Appendices

Appendix A
Community Liaison Committee Draft Terms of Reference

Terms of Reference (ToR) for the Community Liaison Committee (CLC)

Moose River Consolidated (MRC) Project

Draft for Discussion at the First CLC Meeting of the Whole (October 2016)

1.0 PURPOSE

1.1 The purpose of the Community Liaison Committee (CLC) is to allow a respectful and transparent exchange of information between Atlantic Gold (the "Proponent") and the residents of local communities and those in adjacent areas such as the Musquodoboit Valley and Eastern Shore and those representing nearest Mi'kmaq communities to the Moose River Consolidated (MRC) Project (the "Project").

1.2 As such, the CLC is to:

- Provide avenues for community input to the Proponent by two-way sharing of information in a transparent forum on Project matters regarding approvals and permits or operations that have or are perceived to have environmental, social or economic impacts;
- Support improved mechanisms and content of Project information sharing by the Proponent to interested individuals in the community; and,
- Provide a voice to those in the community who have concerns, suggestions or questions.

1.3 The CLC is established to facilitate discussion and sharing of information in an equitable forum between the Community and the Proponent on matters regarding Project design, permitting, site preparation, operation, and decommissioning and reclamation activities. Recommendations made to the Proponent by the CLC are formally considered and responded to by the Proponent.

1.4 CLCs are used most successfully to facilitate communication between community members and a project proponent when they provide a public forum to present factual information about the development. CLCs are most effective when issues raised by the community are addressed transparently and in a timely fashion.

2.0 MANDATE

2.1 The CLC members serve as an advisory board for the Company by providing a representative cross-section of community opinions, concerns and suggestions on the MRC Project, including the Touquoy Gold Mine and Beaver Dam Gold Mine, as well as the Cochrane Hill gold deposit and the Fifteen Mile Stream gold deposit.

2.2 This Terms of Reference (ToR) meets and exceeds the expectations for a CLC as documented in the Nova Scotia Guide for the Formation and Operation of a Community Liaison Committee (Nova Scotia, 2010) and the existing Project environmental approvals.

2.3 The CLC works collaboratively with the Proponent in an advisory fashion to develop practical plans and procedures to minimize Project impacts to valued environmental and socio-economic components based on scientifically defensible information.

2.4 Topics of discussion related to the Project include but are not limited to environmental monitoring, dispute/complaint resolution, wetlands, compensation plans, mine development, operations and reclamation plans, as well as the Nova Scotia Environment (NSE) plan for procuring conservation lands. Existing and anticipated future approvals indicate specific plans where the CLC must be engaged as part of their development.

2.5 The CLC is not a decision-making forum; yet the Company anticipates insight into perceptions of the community and suggestions on community engagement and potential mitigative measures for the Project.

2.6 At its foundation, the CLC provides a conduit for dialogue; many residents may not be comfortable to hold discussions with developers, so the CLC provides a more approachable mechanism. To facilitate this mandate, an atmosphere of respect is to be maintained within the CLC to allow diverse views to be presented. Further, members of the CLC are accountable to the community that is represented.

3.0 MEMBERSHIP

3.1 The CLC membership is structured to provide a balance in terms of interests in the Project, location relative to the Project, and perspectives on the Project, as well as demographics and culture.

3.2 While the CLC is a voluntary position, the Proponent will reimburse reasonable expenses (travel, etc.) based on an agreed standard quarterly stipend per member. The amount will be reviewed annually.

3.3 The criteria for selection is based on Nova Scotia Guide (2010) and is a balance of members (as a minimum of six but limited to ten) who reside in the geographic area of the Project and include representation from the Mi'kmaq of Nova Scotia. Specifically, this includes:

- Balanced geographic membership from local communities, such as Mooseland, Middle Musquodoboit, Upper Musquodoboit, Sheet Harbour, Tangier and Musquodoboit Harbour; and
- One member each from the two closest Mi'kmaq communities, Millbrook and Sipekne'katik First Nations, as appointed by Chief and Council of each community.

3.4 Membership is reviewed annually as part of a regular CLC meeting. Resignations are to be received in writing. The up-to-date CLC membership is shared with NSE.

3.5 To ensure balance but also necessary transparency, new members are recruited annually based on advice of the existing CLC members via the following:

- Advertise via the community engagement activities (e.g., community meetings, website, etc.);
- Extend direct invitation to specific stakeholder groups or the Mi'kmaq of Nova Scotia;
- Solicit recommendations from elected officials and other community leaders, as well as existing CLC members;
- Allow at minimum a two-week nomination period; and
- Review expressions of interest by existing CLC members with new appointments subject to approval of the Company.

4.0 ROLES AND RESPONSIBILITIES

Chair

4.1 At the formation of the CLC, an interim chair may be a representative of the Company responsible for environmental management and community engagement. At the discretion of the CLC members, a Chair is to be elected from within the CLC membership by a ballot vote of members during a regular meeting. The Company representative is to continue to support the role of the Chair as requested by the elected Chair.

4.2 The role and responsibilities of the Chair include:

- Ensuring that the CLC members are provided with necessary information and technical support to assist them in their role;
- Facilitating discussion such that there is balance within members' perspectives and that individual members are not either unduly interrupted nor dominate discussion;
- Allowing constructive and thorough discussion while ensuring that agreed upon agenda and schedule are followed; and,
- Maintaining the structure of the CLC as outlined in the ToR, including but not limited to, procedural voting aspects and annual review of the ToR.

Members

4.3 As individual members of the CLC are representatives of their community, the members are responsible to both share perspectives of their community with the CLC and convey factual information to interested members of their community. As such, each CLC member is to participate in discussions, provide input and ideas from their perspective, and actively listen to other points of view. Only with this contribution from each member can the CLC's mandate be achieved.

4.4 The role and responsibilities of the members include:

- Signing the CLC Member Acceptance of the ToR once it is finalized as agreed by majority vote of the CLC;
- Committing to at least one year of participation as an active member of the CLC;

- Working to fulfill the purpose and mandate of the CLC as per this ToR, including conducting themselves with respect and accountability as a CLC member;
- Attending CLC meetings in a regular and timely manner as per the agreed upon schedule with understanding that resignation is required after two consecutive unexplained absences;
- Allowing name, email and telephone number to be published as a CLC member;
- Completing appropriate review of meeting minutes and Project information, including the engagement materials and mitigation measures, to the best of the individual's abilities;
- Listening to other members of the CLC and information presented by the Company during CLC meetings;
- Identifying Project-related concerns of the community or group that the individual member represents;
- Providing constructive comments on the mitigative measures proposed by the Company; and
- Assisting the Company in informing the community and other organizations on items related to the Project that are of interest or concern to the stakeholders and the Mi'kmaq of Nova Scotia.

Company

4.5 There is a dual role and responsibility of the Company; that is, the Company will both support the CLC administratively, financially and technically while respectfully considering the perspectives and opinions shared by the CLC members.

4.6 The roles and responsibilities of the Company include:

- Attending the CLC meetings and listening carefully with due consideration the concerns and suggestions brought forward by the CLC members;
- Keeping the CLC members up-to-date on the Project, including sharing documentation in a timely manner to allow members to review prior to next meeting;
- Distributing the agreed upon agenda, ensuring that notes are taken of the meetings, and posting approved agenda and notes on the Project website;
- Supporting the CLC as appropriate with administrative, technical or financial requirements of the CLC as the Company deems appropriate; and
- Providing updates to the CLC on timely responses and/or actions subsequent to concerns brought forth by the CLC.

Guests

4.7 Guest speakers and attendees, e.g. from local non-governmental organizations, may be part of some CLC meeting. Guests are only to attend the meetings where approved by the CLC and as appropriate given the agreed agenda items. Guests may also include government representatives.

4.8 The roles and responsibilities of CLC guests include:

- Respecting the mandate of the CLC and the role of the Chair, members, and the Company; and
- Fulfilling the role as agreed with the CLC Chair in terms of receiving information on the Project and/or providing advice to assist the CLC in meeting its mandate.

5.0 STRUCTURE

Meeting Format and Frequency

5.1 The first agenda will be proposed by the Company and consists of introductions of the members and the Company, Project update and review and comment upon the draft ToR. The agenda for each subsequent meeting will be set by the CLC with the Chair asking each member in turn if they have specific items to include in the next agenda. In order to keep meetings to a reasonable length of two hours, the Chair may elect to move subsequent items to the next scheduled meeting.

5.2 Standard agenda items will include:

- Review and approval of past meeting minutes and addition of items to agenda;
- Project update by the Company;
- Discussion of CLC comments or concerns;
- Other agenda items as appropriate, including topic(s) of focus and invited guests if appropriate; and
- Determination of next meeting date and agenda for next meeting.

5.3 Meetings will be run in a roundtable format as led by the Chair who will start with review of past minutes and call for new items on proposed agenda. Meeting frequency is proposed as quarterly; however, depending on items for discussion, meetings may be held more frequently. The date of next meeting will be confirmed by the Chair and other members at conclusion of each meeting based on annual schedule.

5.4 While most input of the CLC is individual opinion and perspective for consideration of the Company, voting will be used for several procedural aspects. These include, but are not limited to: finalizing the ToR; determining timing of next meeting if more frequent than quarterly; and electing the Chair. With the exception of electing the chair, each member will vote with a show of hands as facilitated by the Chair or delegate. Private ballot voting will be used to elect the Chair.

Records

5.5 Records relating to the CLC include: the final ToR; the list of current CLC members; the meeting agendas and minutes; and Project specific information. Publishing these records for the community and other interested stakeholders and the Mi'kmaq of Nova Scotia to review is important for transparency. This facilitates information sharing back and forth between the community and Company; recording CLC meetings and sharing minutes, as well as supporting documentation, is an important part of fulfilling the CLC's mandate.

5.6 Modes of publishing will be determined by the Company; the CLC can provide advice on best modes of communication depending on the record. These can include any of the following: newspaper ads; posters; newsletters; use of local government; website; social media; and an email distribution list. Ideally a combination of modern and traditional publishing is used.

Role of the Chair

5.7 As laid out within the ToR, the Chair (or designate) maintains structure and functionality of the CLC meetings. While the Chair is a member of the CLC, (s)he only votes on procedural matters where a tie has formed. The Chair limits discussion to items on the agenda and keeps on schedule while ensuring that each member has contributed as appropriate. The Chair liaises with the Company to ensure that appropriate support is provided to the CLC members.

5.8 It is proposed that the Chair be elected from within the CLC membership by ballot vote at the third CLC meeting. The term of the Chair is annual.

Support of the CLC

5.9 Necessary technical, financial and administrative support to facilitate a functioning CLC will be provided by the Company at the discretion of the Company. Through the Chair, the CLC members may request additional support of the Company as appropriate to facilitate the mandate of the CLC; this may include presentations by specialists to assist the CLC members in understanding technical documentation.

5.10 A maximum of two weeks after a meeting, the Company will distribute draft meeting minutes and the proposed agenda for the next meeting to CLC members. The Company will also distribute Project specific information in a timely fashion to allow suitable review of the material by CLC members before the next meeting.

Rules of Order

5.11 Where members of the CLC are not able to attend an upcoming meeting, (s)he will email, call or visit the Chair at least 24hours prior to the meeting time. Failure to do so for two consecutive meetings will result in automatic resignation from the CLC; the Chair will send a letter accordingly. Where another nomination exists for that geographical area, stakeholder group or Mi'kmaq community, a new member will be selected; otherwise, the position must be advertised.

5.12 Typically, the CLC meetings are limited to members who are nominated to represent the community. Guests may be allowed at the CLC meetings at the discretion of the Chair where a specific justification exists pertinent to the meeting agenda. In this case, the Chair will allow comments or questions from observers pertaining to an agenda item after the CLC comments or questions have been addressed.

5.13 Quorum will consist of five members of the CLC plus attendance of at least one Company representative. Quorum is required for voting matters only.

5.14 Each member of the CLC, the Company representatives, any invited third parties and observers must conduct themselves in a respectful manner. The Chair has the right to exclude any party who is disrupting the CLC meeting.

Review of Terms of Reference

5.15 As its first matter of business, the CLC will review the draft ToR and provide suggestions to finalize this document. The Company will note the proposed changes and attempt to address any voiced concerns via edits. It is the goal that at the subsequent meeting, the CLC will approve the agreed upon final version of the ToR via a majority vote. Accordingly, each member would sign and date the CLC Member Acceptance (Attachment A). Alternatively, subsequent amendments may be suggested if the majority does not support the revised ToR; in this case, the Company will make a second round of edits based on voiced concerns and submit to members for review and vote at the subsequent meeting.

5.16 This ToR will be reviewed and amended by the CLC annually. This is important to ensure that the CLC is well supported to fulfill its purpose and mandate. It is expected that as the Project progresses through various stages that the ToR will be amended accordingly to ensure an effective CLC formation and structure.

Attachment A CLC Member Acceptance

I have read, understand and agree to the Terms of Reference for the Community Liaison Committee of the Moose River Consolidated Project by Atlantic Gold as noted in this document (*date*):

____

Name of CLC Member (printed)

____

Signature of CLC Member

____

Date

Appendix B
Summary of Stakeholder and Mi'kmaq Engagement

Summary of Stakeholder and Mi'kmaq Engagement as Completed for the Project as of May 2017

Beaver Dam Mine Project Environmental Impact Statement
Atlantic Gold Corporation

The following table summarizes the main stakeholder and Mi'kmaq engagement activities conducted by Atlantic Gold for this Project to date since commencement of the federal environmental assessment (EA) process in December 2015. This includes the organization engaged (community group, regulatory agency, Mi'kmaq group, etc.), the date, means of engagement and a summary of key issues if any and topics discussed. Atlantic Gold will continue its engagement over the lifetime of the Project as described in the EIS Sections 3 and 4.

Beyond the summary below of key engagement activities (calls emails, meetings, presentations, site visits, etc.), Atlantic Gold has maintained a detailed tracking table recording all modes of communication associated with the Moose River Consolidated (MRC) Project and notes from each, including attendees, specific comments and action items. The summary below does not include each email or telephone call but includes those where material information / input shared. The Summary below includes those engagement activities where the Beaver Dam Mine Project was a key focus; many additional meetings occurred specific to the Touquoy Gold Project, e.g., with Nova Scotia Environment (NSE) and Department of Natural Resources (DNR), as part of planning and permitting for construction in 2016 and operation in 2017. Additional details can be provided to regulators upon request.

Organization	Date	Means	Key Issues
Canadian Environmental Assessment Agency (CEA Agency)	January 22, 2016	Meeting	Discussed Final Guidelines and process for federal and provincial EAs, as well as planned regulatory workshop
Community Liaison Committee (CLC)	February 25, 2016	Meeting	Updated CLC members on MRC Project, including Beaver Dam Mine Project ongoing EA and planned open houses in spring 2016
Office of Aboriginal Affairs (OAA)	February 26, 2016	Meeting	Updated OAA staff on Atlantic Gold's projects, including Beaver Dam EA, and discussed engagement with the Mi'kmaq
Kwilmu’kq Maw-Klusuaqn Negotiation Office (KMKNO)	February 26, 2016	Meeting	Update on MRC Project and review of draft Mutual Benefits Agreement (MBA) with KMKNO Benefits Officer
KMKNO	March 2, 2016	Meeting	Review progress on draft MBA and discuss opportunities with KMKNO staff and lead Benefits Chief
Sipekne'katik First Nation	March 7, 2016	Meeting	Update on MRC Project, including Beaver Dam EA and review engagement opportunities with staff
CEA Agency / NSE EA Branch	April 5, 2016	Meeting	Planning for regulatory workshop and update on Project EA, including baseline data collection and engagement
KMKNO	April 6, 2016	Meeting	Progress on draft MBA with KMKNO staff and lead Benefits Chief
KMKNO	April 6, 2016	Meeting	Review of MRC Project and update on key issues for Touquoy and Beaver Dam including planning information sharing
OAA	April 20, 2016	Meeting	Update on MRC Project and engagement with KMKNO and Sipekne'katik First Nation

Organization	Date	Means	Key Issues
Sipekne'katik First Nation	April 21, 2016	Presentation	Formal presentation to Sipekne'katik Chief and Council on MRC Project including Beaver Dam and planned engagement with questions on potential effects including water and flora and fauna
KMKNO and Millbrook First Nation	April 22, 2016	Meeting	Discussion of proposed transportation of ore from Beaver Dam mine site to Touquoy for processing as part of the Project, including review of two options where one avoids passing Beaver Lake
Acadia First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Annapolis Valley First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Bear River First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Chapel Island First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Eskasoni First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Glooscap First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Membertou First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Paq’tnkek (Afton) First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Pictou Landing First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Wagmatcook First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
We’koqma’q First Nation	April 29, 2016	Email	Update on MRC Project and ongoing Mi'kmaq engagement, sharing information on open houses in May, and offer to further engage
Public notices	April / May 2016	Advertisements	Advertisements in local community (TownCryer, Eastern Shore Cooperator, Guysborough Journal) and postings in community boards in nearby communities to advertise open houses and update community on MRC Project, including Beaver Dam EA
CLC	May 5, 2016	Meeting	Review of planned construction at Touquoy and Beaver Dam EA process plus overview of community open houses
Millbrook First Nation	May 12, 2016	Presentation	Formal presentation to Millbrook Chief and Council on MRC Project including Beaver Dam and planned engagement with questions on potential effects and opportunities associated with Beaver Dam, including trucking and fish

Organization	Date	Means	Key Issues
Federal and provincial regulators	May 13, 2016	Workshop	Half-day workshop for regulators on the Beaver Dam Mine Project including review of baseline data collection and key potential interactions with environment
Millbrook First Nation	May 16, 2016	Open House	Community open house from 3-8pm held within Millbrook First Nation with information panels and one-on-one discussions; comments focused on employment opportunities and potential effects, including accidents and malfunctions and trucking of ore (16 attendees)
Sipekne'katik First Nation	May 17, 2016	Open House	Community open house from 3-8pm held within Sipekne'katik First Nation with information panels and one-on-one discussions; comments focused on employment opportunities and potential effects, including potential impact to water quality and fish habitat (16 attendees)
Middle Musquodoboit	May 18, 2016	Open House	Public open house from 3-8pm held at Natural Resources Education Centre with information panels and one-on-one discussions; comments focused on employment opportunities and potential effects, including effects on wetlands and fish habitat (61 attendees)
Sheet Harbour	May 19, 2016	Open House	Public open house from 3-8pm held at Sheet Harbour Lions Club with information panels and one-on-one discussions; comments focused on employment opportunities and potential effects, including accidents and malfunctions, loss of habitat and trucking of ore (33 attendees)
Transportation Infrastructure Renewal	June 2, 2016	Meeting	Discussion on road network including Beaver Dam proposed haul routes and potential alternative of crossing Hwy 224
Millbrook First Nation	June 29, 2016	Call	Discussion of potential short- and long-term economic opportunities with Employment Officer
Mi'kmaw Conservation Group (MCG)	July 12, 2016	Call	Review of opportunities for environmental monitoring including capacity building with MCG staff for MRC Project
Sipekne'katik First Nation	August 9, 2016	Call	Discussion of potential short- and long-term economic opportunities with Employment Officer
Sheet Harbour Chamber of Commerce	September 7, 2016	Presentation	Overview of MRC Project, including Beaver Dam for members and invited guests, including discussion of economic opportunities, potential environmental effects and Beaver Dam EA process
Sipekne'katik First Nation	October 6, 2016	Mini-job fair	Sharing of employment opportunities in short and long term with attendees of job fair as advertised by the Sipekne'katik Employment Officer
Sipekne'katik First Nation	October 6, 2016	Meeting	Update on MRC Project and specific discussion on Beaver Dam, including engagement with community once EIS is available and offer to share aspects of EIS prior to registration
KMKNO	October 20, 2016	Meeting	Discussion of engagement with the Assembly and Millbrook and Sipekne'katik First Nations and planning a leadership meeting with Assembly

