and scope lines are assembled prior to installation so that all connections and intersections of the lines can be properly secured. The scope of the lines is targeted to be 3:1 at high tide. The types of moorings to be used at each point on the grid are shown on the top view diagram supplied with the application.

Each cross line is marked with an 18" inflatable yellow buoy. These buoys can stay out all winter and have less of a tendency to be destroyed or move with the ice. Other types of buoys get moved or sheared by winter ice. Although the cages are moved in the winter, the line/grid marker buoys are left year-round.

Cage installation: Cages are assembled on shore, inspected, then pulled into the water then towed to their location where bridles are attached to the cage collars as shown in the diagram. Cages will be removed during the winter (prior to ice formation), and replaced each spring.

Anticipated impacts

Site location considerations and mitigation practices have been described in a Development Plan and submitted to NSDFA. These will be reviewed according to the Aquaculture Licencing and Leasing regulations for Nova Scotia. The plan recognizes potential impacts and describes practices intended to reduce impacts to other users of the local waters, including the fishery, wildlife (including Atlantic salmon), local residents, and seasonal visitors. Ongoing environmental monitoring in terms of benthic impacts is part of this plan.

Navigation Protection Act Notice of Works Form
Waycobah First Nation, North Aberdeen Finfish Aquaculture

WBN1 45 58 54.4N, 61 01 14.92W

WBN2 45 58 40.4N, 61 01 51.51W

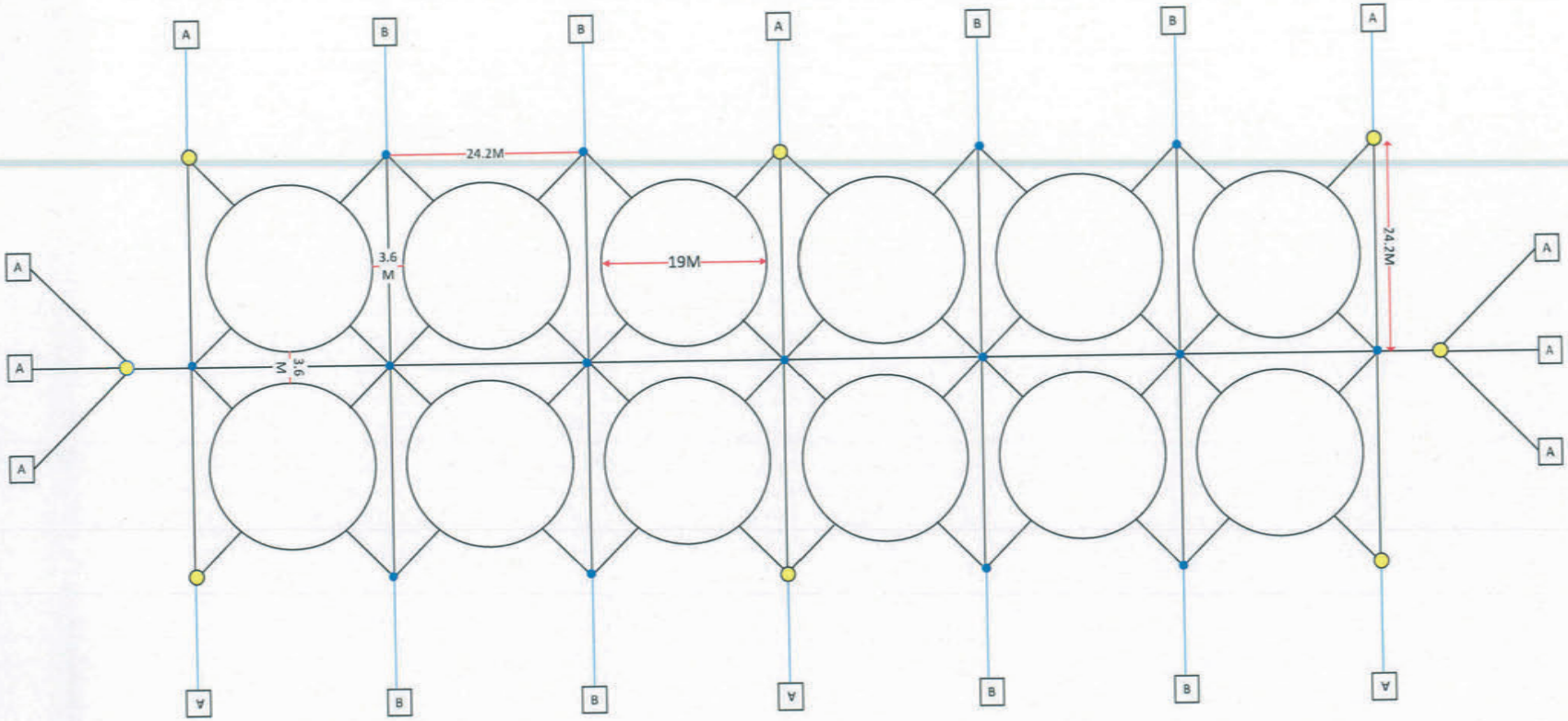
WBN3 45 58 30.40N,61 01 42.65W

WBN4 45 58 41.78N, 61 01 6.14W

Centre 45 58 41.78N, 61 01 28.51W


hycocomagh Bay 32 hectares
North Side Whycocomagh Bay
WBN 1
WBN 4
Centre Aberdeen North
WBN 2
WBN 3

Top view of a single cage array of 12 cages.
Two arrays (24 cages) will be deployed at the site from May to December each year.
Cages will be moved prior to ice formation. Moorings will stay in place during this winter period.



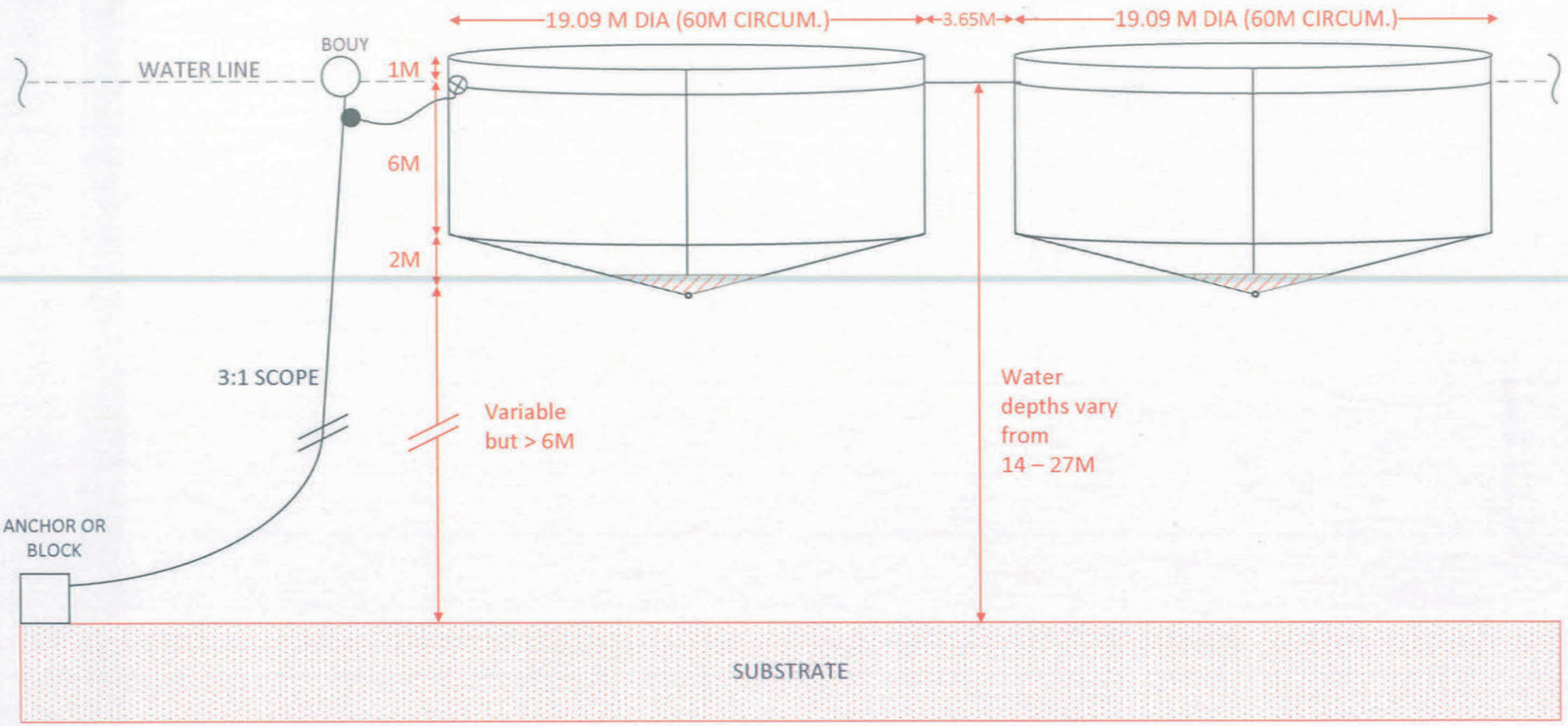
NOTES

- Red Lines represent distance measurements (m)
- Black lines show 1.25 in grid line rope distribution
- Cages are 60m circumference.

LEGEND

- A — Steel Anchors
- B — Concrete Blocks (1,200 Kg ea.)
- Compensator bouys (0.6m diameter, 0.9m high)
- Yellow bouys (0.9m diameter, 2.75m high)

Client: We'koqma'q First Nation		
Sheet Title: Aberdeen Leases – Top View		
Scale: 0.25": 5'	DWN BY: AJD	1 of 1
Date: Feb 20, 2019		



LEGEND

- ● Steel ring with shackles
- ⊗ Tied to cage collar

Client: We'koqma'q First Nation		
Sheet Title: Sea Cage Side View		
Scale: 0.25": 2m	DWN BY: AJD	1 of 1
Date: Feb 20, 2019		

NAVIGATION PROTECTION ACT (NPA)
NOTICE OF WORKS FORM

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SUPPORTING DOCUMENTATION REQUIREMENTS

Mandatory Information Checklist
(incomplete information will be returned with no action)

- [x] Completed and signed "Notice of Works Form" with all mandatory fields completed
- [x] Map showing location of project [1]
- [x] Top/Plan drawing with dimensions [1]
- [x] Side/Profile drawing with dimensions [1]

[1] If you are submitting a Notice of Works in paper form, please provide two (2) copies of each supporting document. If the Notice of Works is submitted electronically, please ensure to attach all relevant documents (individually scanned).

Recommended Information
(may expedite your review)

- [ ] Body of water details
- [ ] Land use/Ownership information
- [ ] Body of water use information
- [ ] Impacts, obstructions and mitigation plans
- [ ] Any environmental review information
- [ ] Operation, maintenance and marking plans
- [ ] Photographs of work site and body of water
- [ ] Aboriginal consultation results
- [ ] Other government agencies involved
- [ ] Water lot lease information
- [ ] Opt-in request annex (non-scheduled navigable waters only)

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- All plans and drawings must be legible when printed on 11" x 17" paper
- Your completed Notice to the Minister should be sent to the appropriate regional office as outlined below

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Pacific Region Office
820-800 Burrard Street
Vancouver BC V6Z 2J8
Telephone: 604-775-8867
Email: NPPPAC-PPNPAC@tc.gc.ca

Prairie and Northern Region Office
Canada Place 1100-9700 Jasper Ave
Edmonton AB T5J 4E6
Telephone: 780-495-8215
Email: NPPPNR-PPNRPN@tc.gc.ca

Ontario Region Office
100 South Front Street, 1st Floor
Sarnia ON N7T 2M4
Telephone: 519-383-1863
Email: NPPONT-PPNONT@tc.gc.ca

Headquarters Office
(For info on the NPP and NPA ONLY)
Notices not processed at this office
Tower C, 330 Sparks Street, 18th Floor
Ottawa ON K1A 0N5
Telephone: 613-991-3476
Email: NPPHQ-PPNAC@tc.gc.ca

Quebec Region Office
401-1550 d'Estimauville Avenue, 5th Floor
Quebec QC G1J 0C8
Telephone: 877-646-6420
Email: PPNQUE-NPPQUE@tc.gc.ca

Atlantic Region Office
95 Foundry Street, 6th Floor
P.O. Box 42
Moncton NB E1C 8K6
Telephone: 506-851-3113
Email: NPPATL-PPNATL@tc.gc.ca

NAVIGATION PROTECTION ACT
NOTICE OF WORKS FORM

TC file number (if known):

Are you the riparian property owner? ◯Yes ◯No

GENERAL INFORMATION

Official and/or local name(s) of the body of water (Required)
Whycocomagh Bay, Bras D'Or Lake

Is the body of water listed on the schedule to the NPA?
◉Yes ◯No ◯Unknown

Are you also requesting an Approval, if required?
◉Yes ◯No

Is this an Opt-in request?
◯Yes ◉No

Are you representing an Aboriginal group?
◉Yes ◯No

Is the work near/on First Nations reserve or land claim?
◉Yes ◯No ◯Unknown

Does this project involve throwing or depositing materials in water?
◯Yes ◉No

Does this project involve dewatering a body of water?
◯Yes ◉No

OWNER CONTACT INFORMATION[2]

Individual or company name (Required)
Waycobah First Nation

Contact name (Required)
Donald Davis

Mailing address (Required)
[redacted]
[redacted] Whycocomagh

City/Town (Required)
Whycocomagh

Province/Territory (Required)
NS

Postal code (Required)
B0E3M0

Primary telephone number (999-999-9999) (Required)
[redacted]

Other telephone number (999-999-9999)
[redacted]

E-mail
[redacted]

Owner's agent/mandatary (contractor/consultant/representative/co-proponent, if any)

Company name

Contact name

Mailing address

City/Town

Province/Territory

Postal code

Primary telephone number (999-999-9999) (Required)

Other telephone number (999-999-9999)

E-mail

WORK SITE INFORMATION

Nearest municipality/county/district (Required)
Inverness

Province/Territory (Required)
NS

Site location such as lot, concession, section, township, range, meridian, 911 address, property identification, etc. (Required)
Whycocomagh Portage, NS

Site position Latitude North (Required)
Degrees 45 Minutes 57 Seconds 38.14

Site position Longitude West (Required)
Degrees -61 Minutes 01 Seconds 38.31

Hydro chart number: 4278

Topo map number: 011F14

Body of water details, such as characteristics, bank/bottom features, biological components, flow/tides, etc.

See attached

Potential obstructions, such as natural/man-made, other works, navigation aids, etc.

n/a

Land use/Ownership, such as past/current, private/government, rural/suburban, coastal, environmental, etc.

Shore line is a rural area. Site location was chosen partly because of limited use of shoreline.

BODY OF WATER USE INFORMATION

Navigation types (check all that apply)

☑ Commercial ☑ Recreational

Maximum vessel size

Length 48' Width 20' Draft 8"

Traffic direction

○ One-way ◉ Two-way

Manoeuvrability (check all that apply)

☐ Poor ☑ Good ☐ Excellent

Day/Night

◉ Day ○ Night ○ Both

Volume

◉ Low ○ Medium ○ High

Navigation season(s) (check all that apply)

☐ Winter ☑ Spring ☑ Summer ☑ Fall

Other uses such as cottagers, special events, fishing, etc.

Maximum vessel indicated above is a barge to be used for Waycobah's finfish operations. Other users would be recreational small sailing craft and small fishing boats.

PROJECT INFORMATION

Name of work such as bridge, dam, marina, etc. (Required)

Finfish aquaculture

Type of work (check all that apply) (Required)

☐ Construct ☑ Place ☐ Alter

☐ Repair ☐ Decommission ☐ Rebuild

☐ Permanent ☐ Temporary ☐ Remove

Brief project description (or attach) such as status, structures, operation, etc. (Required)

See attached

Method of construction such as temporary works, activities, etc. (Required)

See attached

Anticipated impacts such as source, severity, mitigation, marking, waste/debris management, use, cumulative, etc.

See attached

Expected start date (dd-mm-yyyy) (Required)

01-05-2019

Expected completion date (dd-mm-yyyy) (Required)

Ongoing

Canada

ENVIRONMENTAL REVIEW INFORMATION

Is the work located on Federal lands?

◯ Yes ◯ No ◯ Unknown

Is the project a designated project under the *Regulations Designating Physical Activities* under the *Canadian Environmental Assessment Act, 2012*?

◯ Yes ◯ No ◯ Unknown

Is the project subject to Northern Environmental Assessment (EA) Regime(s)?

◯ Yes ◯ No ◯ Unknown

If yes, identify the northern EA regime(s) that apply

- ☐ Inuvialuit Final Agreement (IFA)
- ☐ *Mackenzie Valley Resource Management Act* (MVRMA)
- ☐ Nunavut Land Claims Agreement (NLCA)
- ☐ *Yukon Environmental and Socio-economic Assessment Act* (YESAA)

Other Federal Organizations involved

- ☐ Canadian Environmental Assessment Agency (CEAA)
- ☐ Fisheries and Oceans Canada (DFO)
- ☐ Major Projects Management Office (MPMO)
- ☐ Aboriginal Affairs and Northern Development Canada (AANDC)
- ☐ Environment Canada (EC)
- ☐ Natural Resources Canada (NRCan)
- ☐ Northern Projects Management Office (NPMO)
- ☐ Other: _____

OWNER AUTHORIZATION[2]

I hereby certify that the information contained herein and in any of the supporting documents is complete, true and accurate to the best of my knowledge and belief, and that I am authorized, as the owner, to submit this Notice to the Minister.

[redacted]

Signature (Required)

26/02/2019

Date (dd-mm-yyyy) (Required)

[redacted]

Print Name (Required)

FOR OFFICE USE ONLY

	Date stamped (dd-mm-yyyy)

[2] "Owner", in relation to a work, means the actual or reputed owner of the work or that owner's agent or mandatary. It includes a person who is in possession or claiming ownership of the work and a person who is authorizing or otherwise responsible for the construction, placement, alteration, repair, rebuilding, removal, decommissioning, maintenance, operation, safety or use of the work. It also includes a person who proposes to construct or place a work.