Organization	Date	Means	Key Issues
CLC	October 29, 2016	Meeting	CLC meeting and site tour at Touquoy Gold Project site in Moose River, including update on MRC Project including the Beaver Dam EA process; members agreed to focused on Beaver Dam meeting and inviting local community groups as guests
CEA Agency / NSE EA Branch	November 1, 2016	Meeting	Update to regulators of EIS development and engagement plus proposed alterative of haul route from Beaver Dam to avoid homes and Beaver Lake; need for information to supplement Project Description
Millbrook First Nation	November 4, 2016	Presentation	Presentation and round table discussion with Chief and Council and key staff regarding the MRC Project, including Beaver Dam; questions included benefits, haul route, potable water at Beaver Lake, and contingency planning
KMKNO	November 7, 2016	Call	Discussion of technical aspects of all projects, including Beaver Dam, e.g., schedule update, haul route, offer to share aspects of EIS prior to registration
KMKNO	November 8, 2016	Meeting	Review of draft MBA and ongoing sharing of opportunities, discussion of approach to finalize MBA and logistics of implementation
Millbrook First Nation	November 10, 2016	Mini-job fair	Sharing of employment opportunities in short and long term with attendees of job fair as advertised by the Millbrook Community Engagement Liaison
Mooseland Community	November 18, 2016	Meeting	Community meeting organized with local RCMP to focus on concern with traffic on Mooseland Road; however, update also provided on MRC Project including Beaver Dam
OAA	November 21, 2016	Meeting	Update on Atlantic Gold's engagement of the Mi'kmaq including Beaver Dam Mine Project
Federal and provincial regulators, KMKNO and Millbrook and Sipekne'katik First Nations	November 29, 2016	Site Tour	Site tour of Beaver Dam mine site, haul route and proposed changes to Touquoy site with federal and provincial regulators and staff of KMKNO and Millbrook and Sipekne'katik First Nations
Millbrook First Nation	December 2, 2016	Mini-job fair	Sharing of employment opportunities in short and long term with attendees of job fair in Sheet Harbour IR as advertised by the Millbrook Community Engagement Liaison
CLC and invited guests	December 3, 2016	Meeting	Meeting with CLC members and invited guests from Eastern Shore Forestry Watch Association and Nova Scotia Salmon Association to focus on the Beaver Dam Mine Project, including presentations from EA Study Team and round table discussion; issues raised included watercourses, fish habitat, water quality, groundwater levels, traffic, recreation and contingency planning
Municipality of the District of Saint Mary's	January 4, 2017	Presentation	Presentation to Warden and Councillors on Atlantic Gold's project development in NS, including Beaver Dam Mine site and upcoming release of EIS
Assembly Benefits Committee Chiefs	February 3, 2017	Presentation	Presentation to five Benefits Committee Chiefs and key staff of KMKNO re: MRC Project and advanced exploration ongoing in terms of short and long term opportunities for benefits to the Mi'kmaq of Nova Scotia

Organization	Date	Means	Key Issues
Millbrook First Nation	February 15, 2017	Email	Update on Beaver Dam EIS submission, sharing of MEKS, and ongoing discussion of best approaches for information sharing to support Millbrook community engagement (to support request for additional information on contingency planning as requested), site visit for Chief and Council and members of Beaver Lake and logistics to provide additional information associated with potential impacts and discuss benefits
Sipekne'katik First Nation	February 15, 2017	Email	Update on Beaver Dam EIS submission, sharing of MEKS, and offer to meet and/or provide more information (date being planned to present to Chief and Council and discussion of community meeting once EIS released)
Eastern Shore Forestry Watch	February 15, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information on Beaver Dam and Touquoy Gold Mine (date being planned to meet as per follow up correspondence)
Nova Scotia Salmon Association	February 15, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information and approach to sharing data (date being planned to meet as per follow up correspondence)
Mi'kmaw Conservation Group (MCG)	March 23, 2017	Call	Initial discussion of opportunities with Touquoy, Beaver Dam and other potential projects for environmental monitoring
Native Council of Nova Scotia	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information (date being planned to meet as per follow up correspondence)
Acadia First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Annapolis Valley First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Bear River First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Chapel Island First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Eskasoni First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Glooscap First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Membertou First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Paq’tnkek (Afton) First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information

Organization	Date	Means	Key Issues
Pictou Landing First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Wagmatcook First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
We'koqma'q First Nation	March 27, 2017	Email	Update on Beaver Dam EIS submission, overall MRC Project update and offer to meet and/or provide more information
Community Liaison Committee (CLC)	April 1, 2017	Meeting	CLC meeting in Moose River, including update on MRC Project including the Beaver Dam EA process, agreement to minor edits to the CLC Terms of Reference, discussion of cyanide transpiration, employment and engagement activities; comment received from Millbrook member re: request for information on contingency planning and reclamation as per prior Chief and Council meeting in Nov 2016
Key staff of MCG and KMKNO	April 6, 2017	Meeting	Review of environmental monitoring and other participation opportunities, such as wetland compensation planning, for MCG to use existing capacity and build future capacity as part of developing the Company's projects, including the Beaver Dam Mine Project.
Key interested staff and councillors from Sipek'nekatik and Millbrook First Nations plus MCG	May 3, 2017	Presentation	Presentation by Atlantic Gold staff on emergency response planning, environmental monitoring and reclamation for Touquoy and Beaver Dam sites, including cyanide transport, handling, monitoring and discharge; specific discussions on management of effluent, cyanide handling, incl Cyanide Code, and effect on local hydrology, e.g., Cameron Flowage water levels due to Beaver Dam pit development.

Beyond May 2017, ongoing engagement is planned to support the federal and provincial EA processes for the Beaver Dam Mine Project, including specific meetings with Mi'kmaq groups and community groups. As part of overall MRC Project engagement strategy, engagement activities will continue and will be responsive to questions and concerns identified of the stakeholders and the Mi'kmaq of Nova Scotia.

Appendix C
Sediment Baseline Analytical Results

Table 1: General Chemistry

		CCME FAL	MMER	WC-2
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.160
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.220
Hardness (CaCO3)	mg/L			3.3
Ion Balance (% Difference)	%			15.8
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			4.0
Colour	TCU			270
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			19
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	4.65
Reactive Silica (SiO2)	mg/L			1.7
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			2.3
Turbidity	NTU			0.95
Conductivity	uS/cm			25

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-2
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		350
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	1.9
Total Barium (Ba)	ug/L			2.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.014
Total Calcium (Ca)	ug/L			780
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		880
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.79
Total Magnesium (Mg)	ug/L			320
Total Manganese (Mn)	ug/L			29
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			180
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2100
Total Strontium (Sr)	ug/L			4.5
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.3
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-3
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			8.0
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.170
Hardness (CaCO3)	mg/L			2.8
Ion Balance (% Difference)	%			25.9
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.6
Colour	TCU			220
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			16
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.07
Reactive Silica (SiO2)	mg/L			0.85
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.83
Conductivity	uS/cm			18

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-3
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100[(1)]**		320
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	1.2
Total Barium (Ba)	ug/L			2.1
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[(2)]**		<0.010
Total Calcium (Ca)	ug/L			620
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4[(3)]**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		780
Total Lead (Pb)	ug/L	**1 - 7[(4)]**	**400**	0.52
Total Magnesium (Mg)	ug/L			310
Total Manganese (Mn)	ug/L			28
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150[(5)]**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			170
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			1800
Total Strontium (Sr)	ug/L			4.6
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			3.3
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	6.3

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-7
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.220
Hardness (CaCO3)	mg/L			2.9
Ion Balance (% Difference)	%			33.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.8
Colour	TCU			230
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			20
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	4.61
Reactive Silica (SiO2)	mg/L			3.2
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.0
Conductivity	uS/cm			28

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

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NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-7
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100**[(1)]		440
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37**[(2)]		0.013
Total Calcium (Ca)	ug/L			540
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.44
Total Copper (Cu)	ug/L	**2 - 4**[(3)]	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		730
Total Lead (Pb)	ug/L	**1 - 7**[(4)]	**400**	0.86
Total Magnesium (Mg)	ug/L			370
Total Manganese (Mn)	ug/L			23
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150**[(5)]	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			190
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2300
Total Strontium (Sr)	ug/L			6.4
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.3
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

	Units	CCME FAL	MMER	WC-8
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			10
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.220
Hardness (CaCO3)	mg/L			3.9
Ion Balance (% Difference)	%			33.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.8
Colour	TCU			220
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			16
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.56
Reactive Silica (SiO2)	mg/L			1.7
Total Suspended Solids	mg/L			7.2
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.83
Conductivity	uS/cm			25

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-8
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		440
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	2.1
Total Barium (Ba)	ug/L			3.8
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.015
Total Calcium (Ca)	ug/L			900
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.77
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		1000
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.52
Total Magnesium (Mg)	ug/L			390
Total Manganese (Mn)	ug/L			29
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	2.1
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			220
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2200
Total Strontium (Sr)	ug/L			6.9
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			6.5
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	13

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-9
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			9.0
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.220
Hardness (CaCO3)	mg/L			3.6
Ion Balance (% Difference)	%			37.5
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.6
Colour	TCU			120
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			9.5
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.59
Reactive Silica (SiO2)	mg/L			0.68
Total Suspended Solids	mg/L			2.8
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.6
Conductivity	uS/cm			20

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-9
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		360
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			17
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.016
Total Calcium (Ca)	ug/L			700
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.49
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		930
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.52
Total Magnesium (Mg)	ug/L			440
Total Manganese (Mn)	ug/L			63
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			530
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2400
Total Strontium (Sr)	ug/L			8.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			3.6
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.5

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-10
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.230
Hardness (CaCO3)	mg/L			3.1
Ion Balance (% Difference)	%			35.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.8
Colour	TCU			270
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			19
Orthophosphate (P)	mg/L			0.011
pH	pH	**6.5-9**	**6-9.5**	4.67
Reactive Silica (SiO2)	mg/L			3.3
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.7
Conductivity	uS/cm			27

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-10
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		500
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.022
Total Calcium (Ca)	ug/L			600
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		980
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.88
Total Magnesium (Mg)	ug/L			390
Total Manganese (Mn)	ug/L			28
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			230
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2300
Total Strontium (Sr)	ug/L			7.2
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			7.6
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.1

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-11	
Sampling Date				**9-Jun-16**	**9-Jun-16**
Calculated Parameters	**Units**				(DUP 4)
Anion Sum	me/L			0.100	0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Calculated TDS	mg/L			10	10
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Cation Sum	me/L			0.210	0.200
Hardness (CaCO3)	mg/L			3.0	2.9
Ion Balance (% Difference)	%			35.5	29.0
Langelier Index (@ 20C)	N/A			NC	NC
Langelier Index (@ 4C)	N/A			NC	NC
Nitrate (N)	mg/L	**2.935**		<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC
Saturation pH (@ 4C)	N/A			NC	NC
Inorganics					
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			3.5	3.7
Colour	TCU			220	220
Nitrate + Nitrite	mg/L			<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050
Total Organic Carbon (C)	mg/L			16	15
Orthophosphate (P)	mg/L			0.010	0.010
pH	pH	**6.5-9**	**6-9.5**	5.09	4.97
Reactive Silica (SiO2)	mg/L			2.3	2.3
Total Suspended Solids	mg/L			2.8	<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0
Turbidity	NTU			1.2	1.6
Conductivity	uS/cm			24	22

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

	Units	CCME FAL	MMER	WC-11	
Sampling Date				9-Jun-16	9-Jun-16
Metals					(DUP 4)
Total Aluminum (Al)	ug/L	**5 / 100(1)**		450	430
Total Antimony (Sb)	ug/L			<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0	<1.0
Total Barium (Ba)	ug/L			4.0	4.0
Total Beryllium (Be)	ug/L			<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.018	0.012
Total Calcium (Ca)	ug/L			580	570
Total Chromium (Cr)	ug/L			<1.0	<1.0
Total Cobalt (Co)	ug/L			<0.40	<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		900	770
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.74	0.63
Total Magnesium (Mg)	ug/L			370	360
Total Manganese (Mn)	ug/L			36	35
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100
Total Potassium (K)	ug/L			300	280
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10
Total Sodium (Na)	ug/L			2400	2300
Total Strontium (Sr)	ug/L			7.2	7.1
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0
Total Titanium (Ti)	ug/L			6.3	5.7
Total Uranium (U)	ug/L	**15**		<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-12
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			13
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.250
Hardness (CaCO3)	mg/L			3.5
Ion Balance (% Difference)	%			38.9
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.072
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.5
Colour	TCU			290
Nitrate + Nitrite	mg/L			0.072
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies**(1)		0.062
Total Organic Carbon (C)	mg/L			19
Orthophosphate (P)	mg/L			0.012
pH	pH	**6.5-9**	**6-9.5**	4.60
Reactive Silica (SiO2)	mg/L			3.9
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.73
Conductivity	uS/cm			28

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-12
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		510
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.0
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.020
Total Calcium (Ca)	ug/L			650
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		1100
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.98
Total Magnesium (Mg)	ug/L			470
Total Manganese (Mn)	ug/L			20
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			220
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2500
Total Strontium (Sr)	ug/L			8.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			7.3
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-13
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.0900
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			10
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			3.0
Ion Balance (% Difference)	%			40.0
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.3
Colour	TCU			190
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			12
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.00
Reactive Silica (SiO2)	mg/L			2.4
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.1
Conductivity	uS/cm			22

Notes

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(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

	Units	CCME FAL	MMER	WC-13
Sampling Date				9-Jun-16
Metals				
Total Aluminum (Al)	ug/L	**5 / 100(1)**		420
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.4
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.016
Total Calcium (Ca)	ug/L			580
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.53
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		830
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.70
Total Magnesium (Mg)	ug/L			380
Total Manganese (Mn)	ug/L			54
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			280
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2500
Total Strontium (Sr)	ug/L			7.2
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			5.8
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-14
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			2.5
Ion Balance (% Difference)	%			31.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.7
Colour	TCU			130
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			9.2
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	5.19
Reactive Silica (SiO2)	mg/L			3.7
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.3
Conductivity	uS/cm			21

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

Sampling Date	Units	CCME FAL	MMER	WC-14
				9-Jun-16
Metals				
Total Aluminum (Al)	ug/L	**5 / 100(1)**		340
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.014
Total Calcium (Ca)	ug/L			490
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			1.2
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		1200
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			300
Total Manganese (Mn)	ug/L			100
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			150
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2400
Total Strontium (Sr)	ug/L			6.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			5.4
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-15
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.200
Hardness (CaCO3)	mg/L			3.2
Ion Balance (% Difference)	%			33.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.7
Colour	TCU			140
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			13
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	5.22
Reactive Silica (SiO2)	mg/L			4.2
Total Suspended Solids	mg/L			1.8
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.75
Conductivity	uS/cm			22

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-15
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		470
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.4
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.013
Total Calcium (Ca)	ug/L			720
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.66
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		700
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			340
Total Manganese (Mn)	ug/L			41
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			160
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2300
Total Strontium (Sr)	ug/L			7.6
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			6.2
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-16
Sampling Date				**9-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.190
Hardness (CaCO3)	mg/L			3.4
Ion Balance (% Difference)	%			26.7
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.9
Colour	TCU			190
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			17
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	5.02
Reactive Silica (SiO2)	mg/L			3.5
Total Suspended Solids	mg/L			3.6
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.45
Conductivity	uS/cm			22

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-16
Sampling Date				**9-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		460
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			5.1
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.018
Total Calcium (Ca)	ug/L			760
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.49
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		520
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			370
Total Manganese (Mn)	ug/L			31
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			160
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2100
Total Strontium (Sr)	ug/L			9.3
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			6.2
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-17	
Sampling Date				**9-Jun-16**	**9-Jun-16**
Calculated Parameters	**Units**				(DUP 3)
Anion Sum	me/L			0.100	0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Calculated TDS	mg/L			11	11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Cation Sum	me/L			0.210	0.200
Hardness (CaCO3)	mg/L			3.5	3.3
Ion Balance (% Difference)	%			35.5	33.3
Langelier Index (@ 20C)	N/A			NC	NC
Langelier Index (@ 4C)	N/A			NC	NC
Nitrate (N)	mg/L	**2.935**		<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC
Saturation pH (@ 4C)	N/A			NC	NC
Inorganics					
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			3.7	3.5
Colour	TCU			200	190
Nitrate + Nitrite	mg/L			<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050
Total Organic Carbon (C)	mg/L			16	16
Orthophosphate (P)	mg/L			<0.010	0.010
pH	pH	**6.5-9**	**6-9.5**	5.39	5.83
Reactive Silica (SiO2)	mg/L			3.2	3.2
Total Suspended Solids	mg/L			6.4	2.6
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0
Turbidity	NTU			0.92	1.2
Conductivity	uS/cm			21	22

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-17	
Sampling Date				**9-Jun-16**	**9-Jun-16**
Metals	**Units**				(DUP 3)
Total Aluminum (Al)	ug/L	**5 / 100(1)**		400	390
Total Antimony (Sb)	ug/L			<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0	<1.0
Total Barium (Ba)	ug/L			4.5	4.5
Total Beryllium (Be)	ug/L			<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.014	0.012
Total Calcium (Ca)	ug/L			790	760
Total Chromium (Cr)	ug/L			<1.0	<1.0
Total Cobalt (Co)	ug/L			0.63	0.58
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		930	850
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.53	0.59
Total Magnesium (Mg)	ug/L			360	350
Total Manganese (Mn)	ug/L			46	42
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100
Total Potassium (K)	ug/L			180	210
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10
Total Sodium (Na)	ug/L			2200	2300
Total Strontium (Sr)	ug/L			8.2	7.7
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0
Total Titanium (Ti)	ug/L			6.8	6.6
Total Uranium (U)	ug/L	**15**		<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-23
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			13
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			2.7
Ion Balance (% Difference)	%			31.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			4.0
Colour	TCU			230
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			19
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	4.73
Reactive Silica (SiO2)	mg/L			4.6
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.94
Conductivity	uS/cm			28

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-23
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100[(1)]**		520
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[(2)]**		0.018
Total Calcium (Ca)	ug/L			490
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4[(3)]**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		570
Total Lead (Pb)	ug/L	**1 - 7[(4)]**	**400**	0.77
Total Magnesium (Mg)	ug/L			350
Total Manganese (Mn)	ug/L			30
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150[(5)]**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			330
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2400
Total Strontium (Sr)	ug/L			5.1
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			9.0
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-24
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.120
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			13
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			3.2
Ion Balance (% Difference)	%			27.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.062
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.9
Colour	TCU			230
Nitrate + Nitrite	mg/L			0.062
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			19
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	4.92
Reactive Silica (SiO2)	mg/L			3.9
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.5
Conductivity	uS/cm			24

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-24
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		470
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.6
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.020
Total Calcium (Ca)	ug/L			660
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		690
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.73
Total Magnesium (Mg)	ug/L			380
Total Manganese (Mn)	ug/L			58
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			180
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2400
Total Strontium (Sr)	ug/L			6.5
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			7.1
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-25
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			13
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.230
Hardness (CaCO3)	mg/L			2.6
Ion Balance (% Difference)	%			35.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			4.0
Colour	TCU			230
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			20
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	4.69
Reactive Silica (SiO2)	mg/L			4.3
Total Suspended Solids	mg/L			2.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.3
Conductivity	uS/cm			26

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-25
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		740
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.6
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.022
Total Calcium (Ca)	ug/L			460
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		750
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.91
Total Magnesium (Mg)	ug/L			350
Total Manganese (Mn)	ug/L			31
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			390
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2700
Total Strontium (Sr)	ug/L			5.6
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			12
Total Uranium (U)	ug/L	**15**		0.11
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-26
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.190
Hardness (CaCO3)	mg/L			2.5
Ion Balance (% Difference)	%			26.7
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			4.1
Colour	TCU			190
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			16
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	4.97
Reactive Silica (SiO2)	mg/L			2.6
Total Suspended Solids	mg/L			2.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.1
Conductivity	uS/cm			27

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-26
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100[1]**		390
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.0
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[2]**		0.020
Total Calcium (Ca)	ug/L			460
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4[3]**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		730
Total Lead (Pb)	ug/L	**1 - 7[4]**	**400**	0.64
Total Magnesium (Mg)	ug/L			330
Total Manganese (Mn)	ug/L			48
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150[5]**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			170
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2200
Total Strontium (Sr)	ug/L			4.7
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			6.1
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-27
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.120
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			2.6
Ion Balance (% Difference)	%			27.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			4.1
Colour	TCU			280
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			20
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	4.69
Reactive Silica (SiO2)	mg/L			2.9
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.85
Conductivity	uS/cm			28

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-27
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		350
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.4
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.019
Total Calcium (Ca)	ug/L			450
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		710
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.85
Total Magnesium (Mg)	ug/L			360
Total Manganese (Mn)	ug/L			24
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			210
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2500
Total Strontium (Sr)	ug/L			5.8
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.5
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-28
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			8.0
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.170
Hardness (CaCO3)	mg/L			2.0
Ion Balance (% Difference)	%			21.4
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.9
Colour	TCU			150
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			11
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.23
Reactive Silica (SiO2)	mg/L			<0.50
Total Suspended Solids	mg/L			3.2
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.6
Conductivity	uS/cm			19