The personal information provided on this Notice to the Minister is collected under the authority of the ***Navigation Protection Act***, sections 4, 5, 6, 9, 21, 22, 23 and 24. This information is required for the purpose of processing applications made under the above-noted sections for proposed, commenced or existing works that are or will be constructed, placed, altered, repaired, rebuilt, removed or decommissioned in, on, over, under, through or across any navigable water in Canada. The personal information collected is described in a personal information bank entitled ***Navigation Protection Program*** (bank number TC PPU 086). Under the provisions of the ***Privacy Act***, individuals have the right of access to, correction of and protection of their personal information. Instructions for obtaining personal information are provided in Info Source, a copy of which is available in major public and academic libraries or online at http://www.infosource.gc.ca

Canada

Navigation Protection Act Notice of Works Form Attachments for Waycobah First Nation, South Aberdeen Finfish Aquaculture

Body of water details:

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomagh since 2009
Average wind speed (km/hr) (30m height)	24.3	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease
Wind speed class rating (10m height)	Moderate to High	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)[1]	1.08	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the greatest Hmax measured with the ACDP during October 31, 2018 to December 11, 2018 deployment at a site across the Bay but within 2 km of this site.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (Robin Stuart).		
Annual maximum tide (m)			
Depth of water at each corner of the site (m)	Corner 1: 25.4m Corner 2: 26.1m Corner 3: 13.0m Corner 4: 14.0m Center Lease: 27.9m	Depths taken during baseline EMP sampling	

[1] The wave characteristics were collected off site but within 2 km of this proposed site. They were collected over the autumn months and early winter months of 2018 (October 31, 2018 to December 11, 2018) via deployment of an ADCP (Acoustic Doppler Current Profiler). This monitored a number of variables associated waves at multiple levels in the water column. Although only summaries are depicted within this plan, all of the data derived from this monitoring will be used in the engineering of the cage and infrastructure for this site.

Brief project description

We'koqma'q First Nation is requesting a new marine finfish licence/lease in the Bras D'Or Lake in Inverness County, NS. This proposed site is located on the southeast side of Whycocomagh Bay in the Bras D'Or Lake. This will be a seasonal site and will house 24 polar circle sea cages which will grow Rainbow trout from May to December. The cages will be moored in place with steel anchors and concrete blocks. The cage frames are made of HDPE and are self-floating. The mooring system will permanently remain in place after installation; but the sea cages will be removed each winter, before the area ices over and replaced each spring, after the ice leaves.

Method of construction

Mooring deployment: Moorings are placed on barge. Barge is motored out to the pre-determined waypoint and the mooring is dropped.

Grid system installation: The end moorings and center lines are dropped first. The center line is pulled tight before the cross grids are installed. The grid and scope lines are assembled prior to installation so that all connections and intersections of the lines can be properly secured. The scope of the lines is targeted to be 3:1 at high tide. The types of moorings to be used at each point on the grid are shown on the top view diagram supplied with the application.

Each cross line is marked with an 18" inflatable yellow buoy. These buoys can stay out all winter and have less of a tendency to be destroyed or move with the ice. Other types of buoys get moved or sheared by winter ice. Although the cages are moved in the winter, the line/grid marker buoys are left year-round.

Cage installation: Cages are assembled on shore, inspected, then pulled into the water then towed to their location where bridles are attached to the cage collars as shown in the diagram. Cages will be removed during the winter (prior to ice formation), and replaced each spring.

Anticipated impacts

Site location considerations and mitigation practices have been described in a Development Plan and submitted to NSDFA. These will be reviewed according to the Aquaculture Licencing and Leasing regulations for Nova Scotia. The plan recognizes potential impacts and describes practices intended to reduce impacts to other users of the local waters, including the fishery, wildlife (including Atlantic salmon), local residents, and seasonal visitors. Ongoing environmental monitoring in terms of benthic impacts is part of this plan.

Navigation Protection Act Notice of Works Form
Waycobah First Nation, South Aberdeen Finfish Aquaculture

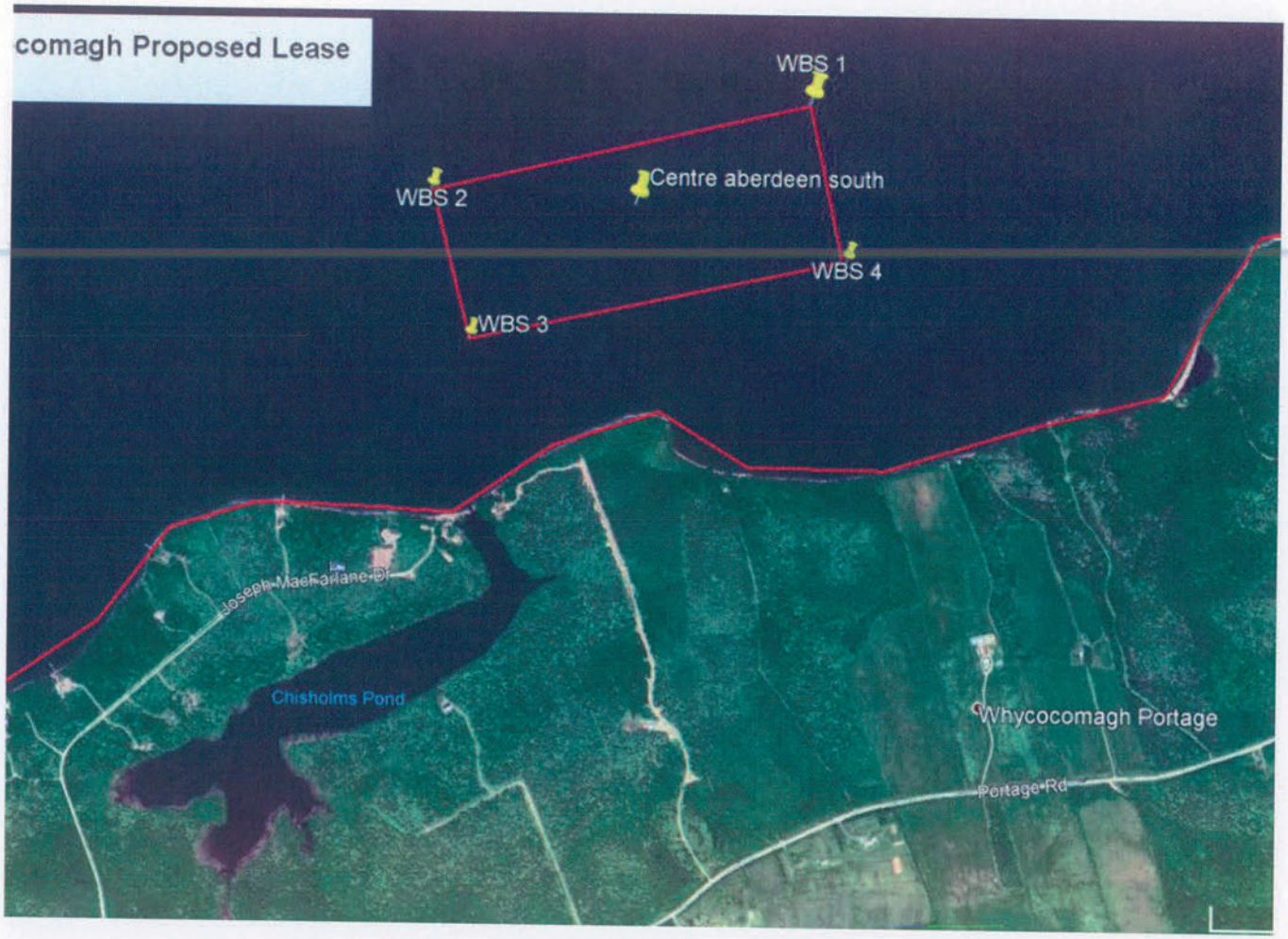
WBS1 45 57 45.9N, 61 01 19.05W

WBS2 45 57 39.1N, 61 02 1.01W

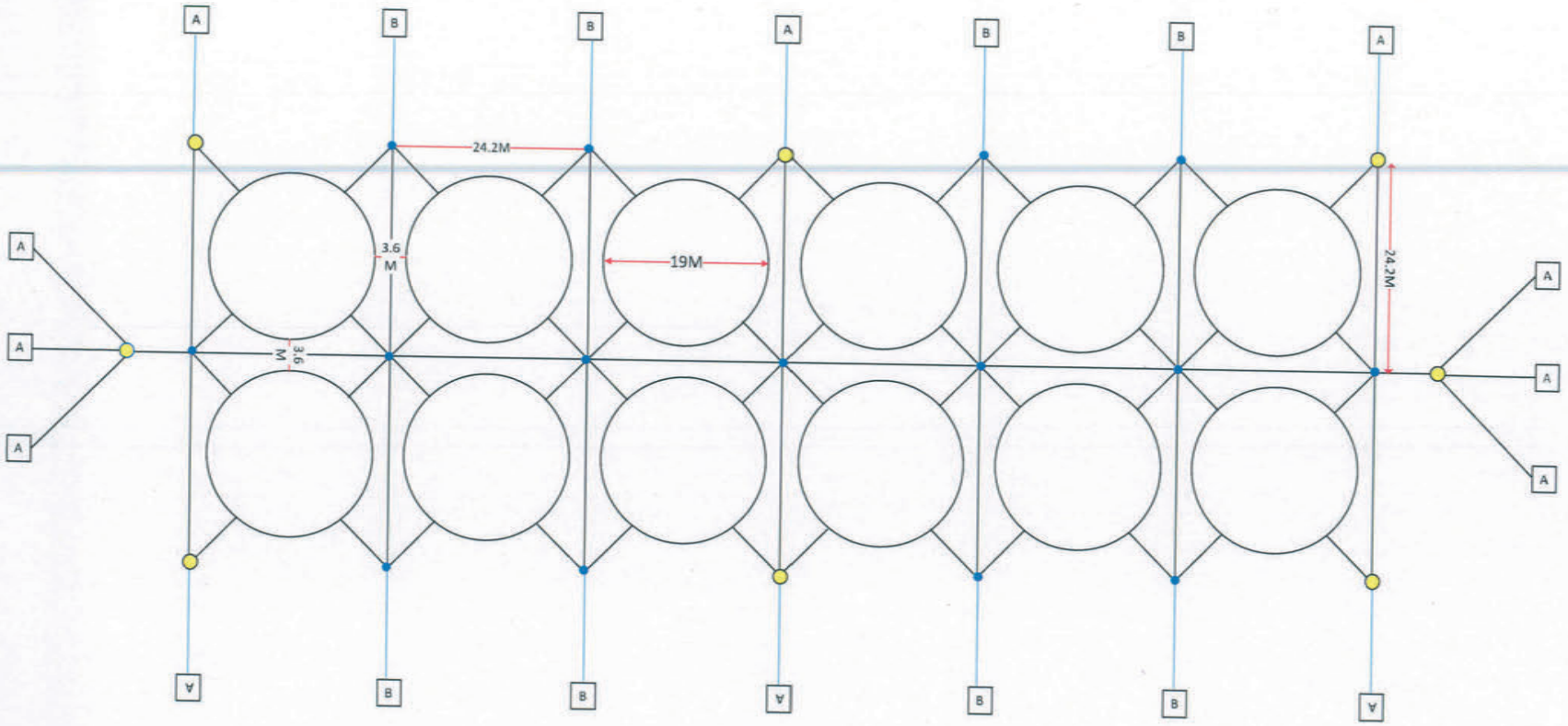
WBS3 45 57 27.7N, 01 01 56.71W

WBS4 45 57 33.9N, 61 01 14.86N

Centre 45 57 38.14N, 61 01 38.31W


comagh Proposed Lease
WBS 1
WBS 2
Centre aberdeen south
WBS 4
WBS 3
Joseph MacFarlane Dr
Chisholms Pond
Whycocomagh Portage
Portage Rd

Top view of a single cage array of 12 cages.
Two arrays (24 cages) will be deployed at the site from May to December each year.
Cages will be moved prior to ice formation. Moorings will stay in place during this winter period.



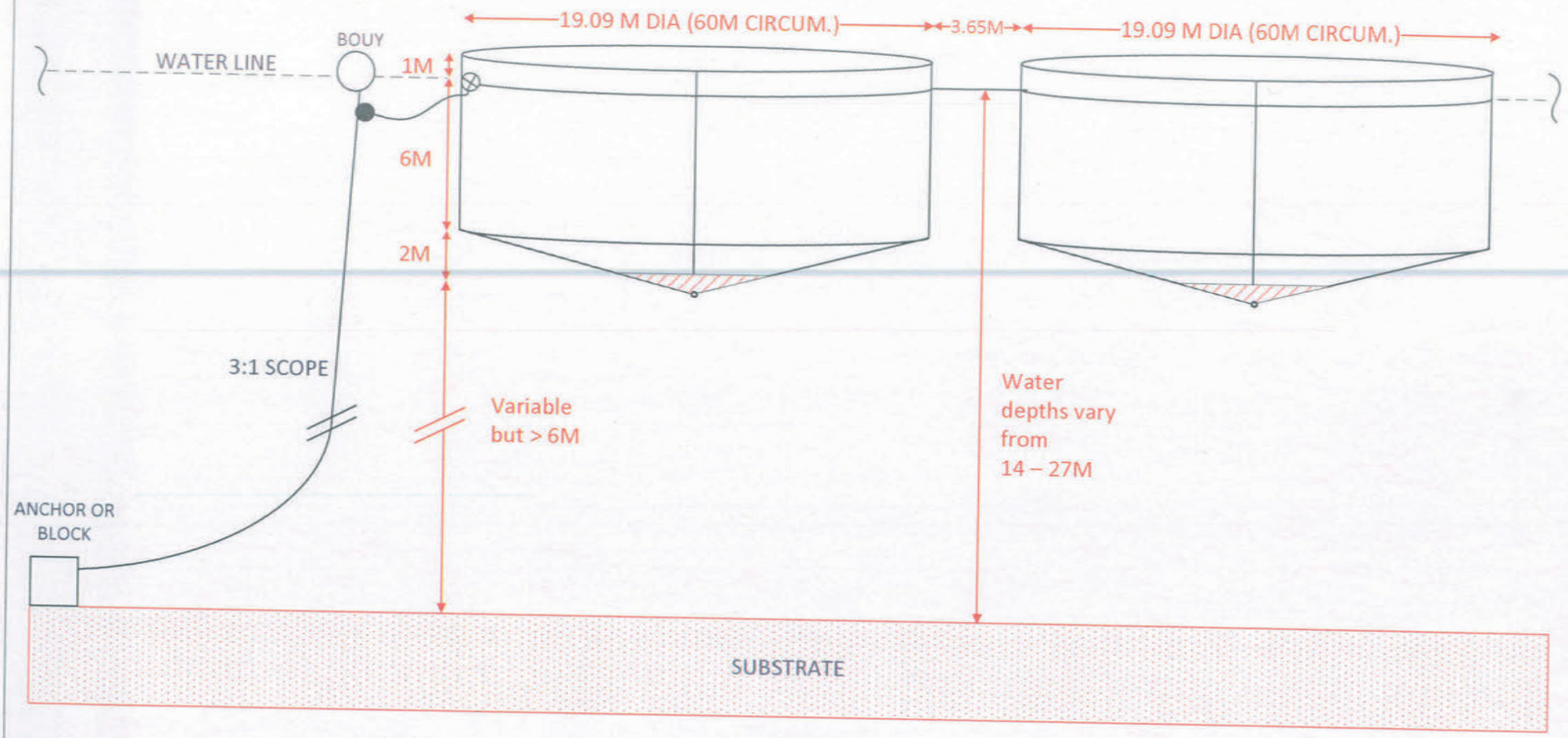
NOTES

- Red Lines represent distance measurements (m)
- Black lines show 1.25 in grid line rope distribution
- Cages are 60m circumference.

LEGEND

- A — Steel Anchors
- B — Concrete Blocks (1,200 Kg ea.)
- Compensator bouys (0.6m diameter, 0.9m high)
- Yellow bouys (0.9m diameter, 2.75m high)

Client: We'koqma'q First Nation		
Sheet Title: Aberdeen Leases – Top View		
Scale: 0.25": 5'	DWN BY: AJD	1 of 1
Date: Feb 20, 2019		



LEGEND

● Steel ring with shackles

⊗ Tied to cage collar

Client: We'koqma'q First Nation		
Sheet Title: Sea Cage Side View		
Scale: 0.25": 2m	DWN BY: AJD	1 of 1
Date: Feb 20, 2019		

4.3 Additional Information Requests and Responses (2019)

NOVA SCOTIA

Fisheries and Aquaculture
1575 Lake Road
Shelburne, Nova Scotia
B0T 1W0

novascotia.ca

Additional Information
AQ#0814
BN#703649483NS0001

July 2, 2019

We'koqma'q First Nation
Attn: Mr. Donald Davis
[redacted],
Whycocomagh, NS B0E 3M0

Dear Mr. Davis;

RE: AQ#0814 Boundary Amendment
Whycocomagh and Indian Island, Whycocomagh Bay, Inverness County, NS

Your aquaculture amendment application is currently in the pre-Network review stage of the application process. Staff have identified missing or incomplete information from the submitted development plan. If you could please answer the following questions, the review of your application will proceed:

1. The strain or potential strains of rainbow trout were not identified in the development plan. What is the most likely strain or strains of rainbow trout this operation would utilize once operational?

2. Expected fallow period has not been specified in the development plan. Please provide more information regarding the expected fallow regime for this site, including timelines for production and fallow cycles.

3. Egg source has not been identified in the development plan. What is the intended source(s) of eggs this operation would utilize once operational?

4. Location map, indicating the exact location of the work, is not present. Please submit map(s) showing entire lease area with works overlaid within the lease.

Please be advised that following further review by Department staff or the review of your application by Network partners, additional information may be required.

Should you have any questions please contact me at 902-875-7440 or by email at lynn.winfield@novascotia.ca .

Sincerely,

[redacted]

E. Lynn Winfield,
Licensing Coordinator
NS Department of Fisheries and Aquaculture

c. Nicole Sampson, Coastal Resource Coordinator
Nathaniel Feindel, Manager of Aquaculture Development
Dr. Gregor Reid, Manager of Aquaculture Operations
Dr. Roland Cusack, Fish Health Veterinarian
Melissa Rommens

WE'KOQMA'Q
PROUD

July 4, 2019
Nova Scotia Fisheries and Aquaculture
1575 Lake Road
Shelburne, NS
B0T 1W0

Dear Ms. Winfield:

Re: AQ#0814Boundary Amendment
Whycocomagh and Indian Island, Whycocomagh Bay, Inverness County, NS

Please accept the following in response to your questions and request for additional information for the above-mentioned application in the letter dated July 2, 2019.

Questions:
1.& 3.The rainbow trout will be from either or both of two egg sources, with the strains identified as follows:

- Trout Lodge: "Silver Steelhead" or "Winter and Fall Strain" See https://www.troutlodge.com/en/trout-genetics/trout-eggs/.
- Riverence: "Steelhead Trout" which were developed from the "Donaldson strain"

2.There was no fallow period identified for the lease since the intent is to not fallow the entire lease, but rather to fallow areas of the lease. The lease will have over-wintering locations as well as grow-out locations with fallow regimesfor these locations as described below.

The over-wintering locations will be inshore, next to the wharves. These locations can be protected from moving ice, and the cages can be provided with upwellers and oxygen supplementation to allow the fish to survive the winter conditions. The over-wintering locations will be used to hold fish to be harvested over the winter months as well as juveniles received in the fall of the year from the hatchery. The fall juveniles are moved off of the over-wintering locations in the spring. No feeding occurs at the over-wintering locations due to low temperatures. The over-wintering locations will be fallow from May to December.

The grow-out locations will be areas away from the wharves, within the boundaries of the lease. The placement of arrays in the grow-out locations will be determined according to results from environmental monitoring and requests from regulators. The grow-out locations will receive fish in the spring. Fish will come from the over-wintering arrays as well as from the hatchery. Feeding will occur at the grow-out locations and the fish will be grown to harvest size. Harvesting will begin in July and continue through to December. In December, any unharvested fish will be moved to the over-wintering locations for winter harvest. The grow-out locations will be fallow from December to April/May.

[redacted] · [redacted] · We'koqma'q, Nova Scotia · B0E 3M0
PHONE [redacted] · FAX [redacted] WEKOQMAQPROUD.CA

WE'KOQMA'Q
PROUD

4. The array locations within the lease will change with the season and from year to year, as indicated in the paragraphs above. We have attached a diagram to show the winter and the grow-out locations for reference. We have also attached a sampleconfiguration of gear on the lease map during the summer months. However, it should be noted that in a proceeding year, the cage arrays may be located elsewhere within the lease area. The intent is to move them to different locations every couple of years or from year to year in order to reduce the risk of cumulative environmental impact.

If you need additional information or have any questions regarding the above, please contact Melissa Rommens and Robin Stuart.

Sincerely,

[redacted]

Donald Davis,
Chief Operating Officer,
We'koqma'q First Nation.

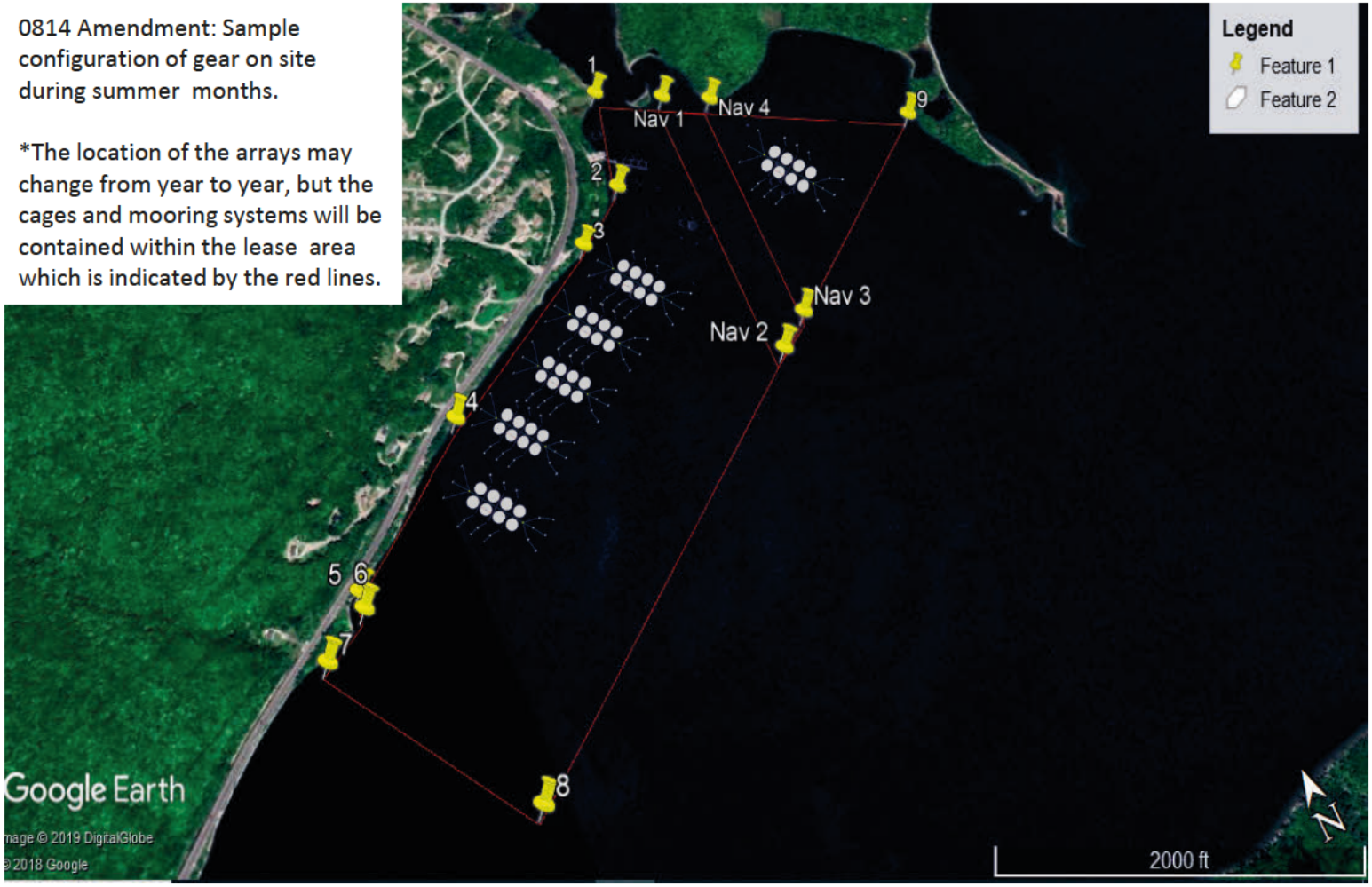
[redacted] [redacted] We'koqma'q, Nova Scotia B0E 3M0
PHONE [redacted] FAX [redacted] WEKOQMAQPROUD.CA

0814 Amendment:
Overwintering locations on lease indicated by blue polygon.
Grow-out locations indicated by orange polygons.



0814 Amendment: Sample configuration of gear on site during summer months.

*The location of the arrays may change from year to year, but the cages and mooring systems will be contained within the lease area which is indicated by the red lines.



NOVA SCOTIA

Fisheries and Aquaculture
1575 Lake Road
Shelburne, Nova Scotia
B0T 1W0

novascotia.ca

Additional Information
AQ#1430
BN#703649483NS0001

We'koqma'q First Nation
Attn: Mr. Donald Davis
[redacted]
Whycocomagh, NS B0E 3M0

Dear Mr. Davis;

RE: Aquaculture Licence and Lease Application AQ#1430
Located in Whycocomagh Bay, (North Aberdeen), Inverness County

Your aquaculture application is currently in the Pre-Network review stage of the application process. Staff have identified missing or incomplete information from the submitted development plan. If you could please answer the following questions, the review of your application will proceed:

1. The strain or potential strains of rainbow trout were not identified in the development plan. What is the most likely strain or strains of rainbow trout this operation would utilize once operational?
2. The maximum site biomass was indicated to be 750,000 kg in the development plan. The plan also indicates that there will be 24 cages on site, stocked with 15,000 fish each. With a market size of 2 kg, this results in a site biomass of 720,000 kg. Could you please provide an explanation of how biomass was calculated?
3. The intended stocking date has passed and needs to be adjusted based on the timelines established within the Department's adjudicative process. What is the revised intended stocking date?
4. Egg source has not been identified in the development plan. What is the intended source(s) of eggs this operation would utilize once operational?
5. It has been identified that more information is required regarding the site design and production plan. Please provide a final site design and detailed production plan including the maximum stocking number for the proposed site.
6. Please submit map(s) showing entire lease area with works overlaid within the lease.

Should you hve any questions please do not hesitate to contact me at 902-875-7440 or by email at Lynn.Winfield@novascotia.ca .

Sincerely,

[redacted]

Lynn Winfield,
Licensing Coordinator

NSDFA – Staff
Melissa Rommens

WE'KOQMA'Q PROUD

August 30, 2019

Nova Scotia Fisheries and Aquaculture
1575 Lake Road
Shelburne, NS
B0T 1W0

Dear Ms. Winfield:

Re: Aquaculture Licence and Lease Application AQ#1430
Located in Whycocomagh Bay, (North Aberdeen), Inverness County

Please accept the following in response to your questions and request for additional information for the above-mentioned application.

Question:

1. *Strain or potential strain:* The rainbow trout will be from either or both of two egg sources:
    - Trout Lodge: "Silver Steelhead" or "Winter and Fall Strain" See https://www.troutlodge.com/en/trout-genetics/trout-eggs/.
    - Riverence: "Steelhead Trout" which were developed from the "Donaldson strain"
2. *Maximum site biomass:* The average size of the fish at market size will be 2.1 kg: 15,000*24*2.1kg = 756,000kg (Or 30,000*12*2.1kg = 756,000. See also answer to Question 5.)
3. *Revised stocking date:* The revised intended stocking date is April/May, 2020.
4. *Egg source:* See answer to Question 1.
5. *More information regarding the site design and production plan, including the maximum stocking number*: As you are aware, Experimental Lease/Licence 5010 was acquired for a site that overlaps this proposed site (1430). The intent of the Experimental Lease/Licence is to trial the use of 90m polar circle cages. Should these cages prove effective and efficient, it is expected that similar cages would be used on this proposed site (1430). The intent would be to keep the biomass the same but use fewer cages. I.e. one array of 12 - 90m cages would be used instead of two arrays of 12-60m cages. This means that the maximum stocking number would not change.
6. *Works overlain on the lease:* See attached for 60m polar circles. It is notable that the placement of arrays may alter from year to year as they will be determined according to results from environmental monitoring and requests from regulators. Please also note that the possibility for a requirement for a new Transport Canada approval with a change of infrastructure (90m cages) is acknowledged.

[redacted] • We'koqma'q, Nova Scotia • B0E 3M0
PHONE [redacted] • FAX [redacted] • WEKOQMAQPROUD.CA

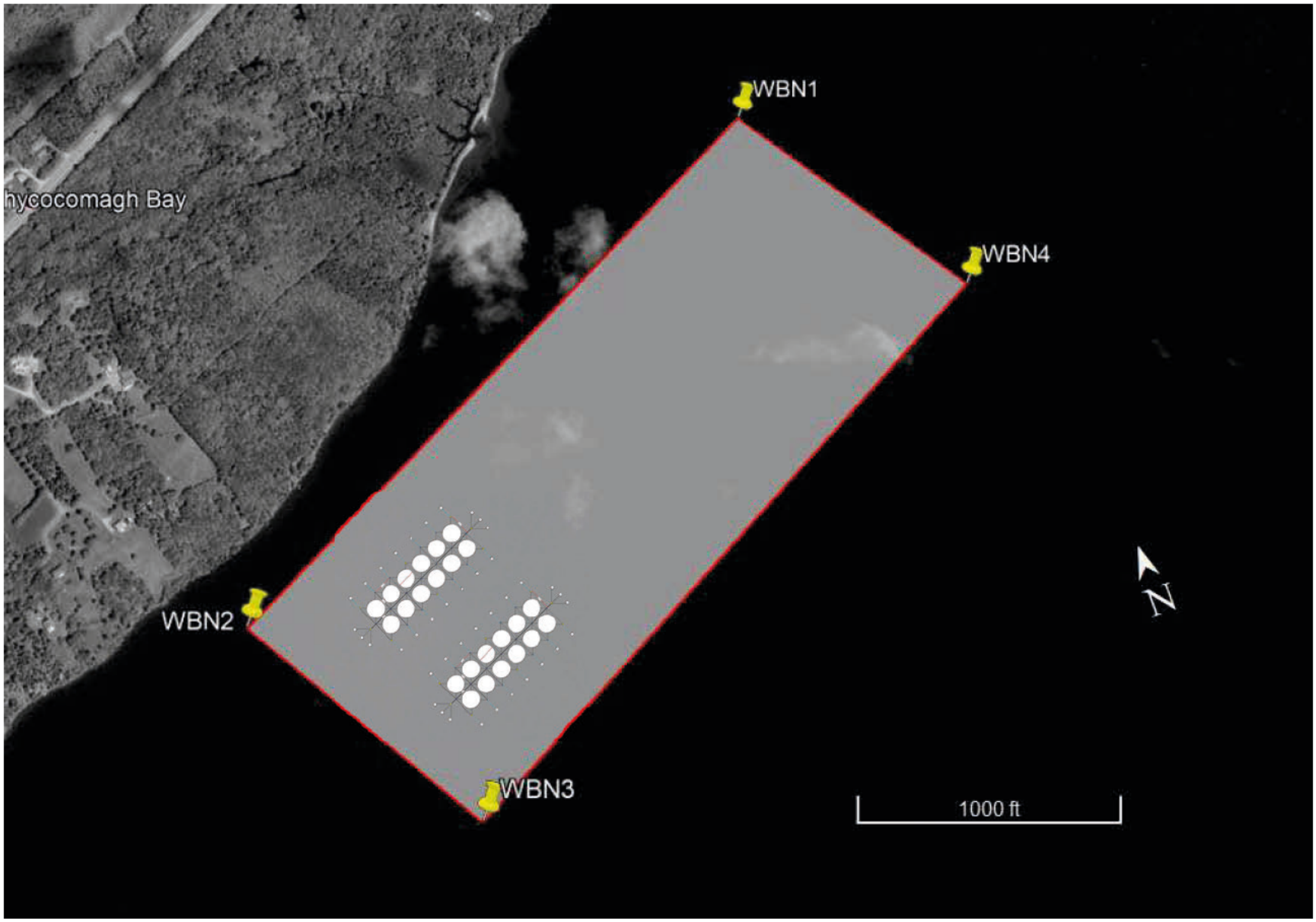
WE'KOQMA'Q
PROUD

If you need additional information or have any questions regarding the above, please contact Melissa Rommens and Robin Stuart.

Sincerely,

Donald Davis,
Chief Operating Officer,
We'koqma'q First Nation.

[redacted] • We'koqma'q, Nova Scotia • B0E 3M0
PHONE [redacted] • FAX 9[redacted] • WEKOQMAQPROUD.CA


WBN1
WBN4
WBN2
WBN3
hycocomagh Bay
N
1000 ft

NOVA SCOTIA

Fisheries and Aquaculture
1575 Lake Road
Shelburne, Nova Scotia
B0T 1W0

novascotia.ca

Additional Information
AQ#1431
BN#703649483NS0001

We'koqma'q First Nation
Attn: Mr. Donald Davis
[redacted],
Whycocomagh, NS
BOE 3MO

Dear Mr. Davis;

RE: Aquaculture Licence and Lease Application AQ#1431
Located in Whycocomagh Bay, (South Aberdeen), Inverness County

Your aquaculture application is currently in the Pre-Network review stage of the application process. Staff have identified missing or incomplete information from the submitted development plan. If you could please answer the following questions, the review of your application will proceed:

1. The strain or potential strains of rainbow trout were not identified in the development plan. What is the most likely strain or strains of rainbow trout this operation would utilize once operational?
2. The maximum site biomass was indicated to be 750,000 kg in the development plan. The plan also indicates that there will be 24 cages on site, stocked with 15,000 fish each. With a market size of 2 kg, this results in a site biomass of 720,000 kg. Could you please provide an explanation of how biomass was calculated?
3. The intended stocking date has passed and needs to be adjusted based on the timelines established within the Department's adjudicative process. What is the revised intended stocking date?
4. Egg source has not been identified in the development plan. What is the intended source(s) of eggs this operation would utilize once operational?
5. Please note that baseline environmental monitoring must be conducted in accordance with the provincial standard operating procedures. This will be required prior to stocking the site.
6. It has been identified that more information is required regarding the site design and production plan. Please provide a final site design and detailed production plan including the maximum stocking number for the proposed site.
7. Please submit map(s) showing entire lease area with works overlaid within the lease.

Should you hve any questions please do not hesitate to contact me at 902-875-7440 or by email at Lynn.Winfield@novascotia.ca .

Sincerely,

[redacted]

Lynn Winfield,
Licensing Coordinator

NSDFA – Staff
Melissa Rommens

WE'KOQMA'Q PROUD

August 30, 2019

Nova Scotia Fisheries and Aquaculture
1575 Lake Road
Shelburne, NS
B0T 1W0

Dear Ms. Winfield:

Re: Aquaculture Licence and Lease Application AQ#1431
Located in Whycocomagh Bay, (South Aberdeen), Inverness County

Please accept the following in response to your questions and request for additional information for the above-mentioned application.