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-28
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		200
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			1.5
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.018
Total Calcium (Ca)	ug/L			350
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		640
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			280
Total Manganese (Mn)	ug/L			31
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			320
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2000
Total Strontium (Sr)	ug/L			3.9
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.8
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-29
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			8.0
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.160
Hardness (CaCO3)	mg/L			2.8
Ion Balance (% Difference)	%			23.1
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.6
Colour	TCU			100
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			6.7
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.62
Reactive Silica (SiO2)	mg/L			0.97
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.63
Conductivity	uS/cm			18

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-29
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		220
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			2.6
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.019
Total Calcium (Ca)	ug/L			650
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		300
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			290
Total Manganese (Mn)	ug/L			41
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			180
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2000
Total Strontium (Sr)	ug/L			5.3
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			2.4
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-30
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			9.0
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.190
Hardness (CaCO3)	mg/L			3.3
Ion Balance (% Difference)	%			31.0
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.056
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.3
Colour	TCU			140
Nitrate + Nitrite	mg/L			0.056
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			9.8
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.31
Reactive Silica (SiO2)	mg/L			1.1
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.3
Conductivity	uS/cm			19

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-30
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		300
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.1
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.016
Total Calcium (Ca)	ug/L			790
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		530
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			330
Total Manganese (Mn)	ug/L			60
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			180
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2100
Total Strontium (Sr)	ug/L			4.6
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.6
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-31
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.0800
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			10
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.200
Hardness (CaCO3)	mg/L			3.5
Ion Balance (% Difference)	%			42.9
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			2.9
Colour	TCU			110
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			10
Orthophosphate (P)	mg/L			0.011
pH	pH	**6.5-9**	**6-9.5**	5.27
Reactive Silica (SiO2)	mg/L			3.0
Total Suspended Solids	mg/L			6.6
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			1.9
Conductivity	uS/cm			20

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-31
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		420
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			6.6
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.030
Total Calcium (Ca)	ug/L			720
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		340
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.53
Total Magnesium (Mg)	ug/L			400
Total Manganese (Mn)	ug/L			100
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			120
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2600
Total Strontium (Sr)	ug/L			6.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.0
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-41
Sampling Date				**23-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.170
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			19
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			2.0
Ion Balance (% Difference)	%			10.5
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.58
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			4.5
Colour	TCU			89
Nitrate + Nitrite	mg/L			0.58
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		0.057
Total Organic Carbon (C)	mg/L			6.4
Orthophosphate (P)	mg/L			0.013
pH	pH	**6.5-9**	**6-9.5**	4.74
Reactive Silica (SiO2)	mg/L			7.8
Total Suspended Solids	mg/L			7.2
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			3.4
Conductivity	uS/cm			37

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-41
Sampling Date				
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		330
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.1
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.017
Total Calcium (Ca)	ug/L			380
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		130
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.55
Total Magnesium (Mg)	ug/L			250
Total Manganese (Mn)	ug/L			5.3
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			370
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			3200
Total Strontium (Sr)	ug/L			4.3
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			5.9
Total Uranium (U)	ug/L	**15**		0.72
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-42
Sampling Date				
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.190
Hardness (CaCO3)	mg/L			1.9
Ion Balance (% Difference)	%			31.0
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.058
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.5
Colour	TCU			140
Nitrate + Nitrite	mg/L			0.058
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		0.19
Total Organic Carbon (C)	mg/L			8.5
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.79
Reactive Silica (SiO2)	mg/L			4.6
Total Suspended Solids	mg/L			<2.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.52
Conductivity	uS/cm			24

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-42
Sampling Date				
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		350
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.3
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.015
Total Calcium (Ca)	ug/L			350
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		360
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			250
Total Manganese (Mn)	ug/L			36
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			190
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2700
Total Strontium (Sr)	ug/L			4.1
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.7
Total Uranium (U)	ug/L	**15**		0.21
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-43	
Sampling Date				**8-Jun-16**	**8-Jun-16**
Calculated Parameters	**Units**				(DUP 1)
Anion Sum	me/L			0.120	0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Calculated TDS	mg/L			12	11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Cation Sum	me/L			0.300	0.270
Hardness (CaCO3)	mg/L			7.0	6.3
Ion Balance (% Difference)	%			42.9	42.1
Langelier Index (@ 20C)	N/A			NC	NC
Langelier Index (@ 4C)	N/A			NC	NC
Nitrate (N)	mg/L	**2.935**		<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC
Saturation pH (@ 4C)	N/A			NC	NC
Inorganics					
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			4.1	3.9
Colour	TCU			280	280
Nitrate + Nitrite	mg/L			<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050
Total Organic Carbon (C)	mg/L			19	19
Orthophosphate (P)	mg/L			0.011	0.011
pH	pH	**6.5-9**	**6-9.5**	5.13	5.64
Reactive Silica (SiO2)	mg/L			1.2	1.2
Total Suspended Solids	mg/L			7.8	4.4
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0
Turbidity	NTU			11	13
Conductivity	uS/cm			22	24

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-43	
Sampling Date				8-Jun-16	8-Jun-16
Metals	**Units**				(DUP 1)
Total Aluminum (Al)	ug/L	**5 / 100(1)**		1000	820
Total Antimony (Sb)	ug/L			<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	3.8	3.0
Total Barium (Ba)	ug/L			10	9.0
Total Beryllium (Be)	ug/L			<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.016	0.014
Total Calcium (Ca)	ug/L			1400	1300
Total Chromium (Cr)	ug/L			1.4	<1.0
Total Cobalt (Co)	ug/L			0.69	0.61
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	2.3	2.1
Total Iron (Fe)	ug/L	**300**		1600	1300
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	1.8	1.6
Total Magnesium (Mg)	ug/L			870	750
Total Manganese (Mn)	ug/L			83	75
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100
Total Potassium (K)	ug/L			600	460
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10
Total Sodium (Na)	ug/L			1900	2000
Total Strontium (Sr)	ug/L			7.5	7.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0
Total Titanium (Ti)	ug/L			24	19
Total Uranium (U)	ug/L	**15**		<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	6.0	5.5

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-44
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			6.0
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.130
Hardness (CaCO3)	mg/L			1.9
Ion Balance (% Difference)	%			13.0
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.7
Colour	TCU			210
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			15
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	4.97
Reactive Silica (SiO2)	mg/L			<0.50
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.61
Conductivity	uS/cm			26

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-44
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		170
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			1.4
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.016
Total Calcium (Ca)	ug/L			370
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		510
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			230
Total Manganese (Mn)	ug/L			31
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			100
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			1400
Total Strontium (Sr)	ug/L			2.5
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			3.7
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-45
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			10
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.210
Hardness (CaCO3)	mg/L			3.6
Ion Balance (% Difference)	%			31.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.7
Colour	TCU			200
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies[(1)]**		<0.050
Total Organic Carbon (C)	mg/L			14
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	5.21
Reactive Silica (SiO2)	mg/L			1.5
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.72
Conductivity	uS/cm			20

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-45
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100[(1)]**		310
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	30
Total Barium (Ba)	ug/L			3.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[(2)]**		0.019
Total Calcium (Ca)	ug/L			880
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.42
Total Copper (Cu)	ug/L	**2 - 4[(3)]**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		920
Total Lead (Pb)	ug/L	**1 - 7[(4)]**	**400**	0.61
Total Magnesium (Mg)	ug/L			350
Total Manganese (Mn)	ug/L			61
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150[(5)]**	**1000**	5.7
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			190
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2100
Total Strontium (Sr)	ug/L			5.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			4.6
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-46
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.240
Hardness (CaCO3)	mg/L			4.5
Ion Balance (% Difference)	%			37.1
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.065
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.9
Colour	TCU			190
Nitrate + Nitrite	mg/L			0.065
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			12
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	5.59
Reactive Silica (SiO2)	mg/L			2.0
Total Suspended Solids	mg/L			2.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.8
Conductivity	uS/cm			22

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-46
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100**[(1)]		430
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	4.4
Total Barium (Ba)	ug/L			5.1
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37**[(2)]		0.016
Total Calcium (Ca)	ug/L			1100
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4**[(3)]	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		720
Total Lead (Pb)	ug/L	**1 - 7**[(4)]	**400**	0.68
Total Magnesium (Mg)	ug/L			440
Total Manganese (Mn)	ug/L			47
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150**[(5)]	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			280
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2500
Total Strontium (Sr)	ug/L			6.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			12
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-47
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			14
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.350
Hardness (CaCO3)	mg/L			7.7
Ion Balance (% Difference)	%			52.2
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		0.17
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.6
Colour	TCU			240
Nitrate + Nitrite	mg/L			0.17
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			19
Orthophosphate (P)	mg/L			0.011
pH	pH	**6.5-9**	**6-9.5**	5.43
Reactive Silica (SiO2)	mg/L			2.6
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.99
Conductivity	uS/cm			25

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-47
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		810
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	1.9
Total Barium (Ba)	ug/L			9.3
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.030
Total Calcium (Ca)	ug/L			1800
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			0.89
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		1000
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	1.3
Total Magnesium (Mg)	ug/L			760
Total Manganese (Mn)	ug/L			140
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			260
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			3300
Total Strontium (Sr)	ug/L			10
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			15
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.6

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-19
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			11
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.230
Hardness (CaCO3)	mg/L			2.8
Ion Balance (% Difference)	%			39.4
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.5
Colour	TCU			130
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			13
Orthophosphate (P)	mg/L			0.010
pH	pH	**6.5-9**	**6-9.5**	5.35
Reactive Silica (SiO2)	mg/L			2.0
Total Suspended Solids	mg/L			2.4
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.1
Conductivity	uS/cm			19

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-19
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		390
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.6
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.019
Total Calcium (Ca)	ug/L			560
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			2.3
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		1900
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			350
Total Manganese (Mn)	ug/L			280
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			260
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2100
Total Strontium (Sr)	ug/L			5.5
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			7.7
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-20	
Sampling Date				**8-Jun-16**	**8-Jun-16**
Calculated Parameters	**Units**				(DUP 2)
Anion Sum	me/L			0.110	0.120
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Calculated TDS	mg/L			14	14
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0
Cation Sum	me/L			0.250	0.250
Hardness (CaCO3)	mg/L			3.0	3.1
Ion Balance (% Difference)	%			38.9	35.1
Langelier Index (@ 20C)	N/A			NC	NC
Langelier Index (@ 4C)	N/A			NC	NC
Nitrate (N)	mg/L	**2.935**		<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC
Saturation pH (@ 4C)	N/A			NC	NC
Inorganics					
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			3.9	4.1
Colour	TCU			250	230
Nitrate + Nitrite	mg/L			<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050
Total Organic Carbon (C)	mg/L			17	18
Orthophosphate (P)	mg/L			0.011	0.012
pH	pH	**6.5-9**	**6-9.5**	4.90	4.94
Reactive Silica (SiO2)	mg/L			4.7	4.7
Total Suspended Solids	mg/L			1.0	2.2
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0
Turbidity	NTU			1.5	2.5
Conductivity	uS/cm			25	26

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-20	
Sampling Date				**8-Jun-16**	**8-Jun-16**
Metals	**Units**				(DUP 2)
Total Aluminum (Al)	ug/L	**5 / 100(1)**		510	520
Total Antimony (Sb)	ug/L			<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0	<1.0
Total Barium (Ba)	ug/L			3.1	3.4
Total Beryllium (Be)	ug/L			<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.018	0.020
Total Calcium (Ca)	ug/L			560	610
Total Chromium (Cr)	ug/L			3.3	<1.0
Total Cobalt (Co)	ug/L			0.81	0.77
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		1800	1700
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.80	0.74
Total Magnesium (Mg)	ug/L			390	390
Total Manganese (Mn)	ug/L			120	110
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100
Total Potassium (K)	ug/L			170	190
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10
Total Sodium (Na)	ug/L			2400	2500
Total Strontium (Sr)	ug/L			5.5	5.8
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0
Total Titanium (Ti)	ug/L			9.2	7.0
Total Uranium (U)	ug/L	**15**		<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.2	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-21
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			14
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.290
Hardness (CaCO3)	mg/L			3.1
Ion Balance (% Difference)	%			45.0
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.9
Colour	TCU			210
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			18
Orthophosphate (P)	mg/L			0.011
pH	pH	**6.5-9**	**6-9.5**	5.05
Reactive Silica (SiO2)	mg/L			3.3
Total Suspended Solids	mg/L			3.6
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			2.4
Conductivity	uS/cm			21

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-21
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100[(1)]**		500
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.4
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[(2)]**		0.019
Total Calcium (Ca)	ug/L			510
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			2.2
Total Copper (Cu)	ug/L	**2 - 4[(3)]**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		3500
Total Lead (Pb)	ug/L	**1 - 7[(4)]**	**400**	<0.50
Total Magnesium (Mg)	ug/L			440
Total Manganese (Mn)	ug/L			230
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150[(5)]**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			170
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2100
Total Strontium (Sr)	ug/L			6.2
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			8.2
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.4

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	WC-22
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.0900
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			13
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.250
Hardness (CaCO3)	mg/L			2.5
Ion Balance (% Difference)	%			47.1
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			3.3
Colour	TCU			120
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			14
Orthophosphate (P)	mg/L			0.012
pH	pH	**6.5-9**	**6-9.5**	5.53
Reactive Silica (SiO2)	mg/L			2.7
Total Suspended Solids	mg/L			7.6
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			3.9
Conductivity	uS/cm			19

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	WC-22
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		450
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			4.5
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.022
Total Calcium (Ca)	ug/L			370
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			9.5
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		3000
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			380
Total Manganese (Mn)	ug/L			900
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			240
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			2000
Total Strontium (Sr)	ug/L			4.8
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			6.9
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-40
Sampling Date				**8-Jun-16**
Calculated Parameters	**Units**			
Anion Sum	me/L			0.210
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Calculated TDS	mg/L			14
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0
Cation Sum	me/L			0.280
Hardness (CaCO3)	mg/L			2.9
Ion Balance (% Difference)	%			14.3
Langelier Index (@ 20C)	N/A			NC
Langelier Index (@ 4C)	N/A			NC
Nitrate (N)	mg/L	**2.935**		<0.050
Saturation pH (@ 20C)	N/A			NC
Saturation pH (@ 4C)	N/A			NC
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L			<5.0
Dissolved Chloride (Cl)	mg/L			7.5
Colour	TCU			65
Nitrate + Nitrite	mg/L			<0.050
Nitrite (N)	mg/L	**0.06**		<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050
Total Organic Carbon (C)	mg/L			5.5
Orthophosphate (P)	mg/L			<0.010
pH	pH	**6.5-9**	**6-9.5**	5.56
Reactive Silica (SiO2)	mg/L			0.73
Total Suspended Solids	mg/L			<1.0
Dissolved Sulphate (SO4)	mg/L			<2.0
Turbidity	NTU			0.67
Conductivity	uS/cm			32

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-40
Sampling Date				**8-Jun-16**
Metals	**Units**			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		200
Total Antimony (Sb)	ug/L			<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0
Total Barium (Ba)	ug/L			3.2
Total Beryllium (Be)	ug/L			<1.0
Total Bismuth (Bi)	ug/L			<2.0
Total Boron (B)	ug/L	**1500**		<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.016
Total Calcium (Ca)	ug/L			660
Total Chromium (Cr)	ug/L			<1.0
Total Cobalt (Co)	ug/L			<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0
Total Iron (Fe)	ug/L	**300**		210
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50
Total Magnesium (Mg)	ug/L			300
Total Manganese (Mn)	ug/L			53
Total Molybdenum (Mo)	ug/L	**73**		<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0
Total Phosphorus (P)	ug/L			<100
Total Potassium (K)	ug/L			220
Total Selenium (Se)	ug/L	**1**		<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10
Total Sodium (Na)	ug/L			4800
Total Strontium (Sr)	ug/L			5.0
Total Thallium (Tl)	ug/L	**0.8**		<0.10
Total Tin (Sn)	ug/L			<2.0
Total Titanium (Ti)	ug/L			<2.0
Total Uranium (U)	ug/L	**15**		<0.10
Total Vanadium (V)	ug/L			<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-1									
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Calculated Parameters	**Units**							SW-1D (DUP)					
Anion Sum	me/L			0.140	0.170	0.100	0.120	0.120	0.060	0.0900	0.0800	0.0800	0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	mg/L			14	16	10	12	13	6	8.0	9.0	10	12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.290	0.290	0.190	0.210	0.210	0.110	0.160	0.170	0.180	0.230
Hardness (CaCO3)	mg/L			5.5	5.0	3.3	3.5	3.5	1.6	2.6	2.9	3.3	4.0
Ion Balance (% Difference)	%			34.9	26.1	31.0	27.3	27.3	29.4	28.0	36.0	38.5	39.4
Langelier Index (@ 20C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrate (N)	mg/L	**2.935**		<0.050	0.061	<0.050	0.087	0.080	0.052	<0.050	0.062	0.051	<0.050
Saturation pH (@ 20C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Inorganics													
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			5.1	5.8	3.4	4.0	4.2	1.9	3.1	2.6	2.8	3.7
Colour	TCU			150	160	99	83	100	85	110	170	160	230
Nitrate + Nitrite	mg/L			<0.050	0.061	<0.050	0.087	0.080	0.052	<0.050	0.062	0.051	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies[1]**		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.10	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L			13	18	8.2	7.0	7.5	6.3	7.5	12	12	11 (1)
Orthophosphate (P)	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	**6.5-9**	**6-9.5**	5.55	4.59	5.23	4.87	4.91	5.19	5.85	6.00	5.57	5.59
Reactive Silica (SiO2)	mg/L			2.5	3.9	2.7	3.8	4.0	1.9	1.1	2.1	2.6	3.2
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU			1.1	0.64	0.59	0.62	0.69	0.76	1.1	1.2	1.1	1.2
Conductivity	uS/cm			30	33	25	27	27	14	16	17	18	21
Total Suspended Solids				-	-	-	-	-	-	-	-	-	-
Field Parameters													
Temperature	°C			15.57	8	4.2	0.16	-	3.62	19.14	19.69	19.90	-
Conductivity	µS/cm			39	36	26.7	25	-	16	22	24	-	-
Total Dissolved Solids	g/L			0.031	0.035	-	0.029	-	-	-	-	-	-
Dissolved Oxygen	mg/L	**5.5-9.5[2]**		9.99	14.31	13.32	37.9	-	14.97	10.63	9.6	-	-
pH		**6.5-9**	**6-9.5**	3.97	2.63	4.1	2.89	-	6.48	5.25	5.49	5.3	-