Question:

1. *Strain or potential strain:* The rainbow trout will be from either or both of two egg sources:
    - Trout Lodge: "Silver Steelhead" or "Winter and Fall Strain" See https://www.troutlodge.com/en/trout-genetics/trout-eggs/.
    - Riverence: "Steelhead Trout" which were developed from the "Donaldson strain"
2. *Maximum site biomass:* The average size of the fish at market size will be 2.1 kg: 15,000*24*2.1kg = 756,000kg (Or 30,000*12*2.1kg = 756,000. See also answer to Question 6.)
3. *Revised stocking date:* The revised intended stocking date is April/May, 2020.
4. *Egg source:* See answer to Question 1.
5. *Baseline environmental monitoring:* Baseline environmental monitoring has been conducted and submitted. Please advise if this was insufficient.
6. *More information regarding the site design and production plan, including the maximum stocking number*: As you are aware, Experimental Lease/Licence 5010 was acquired for a site in a similar vicinity of this requested site (1431). The intent of the Experimental Lease/Licence is to trial the use of 90m polar circle cages. Should these cages prove effective and efficient, it is expected that similar cages would be used on this proposed site (1431). The intent would be to keep the biomass the same but use fewer cages. I.e. one array of 12 - 90m cages would be used instead of two arrays of 12-60m cages. This means that the maximum stocking number would not change.
7. *Works overlain on the lease:* See attached for 60m polar circles. It is notable that the placement of arrays may alter from year to year as they will be determined according to results from environmental monitoring and requests from regulators. Please also note that the possibility for a requirement for a new Transport Canada approval with a change of infrastructure (90m cages) is acknowledged.

[redacted] • We'koqma'q, Nova Scotia • B0E 3M0
PHONE [redacted] • FAX [redacted] • WEKOQMAQPROUD.CA

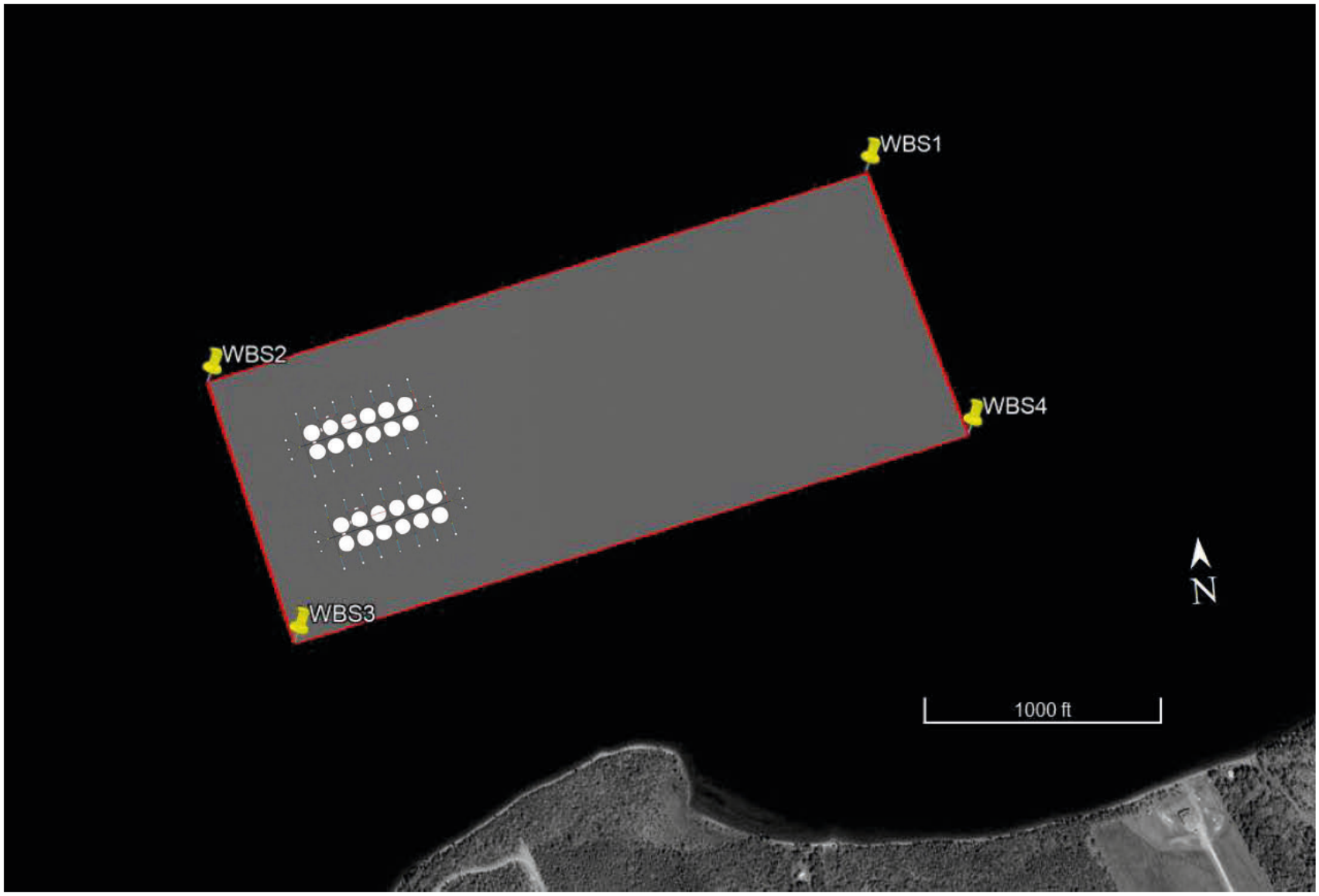
WE'KOQMA'Q PROUD

If you need additional information or have any questions regarding the above, please contact Melissa Rommens and Robin Stuart.

Sincerely,

Donald Davis,
Chief Operating Officer,
We'koqma'q First Nation.

[redacted] • We'koqma'q, Nova Scotia • B0E 3M0
PHONE [redacted] • FAX [redacted] • WEKOQMAQPROUD.CA


WBS1
WBS2
WBS3
WBS4
N
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4.4 Development Plan Revisions AQ#1430 and AQ#1431 (2020)

September 9, 2020

Robert Ceschiutti
Manager of Leasing & Licensing
Nova Scotia Department of Fisheries and Aquaculture
By e-mail: Robert.Ceschiutti@novascotia.ca

Dear Mr. Ceschiutti:

Re: Marine finfish site applications AQ 1430 and 1431

As a follow up to a telephone call July 23, 2020, please be advised of the intended change in plans for both of these proposed sites. The particulars for the revisions to the production plans and cage configurations are attached.

These requested changes are, in part, a result of work conducted on Experimental site AQ 5010. The focus of this experimental work is to assess the suitability of larger cages for rearing rainbow trout in the Bras D'Or Lake. The findings from the work indicate that increased efficiencies are occurring as a result of using fewer, larger cages. This is also allowing improved management of infrastructure (fewer units to care for), and will allow increased feeding vigilance, through the application of a feed barge complete with an improved underwater camera and feed blower system. These changes will require a significant investment in terms of infrastructure and training. However, We'koqma'q has determined that this is the preferred path in order to promote financial and environmental sustainability for the trout farming operation.

Please note that a revised depositional model is not ready at this time but will be forthcoming in the near future. This depositional model will satisfy the AAR Monitoring Standard requirements. Furthermore, a revised CNWA application will be submitted in the upcoming days.

If you have any questions regarding this manner or require additional information, please contact myself and Melissa Rommens.

Yours sincerely,

Donald Davis.

Requested Changes to Development Plans for AQ 1431, 1430

Changes from the original development plans submitted in March 2019 are listed below, where applicable. Note that changes are the same for both of the sites.

SECTION 1: THE OPTIMUM USE OF MARINE RESOURCES

The site size does not change but the expected tonnage will be increased to 1,100 tons. No other changes.

SECTION 2: THE CONTRIBUTION OF THE PROPOSED OPERATION TO COMMUNITY AND PROVINCIAL ECONOMIC DEVELOPMENT

2.1 Production plan

Species: Rainbow trout (no change)

Maximum site biomass (kg): 1,100,000kg (increased biomass)

Maximum cage density during grow out period (kg/m3): 18 kg/m3. Normal operating density will be <15 kg/m3 (no change)

Expected time to achieve maximum production: 5 months from stocking (no change)

Size(s) of cages, including net volumes (m3): 100m polar circle; 8 m depth; 6,350 m3 per cage (increased cages sizes)

Maximum cage number, maximum total net volume (m3): 1 array of 10 cages = 63,500m3 (fewer arrays and fewer cages)

Maximum number of fish per cage during grow out period: 55,000 (increased fish number per cage)

Intended initial stocking date and seed source: May 2021, Big Falls Hatchery (AQ # 1028) and over-wintering stock currently at Marine Licence/Lease AQ # 0814 in Whycocomagh Bay, south of We'koqma'q Reserve. (Stocking date changed from May 2019 to May 2021.)

Expected grow out period: May – December (no change)

Expected fallow period: Cages will be left in a single location for two production cycles with 3 month fallow (January to April) between each cycle. This will be followed by a 15 month fallow (January to April of the next year) of the entire lease if environmental monitoring demonstrates this necessity. The lease has been sized to allow movement of the cage arrays within the lease boundaries so that fallowing of sections within the lease can occur, if desired. (no change)

2.1 Infrastructure

Additional investment into infrastructure will be required. This includes new mooring systems, larger cage arrays, cages, and nets, increased barge and boom capacity, as well as a new feed barge.

No other changes to Section 2.

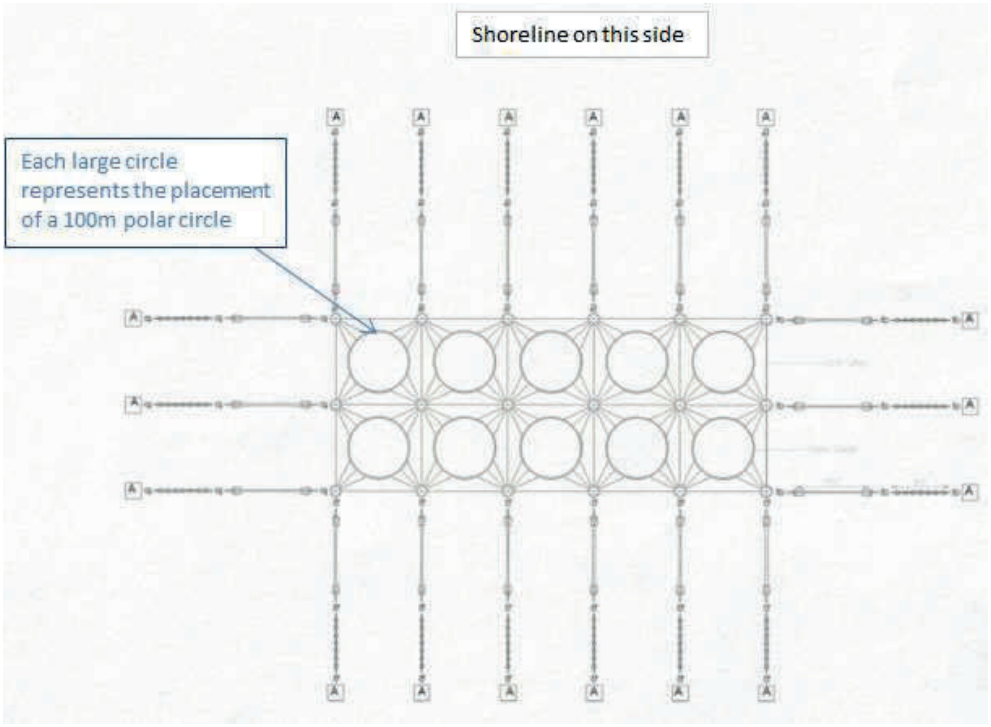
SECTON 3: FISHERIES ACTIVITIES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

No change.

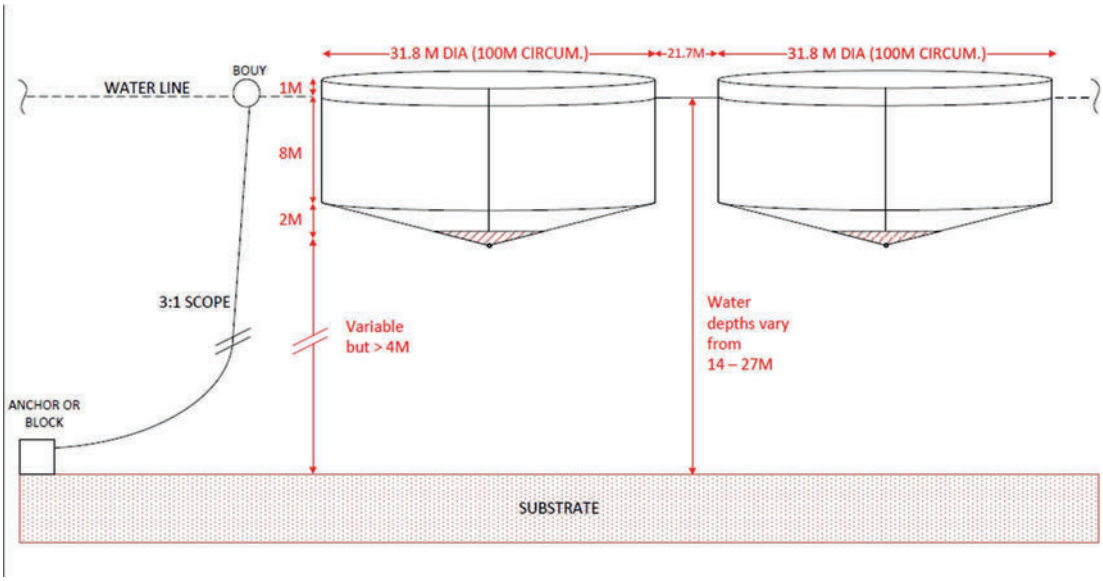
SECTION 4: OCEANOGRAPHIC AND BIOPHYSICAL CHARACTERISTICS OF THE PUBLIC WATERS

4.3 Site design

Updated mooring and cage configuration is shown below.



Cages are all 100m polar circles, 31.8m diameter
Grid 175' X 175' (or 53.3m X 53.3m)
21.7m between cages



No other changes to Section 4.

SECTION 5: THE OTHER USERS OF THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL OPERATION

No change

SECTION 6: THE PUBLIC RIGHT OF NAVIGATION

6.1 Navigation Protection Act approval

A revised CNWA Notice of works will be submitted directly to Transport Canada.

SECTION 7: THE SUSTAINABILITY OF WILD SALMON

No change.

SECTION 8: THE NUMBER AND PRODUCTIVITY OF OTHER AQUACULTURE SITES IN THE PUBLIC WATERS SURROUNDING THE PROPOSED AQUACULTURAL LOCATION

No change.

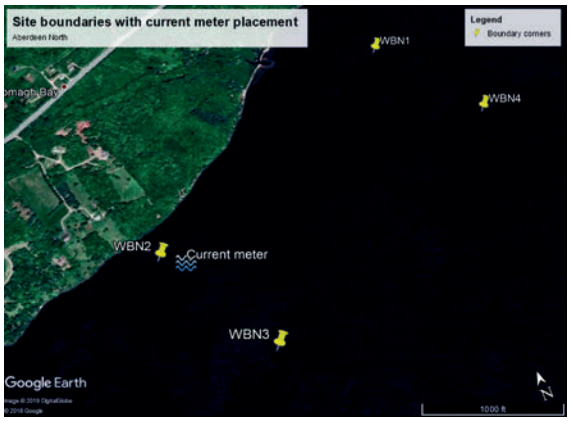
4.5 Depositional Models AQ#1430 and AQ#1431 (2020)

Brief project description

We'koqma'q First Nation is requesting a new marine finfish licence/lease in the Bras D'Or Lake in Inverness County, NS. This proposed site is located on the northeast side of Whycocomagh Bay in the Bras D'Or Lake. This will be a seasonal site and will house 10 of 100m polar circle sea cages which will grow Rainbow trout from May to December. The cages will be moored in place with steel anchors and concrete blocks. The cage frames are made of HDPE and are self-floating. The mooring system will permanently remain in place after installation; but the sea cages will be removed each winter, before the area ices over and replaced each spring, after the ice leaves.

Body of water details:

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomagh since 2009
Average wind speed (km/hr) (30m height)	19 8	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease
Wind speed class rating (10m height)	Low to Moderate	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)	1.08	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the greatest Hmax measured with the ACDP during October 31, 2018 to December 11, 2018 deployment.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (Robin Stuart).		
Annual maximum tide (m)			
Depth of water at each corner of the site (m)	Corner 1: 14.6m Corner 2: 26.6m Corner 3: 26.6m Corner 4: 26.4m Center Lease: 26.4m	Depths taken during benthic sampling	



No th Whycocomagh bay lease -Abe deen

Co ne	Lat	Long
1	45°58'54.44 N	61° 1 14.92 W
2	45°58'40.46 N	61° 1'51.57 W
3	45°58'30.40 N	61° 1'42.65 W
4	45°58'44.28 N	61° 1'6.14 W

Current meter deployment

Instrument

Model	Teledyne RDI Sent nel V100
Se al #	24349
F equency	300kHz

Deployment

Wate Body	Whycocomagh Bay	
Lat tude	45 97742	45°58'38.71 N
Long tude	-61 03027	61°01'48.97 W
Deployment	31-Oct-18	
Last Read ng	11-Dec-18	
Du at on (d)	41	
F ame	Bottom Mounted T pod	
Alt tude (m)	0.6	Deployed at 0.6m depth
S te Depth (m)	18	Add on 2.1m fo f st B n Rage
		Add on 1 m fo each succeed ng B n

Current Prof le

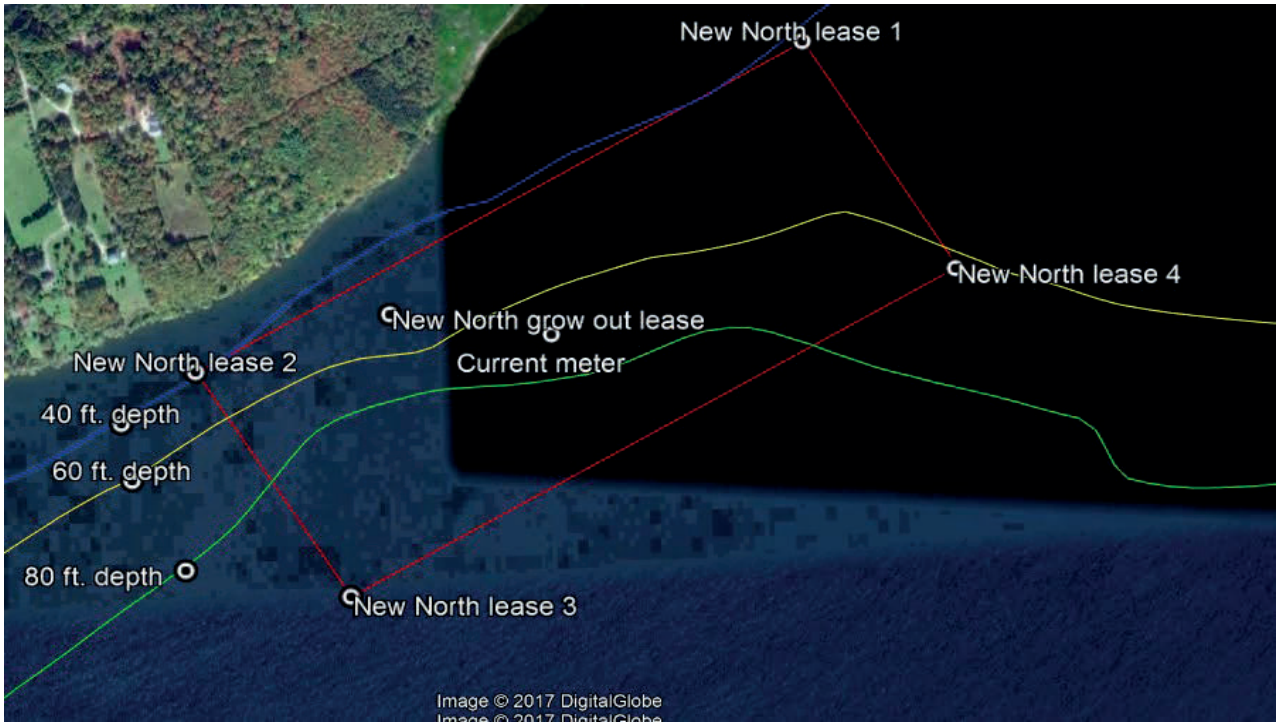
Ensemble Inte val (s)	900	I.e Column l s at 2.7m f om bottom (0.6m 2.1m) OR 2.1 m up f om senso he ght
Ave ag ng Inte val (s)	300	Each success ve column s 1m up (=b n s ze)
P ngs/Ensemble	200	
B n S ze (m)	1	Cu ent speed s n m/s
1st B n Range (m)	2.1	

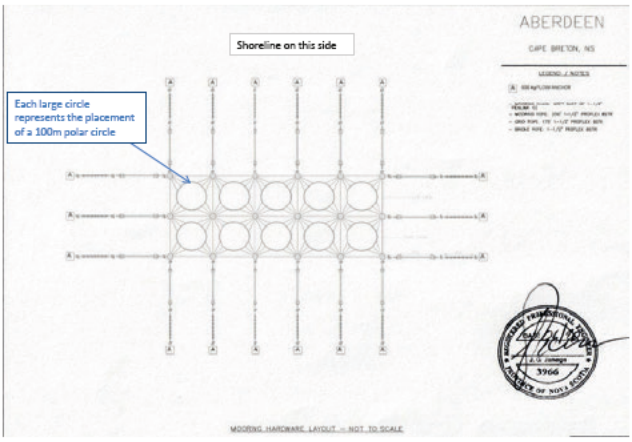
Waves Profile

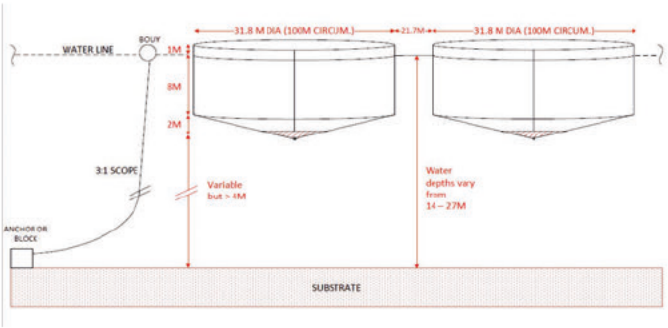
Ensemble Inte val (s)	7200
Ave ag ng Inte val (s)	1200
P ngs/Ensemble	2400

Depth (m)	17.6	15.5	14.5	13.5	12.5	11.5	10.5	9.5	8.5	7.5	6.5	5.5	4.5	3.5	2.5	1.5
Current minimum (m/s)		0.001	0	0.001	0	0	0.001	0	0.001	0.001	0	0.002	0.001	0.001	0.003	0.003
Current maximum (m/s)		0.354	0.352	0.374	0.378	0.392	0.407	0.407	0.408	0.415	0.408	0.394	0.42	0.487	2.061	1.892
Current average (m/s)		0.0633	0.0765	0.0860	0.0918	0.0936	0.0943	0.0952	0.0969	0.0998	0.1015	0.1033	0.1065	0.0777	0.2072	0.4119

Bathymetric lines:
Blue 40 ft
Yellow 60 ft
Green 80 ft







Cages are all 100m polar circles 31.8m diameter
Grid 175' X 175' (or 53.3m X 53.3m)
21.7m between cages

2.1 Production plan

Species: **Rainbow trout.**

Maximum site biomass (kg): 1,100,000kg

Maximum cage density during grow out period (kg/m ^{3}): 18 kg/m^3. Normal operating density will be <15 kg/m^3

Expected time to achieve maximum production **:** 5 months from stocking

Size(s) of cages, including net volumes (m ^{3}): **10**0m polar circle; 8 m depth; 6,350 m^3 per cage

Maximum cage number, maximum total net volume (m ^{3}): 1 array of 10 cages = 63,500m^3

Maximum number of fish per cage during grow out period: **5**5,000

Intended initial stocking date and seed source: May 2021, Big Falls Hatchery (AQ # 1028) and over-wintering stock currently at Marine Licence/Lease AQ # 0814 in Whycocomagh Bay, south of We'koqma'q Reserve.

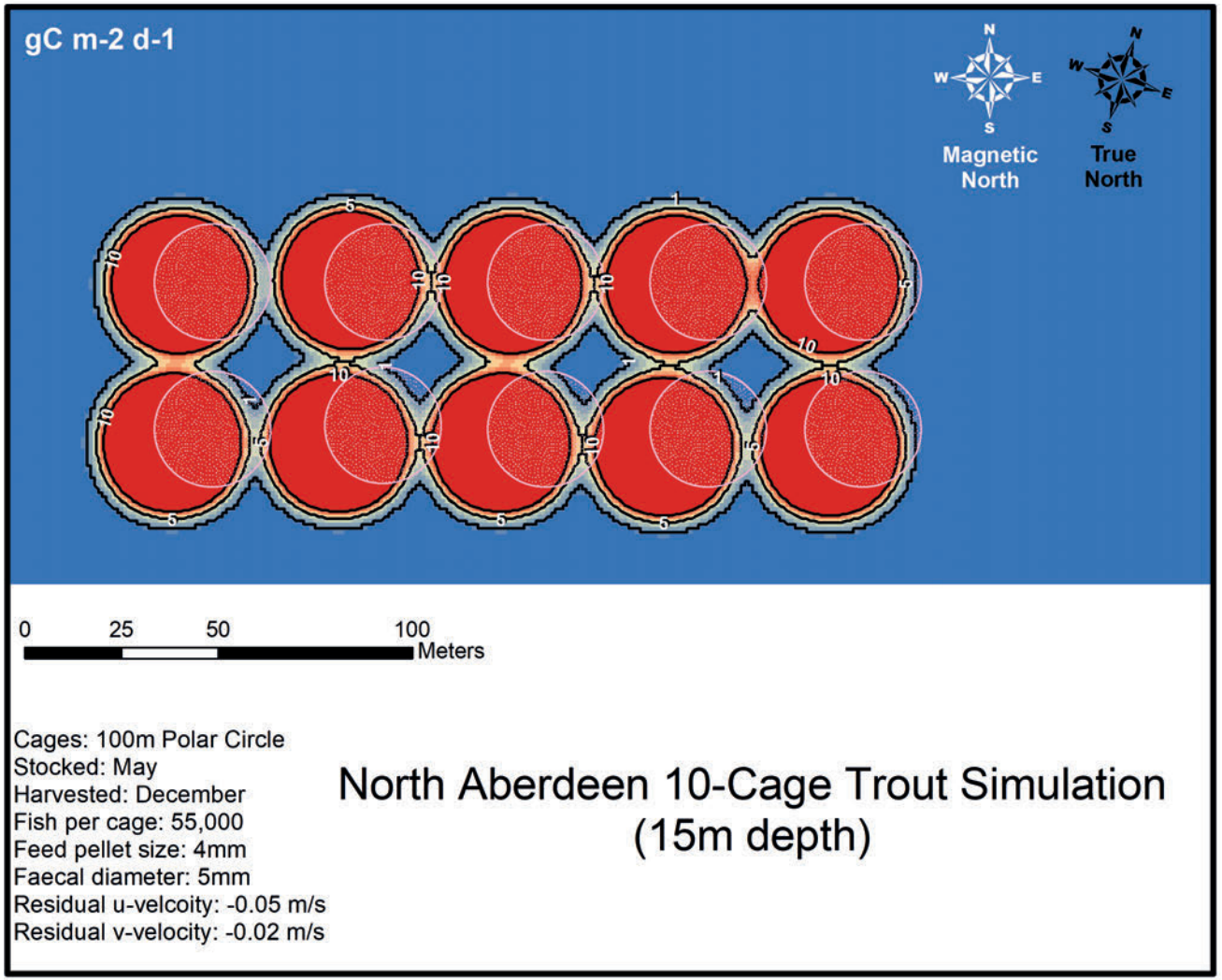
Expected grow out period: May – December

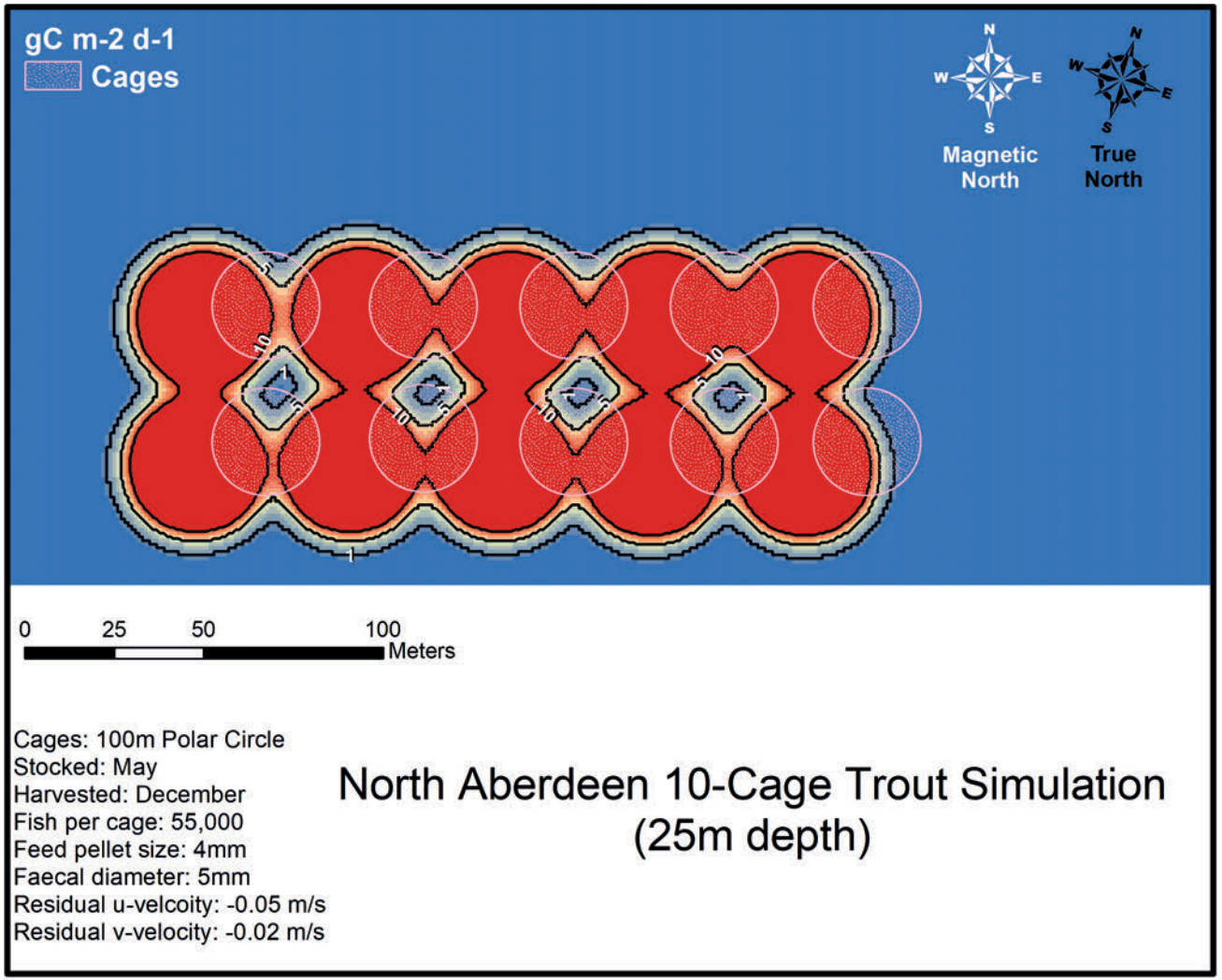
Expected fallow period: Cages will be left in a single location for two production cycles with 3-4 month fallow (January to April) between each cycle. This will be followed by a 15-16 month fallow (January to April of the next year) of the entire lease if environmental monitoring demonstrates this necessity. The lease has been sized to allow movement of the cage arrays within the lease boundaries so that fallowing of sections within the lease can occur, if desired.

Maximum daily feed rate = 2% of maximum biomass
2% of 1,100,000 kg = 22,000 kg

Maximum feed = 1.3 X maximum biomass (FCR 1.3 assumed)
1.3 * 1,100,000 kg = 1,430,000 kg

Feed: Skretting, Trout Premium or similar


gC m-2 d-1
N
W
E
S
Magnetic North
True North
0
25
50
100
Meters
Cages: 100m Polar Circle
Stocked: May
Harvested: December
Fish per cage: 55,000
Feed pellet size: 4mm
Faecal diameter: 5mm
Residual u-velcoity: -0.05 m/s
Residual v-velocity: -0.02 m/s
North Aberdeen 10-Cage Trout Simulation
(15m depth)

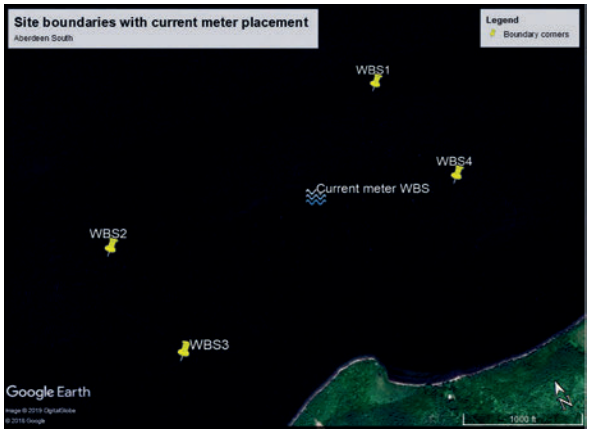

gC m-2 d-1
Cages
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Magnetic North
True North
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Cages: 100m Polar Circle
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Fish per cage: 55,000
Feed pellet size: 4mm
Faecal diameter: 5mm
Residual u-velcoity: -0.05 m/s
Residual v-velocity: -0.02 m/s
North Aberdeen 10-Cage Trout Simulation
(25m depth)

Brief project description

We'koqma'q First Nation is requesting a new marine finfish licence/lease in the Bras D'Or Lake in Inverness County, NS. This proposed site is located on the southeast side of Whycocomagh Bay in the Bras D'Or Lake. This will be a seasonal site and will house 10 of 100m polar circle sea cages which will grow Rainbow trout from May to December. The cages will be moored in place with steel anchors and concrete blocks. The cage frames are made of HDPE and are self-floating. The mooring system will permanently remain in place after installation; but the sea cages will be removed each winter, before the area ices over and replaced each spring, after the ice leaves.