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-1									
Sampling Date				9-Oct-14	13-Nov-14	18-Dec-14	22-Jan-15	22-Jan-15	29-Apr-15	28-May-15	30-Jun-15	29-Jul-15	24-Aug-15
Metals	Units							SW-1D (DUP)					
Total Aluminum (Al)	ug/L	**5 / 100(1)**		330	320	220	200	200	140	190	280	280	400
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	2.7	1.5	1.3	<1.0	<1.0	<1.0	2.6	2.5	3.7	1.3
Total Barium (Ba)	ug/L			5.8	5.6	3.1	3.3	3.4	1.7	2.4	3.0	3.2	4.6
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.024	0.029	0.023	0.012	0.022	0.012	<0.010	0.028	0.014	0.022
Total Calcium (Ca)	ug/L			1200	1100	780	720	740	350	630	690	790	770
Total Chromium (Cr)	ug/L			<1.0	<1.0	<1.0	1.6	<1.0	<1.0	3.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L			0.51	0.52	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.53
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		670	630	330	350	340	240	360	580	750	1000
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.54	<0.50	0.57
Total Magnesium (Mg)	ug/L			590	560	330	400	410	170	240	290	310	420
Total Manganese (Mn)	ug/L			79	68	41	51	53	27	31	37	43	58
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.015	<0.013	<0.013	0.032
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100	<100	<100	<100	<100	<100	150	170	140
Total Potassium (K)	ug/L			570	550	380	380	370	330	340	170	210	170
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			3100	3000	2100	2300	2400	1200	1800	1900	1900	2300
Total Strontium (Sr)	ug/L			11.0	10	5.8	6.3	6.6	2.9	4.6	5.9	6.3	7.4
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			3.8	3.2	3.3	2.4	2.2	3.2	2.7	3.7	3.7	5.0
Total Uranium (U)	ug/L	**15**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.0	5.1	7.8	<5.0	<5.0	<5.0	6.8	<5.0	<5.0	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (μg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (μg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 μg/L for hardness <82 mg/L and an upper limit of 4 μg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (μg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 μg/L for hardness <60 mg/L and an upper limit of 7 μg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (μg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 μg/L for hardness <60 mg/L and an upper limit of 150 μg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-2A										
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Calculated Parameters	**Units**						SW-2AD (DUP)				SW-2AD (DUP)			
Anion Sum	me/L			0.150	0.180	0.100	0.110	0.130	0.0500	0.0900	0.0900	0.0800	0.0800	0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	mg/L			14	17	10	10	13	6.0	7.0	7.0	8.0	9.0	12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.290	0.300	0.180	0.180	0.210	0.110	0.140	0.140	0.160	0.180	0.220
Hardness (CaCO3)	mg/L			5.1	4.9	2.9	2.8	3.4	1.4	2.1	2.0	2.6	2.9	3.6
Ion Balance (% Difference)	%			31.8	25.0	28.6	24.1	23.5	37.5	21.7	21.7	33.3	38.5	37.5
Langelier Index (@ 20C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrate (N)	mg/L	**2.935**		0.11	0.065	<0.050	<0.050	0.079	<0.050	<0.050	<0.050	0.055	<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Inorganics														
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			5.0	6.3	3.6	3.8	4.2	1.6	3.1	3.1	2.8	2.8	3.7
Colour	TCU			160	160	100	100	110	96	120	120	170	180	230
Nitrate + Nitrite	mg/L			0.11	0.065	<0.050	<0.050	0.079	<0.050	<0.050	<0.050	0.055	<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies**(1)		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.052	<0.050	<0.050	<0.050	0.084
Total Organic Carbon (C)	mg/L			14	19	8.9	9.1	7.4	5.5	7.9	8.1	12	13	14 (1)
Orthophosphate (P)	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	**6.5-9**	**6-9.5**	5.06	4.54	4.88	4.75	4.75	5.08	5.59	5.36	5.29	5.26	5.16
Reactive Silica (SiO2)	mg/L			2.7	3.9	2.8	2.7	3.7	1.9	1.1	1.1	1.9	2.6	3.2
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU			1.1	0.50	0.59	0.23	0.70	0.29	1.5	1.4	0.99	0.97	1.9
Conductivity	uS/cm			31	33	25	25	28	13	16	15	17	19	21
Total Suspended Solids				-	-	-	-	-	-	-	-	-	-	-
Field Parameters														
Temperature	°C			13.57	7.89	4.2	-	0.27	3.34	20.64	-	18.81	21.2	-
Conductivity	µS/cm			38	37	27.4	-	25	16	23	-	24	-	-
Total Dissolved Solids	g/L			0.031	0.036	-	-	0.03			-		-	-
Dissolved Oxygen	mg/L	**5.5-9.5**(2)		8.97	13.07	12.88	-	36.14	15.35	9.91	-	9.18	-	-
pH		**6.5-9**	**6-9.5**	4.09	3.08	3.75	-	3.56	6.53	4.63	-	4.00	4.94	-

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-2A										
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Metals	**Units**						SW-2AD (DUP)	.			SW-2AD (DUP)			
Total Aluminum (Al)	ug/L	**5 / 100(1)**		330	340	210	210	210	140	190	190	280	300	400
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	1.1	<1.0	1.5	1.3
Total Barium (Ba)	ug/L			5.6	5.8	3.2	3.0	3.3	1.6	2.2	2.2	3.0	3.5	4.6
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.026	0.028	0.017	0.017	0.013	<0.010	0.013	0.013	0.012	0.017	0.022
Total Calcium (Ca)	ug/L			1100	1000	640	590	680	290	470	460	580	620	770
Total Chromium (Cr)	ug/L			1.4	1.6	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L			0.49	0.58	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.53
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		740	700	360	350	340	260	410	400	590	820	1000
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	0.78	0.55	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.55	0.62	0.57
Total Magnesium (Mg)	ug/L			570	570	320	310	410	160	220	210	280	330	420
Total Manganese (Mn)	ug/L			77	71	43	42	51	25	27	27	35	40	58
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.013	0.013	<0.013	<0.013	0.035
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	110	<100	<100	<100	<100	<100	<100	150	170	140
Total Potassium (K)	ug/L			600	600	370	340	380	330	290	290	160	200	170
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			3100	3100	2100	2000	2400	1200	1600	1600	1900	1900	2300
Total Strontium (Sr)	ug/L			11.0	9.5	5.6	5.2	6.6	3.0	4.1	3.9	5.0	6.3	7.4
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			4.2	3.8	2.6	2.6	2.2	3.2	2.0	2.4	3.6	4.6	5.0
Total Uranium (U)	ug/L	**15**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	6.9	6.2	5.5	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-4A									
Sampling Date				**9-Oct-14**	**13-Nov-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Calculated Parameters	**Units**					SW-4AD (DUP)		No Sample					
Anion Sum	me/L			0.150	0.180	0.180	0.110		0.0400	0.110	0.0700	0.0700	0.110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	mg/L			15	16	16	11		6.0	9.0	8.0	9.0	12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.300	0.300	0.300	0.200		0.120	0.180	0.170	0.190	0.230
Hardness (CaCO3)	mg/L			5.9	5.6	5.6	3.5		1.6	3.1	3.0	3.6	3.9
Ion Balance (% Difference)	%			33.3	25.0	25.0	29.0		50.0	24.1	41.7	46.2	35.3
Langelier Index (@ 20C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Nitrate (N)	mg/L	**2.935**		0.093	0.062	<0.050	<0.050		<0.050	<0.050	0.064	<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Inorganics													
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			5.0	6.2	6.4	3.9		1.3	3.8	2.2	2.6	3.7
Colour	TCU			120	130	130	88		100	130	160	170	260
Nitrate + Nitrite	mg/L			0.093	0.062	<0.050	<0.050		<0.050	<0.050	0.064	<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050	<0.050	<0.050		0.073	0.092	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L			9.3	16	16	8.2		5.5	9.7	12	18	14 (1)
Orthophosphate (P)	mg/L			<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	**6.5-9**	**6-9.5**	5.57	4.76	4.71	4.96		5.14	5.74	5.42	5.09	4.93
Reactive Silica (SiO2)	mg/L			3.4	3.5	3.6	2.9		2.5	1.5	2.0	2.3	3.0
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU			1.4	0.68	0.65	0.80		0.38	1.4	1.3	0.81	1.0
Conductivity	uS/cm			29	31	31	24		15	18	17	19	21
Total Suspended Solids				-	-	-	-		-	-	-	-	-
Field Parameters													
Temperature	°C			10.85	8.98	-	5.1		5.98	22.45	20.72	22.4	-
Conductivity	µS/cm			34	35	-	24.9		31	27	32	-	-
Total Dissolved Solids	g/L			0.03	0.033	-	-		-	-	-	-	-
Dissolved Oxygen	mg/L	**5.5-9.5(2)**		7.11	10.4	-	7.82		13.48	7.88	6.8	-	-
pH		**6.5-9**	**6-9.5**	4.27	3.71	-	3.75		6.56	5.34	5.34	4.92	-

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-4A									
Sampling Date				**9-Oct-14**	**13-Nov-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Metals	**Units**					SW-4AD (DUP)		No Sample					
Total Aluminum (Al)	ug/L	**5 / 100[(1)]**		250	300	310	220		130	240	300	350	390
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	5.8	2.9	2.8	2.0		1.1	7.3	5.4	5.6	5.6
Total Barium (Ba)	ug/L			3.4	4.6	4.4	3.2		1.7	2.8	2.8	3.7	3.4
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50		<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[(2)]**		0.015	0.024	0.025	0.044		0.012	0.013	0.016	0.014	0.021
Total Calcium (Ca)	ug/L			1500	1300	1300	810		350	780	710	860	930
Total Chromium (Cr)	ug/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L			0.43	0.53	0.59	<0.40		<0.40	0.42	<0.40	0.63	0.48
Total Copper (Cu)	ug/L	**2 - 4[(3)]**	**600**	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		690	540	540	320		160	580	650	840	1100
Total Lead (Pb)	ug/L	**1 - 7[(4)]**	**400**	0.54	<0.50	<0.50	<0.50		<0.50	<0.50	0.52	0.56	0.55
Total Magnesium (Mg)	ug/L			540	590	590	350		170	280	290	360	370
Total Manganese (Mn)	ug/L			53	58	58	41		20	37	32	42	51
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	<0.013	<0.013		<0.013	0.015	<0.013	<0.013	0.028
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150[(5)]**	**1000**	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	100	100	<100		<100	<100	140	150	150
Total Potassium (K)	ug/L			450	500	520	480		290	280	140	180	200
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			3200	3100	3200	2300		1300	1900	1900	1700	2200
Total Strontium (Sr)	ug/L			10	9.1	9.2	5.7		2.8	5.1	5.0	6.4	7.2
Total Thallium (Tl)	ug/L	**1**		<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			5	3.7	3.9	2.3		2.4	4.7	3.8	3.8	4.9
Total Uranium (U)	ug/L	**15**		<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	2.9	2.8	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	19	7.8	6.9	12		<5.0	7.5	<5.0	<5.0	6.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{(0.83(\log[hardness])-2.46)}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-5									
Sampling Date				**9-Oct-14**	**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Calculated Parameters	**Units**				SW-5D (DUP)								
Anion Sum	me/L			0.480	0.480	0.520	0.340	0.400	0.100	0.360	0.350	0.360	0.410
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			14	14	11	6.1	8.0	<1.0	7.8	9.3	11	13
Calculated TDS	mg/L			28	28	33	23	27	12	21	21	21	25
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.480	0.470	0.510	0.340	0.430	0.240	0.350	0.350	0.340	0.420
Hardness (CaCO3)	mg/L			16	16	17	10	14	7.3	11	12	12	15
Ion Balance (% Difference)	%			0.00	1.05	0.970	0.00	3.61	41.2	1.41	0.00	2.86	1.20
Langelier Index (@ 20C)	N/A			(2.56)	(2.54)	-2.74	-3.79	-3.17	NC	-3.22	-3.00	-2.84	-2.55
Langelier Index (@ 4C)	N/A			(2.81)	(2.80)	-2.99	-4.04	-3.42	NC	-3.48	-3.26	-3.09	-2.80
Nitrate (N)	mg/L	**2.935**		0.10	0.15	0.051	0.094	0.096	0.870	<0.050	0.063	<0.050	0.055
Saturation pH (@ 20C)	N/A			9.43	9.46	9.52	10.0	9.77	NC	9.84	9.76	9.66	9.50
Saturation pH (@ 4C)	N/A			9.69	9.71	9.77	10.3	10.0	NC	10.1	10.0	9.92	9.75
Inorganics													
Total Alkalinity (Total as CaCO3)	mg/L			14	14	11	6.1	8.0	<5.0	7.8	9.3	11	13
Dissolved Chloride (Cl)	mg/L			4.0	4.1	5.2	4.0	5.0	1.5	3.4	1.9	1.7	2.2
Colour	TCU			22	23	26	30	23	28	27	23	24	37
Nitrate + Nitrite	mg/L			0.10	0.15	0.051	0.094	0.096	0.087	<0.050	0.063	<0.050	0.055
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies[1]**		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.052	<0.050	<0.050
Total Organic Carbon (C)	mg/L			4.1	4.3	3.5	4.0	3.1	3.5	3.6	4.1	5.3	4.3
Orthophosphate (P)	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	0.011
pH	pH	**6.5-9**	**6-9.5**	6.88	6.92	6.78	6.23	6.60	6.14	6.62	6.76	6.83	6.95
Reactive Silica (SiO2)	mg/L			1.8	1.8	3.1	3.0	3.1	2.3	<0.50	0.92	0.77	2.5
Dissolved Sulphate (SO4)	mg/L			3.5	3.6	7.0	4.6	4.4	2.5	5.0	5.0	4.5	3.6
Turbidity	NTU			0.44	0.81	1.4	6.2	2.4	0.69	1.2	0.83	0.91	1.2
Conductivity	uS/cm			48	47	49	35	45	28	34	35	32	40
Total Suspended Solids				-	-	-	-	-	-	-	-	-	-
Field Parameters													
Temperature	°C			13.98	-	7.76	4.6	1.75	2.7	20.84	20.51	22.4	-
Conductivity	µS/cm			53	-	49	35.7	36	27	40	40	-	-
Total Dissolved Solids	g/L			0.044	-	0.048	-	0.041	-	-	-	-	-
Dissolved Oxygen	mg/L	**5.5-9.5[2]**		8.26	-	15.04	13.08	39.05	14.95	8.59	9.13	-	-
pH		**6.5-9**	**6-9.5**	5.46	-	4.61	5.94	4.8	6.67	6.56	6.34	6.39	-

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-5									
Sampling Date				**9-Oct-14**	**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Metals	**Units**				SW-5D (DUP)								
Total Aluminum (Al)	ug/L	**5 / 100(1)**		28	29	100	460	210	98	61	45	43	52
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	29	30	15	17	22	15	41	32	20	47
Total Barium (Ba)	ug/L			4.5	4.6	5.5	6.1	6.1	4.6	4.4	3.6	4.1	4.5
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		<0.010	0.016	<0.010	0.010	0.011	0.018	<0.010	<0.010	<0.010	<0.010
Total Calcium (Ca)	ug/L			5000	4900	5300	3000	4100	2200	3500	3600	3800	4500
Total Chromium (Cr)	ug/L			<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L			<0.40	<0.40	<0.40	<0.40	0.44	0.61	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		400	400	470	730	680	560	880	530	610	750
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50	<0.50	<0.50	0.57	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Magnesium (Mg)	ug/L			940	920	970	640	780	430	600	640	720	870
Total Manganese (Mn)	ug/L			60	59	28	25	150	200	65	50	45	97
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.015	<0.013	<0.013	0.027
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100	<100	<100	<100	<100	<100	140	170	150
Total Potassium (K)	ug/L			730	710	1000	720	740	480	670	580	350	450
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			2700	2700	2900	2200	2700	1400	1700	1800	1500	2000
Total Strontium (Sr)	ug/L			28.0	27	26	15	21	11	18	20	25	27
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			<2.0	<2.0	3.2	14	4.2	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium (U)	ug/L	**15**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	<2.0	3.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0	<5.0	<5.0	<5.0	<5.0	5.4	<5.0	<5.0	<5.0	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[\text{hardness}])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-6A									
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Calculated Parameters	**Units**							No Sample			SW-6AD (DUP)		
Anion Sum	me/L			0.130	0.160	0.110	0.120		0.0700	0.0700	0.0700	0.0700	0.100
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	mg/L			13	15	11	12		7.0	7.0	7.0	8.0	12
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.240	0.270	0.190	0.210		0.140	0.170	0.160	0.170	0.240
Hardness (CaCO3)	mg/L			4.5	5.0	3.5	3.9		2.5	2.8	2.8	3.2	4.4
Ion Balance (% Difference)	%			29.7	25.6	26.7	27.3		33.3	41.7	39.1	41.7	41.2
Langelier Index (@ 20C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Nitrate (N)	mg/L	**2.935**		0.080	<0.050	<0.050	<0.050		<0.050	0.053	0.059	<0.050	<0.050
Saturation pH (@ 20C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A			NC	NC	NC	NC		NC	NC	NC	NC	NC
Inorganics													
Total Alkalinity (Total as CaCO3)	mg/L			<5.0	<5.0	<5.0	<5.0		<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl)	mg/L			4.3	5.8	3.8	4.2		2.5	2.2	2.2	2.4	3.5
Colour	TCU			80	99	87	82		88	140	130	140	220
Nitrate + Nitrite	mg/L			0.080	<0.050	<0.050	<0.050		<0.050	0.053	0.059	<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies[(1)]**		<0.050	<0.050	<0.050	<0.050		<0.050	0.22	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L			9.1	13	8.1	8.9		7.3	10	11	13	12 (1)
Orthophosphate (P)	mg/L			<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	**6.5-9**	**6-9.5**	5.73	5.05	5.13	5.09		5.76	5.79	5.64	5.50	5.37
Reactive Silica (SiO2)	mg/L			3.3	3.5	2.8	3.4		1.1	1.3	1.2	1.6	2.7
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU			0.30	0.69	0.42	0.44		0.43	0.65	1.1	0.49	0.54
Conductivity	uS/cm			25	28	24	25		16	16	16	16	20
Total Suspended Solids				-	-	-	-		-	-	-	-	-
Field Parameters													
Temperature	°C			10.98	8.04	4.6	1.15		17.4	18.09	-	20.4	-
Conductivity	μS/cm			31	32	25.7	23		34	22	-	-	-
Total Dissolved Solids	g/L			0.028	0.032	-	0.027		-	-	-	-	-
Dissolved Oxygen	mg/L	**5.5-9.5[(2)]**		8.88	14.49	12.01	42.34		10.89	9.17	-	-	-
pH		**6.5-9**	**6-9.5**	3.56	3.43	4.49	3.98		5.72	8.73	-	5.02	-

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-6A								
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**28-May-15**	**30-Jun-15**	**30-Jun-15**	**29-Jul-15**	**24-Aug-15**
Metals	**Units**									SW-6AD (DUP)		
Total Aluminum (Al)	ug/L	**5 / 100[1]**		220	290	240	250	220	290	39	320	470
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	4.0	1.9	1.1	1.0	3.2	3.0	130	2.8	7.6
Total Barium (Ba)	ug/L			3.2	4.1	3.1	3.0	2.3	2.6	5.4	3.1	3.8
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37[2]**		0.024	0.021	0.014	0.011	<0.010	0.016	0.061	0.012	0.031
Total Calcium (Ca)	ug/L			1000	1200	790	880	620	670	4900	770	1000
Total Chromium (Cr)	ug/L			<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L			<0.40	0.44	<0.40	<0.40	<0.40	<0.40	1.8	<0.40	1.0
Total Copper (Cu)	ug/L	**2 - 4[3]**	**600**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.0	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		500	480	330	380	370	550	1400	750	1500
Total Lead (Pb)	ug/L	**1 - 7[4]**	**400**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Magnesium (Mg)	ug/L			470	510	360	410	230	270	660	310	430
Total Manganese (Mn)	ug/L			50	51	39	46	29	33	110	38	100
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	<0.013	<0.013	0.017	<0.013	0.013	<0.013	0.035
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150[5]**	**1000**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.2	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100	<100	<100	<100	140	140	160	150
Total Potassium (K)	ug/L			340	470	300	300	280	190	640	200	240
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			2800	3000	2200	2300	1700	1800	1900	1700	2200
Total Strontium (Sr)	ug/L			7.1	7.7	5.9	6.1	4.4	4.8	19	5.5	7.6
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			2.7	3.1	2.8	2.6	2.8	3.4	<2.0	3.5	4.3
Total Uranium (U)	ug/L	**15**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L			<2.0	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	<5.0	5.5	<5.0	<5.0	5.7	<5.0	13	<5.0	<5.0

Notes

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(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{(0.83(\log[\text{hardness}])-2.46)}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(\text{hardness})]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(\text{hardness})]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(\text{hardness})]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-9									
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**29-Jul-15**	**24-Aug-15**
Calculated Parameters	**Units**											SW-9 (DUP)	
Anion Sum	me/L			0.310	0.200	0.140	0.180	0.100	0.170	0.130	0.250	0.250	0.150
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			5.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.6	5.5	<1.0
Calculated TDS	mg/L			23	17	12	16	9	13	13	18	18	15
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.420	0.340	0.230	0.290	0.180	0.260	0.310	0.330	0.340	0.330
Hardness (CaCO3)	mg/L			10	6.4	4.1	5.0	2.8	4.7	7.4	8.0	8.2	7.5
Ion Balance (% Difference)	%			15.1	25.9	24.3	23.4	28.6	20.9	40.9	13.8	15.3	37.5
Langelier Index (@ 20C)	N/A			(4.22)	NC	NC	NC	NC	NC	NC	-3.90	-3.83	NC
Langelier Index (@ 4C)	N/A			(4.47)	NC	NC	NC	NC	NC	NC	-4.16	-4.08	NC
Nitrate (N)	mg/L	**2.935**		0.091	<0.050	<0.050	0.051	<0.050	<0.050	<0.050	0.064	<0.050	<0.050
Saturation pH (@ 20C)	N/A			10.2	NC	NC	NC	NC	NC	NC	10.3	10.3	NC
Saturation pH (@ 4C)	N/A			10.4	NC	NC	NC	NC	NC	NC	10.5	10.5	NC
Inorganics													
Total Alkalinity (Total as CaCO3)	mg/L			5.8	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.6	5.5	<5.0
Dissolved Chloride (Cl)	mg/L			6.7	7.2	4.8	6.2	3.4	6.1	4.8	4.8	4.9	5.4
Colour	TCU			160	140	110	73	82	80	150	130	130	180
Nitrate + Nitrite	mg/L			0.091	<0.050	<0.050	0.051	<0.050	<0.050	<0.050	0.064	<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050	<0.050	<0.050	0.082	<0.050	0.14	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L			17	18	8.9	7.0	6.1	6.7	12	12	12	11 (1)
Orthophosphate (P)	mg/L			<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	**6.5-9**	**6-9.5**	5.94	4.96	5.06	5.44	5.77	6.17	6.33	6.36	6.43	6.05
Reactive Silica (SiO2)	mg/L			3.2	3.1	2.4	3.5	1.6	1.5	2.2	2.7	2.6	2.3
Dissolved Sulphate (SO4)	mg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU			1.5	0.74	0.49	0.77	1.0	0.72	0.99	1.0	0.93	0.82
Conductivity	uS/cm			39	35	27	32	19	29	29	30	30	29
Total Suspended Solids				-	-	-	-	-	-	-	-	-	-
Field Parameters													
Temperature	°C			16.03	7.84	4	0.07	2.72	20.69	18.96	20.3	-	-
Conductivity	µS/cm			47	36	28.2	26	20	34	34	-	-	-
Total Dissolved Solids	g/L			0.037	0.037	-	0.033		-	-	-	-	-
Dissolved Oxygen	mg/L	**5.5-9.5(2)**		9.82	12.85	12.34	21.9	15.27	10.89	9.9	-	-	-
pH		**6.5-9**	**6-9.5**	4.90	3.17	4.66	3.68	6.6	5.72	8.04	6.14	-	-

Notes

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(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-9									
Sampling Date				**9-Oct-14**	**13-Nov-14**	**18-Dec-14**	**22-Jan-15**	**29-Apr-15**	**28-May-15**	**30-Jun-15**	**29-Jul-15**	**29-Jul-15**	**24-Aug-15**
Metals	**Units**											SW-1 (DUP)	
Total Aluminum (Al)	ug/L	**5 / 100(1)**		410	330	310	210	160	170	280	260	270	320
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Barium (Ba)	ug/L			6.6	5.7	3.5	3.4	2.1	2.4	3.3	3.4	3.3	4.2
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.024	0.025	0.019	0.010	0.014	<0.010	0.014	<0.010	<0.010	0.015
Total Calcium (Ca)	ug/L			2300	1400	890	1100	640	1100	1700	1800	1900	1700
Total Chromium (Cr)	ug/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0
Total Cobalt (Co)	ug/L			<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		620	500	280	290	220	210	440	490	510	580
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Magnesium (Mg)	ug/L			1100	700	450	530	300	480	740	830	840	810
Total Manganese (Mn)	ug/L			140	75	51	51	36	34	57	56	60	76
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	<0.013	<0.013	<0.013	0.013	<0.013	<0.013	0.013	0.032
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L			<100	<100	<100	<100	<100	<100	150	160	170	160
Total Potassium (K)	ug/L			640	530	340	350	300	270	200	210	240	180
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			4000	3900	2900	3900	2400	3500	3100	3300	3500	3500
Total Strontium (Sr)	ug/L			10	7.7	5.0	5.6	2.8	4.2	5.9	6.5	5.9	6.6
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			4.8	4.1	3.5	2.8	3.1	3.0	3.1	3.6	4.9	4.3
Total Uranium (U)	ug/L	**15**		0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	0.13	0.11
Total Vanadium (V)	ug/L			<2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	5.2	7.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465} * 0.2$ for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

(4) Lead guideline based on sample hardness: lead guideline (µg/L) = $e^{1.273[\ln(hardness)]-4.705}$ for hardness >60 to ≤180 mg/L, or a lower limit of 1 µg/L for hardness <60 mg/L and an upper limit of 7 µg/L for hardness >180 mg/L (see CCME Summary Table).

(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Table 1: General Chemistry

		CCME FAL	MMER	SW-10			
Sampling Date				**30-Jun-15**	**29-Jul-15**	**24-Aug-15**	**24-Aug-15**
Calculated Parameters	**Units**						SW-10 (DUP)
Anion Sum	me/L			0.450	0.580	0.770	0.780
Bicarb. Alkalinity (calc. as CaCO3)	mg/L			8.0	11	25	25
Calculated TDS	mg/L			32	39	55	55
Carb. Alkalinity (calc. as CaCO3)	mg/L			<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L			0.450	0.510	0.960	0.960
Hardness (CaCO3)	mg/L			15	20	30	30
Ion Balance (% Difference)	%			0.00	6.42	11.0	10.3
Langelier Index (@ 20C)	N/A			-3.05	-3.09	-2.67	-2.60
Langelier Index (@ 4C)	N/A			-3.31	-3.35	-2.92	-2.85
Nitrate (N)	mg/L	**2.935**		0.060	0.070	<0.050	<0.050
Saturation pH (@ 20C)	N/A			9.70	9.46	8.91	8.91
Saturation pH (@ 4C)	N/A			9.96	9.71	9.16	9.16
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L			8.0	11	25	25
Dissolved Chloride (Cl)	mg/L			2.9	2.2	2.9	3.1
Colour	TCU			9.4	<5.0	100	110
Nitrate + Nitrite	mg/L			0.060	0.070	<0.050	<0.050
Nitrite (N)	mg/L	**0.06**		<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	**Varies(1)**		<0.050	<0.050	0.10	0.19
Total Organic Carbon (C)	mg/L			2.1	1.8	7.6	7.4
Orthophosphate (P)	mg/L			<0.010	0.012	0.064	0.064
pH	pH	**6.5-9**	**6-9.5**	6.65	6.37	6.24	6.31
Reactive Silica (SiO2)	mg/L			4.7	6.0	7.0	7.0
Dissolved Sulphate (SO4)	mg/L			9.6	14	8.8	8.9
Turbidity	NTU			1.0	<0.10	10	8.3
Conductivity	uS/cm			46	54	75	76
Total Suspended Solids				-	-	-	-
Field Parameters							
Temperature	°C			14.14	17.6	-	-
Conductivity	µS/cm			51	-	-	-
Total Dissolved Solids	g/L			-	-	-	-
Dissolved Oxygen	mg/L	**5.5-9.5(2)**		11.8	-	-	-
pH		**6.5-9**	**6-9.5**	6.55	5.88	-	-

Notes

CCME FAL - Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Freshwater Aquatic Life (provided for reference)

MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Ammonia guideline dependent on temperature and pH, *e.g.* , if T = 10°C, guideline for total ammonia-N varies from 83.88 mg/L at pH = 6.0 to 0.02 mg/L at pH = 10 (see CCME Fact Sheet).

(2) Dissolved oxygen - lowest acceptable concentration ranges from 5.5 mg/L for warm water biota at other life stages to 9.5 mg/L for cold water biota at early life stages (see CCME Summary Table).

- denotes not analyzed

NC = not calculated

Table 2: Metals

		CCME FAL	MMER	SW-10			
Sampling Date				**30-Jun-15**	**29-Jul-16**	**24-Aug-15**	**24-Aug-15**
Metals	**Units**						SW-10 (DUP)
Total Aluminum (Al)	ug/L	**5 / 100(1)**		39	28	220	210
Total Antimony (Sb)	ug/L			<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	**5.0**	**1000**	130	36	380	370
Total Barium (Ba)	ug/L			5.4	7.3	7.1	6.9
Total Beryllium (Be)	ug/L			<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	ug/L			<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	**1500**		<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	**0.04 - 0.37(2)**		0.061	0.10	0.011	<0.010
Total Calcium (Ca)	ug/L			4900	6400	10000	10000
Total Chromium (Cr)	ug/L			<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L			1.8	1.4	2.2	2.3
Total Copper (Cu)	ug/L	**2 - 4(3)**	**600**	3.0	3.6	<2.0	<2.0
Total Iron (Fe)	ug/L	**300**		1400	78	6000	5900
Total Lead (Pb)	ug/L	**1 - 7(4)**	**400**	<0.50	<0.50	1.1	1.2
Total Magnesium (Mg)	ug/L			660	900	1200	1200
Total Manganese (Mn)	ug/L			110	78	290	280
Total Mercury (Hg)	ug/L	**0.026**		<0.013	<0.013	0.025	0.028
Total Molybdenum (Mo)	ug/L	**73**		<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	**25 - 150(5)**	**1000**	7.2	8.7	6.2	6.1
Total Phosphorus (P)	ug/L			140	170	140	140
Total Potassium (K)	ug/L			640	790	1000	1000
Total Selenium (Se)	ug/L	**1**		<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	ug/L	**0.1**		<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L			1900	2100	2500	2400
Total Strontium (Sr)	ug/L			19	26	33	33
Total Thallium (Tl)	ug/L	**0.8**		<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L			<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L			<2.0	<2.0	2.8	2.9
Total Uranium (U)	ug/L	**15**		<0.10	<0.10	0.21	0.20
Total Vanadium (V)	ug/L			<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	**30**	**1000**	13	19	<5.0	<5.0

Notes

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MMER - Federal Metal Mining Effluent Regulations - guidelines shown represent maximum authorized concentrations in a grab sample (provided for reference)

(1) Aluminum guideline dependent on pH. Guideline is 5 ug/L if pH <6.5 and 100 ug/L if pH ≥ 6.5 (see CCME Summary Table).

(2) Cadmium guideline (updated for 2014) (µg/L) = $10^{\{0.83(\log[hardness])-2.46\}}$ for hardness between 17-280 mg/L $CaCO_3$ or a lower limit of 0.04 ug/L for hardness < 17mg/L or an upper limit of 0.37 ug/L for hardness >280 mg/L (see CCME Fact Sheet).

(3) Copper guideline based on sample hardness: copper guideline (µg/L) = $e^{0.8545[\ln(hardness)]-1.465}$ * 0.2 for hardness ≥82 to ≤180 mg/L, or a lower limit of 2 µg/L for hardness <82 mg/L and an upper limit of 4 µg/L for hardness >180 mg/L (see CCME Summary Table).

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(5) Nickel guideline based on sample hardness: nickel guideline (µg/L) = $e^{0.76[\ln(hardness)]+1.06}$ for hardness >60 to ≤180 mg/L, or a lower limit of 25 µg/L for hardness <60 mg/L and an upper limit of 150 µg/L for hardness >180 mg/L (see CCME Summary Table).

- denotes not analyzed

Appendix D
Surface Water Baseline Analytical Results

Table 1: Metals

		CCME ISQG	CCME PEL	21-Jul-16								
Sampling Location				**SED1**	**SED2**	**SED3**	**SED4**	**SED5**	**SED6**	**SED7**	**SED8**	**SED9**
Metals	**Units**											
Total Aluminum (Al)	mg/kg			15000	8800	18000	20000	22000	18000	18000	2600	12000
Total Antimony (Sb)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	mg/kg	**5.9**	**17**	78	110	73	58	41	400	300	<2.0	5.1
Total Barium (Ba)	mg/kg			69.0	24.0	32.0	28.0	61.0	29.0	32.0	7.5	36.0
Total Beryllium (Be)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	mg/kg			<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	mg/kg	**0.6**	3.5	<0.30	<0.30	<0.30	<0.30	1.8	<0.30	<0.30	<0.30	<0.30
Total Chromium (Cr)	mg/kg	**37.3**	90	23	12	26	25	23	23	25	4.7	16
Total Cobalt (Co)	mg/kg			7	3.1	8	18	6.2	17	15	<1.0	2.9
Total Copper (Cu)	mg/kg	**35.7**	**197**	12	4.5	6.6	15	56	9.2	14	2.2	8.7
Total Iron (Fe)	mg/kg			28000	11000	34000	35000	12000	36000	28000	2400	6300
Total Lead (Pb)	mg/kg	**35**	**91.3**	7.8	7.2	13	23	12	26	9.6	13.00	24
Lithium	mg/kg			40	18	28	37	34	23	40	<2.0	12
Total Manganese (Mn)	mg/kg			420	200	420	1000	200	670	690	40	160
Total Mercury (Hg)	mg/kg	**0.17**	0.486	0.014	0.027	0.31	0.1	0.077	0.04	0.015	0.088	0.13
Total Molybdenum (Mo)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	mg/kg			16	8.8	15	16	30.0	12	19	2.5	6.5
Rubidium	mg/kg			12	6.0	16.0	8.1	6.3	11	15	3	9
Total Selenium (Se)	mg/kg			<1.0	<1.0	<1.0	<1.0	3.7	<1.0	<1.0	<1.0	1.7
Total Silver (Ag)	mg/kg			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Strontium (Sr)	mg/kg			5.9	8.2	<5.0	6.5	21.0	<5.0	6.7	<5.0	7.7
Total Thallium (Tl)	mg/kg			<0.10	<0.10	0.14	0.21	0.14	0.18	0.12	<0.10	0.18
Total Tin (Sn)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium (U)	mg/kg			0.77	0.43	0.44	0.66	3.4	0.61	0.69	0.32	1.2
Total Vanadium (V)	mg/kg			24	12	35	31	22	42	27	3.5	17
Total Zinc (Zn)	mg/kg	**123**	**315**	49.0	29.0	55.0	63.0	89	54.0	53.0	<5.0	21

Notes

CCME ISQG - Canadian Council of Ministers of the Environment, Interim Sediment Quality Guidelines

CCME PEL - Canadian Council of Ministers of the Environment, Probable Effects Level

Appendix E
Hydrogeological Reports

SEABRIGHT RESOURCES INC.

HYDROGEOLOGICAL INVESTIGATION
BEAVER DAM MINE

PROJECT NO. M1289

Jacques, Whitford and Associates Limited

1046 Barrington Street
Halifax, Nova Scotia
B3H 2R1

Tel: (902) 423-6325
Telex: 019-21745

Site Investigations, Blasting Control, Materials, Mining, Hydrogeology, Earthworks, Foundations, Environmental

Sydney, N.S.
Charlottetown, P.E.I.
Saint John, N.B.
Fredericton, N.B.
Bathurst, N.B.
Moncton, N.B.
St. John's, Nfld

July 30, 1986
Project No. M1289

Seabright Resources Inc.
Suite 301, 6100 Young Street
Halifax, Nova Scotia

Attention: Mr. P. Keohane, P.Eng.

Dear Sir:

Re: Hydrogeological Study Report - Beaver Dam Mine

Please find enclosed four copies of the above report. This report outlines the results of three separate hydrogeologic studies at the Beaver Dam site:

- Packer Injection Study
- Austin Shaft Dewatering Program
- Groundwater Exploration Program

Please contact either myself or Suther A. Yuill, P.Eng. at this office should you have any questions regarding the enclosed.

Sincerely yours,

JACQUES, WHITFORD & ASSOCIATES LTD.

<Original signed by>

for David S. MacFarlane, M.Sc.

DSM/sd

Consulting Engineers

PROJECT NO. M1289

HYDROGEOLOGICAL INVESTIGATION

PREPARED FOR

SEABRIGHT RESOURCES INC.
BEAVER DAM MINE
HALIFAX COUNTY, N.S.

BY

JACQUES, WHITFORD & ASSOCIATES LTD.

Halifax, Nova Scotia July 22, 1986

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1.0 INTRODUCTION

1.1 Purpose

At the request of Seabright Resource Inc., Jacques, Whitford and Associates Limited has undertaken a series of field studies at the site of the proposed Beaver Dam Gold Mine. The primary purpose of the work was to obtain site-specific hydrogeologic information sufficient to provide a preliminary prediction of groundwater inflows and mine water quality prior to the construction of the new mine portal. Secondary objectives were to evaluate the feasibility of developing groundwater resources for both mine process and potable uses.

1.2 Location

The Beaver Dam gold mine is located approximately 80 km northeast of the City of Halifax, 55 km southeast of Truro, and 70 km from the Gays River milling facility (Figure 1.1). Access to the site is via a 6 km Nova Scotia Department of Transportation haulage road (Beaver Dam Road), off of Route 224 which connects the Villages of Sheet Harbour and Upper Musquodoboit (Figure 1.1). Upgrading of the mine access road is currently underway. The mine site is located adjacent to the Killag River which lies within the watershed of the West Branch Sheet Harbour River which has a total drainage area of about 300 km^2.

1.3 Report Organization

The field investigations were carried out in three phases between May 6, 1986 and July 12, 1986. Section 2.0 outlines the results of a packer injection program conducted on selected exploration boreholes for the Beaver Dam site. The packer testing program was designed to determine the range of hydraulic conductivity values associated with the various rock types and structures comprising the Beaver Dam ore zones. An estimation of mine inflow rates for sizing of pumps is made based on the range of hydraulic conductivity observed.

Section 3.0 outlines the results of a comprehensive pump test and water quality monitoring program conducted on the existing Austin Mine workings. Analysis of time-drawdown data provide an assessment of the bulk hydraulic properties of the shallow (0-22 m) bedrock zones. The continuous, on-site monitoring of water quality provides on assessment of the expected mine effluent quality from the new mine. Monitoring of water level elevations in diamond drill holes distributed across the proposed mine site was carried out during the shaft dewatering to determine the extent of hydraulic response across the Beaver Dam Mine Site.

Section 4.0 outlines a groundwater exploration program conducted on behalf of Seabright Resources Inc. Test pitting was carried out to determine the feasibility of infiltration gallery construction at Crusher Lake, and pipeline construction from Crusher Lake to the mine. One test well was constructed and pump tested to determine the hydraulic properties of the glacial till overburden, and the feasibility of dug well water supplies.

Section 5.0 is a summary of the findings of the various studies, and their implications on the proposed new mine.

Section 6.0 includes recommendations for monitoring of groundwater quantity and quality during mine construction.

1.4 Previous Studies

Very little previous information regarding groundwater flows in the Beaver Dam area is available. A discussion of the regional hydrogeology of the area is presented in Jacques, Whitford and Associates Limited (1986) Environmental Assessment of the Beaver Dam Mine Site, and is included in Appendix 1 for reference purposes.

2.0 PACKER TESTING PROGRAM

2.1 Purpose

Due to the remote location of the Beaver Dam mine site, and the lack of any previous hydrogeological evaluation in the mine area, there were some concerns regarding the volumes of groundwater which may be generated by a mine in the area. Of particular concern was the possibility of groundwater inflows to the mine excavation from the major fault zones in the area such as Mud Lake Fault, from thick deposits of saturated sand and gravel overlying portions of the area, and from existing mine workings such as the Austin Shaft.

The flow of water into the proposed Beaver Dam Mine workings will be dependant on the degree of secondary permeability of the quartzite bedrock. Groundwater transmission in crystalline bedrock in Nova Scotia is governed by the frequency, orientation and aperture of the fracture joints and faults developed in the bedrock. Two methods of evaluating the hydraulic characteristics of fractured rock are commonly used; large scale pumping tests, and packer injection testing. Pumping tests provide the best assessment of the bulk hydraulic characteristics of the overall rock mass surrounding a mine site, however, such investigations are generally extremely expensive and time consuming, requiring several deep vertical drilled wells and observation wells to render reliable results. Packer testing can provide a good statistical determination of the range and variation of hydraulic conductivity provided sufficient measurements are made.

At the Beaver Dam Mine site, the presence of more than 90 exploration diamond drill holes at various attitudes, and the resultant good understanding of the structural geology of the area provided by the geologic logs, allowed the design of a packer injection testing program sufficient in scope to evaluate the hydraulic properties of the various structures and rock types associated with the new mine.

Preliminary discussions with Seabright Resources geologic personnel, and examination of diamond drill geologic logs and vertical cross-sections, led to the selection of 16 diamond drill holes that should yield good, representative packer test results. The criteria used to choose the holes include:

(i) the holes should be as vertical as possible to minimize possible equipment problems, and to allow closer correlation between measured groundwater levels and acting hydraulic head at each packer test location.

(ii) the holes should intersect the primary zones of interest, i.e. the Mud Lake Fault Zone; the ore zone, both deep and shallow; the axis of the Beaverdam anticline; and representative zones of the three main rock types, grey-wacke, argillite and quartzite.

2.2 Method

Field work was carried out during the period of June 5 to June 15, 1986. Of the sixteen holes chosen, packer tests were carried out in nine holes. Five holes were found to be blocked at various depths and no tests were done. In total, 56 packer tests were performed over a period of 8 days.