Body of water details:

Characteristic	Value	Reference	Comments
Annual maximum wind speed (km/hr)	34.6	www.worldweatheronline.com (for Whycocomagh)	Value stated is the maximum annual average wind speed displayed for Whycocomagh since 2009
Average wind speed (km/hr) (30m height)	24 3	NS Wind Atlas (www.nswindatlas.ca)	Value derived from wind atlas for GPS coordinate at center of lease
Wind speed class rating (10m height)	Moderate to High	Keys et al., 2017. Digital Wind Exposure Map for NS. Forest Research Report FOR 2017-15	Wind speed class rated from "Very Low" to "Very High" based on estimated annual maximum wind speeds across Nova Scotia. Value/rating stated is for shoreline adjacent to proposed site.
Maximum wave height (m)[1]	1.08	Raw data obtained from David Cook (NSDFA) from ACDP deployment.	Value stated is the greatest Hmax measured with the ACDP during October 31, 2018 to December 11, 2018 deployment at a site across the Bay but within 2 km of this site.
Annual minimum tide (m)	The Bras D'Or Lake has very small lunar tidal fluctuations. Whycocomagh Bay, in particular, shows limited change. As extracted from Parker et al., 2007: "A 21-day record from the western end of Whycocomagh Basin indicated no detectable semidiurnal or diurnal tides (Dupont et al. 2003; Petrie 1999)." Results from an ADCP (Acoustic Doppler Current Profiler) deployed in the site region from October 2018 to December 2018 supports this observation with little measured change in depth. Local persons have observed an increasing tidal range in recent years, for example with exceptionally large tides of 0.5m observed in the fall of 2018 (Robin Stuart).		
Annual maximum tide (m)			
Depth of water at each corner of the site (m)	Corner 1: 25.4m Corner 2: 26.1m Corner 3: 13 0m Corner 4: 14 0m Center Lease: 27.9m	Depths taken during baseline EMP sampling	



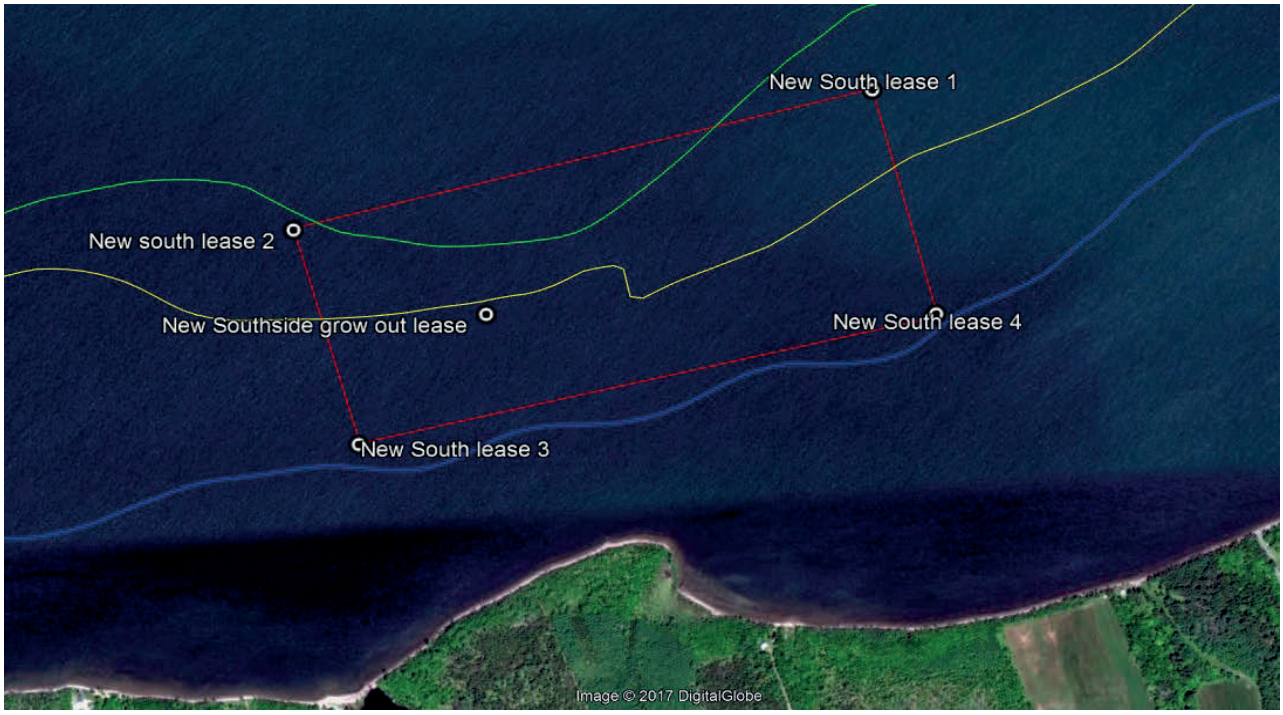
South Whycocomagh bay lease-South Side

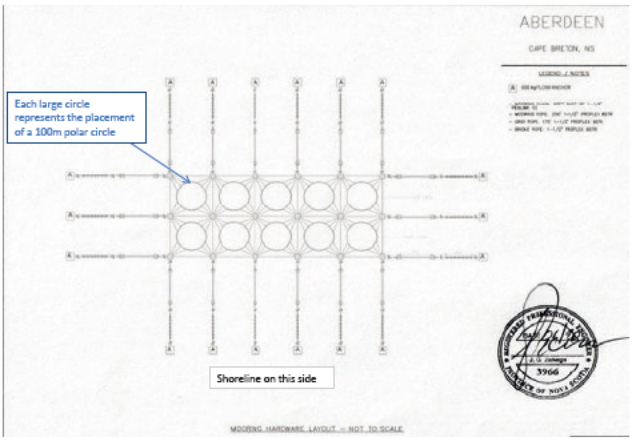
Corner		Lat	Long
	1	45°57'45.91"N	61° 1'19.05"W
	2	45°57'39.19"N	61° 2'1.01"W
	3	45°57'27.75"N	61° 1 56.71"W
	4	45°57'33.96"N	61° 1'14.86"W

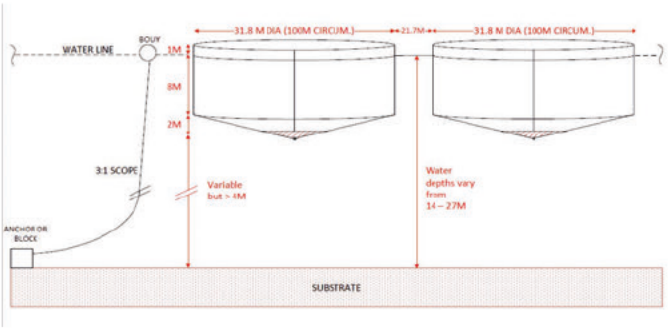
Instrument			
Model	Teledyne RDI Workhorse Sentinel		
Serial #	8891		
Frequency	600 kHz		
Deployment			
WaterBody	Whycocomagh Bay		
Latitude	45.96018	45°57'36.64"N	
Longitude	-61.02591	61°01'33.27"W	
Deployment	05-Jul-18		
Recovery	15-Aug-18		
Duration (d)	41		
Frame	Bottom Mounted Tripod		
Altitude (m)	0.6		
Site Depth (m)	18		Deployed at 0.6m depth
			Add on 2. m for first Bin Rage
			Add on 1 m for each succeeding Bin
Current Profile			
Ensemble Interval (s)	900		
Averaging Interval (s)	300		I.e Column I is at 2.7m from bottom (0.6m 2.1m) OR 2.1 m up from sensor height
Pings/Ensemble	200		Each successive column is 1m up (=bin size)
Bin Size (m)	1		
1st Bin Range (m)	2.1		Current speed is in m/s

Depth (m)	17.8	15.7	14.7	13.7	12.7	11.7	10.7	9.7	8.7	7.7	6.7	5.7	4.7	3.7	2.7
Current minimum (m/s)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Current maximum (m/s)		0.077	0.087	0.084	0.1	0.101	0.12	0.122	0.102	0.117	0.123	0.13	0.165	0.231	0.226
Current average (m/s)		0.021	0.021	0.021	0.022	0.021	0.021	0.022	0.023	0.026	0.031	0.036	0.043	0.046	0.043

Bathymetric lines:
Blue 40 ft
Yellow 60 ft
Green 80 ft







Cages are all 100m polar circles 31.8m diameter
Grid 175' X 175' (or 53.3m X 53.3m)
21.7m between cages

2.1 Production plan

Species: **Rainbow trout.**

Maximum site biomass (kg): 1,100,000kg

Maximum cage density during grow out period (kg/m ^{3}): 18 kg/m^3. Normal operating density will be <15 kg/m^3

Expected time to achieve maximum production **:** 5 months from stocking

Size(s) of cages, including net volumes (m ^{3}): **10**0m polar circle; 8 m depth; 6,350 m^3 per cage

Maximum cage number, maximum total net volume (m ^{3}): 1 array of 10 cages = 63,500m^3

Maximum number of fish per cage during grow out period: **5**5,000

Intended initial stocking date and seed source: May 2021, Big Falls Hatchery (AQ # 1028) and over-wintering stock currently at Marine Licence/Lease AQ # 0814 in Whycocomagh Bay, south of We'koqma'q Reserve.

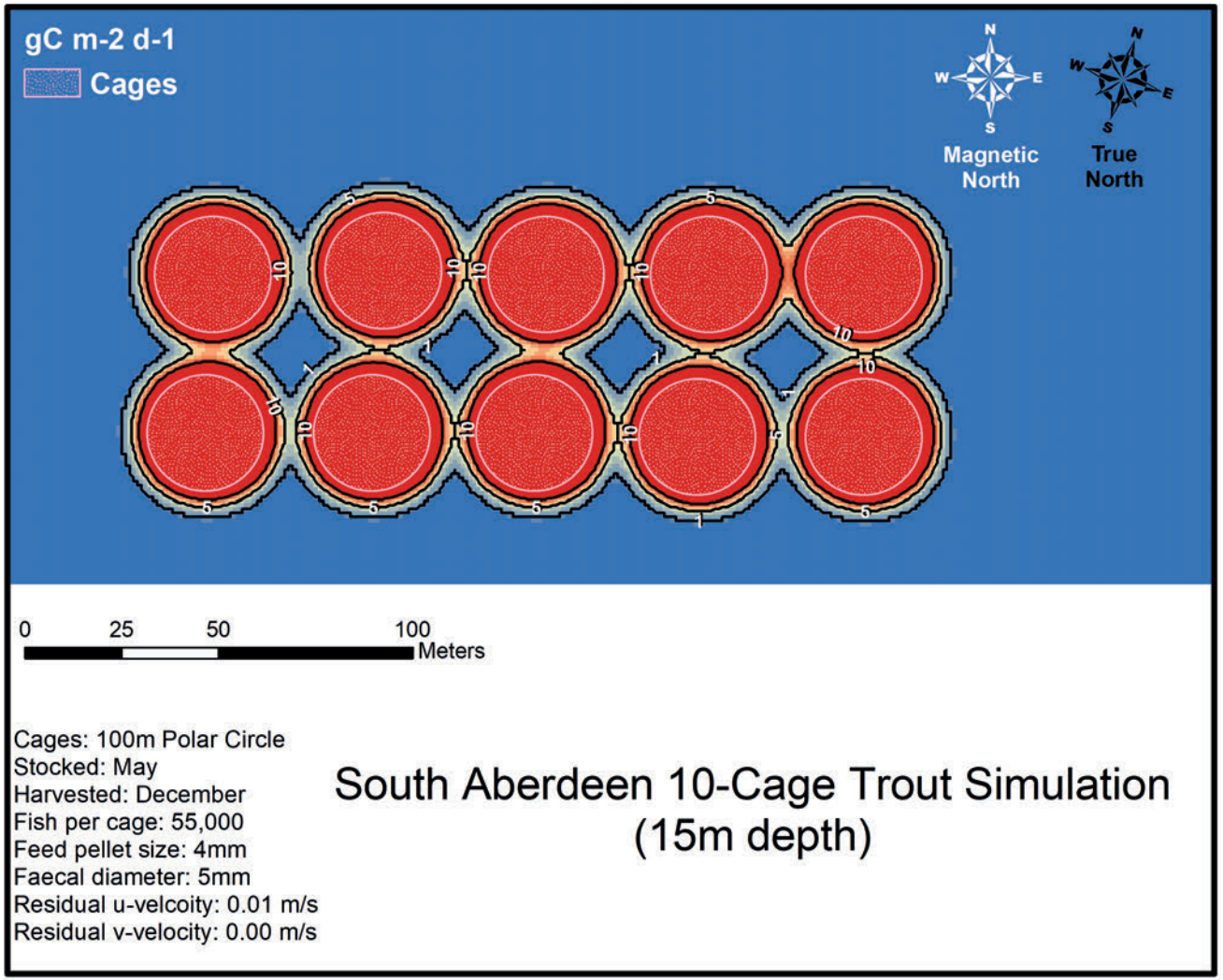
Expected grow out period: May – December

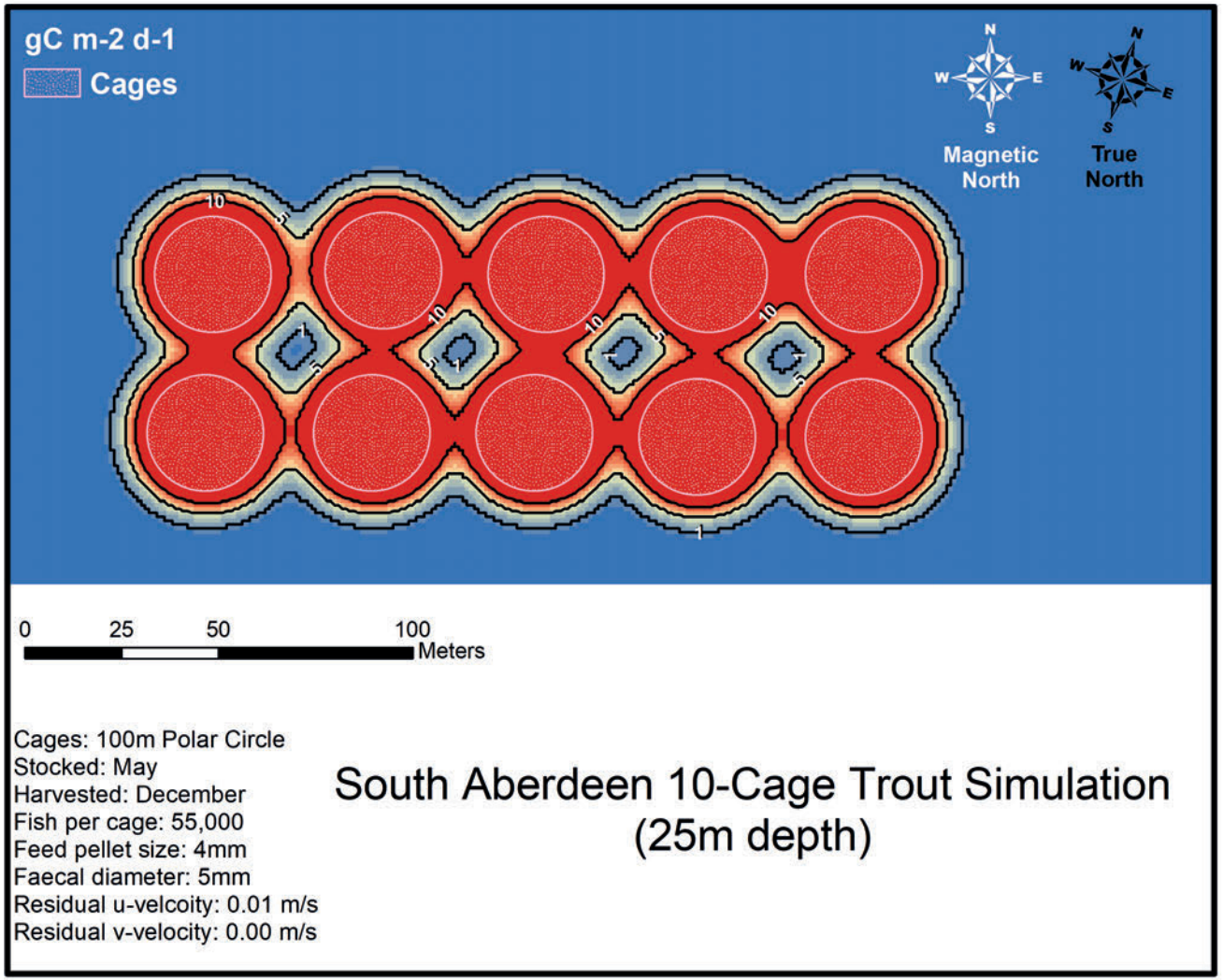
Expected fallow period: Cages will be left in a single location for two production cycles with 3-4 month fallow (January to April) between each cycle. This will be followed by a 15-16 month fallow (January to April of the next year) of the entire lease if environmental monitoring demonstrates this necessity. The lease has been sized to allow movement of the cage arrays within the lease boundaries so that fallowing of sections within the lease can occur, if desired.

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2% of 1,100,000 kg = 22,000 kg

Maximum feed = 1.3 X maximum biomass (FCR 1.3 assumed)
1.3 * 1,100,000 kg = 1,430,000 kg

Feed: Skretting, Trout Premium or similar


gC m-2 d-1
Cages
N
W
E
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Magnetic North
True North
0
25
50
100
Meters
Cages: 100m Polar Circle
Stocked: May
Harvested: December
Fish per cage: 55,000
Feed pellet size: 4mm
Faecal diameter: 5mm
Residual u-velcoity: 0.01 m/s
Residual v-velocity: 0.00 m/s
South Aberdeen 10-Cage Trout Simulation
(15m depth)


gC m-2 d-1
Cages
N
W
E
S
Magnetic North
True North
10
5
1
0
25
50
100
Meters
Cages: 100m Polar Circle
Stocked: May
Harvested: December
Fish per cage: 55,000
Feed pellet size: 4mm
Faecal diameter: 5mm
Residual u-velcoity: 0.01 m/s
Residual v-velocity: 0.00 m/s
South Aberdeen 10-Cage Trout Simulation
(25m depth)

4.6 Updates to Development Plans (2023)

Updates to Aquaculture Applications 0814, 1430, 1431

We'koqma'q First Nation

July 20, 2023

Introduction

In February, 2019, We'koqma'q First Nation submitted three application packages for commercial cage culture sites in the Bras D'Or Lakes near their Mi'kmaq community. These packages requested two new commercial marine finfish leases and a boundary amendment to amalgamate three existing small commercial marine finfish leases. These proposed sites are within the Option to Lease # 1413 and are located on the northeast side of Whycocomagh Bay near Aberdeen, the southeast side of Whycocomagh Bay, near Aberdeen, and in the west end of Whycocomagh Bay, south of the village of Whycocomagh.

These submissions and the aquaculture activities they will allow are part of We'koqma'q's long term objectives of achieving financial stability for the community, sustaining employment for band members and developing a vertically integrated fishery that will continue for generations.

In the years previous to these applications, We'koqma'q focused on building an egg-to-plate steelhead trout aquaculture operation. This included acquiring and investing in a hatchery with historical success with salmonid production, investing in sea pen infrastructure and capacity, and modernizing the local processing plant. The next logical step became to expand their steelhead trout farming activities in the lake.

At the time of the applications, We'koqma'q had seven years of experience operating a marine finfish site, three as a contract grower and four as the business owner. This informed the original applications. However, more than four years have passed since the submission, and We'koqma'q has been working hard to better understand the fish, the environment's capacity for aquaculture, and how best to sustainably farm the waters of their local community.

Modifications to plans have been submitted to NSDFA since the original application, but additional information and experience have been gained since then and consultants' advice has been reviewed. This document outlines a revised production plan and other updates for the requested sites to bring the adjudicative applications that are in progress up to date. Since the sites are intended to operate together, as a single farm, the updates to all of the development plans are described within this single document which is intended to supplement the original applications.