The packer test equipment consisted of two, one metre-long inflatable packers, connected by a 4.5 m perforated pipe. A small diameter line connected the packers to a source of nitrogen gas at the surface, which was used to inflate the packers and seal the zone between them. The perforated pipe was connected to a high pressure hose line which also ran to the surface. The hose line was connected, through a flow meter and pressure gauge, to a pump. The entire packer apparatus was raised and lowered by a wireline winch system.

The wireline cable was marked in order to determine testing depths. The hose line underwent a certain amount of stretching and thus, would not have been reliable for depth measurements. All hose line connections were pressure tested to ensure that leakage was not taking place. The use of the high pressure hose resulted in superior packer testing results, than would have been the case with the usual E-Rod methods.

The following testing procedure was employed: The packer apparatus was lowered to the required testing depth, and a nitrogen pressure of 300 psi was applied to the packer. After a short wait of approximately 2 minutes, to ensure that the packers had inflated and there were no leaks in the nitrogen line, the pump was started, and water was allowed to flow into the packered zone, at an initial pressure of 25 psi above hydraulic head at that point. This pressure was maintained and the amount of flow recorded every minute until a steady state condition was reached. The water pressure was then sequentially increased to 50 psi and 90 psi, and similar measurements were taken at those pressures. On completion of the testing, the nitrogen pressure was released. When the packers had deflated, the apparatus could be located at the next testing depth. The wireline-winch packer apparatus devised for this study provided an efficient and cost-effective method of testing inclined boreholes.

The tested intervals for each hole are listed on Table 2.1. Hydraulic conductivities (K) were calculated at each pressure level, and the geometric means of the results at each testing interval are given in Table 2.2. Geometric means are considered most appropriate for log-normally distributed hydraulic conductivity data. Figure 2.1 illustrates a typical cross-section through the Beaver Dam Anticline in the vicinity of the portal area and also shows the distribution of packered zones.

2.3 Discussion of Results

Hydraulic conductivities ranged from 1.0×10^{-6} m/sec to 3.7×10^{-10} m/sec, with an overall geometric mean of 2.7×10^{-8} m/sec. The three different rock types had the following geometric mean hydraulic conductivities: argillite, 8.2×10^{-9} m/sec; greywacke, 4.8×10^{-8} m/sec.; quartzite, 2.0×10^{-7} m/sec. Tests conducted in the Mud Lake Fault Zone indicated a mean K of 2.3×10^{-8} m/sec. The mean hydraulic conductivity along the Beaver Dam Anticlinal axis was 9.1×10^{-7} m/sec.

FIGURE 2.1 Typical Geologic Cross - Section (0 + 75 W) Illustrating the Location of Packer Injection Zones. Hydraulic Conductivity Values in m/sec.

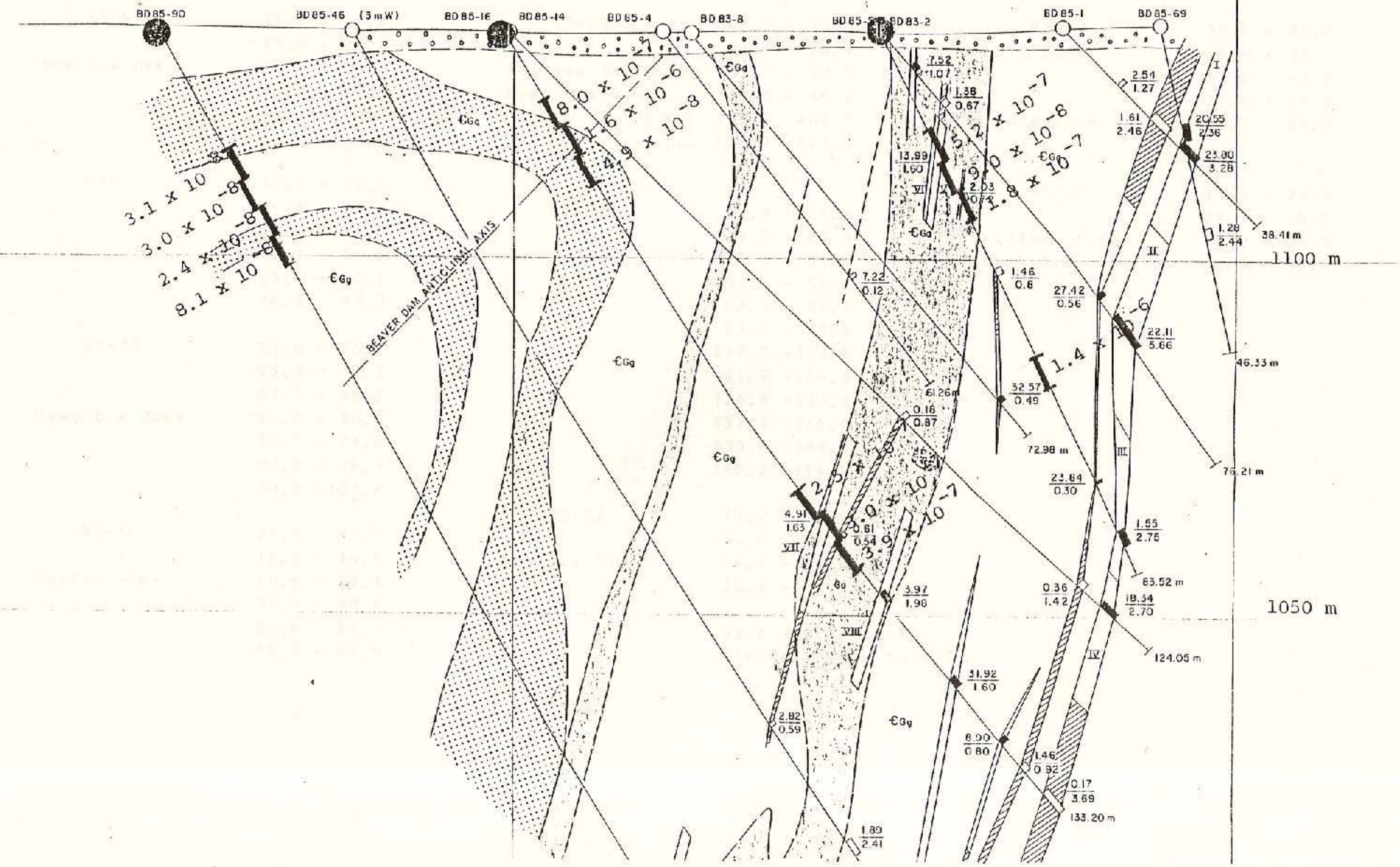


TABLE 2.1: PACKER TESTING INTERVALS

Diamond Drill Hole	Tested Interval (m)
85-5	15.2 - 19.8
	19.8 - 24.4
Shallow Ore	24.4 - 29.0
	50.3 - 54.9 hole blocked below 55m
85-7	15.2 - 19.8
	19.8 - 24.4
	24.4 - 29.0
Faulted Zone	56.4 - 61.0
	65.5 - 70.1
	88.4 - 93.0
85-13	21.6 - 26.2
	25.9 - 30.5
	81.7 - 86.3
Deep Ore Zone	86.0 - 90.6
	90.2 - 94.8
	94.5 - 99.1
	98.8 -103.4
85-16	10.6 - 15.2
	15.2 - 19.8
Portal Area	19.8 - 24.4
	76.2 - 80.8
	80.8 - 85.3
	85.3 - 89.9

Diamond Drill Hole	Tested Inverval (m)
85-29	13.7 - 18.3
	24.1 - 28.7
Shallow Anticline	33.5 - 38.1
Deep Ore	39.6 - 44.2
	102.1 -106.7
	106.7 -111.3
85 -43	19.8 - 24.4
	24.4 - 29.0
Anticline	47.2 - 51.8
	51.8 - 56.4
	62.5 - 67.1
	67.1 - 71.6
	117.3 -121.9
	121.9 -126.5
	126.5 -131.1
	131.1 -135.6
	135.6 -140.2
	140.2 -144.8
85-82	15.2 - 19.8
	19.8 - 24.4
Shallow Fault	24.4 - 29.0
	30.5 - 35.1
	41.1 - 45.7
	45.7 - 50.3* hole blocked below 52 m

Diamond Drill Hole	Tested Interval (m)
85-83	39.6 - 44.2
Fault Zone	48.8 - 53.3
	57.9 - 62.5
	71.6 - 76.2
Mineralized	80.8 - 85.3
85-90	19.8 - 24.4
	24.4 - 29.0
Shallow Broken	29.0 - 33.5
Quartzite	33.5 - 38.1

TABLE 2.2: HYDRAULIC CONDUCTIVITIES

Diamond Drill Hole	Depth (m)	K (m/sec)	D.D.H	Depth (m)	K (m/sec)	D.D.H.	Depth (mm)	K (m/sec)
85-5	15.2 - 19.8	5.2×10^{-7}	85-29	13.7 - 18.3	4.7×10^{-7}	85-83	39.6 - 44.2	1.5×10^{-8}
	19.8 - 24.4	9.0×10^{-8}		24.1 - 28.7	9.9×10^{-8}		48.3 - 53.3	1.0×10^{-8}
	24.4 - 29.0	1.8×10^{-7}		33.5 - 38.1	9.4×10^{-7}		57.9 - 62.5	1.2×10^{-9}
	50.3 - 54.9	1.4×10^{-6}		39.6 - 44.2	9.0×10^{-8}		71.6 - 76.2	7.1×10^{-9}
				102.1 -106.7	4.9×10^{-8}		80.8 - 85.3	2.7×10^{-8}
85-7	15.2 - 19.8	4.7×10^{-8}		106.7 -111.3	1.6×10^{-8}			
	19.8 - 24.4	1.1×10^{-8}				85-90	19.8 - 24.4	3.1×10^{-8}
	24.4 - 29.0	8.4×10^{-7}	85-43	19.8 - 24.4	8.3×10^{-9}		24.4 - 29.0	3.0×10^{-8}
	56.4 - 61.0	2.0×10^{-9}		24.4 - 29.0	2.6×10^{-8}		29.0 - 33.5	2.4×10^{-8}
	65.5 - 70.1	5.4×10^{-7}		47.2 - 51.8	1.0×10^{-6}		33.5 - 38.1	8.1×10^{-8}
	88.4 - 93.0	3.0×10^{-8}		51.8 - 56.4	2.3×10^{-7}			
				62.5 - 67.1	2.7×10^{-9}			
	21.6 - 26.2	2.0×10^{-8}		67.1 - 71.6	3.4×10^{-9}			
	25.9 - 30.5	2.4×10^{-8}		117.3 -121.9	1.0×10^{-9}			
	81.7 - 86.3	5.8×10^{-8}		121.9 -126.5	7.6×10^{-10}			
	86.0 - 90.6	4.1×10^{-8}		126.5 -131.1	2.6×10^{-9}			
	90.2 - 94.8	2.8×10^{-8}		131.1 -135.6	1.6×10^{-9}			
	94.5 - 99.1	2.5×10^{-8}		135.6 -140.2	5.5×10^{-10}			
	98.8 -103.4	4.3×10^{-8}		140.2 -144.8	3.7×10^{-10}			
85-16	10.6 - 15.2	8.0×10^{-7}	85-82	15.2 - 19.8	3.6×10^{-8}			
	15.2 - 19.8	1.6×10^{-6}		19.8 - 24.4	1.1×10^{-6}			
	19.8 - 24.4	4.9×10^{-8}		24.4 - 29.6	1.9×10^{-6}			
	76.2 - 80.8	2.5×10^{-7}		30.5 - 35.1	8.0×10^{-7}			
	80.8 - 85.3	3.0×10^{-7}		41.1 - 45.7	6.1×10^{-7}			
	85.3 - 89.9	3.9×10^{-7}		45.7 - 50.3	4.6×10^{-7}			

TABLE 2.3: INFLOW RATES

Level	Tunnel Length (m)	Hydraulic Conductivity (m/sec)	Inflow Rate (l/s [igpm])
1125	615	5.0×10^{-7}	4.9 [65.0]
1100	590	1.0×10^{-7}	0.9 [12.5]
1075	595	1.0×10^{-8}	0.1 [1.5]
1050	555	5.0×10^{-8}	0.4 [6.0]
		TOTAL	6.3 [85.0]

The testing program has demonstrated that, with the exception of shallow bedrock zones and the anticline axis, the bedrock at Beaver Dam Mine is considered to be relatively tight. This likely accounts for the poor water well yields reported for the Guysborough county area southeast of the site. Hydraulic conductivity generally decrease with depth, as would be expected, and tends to be lower in the mineralized argillite and quartzite zones then in the quartzite host rock. The higher bedrock permeabilities associated with the anticline axis (range 1.1 x 10^{-6} m/s to 4.7 x 10^{-7} m/s) are associated with the increased fracturing and deformation in the core of the overturned anticline fold. Hydraulic conductivity can be expected to be higher on the southern limb where bedding is more or less vertical.

Testing has shown that the hydraulic conductivity of the Mud Lake Fault zone is relatively low (mean 2 x 10^{-8} m/s) ranging from 1.1 x 10^{-6} m/s near ground surface at borehole 85-82 to 1.2 x 10^{-9} m/s) at 60 m depth at borehole 85-83. This is likely due to the presence of clay-like gouge materials which would tend to fill fractures and block groundwater flow. The Seabright Resources Geologist's log's describe the material as highly brecciated, very broken quartzite containing black graphite gouge material with poor core recoveries. The boreholes, as a result, were often unstable and tended to deform or cave in the fault areas. Several of the holes originally selected for packer testing (62, 5, 82) were found to be blocked at various depths.

It is concluded from the above, that the Mud Lake Fault zone will not likely be a major source of groundwater inflow to the mine. It should be noted, however, that the fault zones are saturated, and could be very unstable and would require special consideration should mining penetrate such rock materials.

The ore zones tend to exhibit the lowest values of hydraulic conductivity (geometric mean 1.5 x 10^{-8} m/s, range 5 x 10^{-7} m/s to 3.7 x 10^{-10} m/s). This is likely due to the presence of abundant quartzite veins and mineralized fill material in the rock fractures. Permeability appears to decrease with depth (K 10^{-10} m/s, borehole 85-43, 85-16). This suggests that the mine zones should be relatively "dry", with the majority of groundwater inflows occurring at shallower levels and via major joints in the bedrock.

Borehole 85-16 is located on the baseline at 0 + 75 m west, and penetrates the shallow bedrock zone where the mine portal will be constructed. Bedrock permeability inferred from the packer testing (Table 2) ranges from 1.6 x 10^{-6} m for a fractured quarzite zone about 13 to 14 meters in depth, to 5.0 x 10^{-10} m/s, averaging 3.5 x 10^{-7} m/s for the upper 78 m of bedrock at the portal location. This suggests that no large groundwater flow would be expected from bedrock in the immediate area of the portal. The most likely source of inflow would be from the overlying glacial tills (estimated K = 2 x 10^{-5} m/s from pump test of test hole # 1) and possibly from an old mine shaft found during portal preparation work approximately 50 meters to the north. The shaft was pumped out by Seabright personnel to a depth of 4.6 m (5.5 m to bottom) and exhibited a very slow recovery, confirming the above predictions. The dewatering of Austin Shaft 100 m to the east, (Section 3.0) with an estimated k of 9 x 10^{-7} m/s exhurted a low flow rate in the order of 3 L/S (40 igpm).

2.4 Calculation of Mine Inflow

In order to calculate the quantity of water inflow that might be expected into the mine workings, several assumptions were made. It was assumed that the hydraulic gradient at every point was equal to one. This is the worst case, and in practice the gradient will likely be somewhat less than one, especially after long time period when dewatering of the overlying rock mass has been achieved.

Actual gradients, however, could not be determined with the existing inclined borehole setups. It was also assumed that seepage would be occurring through all faces of the tunnels, (i.e. roof, floor and walls). Although it is acknowledged that most flow will be via individual fractures, the scale of the mine is large enough that sufficient fracture interconnectivity should occur to result in a hydraulic continuity around the mined area.

Plans of initial workings at four levels, 1125, 1100, 1075 and 1050 were measured to estimate exposed tunnel surface areas, assuming 4 m square tunnels. The average hydraulic conductivities at each level were used. Table 3 gives the measured tunnel lengths, hydraulic conductivities used, and calculated inflow rates.

The total calculated inflow into the tunnels at four levels, 6.3 l/s (85 igpm), may be affected by ore seam workings, fractures not encountered in the packer testing program and fluctuations in groundwater levels, but the calculated value should be representative of average conditions.

A projected mine inflow rate in the order of 100 igpm is considered reasonable for this area. Pump testing of the existing Austin Shaft supports this conclusion with an average inflow of 40 igpm at the 22 m level. Mine discharge rates of 50 igpm and 230 igpm were estimated for the Lake and Holman shafts respectively at nearby Caribou mine (NSDOE Files). During initial portal construction, flow rates may reach or exceed this projection due to inflow from the shallow overburden aquifer or surface water, but rates should decline once the incline portal has been stabilized. During mining, it is possible to encounter sudden groundwater flows from individual fractures, however, such flows should be short term as the fracture is dewatered.

2.5 Summary

A total of 56 determinations of bedrock permeability from 9 inclined exploration boreholes represent the range of hydraulic conductivity variation expected for the various rock types and structures associated with the Beaver Dam Mine. Bedrock hydraulic conductivity averaged 3×10^{-8} m/s for the site, ranging from 1×10^{-6} m/s to 4×10^{-10} m/s. The highest values were found to be associated with the anticline axis and the lowest values were associated with the deep ore zones. The Mud Lake Fault zone was found to have a low K, and the portal area was also found to be relatively tight.

In conclusion, no anomalous water-bearing fracture zones were detected by this packer program. For the exploration portal, an estimated mine inflow rate in the order of 6.3 L/S (85 igpm) is calculated. Full scale mining should be less than 15 L/S (200 ipgm). Dewatering testing conducted on the nearby Austin Shaft suport these predictions.

Pump sizing should therefore be capable of handling both the inflow water and process water used for drilling (est. 3-8 L/S (50 igpm). Some recycling of process water may be feasible within the mine.

3.0 AUSTIN SHAFT PUMP TEST AND GEOCHEMICAL EVALUATION

3.1 Purpose

A comprehensive geochemical monitoring program was conducted concurrent with a dewatering test of the existing Austin Mine workings located approximately 150 meters east of the proposed new mine portal. The primary purpose of the dewatering program was to provide additional site-specific hydrogeologic and groundwater quality information for the prediction and assessment of mine pumping requirements and effluent chemical quality for the new gold mine. The specific objectives of the study were to:

- Assess the bulk hydraulic properties of the shallow bedrock zone (0 - 22 m depth) as an aid in predicting mine inflow for the new mine.

- Evaluate water quality characteristics during pumping of the workings, with particular attention to geochemical variations during drawdown.

- To determine the degree of fracture continuity across the Beaver Dam mine site by monitoring drawdown response in available diamond drill holes during pumping of Austin Shaft.

A secondary purpose, was to allow Seabright geologists an opportunity to examine the old workings.

3.2 Method

A high capacity, 40 hp submersible turbine pump was installed to a depth of 22 m in the Austin Mine shaft by R. Hopper Well Drilling Limited. Discharge was controlled by an orifice plate and discharge water was directed to a waste rock pile adjacent to a large swamp area. Drawdown was monitored with an electric tape in a drop tube strapped to the pump riser pipe. A valve and flow-through cell were connected to the discharge pipe to facilitate water quality monitoring and sample collection.

Pumping began on June 18, 1986 at 1330 hours at a discharge rate of 500 igpm. Drawdown, ph, dissolved oxygen, temperature and electrical conductance were monitored for a total of 16 hours until drawdown reached the top of the pump bowls (20.5 m). Pumping was terminated at 0535 hours June 19, 1986 and recovery was monitored for 7 hours. The pump was again turned on, for approximately 1.5 hours until water level again reached the top of the pump. The mine was then allowed to recover for a period of two weeks.

Because the initial pump could only dewater the mine to within 1.5 meters of the bottom, a second 30 hp centrifugal pump was acquired and installed in the well on July 8, 1986. The larger submersible pump was started on July 8, 1986 at 1350 hours at a pumping rate of 480 ipgm. The pump was shut down for 6 hours to observe recovery trends, and then restarted. Drawdown and water quality were monitored in a similar manner to test #1. When the large pump broke suction on July 9, 1986 at 1440 hours at 20.8 m after a total of 14 hours of pumping, the smaller centrifugal pump was started at a rate of 166 igpm until it broke suction at 1130 hours, July 10, 1986 at about 21.6 m depth. The initial 10 minutes of pumping after start-up of the second pump produced slightly turbid water due to pump turbulance, however, this quickly shifted to a colorless, ordorless discharge throughout the remainder of the test.

Pumping rate dropped to approximately 38 igpm and remained stable for the final 7 hours of the test. A steady-state flow rate of 38 igpm was measured for the Austin shaft at 21.6 m of depth. Time drawdown data and plots are presented in Appendix 2.

During the mine dewatering, continuous monitoring of water quality was maintained, and selected samples were sent to the Environmental chemistry laboratory for analysis of metals and major ions. Field monitoring of ph, temperature, dissolved oxygen and electrical conductance were performed in a flow-through cell specially devised for this project. This device prevented the rapid degassing of the mine water and prevented contact with the atmosphere, resulting in more reliable measurement of these sensitive parameters. Samples subjected to metal analysis were field preserved with nitric acid in test # 1, and unpreserved in test #2.

Appendix 2 contains drawdown and recovery data and time-drawdown plots for the two pump tests. The results of laboratory analysis and field analysis of water quality for the two pumping tests are presented on Tables 3.1 to 3.3. A summary of available groundwater quality data for the Beaver Dam site is presented on Table 3.4. The orientation of Austin Shaft and diamond drill holes monitored during the test are shown on Figure 1.2.

3.3 Discussion of Results

Time drawdown data for the two dewatering tests were very similar (Appendix 1). At a pumping rate of 480 to 500 igpm, an average drawdown of 192 cm/hr (1.5 inches/min) was observed until water level reached the top of the drift where drawdown decreased to approximately 13 cm/hr as the workings were dewatered. In test #2, when the centrigugal pump was in operation at a rate of 167 igpm, drawdown continued from 20.8 m to suction break at approximately 21.8 m at a rate of about 5 cm/hr, accelerating over the last 0.3 m due to depression-dewatering around the pump. In both tests, the Austin shaft exhibited a consistant recovery rate of 2.5 cm/hr (1"/hr) within the workings, accelerating to about 5 cm/hr within the shaft. It took approximately 2 weeks for full recovery to occur after test #1. The faster drawdown rate exhibited during pump test #2 may be due to a combination of distance-dewatering effects (incomplete recovery), low permeability of the bedrock, lack of rainfall, and lower mean static water level (1.2 cm lower than the June 18 test).

When drawdown reached the bottom of the pump at 21.8 m below shaft collar, the discharge decreased to a steady-state pumping rate of 3 L/S (38 igpm) throughout the final 7 hours of testing. The discharge remained clear, and no evidence of excessive turbidity was observed. Minutes prior to the drop in discharge rate, increasing amounts of clean bark chips and wood debris were observed in the flow-through cell, which signalled that drawdown was approaching the intake screen. The water remained clear and odor-free over the last few hours of pumping.

An empirical estimate of mine water volume 2273 m^3 (0.5 MIG) was made based on the assumption of 2300 m^3 (625,000 imp gal) water pumped and 3 L/S (40 igpm) mine inflow rate. Assuming a 40 igpm steady state flow rate, a bulk apparent transmissivity of 18.7 $m^3/d/m$ (1253 igpd/ft) is estimated assuming a tunnel length of 425 m (from mapping supplied by Seabright Inc.) and an average drift size of 2 m square. This suggests a hydraulic conductivity in the order of 9 x 10^{-5} cm/s, for the upper 22 m of bedrock in this area.

The Austin Shaft, containing approximately 2300 m^3 of water, exhibits a steady shaft pumping rate of 3 L/S (38 igpm). This value is lower than estimates of steady state discharge rates reported from the nearby Caribou Gold Mine (NSDOE, 1983). The Holman Shaft containing 45,500 m^3 of water was pumped at a rate of 17.4 LS (230 igpm) and the Lake Shaft containing 25,000 m^3 of water was pumped at 3.8 L/S (50 igpm).

To assess the impact of the Austin Shaft on the proposed portal, and to determine the area affected by the mine dewatering, several of the existing diamond drill holes were monitored periodically during the dewatering operation. (Table 3.5). Drawdown distribution in various boreholes during both tests showed that there is hydraulic continuity over a large area of the mine site. The greatest drawdowns were observed in the area bounded by lines 0 + 25 E and 0 + 75 E, which is underlain by the Austin workings. Drawdowns of greater than 12.2 m (40 ft) were observed at boreholes 52 and 59, which are believed to penetrate the northern extensions of the Austin workings. Running water could be heard at borehole 52. Several of the boreholes immediately adjacent to the Austin workings (83-71, 85-2, 85-3) were dry to depths greater than 7.6 m. Drawdowns of up to 1 m were observed as far west as BD-85-18, and 85-1 in the vicinity of the proposed portal (0 + 75E). It is possible that some of these inclined boreholes may encounter un-mapped workings along the Austin Seam (Figure 1.2). The majority of the boreholes west of line 0 + 50E exhibited minor or no water level response during testing. Because all of the observation holes are inclined at attitudes of 45° to 70°, further assessment of bedrock hydraulic properties is not practical.

It is concluded from the above, that there is a fair to moderate degree of fracture continuity along the Austin Seam, and in shallow bedrock surrounding the Austin Shaft. It is likely that due to the existing natural fracture distribution, and due to blasting of new mine workings, that long term dewatering of mined workings will influence other boreholes at distances exceeding 100 m, and the new mine, in time, would likely dewater the Austin Shaft.

Water Quality

Water quality during the pumping tests remained relatively steady (pH 6.8; D.O. 2.2 ppm; conductance 82 mS; temperature 5.3 °C) until drawdown entered the mine workings. (Tables 3.1 to 3.3). When drawdown reached 1.5 meters from the bottom, the dissolved oxygen content began to rise to about 3.0 ppm (test #1) and 5.0 ppm (test #2) due to uptake of oxygen in the mine shaft. When drawdown broke suction at 21.8 m depth, the dissolved oxygen increased dramatically due to aeration at the pump intake. This was accompanied by a rise in pH as degassing of dissovled CO_2 gas occurred. A laboratory experiment conducted on a preseved water sample exhibited a similar rise in pH from 6.51 to 7.3 after 2 days of exposure to the air. This suggests that mine effluent waters should be of neutral pH and that mine waters are likely saturated with respect to calcite derived from the bedrock.

Throughout the pumping there was continual increase in major ions, TDS (43 to 83 ppm), hardness (28-45 mg/L), pH (6.4-7.4) alkalinity (24-56 mg/L, silica (5.2-9.5 mg/L), suspended solids (0.3 - 7.3 mg/l) and metals such as arsenic (0.04 - 0.17 mg/L); iron (0.32 - 2.6 mg/L), manganese (0.3 - 0.38 mg/L), and a drop in concentration of nitrate (0.13 to (0.05 ppm).

Water Samples

X	Austin Shaft May 6/86, t = 0
1	Austin Shaft June 18/86, t = 1 hr
2	Austin Shaft June 18/86, t =16 hr
3	Austin Shaft June 19/86, t =23 hr
4	Austin Shaft July 10/86, t =52 hr
L	Crusher Lake June 13/86
B	Borehole 86-47 June 13/86
D	Dug Well June 26/86

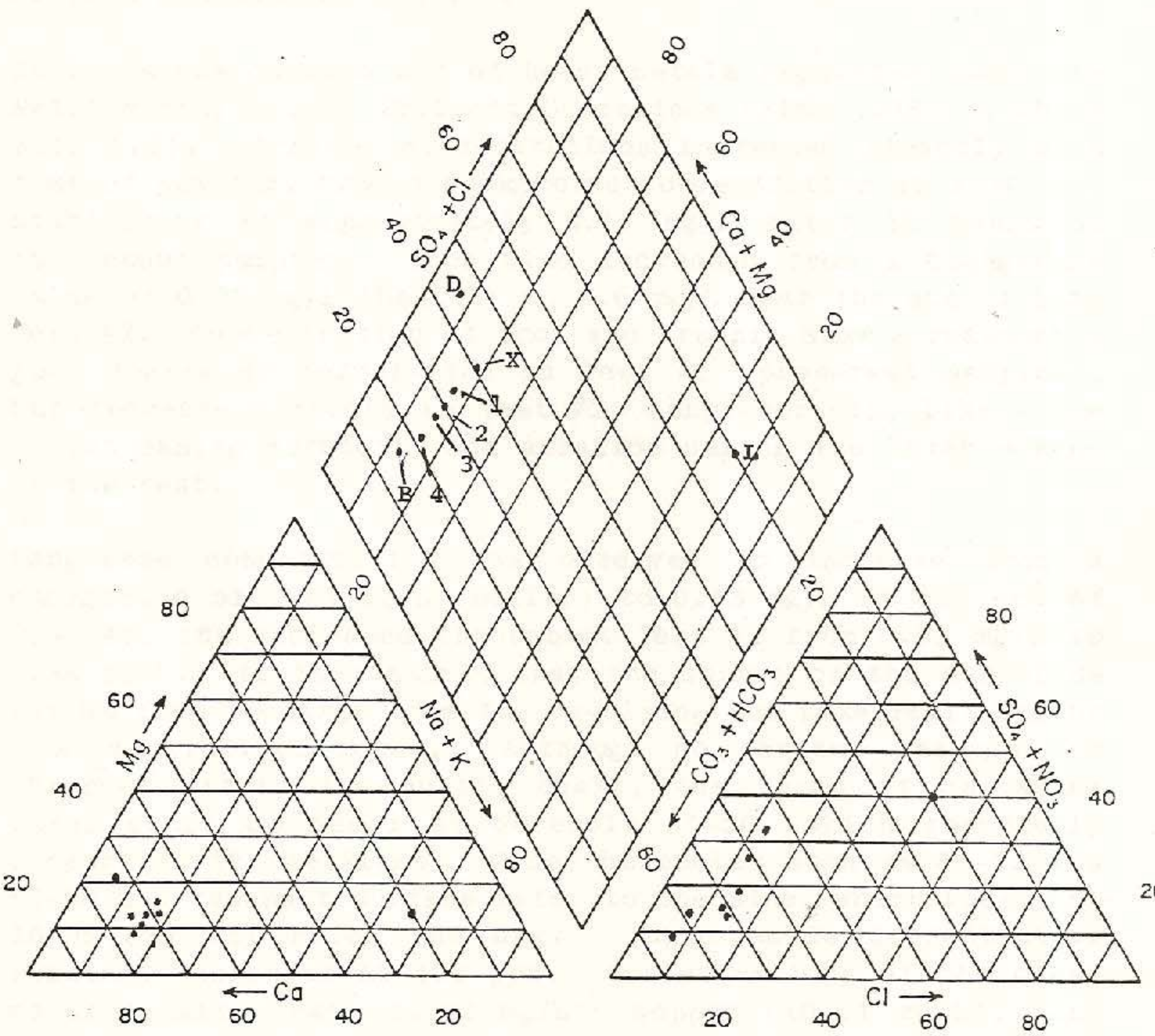


FIGURE 3.1 Distribution of Major Ions, Water Quality Samples Seabright Resources Inc. Beaver Dam Mine, 1986.

It is apparent that, from the unpumped sample bailed from the shaft May 6, 1982, through the two pump tests, the chemistry of the Austin Shaft water is approaching that of natural deep groundwater as exhibited at diamond drill hole 86-47 (Table 3.4). This is illustrated graphically in Figure 3.1 which shows the linear trend in groundwater chemistry towards that of deep groundwater (B). Borehole 86-47 is a flowing artesian well which was pumped several times for drilling water, and is therefore, considered resprentative of the deep bedrock groundwater quality.

Analysis was carried out of heavy metals regulated under the Metal Mining Liquid Effluent Guidelines (EPS, 1978), (Tables 3.1, 3.2). Arsenic concentrations increased steadily with time of pumping, from a background concentration of 0.04 mg/L stabilizing at approximately 0.17 mg/L after 16 hours of continuous pumping. Iron also increased from a background value of 0.32 mg/L (bailed) to 2.6 mg/L near the end of pump Test #2. Concentration of iron and arsenic show a reasonably good degree of correlation in Test #1 (preserved samples), but decrease markedly in Test #2, (unpreserved), likely due to increasing turbidity and aeration during the later stages of the test.

Manganese concentration was observed to increase from a background of 0.03 mg/L (bailed) to 0.13 mg/L at the end of Test #1, and increased throughout Test #2 from 0.23 mg/L to 0.38 mg/L. It is possible that the source of the manganese may be from recharge from the overlying Mud Lake Fault bog or from mineralized zones. Although no obvious leakage was observed within the Austin Shaft, the sound of cascading water could be heard at borehole 85-56, which reportedly penetrates the workings. Other boreholes such as 85-52 and 85-50 may transmit surface water to the mine, which lies just 15 m (50 ft) below the bog. Humic acids concentration remained unchanged at 1.8 ppm. Concentrations of the other major metals, lead (<.002 mg/L); copper (<0.01 mg/L), zinc (0.01 mg/L) and nickel (<.02 mg/L) remained unchanged throughout both tests.

Continuous monitoring of pH was carried out in-situ using a flow-through cell which prevented contact between the sample and the atmosphere. During the May 6, 1986 sampling prior to pumping, pH levels wre measured at 6.8 (Table 3.4). During the first pump tests, ph remained essentially stable at 6.7, but rose to about 7.7 at the beginning of pump Test #2. This increase may be due to oxidation and degassing of groundwater in the mine during the recovery of Test #1. Dissolved oxygen levels increased to 3.0 ppm (Test #1) and 5 ppm (Test #2) after periods of recovery. A similar increase in pH from 6.8 to 7.35 was seen near the end of Test #2 under aeration conditions.

It was noted that after a period of recovery within the workings, there was a large drop in pH from 6.8 to 5.1 (Test #1 after 7 hours of recovery) and from 7.7 to 6.8 after a series of pump stoppages in Test #2. This suggests that there may be some oxidation of sulfide mineralization on the walls and floor of the workings as groundwater recharge occurs. The subsequent rise in pH after 2 1/2 weeks of recovery had occurred and dissolved oxygen had become depleted, suggests buffering of the mine water by such processes as calcite dissolution or sulfate reduction. Acid generation testing conducted on the wasterock from Austin Shaft indicates a mild acid generation capacity (1.2 to 1 ratio). Testing of the non-mineralized quartzite bedrock indicates a significant acid consuming potential (33 to 1 ratio). This could account for the observed variation in pH. It is noted that the drop in pH to 5.1 after 23 hours of pumping in Test #1 resulted in a slight decrease in arsenic concentration to 0.14 mg/L. Arsenic solubility is known to increase with increasing pH.

The chemical analysis and monitoring conducted during the Austin Shaft dewatering indicates that the effluent quality from this mine and the proposed portal should fall within the MMLEG (1978) guidelines. The Beaver Dam metal concentrations are well below those monitored during the Caribou Mine dewatering, carried out in 1983 (Table 3.6). It is interesting to note that the concentrations of arsenic, iron, aluminum and manganese exhibited a significant decrease after passage through a bog area. It is reasonable to conclude that the large bog separating the mine site and Cameron Flowage will afford adequate attenuation of the low levels of metals released from the new mine.

3.4 Summary

A dewatering program conducted on the existing Austin Mine Shaft at Beaver Dam mine has demonstrated that bedrock permeability in the upper 22 m is relatively low in the order of 9.0×10^{-7} m/s, resulting in a steady state discharge rate of only 3 litres/sec (40 ipgm) for the Austin workings. An empirically-derived mine volume of 2273 m^3 (0.5 MIGD) is calculated. The shallow bedrock exhibits a fair to moderate fracture interconnectivity, exhibited by measureable borehole hydraulic head response at distances of up to 100 m from the workings. Approximately one meter of drawdown was observed in boreholes adjacent to the proposed new mine portal, which suggests that there will be some minor hydraulic interaction between the two mines at that point. The majority of the new workings would be located further to the west. The majority of the water pumped from Austin Shaft appears to be derived from deep groundwater, rather than surface sources.

Monitoring of discharge water quality suggests that the effluent from the new mine should meet the requirements of the Metal Mining Liquid Effluent Guidelines. The water is described as a soft slightly oxidized (2 ppm D.O.), calcium bicarbonate water, typical of Meguma-Group groundwater in Nova Scotia. Although there is potential for minor acidic drainage in the mine workings, chemical analysis suggests that there is a reasonable degree of buffering capacity in the groundwater (pH 7.3) and the un-mineralized bedrock. Mine effluent pH should be in the range of 6.0 to 7.5, depending on the pumping rate from the mine, and the relative percentage of sulfide mineralized to non-mineralized wall rock.

Suspended solid loads from undisturbed mine sumpage water should also be within the guideline. Should levels exceed the guideline due to drilling and blasting operations, then measures can be implemented to treat the small flow volumes expected at the discharge point.

TABLE 3.1: AUSTIN SHAFT PUMPING TEST # 1 WATER QUALITY DATA, JUNE 18, 1986

	10 min.	1 hr.	4 hr.	6 hr.	9 hr.	16 hr.	23 hr.*	24 hr.
<u>Metals**</u>								
Arsenic	0.10	0.10	0.14	0.16	0.17	0.17	0.14	0.15
Iron	1.1	0.96	1.5	1.8	1.8	1.4	1.4	1.3
Manganese	0.06	0.05	0.07	0.05	0.09	0.11	0.12	0.13
Lead	<0.002	<.002	<.002	<.002	<.002	<0.002	<.002	<.002
Copper	<0.01	<.01	<.01	<.01	<.01	<0.01	<.01	<.01
Zinc	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Nickel	<0.02	<0.02	<.02	<.02	<.02	<0.02	<.02	<.02
Sodium		2.8				3.3	2.3	
Potassium		1.1				1.1	1.0	
Calcium		13.0				16.0	10.0	
Magnesium		1.3				1.2	1.2	
Hardness		37.8				45.0	30.0	
Alkalinity		31.7				30.5	25.4	
Sulfate		7.2				7.0	7.2	
Chloride		3.8				4.6	3.8	
Flouride						<0.1		
Silicate						6.1		
Phosphate						0.01		
Nitrate						0.07		
Ammonia						<0.05		
TDS						57.0		
Susp. Solids						6.8		
Colour (TCU)						25.0		
Turbidity (JTU)						8.9		
Conductance (uS)						85.0		
pH						6.6		
<u>Field Parameters</u>								
Dissolved O_2(ppm)	1.6	1.8	2.15	2.20	2.35	2.50	3.0	3.2
pH	6.73	6.67	6.74	6.72	6.31	6.81	5.46	6.92
Temp (°C)	5.9	5.5	5.5	5.5	5.2	5.5	5.8	5.8
Cond.(uS)	56.0	55.0	55.0	54.0	59.0	60.0	63.0	62.0
Drawdown(m)	.25	3.83	10.41	12.74	15.29	16.74	16.58	16.81

* 7 hours of recovery between t = 16 hr. and t = 23 hr.
** metals were field preserved with nitric acid

All parameters in mg/L unless otherwise noted.

TABLE 3.2: AUSTIN SHAFT PUMPING TEST # 2 WATER QUALITY DATA, JULY 8-12, 1986.