Updates to the Development Plans

Updates are organized by relevant Development Plan section, where possible.

2.1 Production Plan

The plans below project site capacities based on current knowledge. Stocking of sites will be based on fish performance and environmental monitoring results. All cages will be stocked with rainbow trout grown in brackish/salt water, otherwise known as steelhead trout.

Application No.	**Maximum site biomass (MT)**	**Maximum cage density (kg/m3)**	**Size(s) of cages, including net volumes**	**Maximum cage number**	**Maximum number of fish per cage (at harvest size)**
1430 ("North Aberdeen")	940 MT	18	100m circumference, 6,350 m^3	10	55,000
1431 ("South Aberdeen")	1146 MT	18	100m circumference, 6,350 m^3	10	55,000
0814 ("Inner Bay"): production area	200 MT	18	60m circumference, 1,700m^3	20	15,000
0814 ("Inner Bay"): over-wintering area	2000 MT (winter months only, no feed inputs)	18	60m and 100m cages described above	30	According to cage size

Over-wintering:

In the past, the sites 1430 and 1431 and the outer area ("production area") of 0814 have been exposed to moving ice in the spring. As a result, cages are not left here over the winter and these production areas are used in the ice-free period, from April to December, only. For the winter months, cages are pulled into a sheltered area that is part of the requested 0814 lease[1]. Here, the ice floes do not push through. This is why 0814 has a designated production area and a designated over-wintering area. These are shown in Figure A.

Fallowing:

The plan is to rotate the production area within each of the sites on an annual basis to allow a fallowing time of a production area of 15 months. The requested site areas are large enough to house two grids and enable this to occur. See Figure A. Ultimately, stocking of production areas will be based on environmental monitoring results.

Stocking and Harvest Plans:

We'koqma'q will stock sites from their hatchery: Big Falls Fish Growers. This hatchery is undergoing retrofits to increase the size of juveniles it can produce. We'koqma'q intends to stock sites with fewer,

[1] Within this document the term "lease" is intended to refer to both the lease and licence required for marine finfish aquaculture production in Nova Scotia.

larger fish to reduce the time at sea. Based on current understanding of capacity, maximum annual farm stocking is anticipated to be 620,000 juveniles per year, with an annual harvest of 500,000 fish. This is significantly less than the originally projected plans proposed in 2019 since the focus has shifted to producing a lower number of higher quality fish.

For the past several years, We'koqma'q has been trialing the use of triploid rainbow trout stocks. At this time, the triploid fish are showing similar performance as diploid. We'koqma'q intends to use triploid fish in the future since such stocks are sterile. This is a mitigation measure to reduce risks associated with a fish escape. Effectively, if an escape event were to occur, reproduction of the escaped triploid could not occur.

2.2 Infrastructure

As mentioned previously, We'koqma'q is in the process of upgrading its hatchery in order to produce larger juveniles to shorten time at sea.

In addition to this, recent capital investments at the cage site have been significant. They include a built-for-purpose harvest boat, a passive grading system, an additional net cleaner, and more robust containment equipment: 400 mm SDR 17 Polar Cirkel cages of 100 m diameter, certified to the Norwegian NS 9415 Standard[2]; as well as STAR knotless containment nets of polyolefin fibres[3] - designed to withstand frequent net cleaning.

Finally, two state-of-the-art feeding barges were purchased in 2021. These will enable pan-camera viewing and remote feeding of fish. This technology is anticipated to increase oversight of feeding, to improve feed conversion ratios and reduce environmental impacts. Unfortunately, as of the writing of this document, these barges are still at the dock, waiting for the manufacturer to complete necessary final adjustments. (Estimate start use date of September, 2023.)

3.2 Impact on fisheries activities and 7.2 Support of the sustainability of wild salmon

Mitigating Impacts through Operational Procedures

As indicated in the original applications, three of the greatest perceived risks of finfish aquaculture operations to fisheries and fisheries' habitats as well as wild salmon are: fish escape, disease, and impact on the benthos and water quality. All of these aspects are covered within Farm Management Plan (FMP), mandated for marine finfish aquaculture operations in Nova Scotia. The FMP was still relatively new to the industry in 2019, when the original applications were submitted. Since that time, We'koqma'q has used the FMP as a foundation for establishment of best practices. The execution of these best practices is facilitated by increased personnel capacity described in a later section. Additionally, the function of the FMP has been enhanced by the creation of a new position of Records

[2] https://www.akvagroup.com/plastic-pens/
[3] https://www.garwarefibres.com/products/smolt-grow-out-cages/star

Technician, to better enable the tracking of records and to increase assurances that standard procedures are followed.

Fish Escape

In addition to the minimum requirements that were in place for marine finfish operators at the time of the original application submission and described therein, the Containment Management Framework of the FMP was further clarified in 2021. A significant piece of this clarification was the requirement of "approved/certified engineering documentation pertaining to the integrity of the site's infrastructure. In essence, the site infrastructure design and construction must have been deemed as being satisfactory to reasonably withstand the prevailing oceanographic and meteorological conditions (e.g., weather, currents, ice flow, etc.) at the site's location to ensure the fish stay contained." We'koqma'q has engineering approvals for its current experimental lease installations in North and South Aberdeen. In addition, We'koqma'q has been working with Gael Force[4] since March, 2023 to enhance modelling of mooring systems to detect the weakest points and target these areas for reinforcement. These models will be submitted to NSDFA, once completed. (Estimate completion date of September, 2023.) This work will add an additional layer of diligence regarding the integrity of the infrastructure regarding fish containment. It is notable that We'koqma'q's infrastructure recently (October 2022) withstood the strain of Fiona with no issues.

Disease and Biosecurity

In addition to the fish health elements within the FMP that were described in the original applications, We'koqma'q has increased fish welfare, and subsequently reduced fish health and disease risks, with the addition of the following since the original applications:

- Stocking with a larger juvenile to reduce time at sea and ensure a stronger, more resilient fish at sea pen entry.
- Use of passive grading, when applicable, prior to harvest, to reduce unnecessary fish handling and facilitate the reduction of densities.
- In-house, five-member crew of certified occupational SCUBA divers for inspecting fish and retrieving mortalities in a timely manner.
- Increased use of underwater cameras for observing fish.
- Creation of Records Technician position to ensure inspections, water quality monitoring, and procedures are getting done on schedule and recorded appropriately.

Environmental Impacts

In addition to mandated benthic sampling, We'koqma'q is participating in an enhanced environmental monitoring program at their current experimental finfish aquaculture site that overlaps the 1431 site. This program is collecting environmental monitoring data to proof and hone a model (FINS) developed to predict sulfide levels below a finfish aquaculture operation. FINS uses a diagenesis[5] model (DIGENIX) that incorporates a hydrodynamic model (FVCOM) and depositional model (ORGANIX) to predict expected sulfide level outcomes based on stocking densities, feed rates, cage arrangements and

[4] https://www.gaelforcegroup.com/

[5] Diagenesis refers to the physical, chemical, and biological changes in sediments after deposition.

hydrodynamics of the site. It is anticipated that such a model will help We'koqma'q to proactively minimize impacts on the benthos when planning future fish farming activities.

BAP Certification

As indicated in the original submissions, We'koqma'q aims to achieve the Global Aquaculture Alliance's Best Aquaculture Practices (BAP) certification for its entire production chain. This will provide third party auditing of all aspects listed above. Since the original submissions in 2019, the processing plant has achieved this certification. The marine farm has targeted late 2023 or early 2024 to make an application to a certifying body.

8.1 Interactions with other aquaculture operations

The locations of the sites relative to each other and the intended arrays within the sites are shown in Figure A.

A summary of the purpose for each site and array follows:

0814

Fish will be over-wintered at 0814 at the overwintering location ("0814 OW"). The other arrays at 0814 ("0814 #1", "0814 #2") will receive small fish in early fall. These arrays may also be used for small scale experimental trials (testing stocks, feeds, oxygenation equipment). Biomass at this site will be kept low.

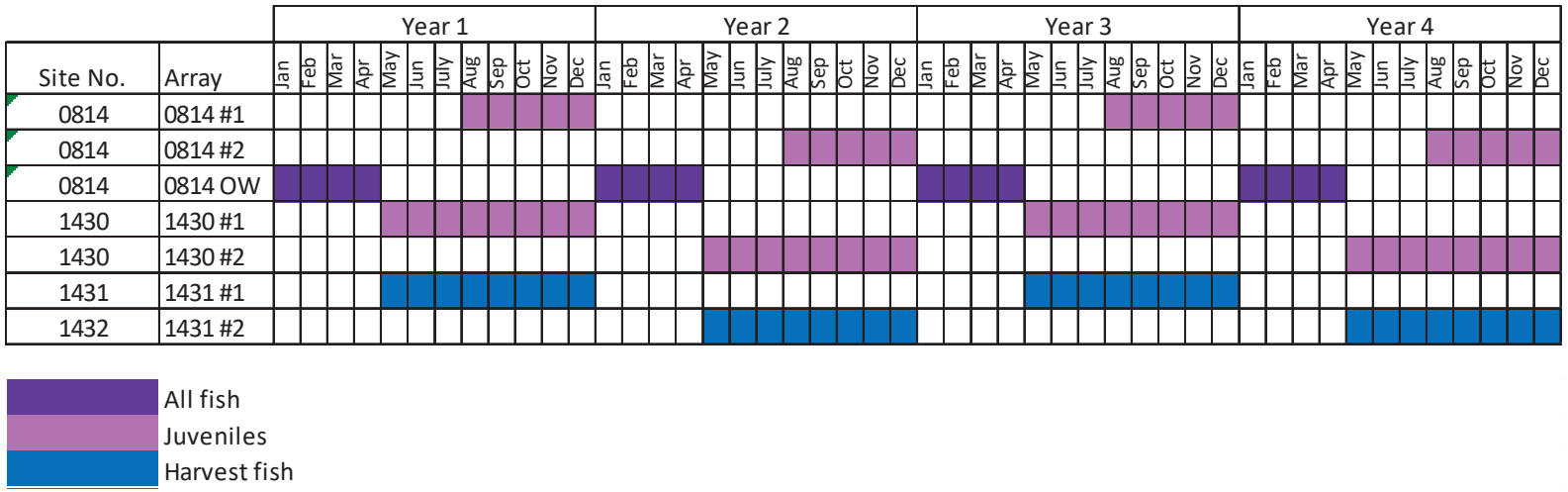
1430

A single array will receive spring juveniles. The array used will alternate between years.

1431

A single array will receive second-year fish to be harvested in this year. The array used will alternate between years.

The production plan is shown as a Gantt chart below. It is important to note that this stocking plan is projected, and actual site stocking will be directed by environmental monitoring results, fish health results, and introductions and transfers permissions.



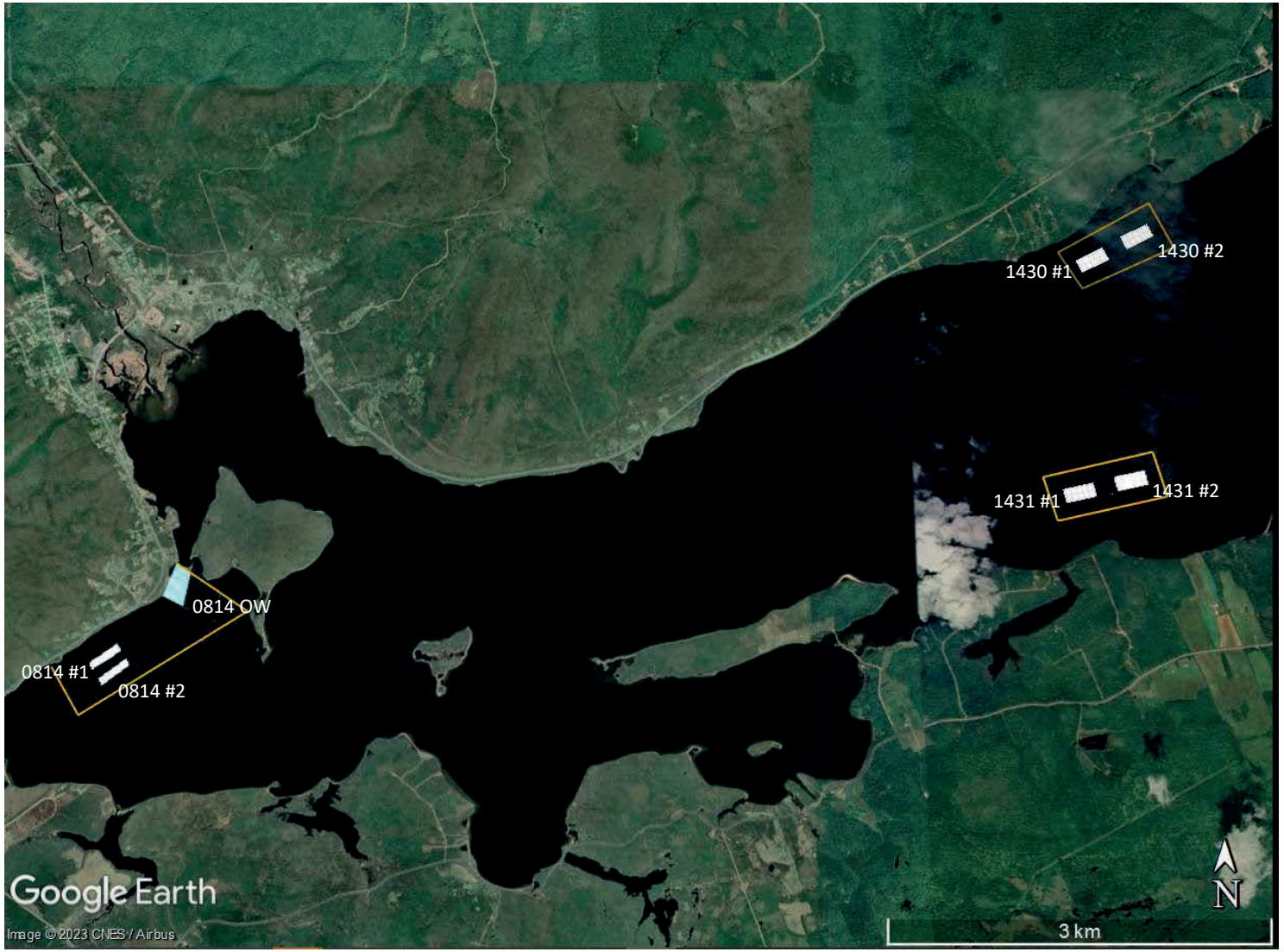


Figure A: Requested commercial leases are outlined in orange. Projected locations of cage arrays for the production season within the leases are the white polygons. Projected location for over-wintering cages is the light blue polygon.

General

Since the original applications were submitted, personnel capacity at the farm has been greatly enhanced, both in terms of acquiring new people, as well as in terms of training retained persons.

Senior Management

Resumes for senior managers within the farming unit are attached. A brief synopsis of their most relevant qualifications and experience follows:

- Manager of Aquaculture Operations: Wade Skinner – more than 15 years of fish farm experience, at a variety of locations and from a range of perspectives, from operations to infrastructure.
- Farm Manager: Anthony Phillips – four years of operational experience at We'koqma'q, significant leadership experience within the community.
- Hatchery Manager: Trissa Dunham – a decade of salmonid hatchery experience, formally trained as a biologist (BSc)
- Processing Plant Manager: Wayne Fowlie – decades of seafood processing experience, aquaculture experience, formally trained as a biologist/biochemist (BSc)
- VP Sales: Steve French – more than thirty years of seafood sales experience, formal business training (BBA)

This group meets frequently (weekly) to discuss and coordinate production planning from egg to plate. They are a solid leadership group with extensive experience in aquaculture and related industries.

Employee Development

Employee capacity at We'koqma'q has been greatly enhanced through investment in training. Recent training programs delivered to employees which are beyond mandated safety and operations requirements are listed below:

- NSCC Aquaculture Operations Certificate (2023) 4 persons
- FishTalk Farm Management software (2023) – 1 person
- Occupational SCUBA Diver Certification (2021) – 5 persons
- Operational Training (2021, 2022) – 4 persons
- Road to BAP Certification Training (2019, 2020) – 36 persons

Development Work

Since the original applications in 2019, We'koqma'q First Nation has successfully applied for, attained, and operated experimental finfish leases in areas overlapping 1430 and 1431, where the current commercial leases are being sought. This experimental work is allowing We'koqma'q to investigate the effectiveness and efficiency of 100m polar circle cages and the suitability of triploid stocks for rainbow trout aquaculture in the Bras D'Or Lakes. It is also enabling the investigation into the applicability of a diagenesis model (FINS) to predict sulfide levels below a finfish aquaculture operation. At another site, We'koqma'q is working to evaluate the commercial performance of a new strain of rainbow trout. All of this development work has informed these updated development plans and will continue to inform the direction that We'koqma'q takes in the future.

WADE SKINNER

[redacted]

More than 15 years of experience as captain/manager and team leader in various sectors of the aquaculture industry. Responsible, punctual, self-motivated, organized and efficient. Extremely dependable and a hard-working individual. Works great alone or as a team member.

EXPERIENCE

MARCH 2023 – PRESENT
MANAGER OF AQUACULTURE OPERATIONS, WE'KOMA'Q FIRST NATION
In charge of farming operations, from egg to plate. Reports to the CEO.

MARCH 2020 – FEBRUARY 2023
REGIONAL OPERATIONS MANAGER NL, AKVAGROUP NA
In charge of various company projects in Atlantic Canada. Reported to the Senior Project manager in Norway daily. As operations manager, my role involved coordinating schedules, meeting deadlines, organizing subcontractors, budgeting, and sales.

JANUARY 2008 – MARCH 2020
HARVEST CAPTAIN, COOKE AQUACULTURE INC.
In charge of all daily operations of the harvest vessel including but not limited to, payroll, scheduling, training crew, maintenance, dry docking and adhering to operational SOP's. Ensure all staff avail of safety equipment and all equipment is inspected and validated appropriately. Ensure vessel budget is within the expected operational cost including, ordering of supplies, fuel, food, etc. Always ensuring top quality Atlantic salmon is delivered to the production plant by the harvest vessel within appropriate temperature, quality, quantity and time.

DECEMBER 2006 – DECEMBER 2007
BRIDGE WATCHMEN & BOSUN, MCKEIL MARINE
Responsible for carrying out the daily duties assigned by the officer of the watch.

MAY 2004-NOVEMBER 2006
CAPTAIN/OPERATOR, SELF EMPLOYED
In charge of all the daily operations of the fishing vessel, ensuring safe working conditions on vessel, complete maintenance of boat, preventative maintenance onshore, fished several species including Cod, Scallop, Halibut, Herring, and Snow Crab.

APRIL 2000 – APRIL 2004
MATE, SELF EMPLOYED
Preparing ship to sail (Fuel, ice, food, etc.), being team leader on deck, responsible for all fishing gear, and general supervision of crew.

JUNE 1990 – MARCH 2000
DECKHAND, SELF EMPLOYED
Fished on various fishing vessels. Included Ground Fishery and Scallop Fishery.

EDUCATION

DECEMBER 2016
SECOND CLASS FISHING MASTERS, TRANSPORT CANADA

JUNE 2015
SEN2, MARINE INSTITUTE

FEBRUARY 2007
BRIDGE WATCH CERTIFICATE, TRANSPORT CANADA

JULY 2006-SEPTEMBER 2006
MARINE EMERGENCY DUTIES (A1, MFA, B1, B2, C), MARINE INSTITUTE

JANUARY 2003-APRIL 2003
ASTRO-NAVIGATION, SEXTANT TRAINING, ROC-MC, MARINE INSTITUTE

OCTOBER 2002- NOVEMBER 2002
SEN1, MARINE INSTITUTE

JUNE 1990
HIGH SCHOOL DIPLOMA, KING ACADEMY

Cooke Aquaculture Leadership Development program certificate, Introduction to Microsoft Office certificate

ACTIVITIES

Volunteer volleyball coach, recreational golfer, enjoy various outdoor activities including camping and boating and winter sports.

Anthony Phillips

We'koqma'q First Nation E-mail: [redacted]

Education

High School Diploma - Whycocomagh Education Center
Whycocomagh, NS 2006

Experience

- **Farm Manager – We'koqma'q First Nation WFN Fish Farm Limited Partnership**

We'koqma'q First Nation 2022 - Current

- **Assistant Farm Manager – We'koqma'q First Nation WFN Fish Farm Limited Partnership**

We'koqma'q First Nation 2021- 2022

- **Harvest Supervisor – We'koqma'q First Nation WFN Fish Farm Limited Partnership**

We'koqma'q First Nation 2019-2021

- **Band Councilor – We'koqma'q First Nation**

We'koqma'q First Nation 1996-2019

- **Heavy Equipment Operator – Georgia Pacific**

Milford, NS 2000-2016

Community Service

- Fire Fighter
- First Responder

Trissa Dunham



EXPERIENCE

Big Falls Fish Growers O/B WHI General Partner Inc, Wolfville NS — *Hatchery Manager*

January 2020 - PRESENT

Hatch and raise Rainbow trout in a freshwater flowthrough hatchery system. Continue with day to day technician and assistant manager duties.

Work closely with all parts of the WFN Fish Farm organization (grow out, processing, sales) to produce a sustainable product and a sustainable operation.

Plan and project inputs and outputs for annual production plans. Coordinate all farming activities and operations such as grading, vaccinating, and shipping.

All administrative duties such as scheduling, payroll, invoice approvals, procuring quotes, and acquiring and scheduling required services and products.

Community involvement such as participating in the Black River Lake Association, giving presentations at local elementary schools, and providing hatchery tours.

Big Falls Fish Growers O/B WHI General Partner Inc, Wolfville NS — *Assistant Hatchery Manager*

January 2018 - December 2019

Hatched and raised Rainbow trout in a freshwater flowthrough hatchery system. Continued day to day technician duties.

Managed personnel and trained new employees.

Performed data collection and analysis.

Created procedures and documentation for safety, biosecurity, and training purposes.

SKILLS

Standard First Aid CPR/AED Level C

Valid Class 5 Nova Scotia Driver License

Basic skills in carpentry, plumbing, and electrical

Advanced skills in Microsoft Excel, Word

Tractor and forklift operations

AWARDS

Mt Allison CIS Academic All-Canadian 2009-2013

Purdy Crawford Award 2010

Women's Soccer Award 2010

Dean's List 2009-2010

Big Falls Fish Growers Ltd, Wolfville NS — *Hatchery Technician*

September 2013 - December 2017

Hatched and raised Atlantic salmon in a freshwater flowthrough hatchery system.

Carried out tasks related to all aspects of animal husbandry from monitoring tank conditions, to feeding, to vaccination.

General site and equipment maintenance and repair.

EDUCATION

Mt Allison University, Sackville NB — *Bachelor of Science*

September 2009 - May 2013

Biology major, Biochemistry minor.

Wayne Fowlie

[redacted]

Qualifications

- Bachelor of Science Degree- Major Biology Chemistry.
- More than ten years' experience in management of processing and manufacturing plants.
- Strong communication skills and interpersonal skills.
- Ability to disseminate, analyze, assess and utilize data in an effective and efficient manner.
- Well-travelled and comfortable in multi-cultural environments.
- Ability to work well under pressure and aggressive schedules and deadlines.
- I am self-motivated, well organized and possess strong leadership traits.
- Extensive experience working with quality control systems.
- Have worked closely with CFIA, FDA in HACCP/QMP Plants both installing and adhering to guidelines.

Employment

Plant Manager
Waycobah Aberdeen Trout Processing Plant April 2020-Present

- Recruitment/selection of maintenance, quality assurance, production and sanitation staff.
- Member of HACCP team and participate in customer audits as they occur throughout the year
- Ensure all employees receive appropriate safety training pertinent for both on and off the job.
- Tasked with ensuring plant fulfills all requirements to become BAP(Best Aquaculture Practices) certified.
- Process flow improvement

Plant Manager April 2015-April 2020
Premium Seafoods Ltd. Arichat, NS

- Responsible for recruitment/selection of maintenance, quality assurance, production and sanitation staff
- Accountable for annual budget maintenance; oversee all operations and modifications
- Mandated to improve production processes to ensure that maximum yield is achieved
- Actively utilize CMMS Maintenance program to track repairs to equipment; Lean Manufacturing principles followed
- Responsible for all production planning and scheduling
- Member of HACCP team and participate in customer audits as they occur throughout the year (BRC, M&S and Sedex audited facility)
- Ensure all employees receive appropriate safety training pertinent for both on and off the job.

Shift Supervisor Mar 2008-April 2015
DSM (Ocean Nutrition Canada) Mulgrave,

- Ensure that GMP standards are followed throughout the plant which produces fish oil concentrates via vacuum distillation vessels resulting in commercial products such as fuel oil, Omega 3, EPA & DHA health food supplement.
- Oversee the operation of the production shift from a managerial perspective.
- Supervise staff providing direction and guidance in daily activities.
- Train staff re proper procedures and use of equipment for safe and efficient performance.
- Conduct annual employee performance reviews.
- Participate in writing of SOP's and maintain MPR's used in various processes.
- Enforce and monitor safety regulations and foster work place safety consciousness.
- Coach and motivate workers including leading by example.

Plant Manager **Oct** 2005-Mar 2008
Marr Pelagics, USA New Bedford, Mass. New Bedford Mass.

- Develop and implement an HACCP plan for Marr Pelagics USA.
- While employed in USA had to liaise with all pertinent government bodies such as FDA, Mass. Health Authority, Public Utilities and Port Authorities to ensure company compliance.
- Hire and maintain personnel as well as train new staff.
- Develop and maintain company sanitation program.
- Coordinate all raw materials landings and oversee proper harvest vessel records to insure quality of raw materials.
- Oversee quality control from raw material to finished product.
- Implement machinery/equipment changes, production systems and work methods.

Quality Control Analyst Ocean Nutrition Canada Jan 2002- Oct 2005
Ocean Nutrition Canada Mulgrave, Nova Scotia

- Perform quality control analysis on all-in process and FP samples entering the lab.
- Conducted chemical analysis based on titrations and use of HPLC and GC.
- Qualifying samples brought to lab and performing analysis based on priorities.
- Inspect all raw materials, packaging and finished products ensuring company standards met.
- Provide input toward the development of MPR's and audit as required.
- Ensure that GMP standards are being met throughout the plants.
- Inspect lab equipment to ensure proper calibrations.

Plant Manager May 1995- Jan 2002
ACS Trading Mulgrave, Nova Scotia

- Provided ongoing reports to company president.
- Managed all plant operations including 150 employees.
- Responsible for ensuring maximum profit on owner's investment.
- Sought out new equipment to increase profit through higher efficiency.
- Promoted company throughout North America and Europe at various trade shows.
- Collaborated with outside contractors in building design (new and existing structures).

Education

Bachelor of Science Degree 1979-1982
Dalhousie University Halifax, NS

Skills

- National Seafood Sector Council & NS School of Fisheries QMPR Program.
- Completion of FDA approved Seafood HACCP Alliance.
- Certified WHMIS instructor.
- GMP certified training.
- Permit preparation training.
- St John's Ambulance first aid.
- Confined Space Certified training.
- Fall Arrest & Scaffolding training.
- "Safe Start" training (train the trainer in house safety training)
- October of 2015 received BRC Food Safety Version 7 training
- Trained in use of SAP
- Completed SQF Quality Code & SQF Ed.8 changes overview.

Stephen A French

CONTACT [redacted]

Education

- **Canadian Institute of Traffic and Transportation** (CITT) **September 1990 – June 1992**

- **B. Business Administration. Major in Economics** **September 1982 — September 1986**
University of New Brunswick – Fredericton, NB

- **High School Diploma / A-Levels** **September 1977 — June 1982**
Fundy High School- St. George, NB

Experience

- **VP Sales – Waycobah Trout Farms**
Cape Breton, NS May 2021 - Current

- **VP Sales – MOWI Canada East / Marine Harvest**
St. George, New Brunswick. July 2018 — May 2020

- **VP Sales & Marketing – Northern Harvest Sea Farms**
St. George, New Brunswick. April 2007 — July 2018

- **Retail Sales Manager (North America) – Marine Harvest**
Pompano, Florida. April 2005— April 2007

- **Retails Sales Manager (North America) – Stolt Sea Farms**
St. George, New Brunswick. - August 2000 – April 2005

- **Sales/Logistics Manager – Ocean Horizons**
St. George, New Brunswick. September 1993 – August 2000

- **Sales/Freight Manager – Connors Brothers Ltd**
Blacks Harbour, New Brunswick. September 1988 – August 1993

Professional Interests:

- **Member of the Minister's Round Table on Fisheries –** created in order for the Minister of Agriculture, Aquaculture, Aquaculture and Fisheries to receive advice from the fishing and seafood processing industry on a regular basis

Personal Interests:

- Active member of the community including coaching basketball

4.7 Updates to Development Plans (2024)

Updates to Aquaculture Applications 0814, 1430, 1431

February 26, 2024

Introduction

In February, 2019, We'koqma'q First Nation submitted three application packages for commercial finfish aquaculture sites in the Bras D'Or Lakes near their Mi'kmaq community. The aquaculture sites and activities they will permit will help We'koqma'q attain financial stability for the community, sustain employment for band members and develop a vertically integrated business that can see success for generations.

Over the years, the original development plans within these applications were updated several times, based on information gleaned from fish production and monitoring operations, with the last update submitted July 20, 2023.

This document represents a further update to the July 20, 2023 submission - to bring the adjudicative applications that are in progress up to date. It defines subtle changes to the infrastructure and production plans based on latest available information and business planning. Since the sites AQ 0814, 1430, and 1431 are intended to operate together, as a single farm, the updates for all of the sites are described within this single document. This document supplements the original applications and their subsequent updates.

Updates to the Development Plans

Only Development Plan sections that required updating are listed below.

2.1 Production Plan

The site capacities described in the production plan of the July 2023 document have not changed and numbers stocked will continue to be informed from fish performance and environmental monitoring results. However, the cages for all sites will be standardized to the 100m circumference polar circle. This includes AQ 0814, which previously was listed as using 60m circumference cages.

2.2 Infrastructure

The above-noted change in cage size for 0814 will require the installation of a new grid/array which will attain engineer's approval pertaining to the integrity of the site's infrastructure to ensure fish containment.

The feeding barges purchased in 2021 that will enable pan-camera viewing and remote feeding of fish were approved for use by Transport Canada in 2023. Moving forward, both the North and South Aberdeen sites (AQ 1430, 1431) will use this technology which is anticipated to increase oversight of feeding, to improve feed conversion ratios and reduce environmental impacts.

8.1 Interactions with other aquaculture operations

The locations of the sites relative to each other and the intended arrays within the sites are shown in Figure A, with this figure updated to show a single 2 X 5 cage array of 100m polar circles on AQ 0814. The other aspects of the figure remain unchanged.

A summary of the purpose for each site and array follows:

0814

Plans to over-winter fish at 0814 at the overwintering location ("0814 OW") remain unchanged. The separate, single production array at 0814 will regularly receive small fish in late fall. This production array at 0814 may also be occasionally used for small scale experimental trials (testing stocks, feeds, oxygenation equipment). Biomass at this site will be kept low.

1430

A single array will receive spring juveniles as well as the juveniles received the previous fall at AQ 0814. The array used will alternate between years.

1431

A single array will receive second-year fish to be harvested in that year. The array used will alternate between years.

Gantt chart

The production plan, shown as a Gantt chart, has been updated to reflect the use of the single 2 X 5 array at 0814 as a nursery. As indicated in all previous submissions, this stocking plan is projected, and actual site stocking will be directed by fish performance, environmental monitoring results, fish health results, and introductions and transfers permissions.

		Year 1												Year 2												Year 3												Year 4											
Site No.	Array	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
0814	0814 #1																																															
0814	0814 OW																																															
1430	1430 #1																																															
1430	1430 #2																																															
1431	1431 #1																																															
1431	1431 #2																																															

All fish
Juveniles
Harvest fish

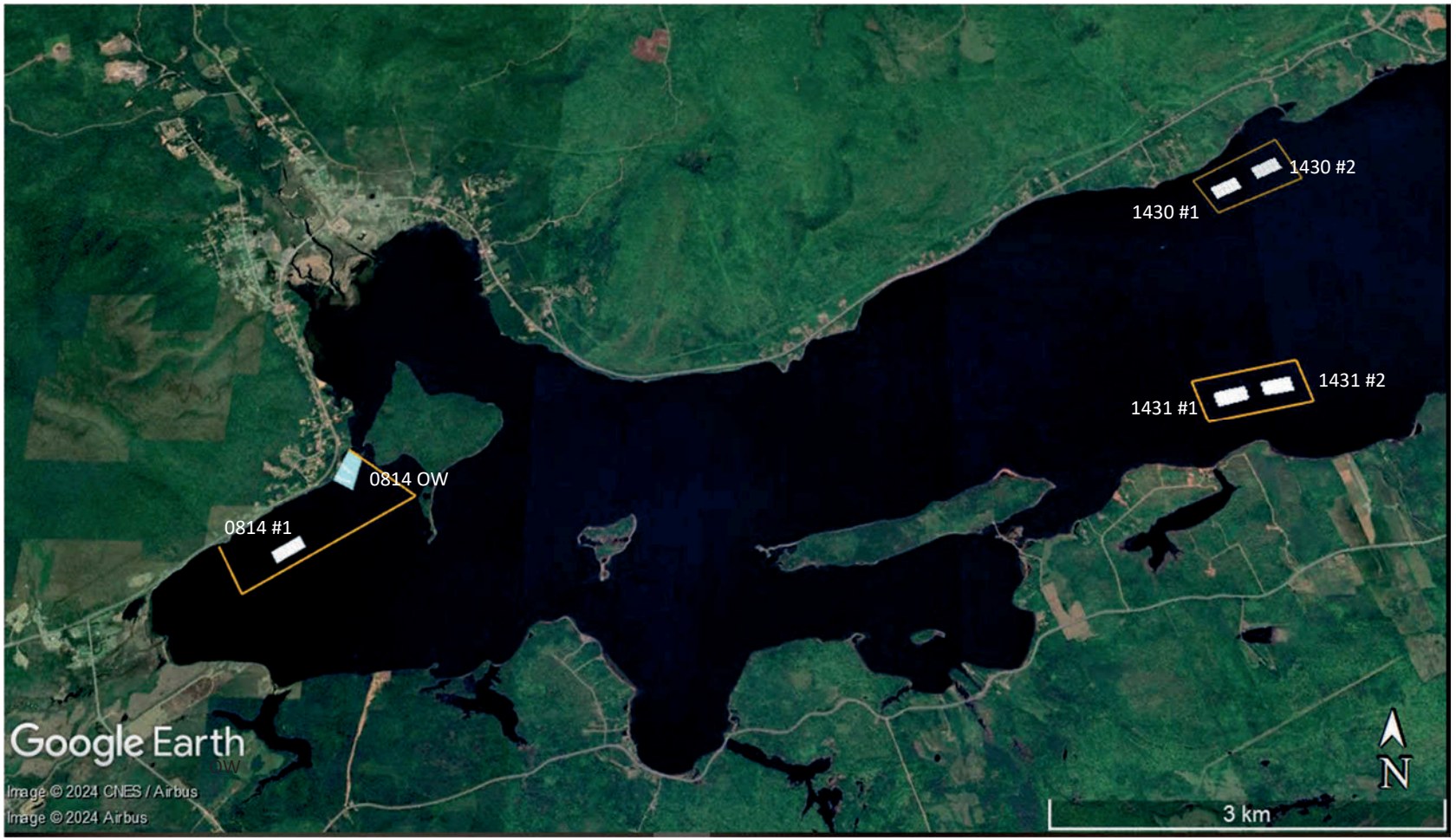


Figure A: Requested commercial leases are outlined in orange. Projected locations of cage arrays for the production season within the leases are the white polygons. Projected location for over-wintering cages is the light blue polygon.