Sample No.	1	2	3*	4	5	6	7
Time	2 hr.	22 hr.	25 hr.	44 hr.	46 hr.	49.5 hr.	52.5 hr.
Metals							
Arsenic	.06	.08	.26	.11	.14	.14	.11
Iron	1.1	1.3	8.9	1.9	2.6	1.3	2.6
Manganese	.23	.27	.40	.32	.35	.33	.38
Lead	<.002	<.002	.009	<.002	<.002	<.002	<.002
Copper	<.01	<.01	.02	<.01	<.01	<.01	<.01
Zinc	.01	.01	.02	<.01	<.01	<.01	<.01
Nickel	<.02	<.02	<.02	<.02	<.02	<.02	<.02
Sodium							4.4
Potassium							1.4
Calcium							21.0
Magnesium							2.0
Hardness							60.5
Alkalinity							56.5
Sulfate							9.4
Chloride							4.4
Flouride							<.1
Silicate							9.5
Phosphate							<.01
Nitrate							<.05
Ammonia							<.05
TDS							83.0
Sup. Solids							7.3
Colour (TCU)							7.5
Turbidity (JTU)							19.0
Conductance (uS)							153.1
pH							7.4
Humic Acid							1.8
Aluminum							0.06
Boron							0.02
Barium							0.007
Beryllium							<0.005
Chromium							<0.01
Cadium							<0.01
Cobalt							0.01
Antimony							<0.02
Selenium							<0.10
Tin							<0.03
Vanadium							<0.01
Field Parameter							
Dissolved O_2	1.59	1.8	-	4.8	15.4**	13.2	13.4
pH	7.78	-	6.98	6.78	7.29	7.29	7.20
Temp (°C)	6.7	-	-	6.3	6.3	6.3	6.3
Cond. (uS)	81.0	-	-	85.0	88.0	89.0	75.0
Drawdown (m)	9.4	16.9	16.9	17.82	17.7	17.7	17.7

* Start-up of centrifugal pump caused a short period of turbidity

** Pump breaking suction, t = 45 hr. All parameters in mg/L unless otherwise noted.

TABLE 3.3: FIELD CHEMISTRY DATA, AUSTIN SHAFT DEWATERING TEST

TEST NO. 1, JUNE 18 - 19, 1986

Time (min)	Drawdown (m)	Temp.(°C)	pH	Cond.(uS)	D.O.(mg/L)	Sample
June 18/86						
13:30	0		6.73	54	2.3	
13:35						
13:39						
13:45	0.25	5.9 4.6	6.7	56	1.60	#1
13:55	0.80	5.5 4.6	6.71	56	1.65	
14: 05	1.52	5.5 4.5	6.72	56	1.75	
14:15	2.69	5.8 4.7	6.72	56	1.65	faint H_2S odor
14:25	3.29	5.5 4.5	6.70	55	1.75	from other shaft
14:35	3.83	5.5 4.5	6.67	55	1.80	#2
15: 03	5.64	5.9 4.8	6.61	52	2. 05	Turbidity Increase
15:35	7.72	5.7 4.7	6.59	50	2. 00	
16:35	9.14	5.5 4.7	6.72	52	2. 00	
17:35	10.41	5.5 4.6	6.74	55	2.15	#3
18:35	11.43	5.5 4.4	6.65	50	2.20	
19:35	12.74	5.5 4.2	6.72	54	2.20	#4
21:35	14.63	5.50 3.8	6.78	59	2.30	
22:35	15.29	5.2 3.6	6.31	59	2.35	#5
23:35	15.87	5.1 3.5	6.48	60	2.32	
June 19/86						
00:35	15.97	5.3 3.5	6.15	60	1.70	
02:45	16.22	5.5 3.5	6.51	60	7.40	MS
04:35	16.58	5.3 3.5	6.4-6.8*	60	2.40	*Shifting
05:35	16.74	5.5 3.5	6.5-6.86*	60	2.50	MS #6
PUMP OFF (SHORT RECOVERY 7 1/2 HOURS) 12:52						
12:52	16.58	5.8 4.0	5.12	64	3.35	#7
13: 01	16.62	5.8 4.2	5.46	63	3. 0	
13:11	16.65	5.8 4.4	5.95	63	3. 0	
13:21	16.70	5.8 4.4	6.71	63	3. 0	
13:31	16.72	5.8 4.6	6.72	62	3. 0	
13:41	16.76	5.8 4.6	6.90	62	3. 05	
14: 01	16.81	5.8 4.6	6.92	62	3.2	#8
14:17	16.86	5.8 4.6	6.92	62	3. 0	
TEST NO. 2, JULY 8 - 11, 1986 July 8/86						
July 8/86						
14: 07		6.9 7.0	7.96	33	1.31	
15: 00	7.28	6.9 6.6	7.80	84	1.40	
16:00	9.39	6.9 6.7	7.78	81	1.59	#1
17:00	11. 08	6.9 6.5	7.69	78	1.98	
18:00	12.45	6.8 6.6	7.69	76	2.25	
July 9/86	PUMP OFF 00: 01 to 06: 00 (6 hr. recovery)					
12: 00	16.89					#2
14:53	16.88	9.2	6.98			#3
July 10/86						
09: 00	17.66	6.8 6.5	6.78	87	5.5	
10: 00	17.82	5.3 6.3	6.78	85	4.8	#4
11: 00	17.96	5.3 6.3	7.10	88	4.8	
12: 00	18. 00	5.3 6.3	7.29	88	15.4	#5
13: 00	18. 00	5.3 6.3	7.33	89	10.6	
13:30	18. 00	5.6 6.3	7.35	89	12.4	
15:30	18. 00	5.6 6.3	7.29	89	13.2	#6
18:30	18. 00	5.3 6.3	7.20	75	13.4	#7

TABLE 3.4: Water Quality Analysis for Groundwater Samples, Beaver Dam Mine (1986)

		AUSTIN MINE SHAFT					
	Depth Below Water	May 6/86 7 metres (Bailed)	May 6/86 17 metres (Bailed)	June 19/86 16 hr. pumping#1	July 10/86 52 hr. pumping#2	June 13/86 Flowing DDH 86-47	June/86 Dug Well pumped
Sodium	mg/L	2.1	2.3	3.3	4.4	4.4	2.0
Potassium	mg/L	0.9	0.8	1.1	1.4	1.3	0.3
Calcium	mg/L	8.3	9.5	16.0	21.0	24.3	21.0
Magnesium	mg/L	1.0	1.1	1.2	2.0	2.0	3.5
Hardness ($CaCO_3$)	mg/L	25.0	28.34	45.0	65.0	69.0	67.0
Alkalinity ($CaCO_3$)	mg/L	20.3	23.5	30.5	56.5	69.0	40.7
Sulfate	mg/L	8.0	8.0	7.0	9.4	7.5	22.0
Chloride	mg/L	3.3	3.1	4.6	4.4	4.6	6.4
Fluoride	mg/L	<0.1	<0.1	<0.1	<.1	0.2	<.1
Silica	mg/L	4.8	5.2	6.1	9.5	12.0	3.9
Orthophosphate	mg/L	0.02	<0.01	.01	<.01	.01	<.01
Nitrate + Nitrite	mg/L	0.18	0.13	.07	<.05	<.05	0.12
Ammonia	mg/L	<0.05	<0.05	<.05	<.05	<.05	<.05
Arsenic	mg/L	0.04	0.04	0.12	0.11	.04	.04
Iron	mg/L	0.3	0.32	1.2	2.6	.50	2.3
Manganese	mg/L	<0.01	0.03	0.15	0.38	.31	.25
Lead (HGA)	mg/L	<0.002	<0.002	.003	<.002	<.002	.009
Copper	mg/L	<0.01	<0.01	.01	<.01	<.01	.01
Zinc	mg/L	<0.01	<0.01	.02	<.01	<.01	.03
Total Dissolved Solids	mg/L	35.0	43.0	57.0	83.0	94.0	84.0
Suspended Solids	mg/L	<0.3	<0.3	6.8	7.3	0.8	382.0
Color	T.C.U.	5.0	5.0	25.0	7.5	20.0	12.5
Turbidity	J.T.U.	1.5	2.3	8.9	19.0	0.4	87.0
Conductivity (umho/cm)	umHo/cm	69.0	76.0	85.0	153.0	161.0	149.0
pH	units	6.30	6.40	6.6	7.3	7.4	6.8
Humic Acid	mg/L	2.0	2.0		1.8		
Aluminum	mg/L	<0.05	<0.05		0.06		
Boron	mg/L	<0.02	<0.02		0.02		
Barium	mg/L	<0.005	<0.005		0.007		
Beryllium	mg/L	<0.005	<0.005		<0.005		
Chromium	mg/L	<0.01	<0.01		<0.01		
Cobalt	mg/L	<0.01	<0.01		0.10		
Nickel	mg/L	<0.02	<0.02	<.02	<.02		
Antimony	mg/L	<0.05	<0.05		<0.02		
Selenium	mg/L	<0.1	<0.1		<0.10		
Tin	mg/L	<0.03	<0.03		<0.03		
Vanadium	mg/L	<0.01	<0.01		<0.01		
Mercury	ug/L	<0.05	<0.05		-		
Cadmium-ICP	mg/L	<0.01	<0.01		<0.01		

Field Measurements

pH	units	6.77	6.80 (downward drift)	6.81	7.20
Conductivity	umho/cm	47.0	50.0	60.0	75.0
Temperature	(°C)	5.0	4.2	5.5	6.3
Dissolved Oxygen	ppm	2.0	2.0 (June 18, 1986)	2.5	13.4
Odor	TOC	NONE	NONE	NONE	NONE

TABLE 3.5: HYDRAULIC HEAD MONITORED AT SELECTED DIAMOND DRILL HOLES DURING THE AUSTIN SHAFT DEWATERING PROGRAM

Beaver Dam Mine
Depth in Meters Below Ground Surface

Borehole No.	Test #1	Test #2
85-8	0.889	2.20
85-18	0.31	1.10
85-4	0.52	--
85-5	0.749	1.51
85-1	0.711	2.18
85-64	0.673	1.91
85-67	0.616	1.32
85-6	0.502	4.81
85-10	0.0	--
85-13	0.013	--
85-31	1.42	4.25
85-34	2.55	3.61
85-82	2.74	2.79
85-52	7.67	12.38
85-50	0.940	--
85-56	6.22	12.35
85-9	0.254	--

TABLE 3.6: CARIBOU GOLD MINE, AUGUST 26, 1983 WATER QUALITY ANALYSIS

Parameter (mg/L)	Discharge Pipe	Surface @ Culvert	Bog Area
Arsenic	1.3	1.3	.25
Iron	3.4	3.0	.22
Manganese	1.5	1.5	.22
Lead	<.002	.002	<.002
Copper	<.01	<.01	<.01
Zinc	0.02	.01	<.01
TDS	204.0	203.0	179.0
Conductivity(umho/cm)	340.0	340.0	300.0
pH	7.1	7.2	7.5
Aluminum	.17	.17	<.05
Boron	<.02	<.02	<.02
Barium	.04	.04	.02
Beryllium	<.005	<.005	<.005
Cadmium	<.002	<.002	<.002
Chromium	<.01	<.01	<.01
Cobalt	<.01	<.01	<.01
Nickel	<.02	<.02	<.02
Antimony	<.05	<.05	<.05
Selenium	<.10	<.10	<.10
Tin	<.03	<.03	<.03
Vanadium	<.01	<.01	<.01

Source: NSDOE Environmental Assessment Records

4.0 WATER SUPPLY EXPLORATION PROGRAM

4.1 Purpose

A program of groundwater exploration was carried out by Jacques, Whitford & Associates Ltd. on behalf of Seabright Resources Inc. to evaluate the feasibility of developing a groundwater supply for potable and mine uses. A groundwater source was preferred over a surface water source for a number of reasons, including possible closer proximity to the mine site, thus reducing capital expenditures for piped service; better overall water quality, which would reduce or eliminate water quality treatment requirements; and long term security of supply, since little is known about the hydrology of the available surface water sources. Projected water demand for both potable and mine supply uses was in the order of 3 liters/second, which, with the appropriate storage capacity, would require a well or wells capable of at least 3 L/S (40 igpm) sustained yield.

4.2 Method

Previous drilling attempts in the area of the temporary construction camp failed to develop a viable bedrock well. A 91 meter test well at the construction camp yielded no water after stimulation by blasting. The low hydraulic conductivity values determined by packer injection testing on selected diamond drill holes (Section 2.0) further suggest a low probability of developing bedrock wells in excess of 0.07 to 0.4 L/S (1 to 5 igpm). An average hydraulic conductivity of 2.7×10^{-8} m/s suggests a bulk transmissivity of 0.21 m^2/d (14.3 igpd/ft) for a 91 m (300 ft) drilled well, which would be expected to yield about 0.1 L/S (1.5 igpm). This is within the range and somewhat lower than values determined for pump testing of wells completed in quartzite bedrock in Halifax County (mean yield 0.2 L/S) and Guysborough County (mean yield 0.23 L/S) (Appendix 1). A further indication of low bedrock transmissivity is the very slow recovery of Austin Shaft after dewatering of 0.6 m/day (see Section 3.0).

Because of the low probability of developing the required 3 L/S from bedrock wells, exploration then focused on the silty sand and gravel glacial till overburden which mantles the mine site. Diamond drilling north of the centre line indicates overburden thickness varying between 1.5 metres to over 22 metres in a bedrock depression developed over Mud Lake Fault, and averaging 3.5 to 4.5 metres in the vicinity of the mine site and portal. Significant volumes of ground-water may be associated with the sand and gravel deposits reported in the Mud Lake Fault Trench, however, this area is designated for future exploration. The flat lying area of the mine site may have some potential for dug well development, but potential for contamination or dewatering due to mine activities is present.

With consideration of the topography, drainage, bedrock structure and available information on overburden thickness, it was reasoned that the best location for dug well exploration may be the base of the slope between the mine site and Crusher Lake. A seismic refraction profile (Figure 4.1) was run normal to the slope at 2 + 00 W adjacent to the waste rock storage area. This profile inferred an undulating bedrock topography and an apparent depth of 5 to 8 m (25 ft). A second possible exploration area was identified near Crusher Lake.

A test pit program was conducted on June 26, 1986 to locate sites for dug wells or lateral screen collectors. Based on the seismic data, Test Pit # 1 was excavated across the apparent bedrock depression from Station 1 + 75 S to 1 + 65 S on line 2 + 00 W. Bedrock was encountered at a depth of 4.9 m, and not the 7.0 m inferred from the seismic profile. Four additional test pits constructed within a 50 m radius of Test Pit # 1 varied in depth from 3.3 m to 4.0 m, with similar stratigraphy.

Four soil samples were collected from Test Pit # 1 for grain size analysis at Jacques, Whitford & Associates Ltd. laboratory (Appendix 3). Overburden is described as a 0.6 m layer of orange-brown silty sand and gravel overlying olive brown sandy gravel with some silt containing angular

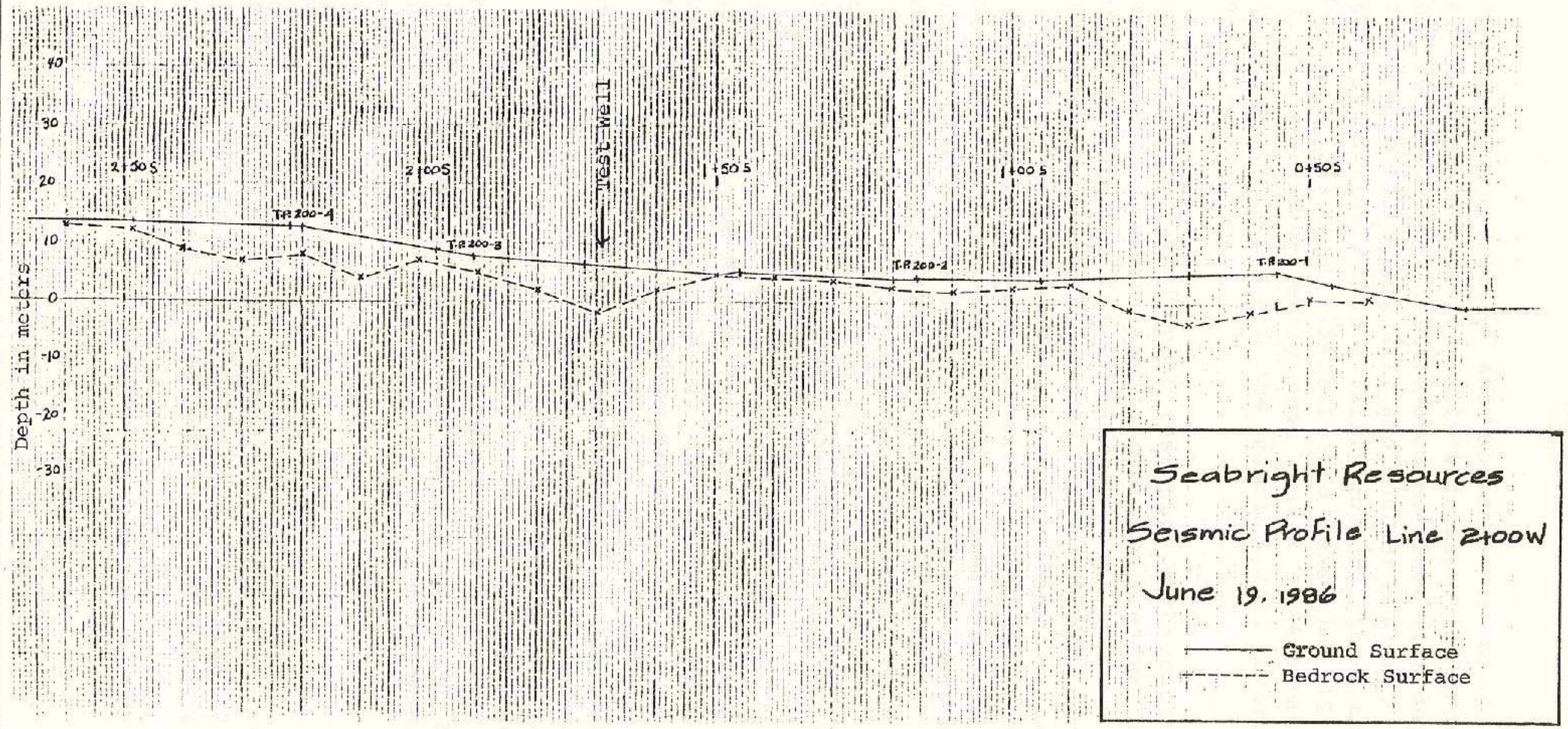


FIGURE 4.1 SEISMIC PROFILE LINE 2 + 00 W. SEABRIGHT RESOURCES INC. BEAVER DAM MINE, HALIFAX COUNTY, N.S.	Scale: 1:1000		Fig. No: 4.1	JACQUES WHITFORD & ASSOC. LTD.
	Date: July 25'86	Dwn. By: DDH	Appd.	

quartzite and slate cobbles and boulders up to 1 m in diameter. Boulder content generally increases with proximity to bedrock surface. Soil texture becomes finer with depth in Test Pit # 1 with increasing silt and boulder content. Grain size distribution lies within a fairly uniform range, averaging 61% gravel, 24% sand, 15% silt and less than 1% clay. Test Pit # 1 was subsequently pump tested to evaluate the hydraulic characteristics of the glacial till overburden (Section 4.3).

On July 11, 1986 five additional test pits were constructed in the vicintiy of Crusher Lake to evaluate the feasibility of induced infiltration from the lake. Preliminary field reconnaissance identified a series of east-west striking bedrock ridges with intervening depressions containing glacial till and bog-organic deposits. Test Pit # 6 was constructed near Crusher Lake on the access road approximately 15 m from a bedrock ridge. Bedrock was encountered at 1.83 m depth, and a good flow of water was observed at 0.6 m depth, however, this was likely derived from a bog area adjacent to the well (pH = 4.6). Overburden was a dense yellow brown silty till, with numerous quartzite fragments.

Test Pits #7 and #9 were constructed to assess the feasibility of burying a pipeline from Crusher Lake. The weathered bedrock surface can be excavated to about 1 m depth, therefore blasting should be minimal.

Test Pit # 8 was constructed adjacent to Crusher Lake to assess the feasibility of installing lateral screens for induced infiltration. Bedrock was encountered at 0.75 m beneath black organic peat deposits. Profiling of the bog area around the southern end of Crusher Lake indicated from 4.3 m near the edge of the lake to 0.6 m of peat bog overlying bedrock. Test pit logs for the 9 test holes are presented in Appendix 3.

4.3 Pump Test Evaluation

A 5.77 m corrugated plastic culvert, 46 cm in diameter was perforated over the bottom 1.8 meters and installed in Test Pit # 1. The hole was backfilled with 1.2 m of coarse gravel followed by 2.4 m of waste rock to above the water table. Glacial till was used to cap the test pit to ground surface. A 3-hp electric submersible pump was installed for pump testing the well.

A series of step drawdown test (1.5 igpm, 12 ipgm, 20 igpm) were carried out and recovery measurements were then made. Analysis of the time-drawdown data infer an apparent transmissivity of 4.85 m^2/d (325 igpd/ft) and a long term continuous safe yield of 1.5 igpm. The hydraulic conductivity of the overburden is estimated at 2 x 10^{-5} cm/s from the pump test data. This is typical of sandy silt glacial tills in Nova Scotia.

A water quality sample was collected at the end of the pumping test and submitted to the Environmental Chemistry laboratory at the Victoria General Hospital for analysis (Table 3.4). The water chemistry is typical of shallow glacial till aquifer in Nova Scotia, exhibiting higher pH (6.8), alkalinity (51 ppm) and less corrosiveness than the lake water. Elevated iron, manganese and turbidity are a consequence of the well construction method, and turbulence caused by overpumping. The detectable arsenic may be derived from the mine waste rock used in the construction of this test well. Final groundwater quality from a properly constructed dug well would be expected to be lower in these parameters. Iron and manganese would be the most likely water quality problems, and these aesthetic concerns can be effectively treated.

4.4 Summary

It is apparent from the testing carried out to date that a large yield of groundwater will not be available from a single well in the immediate vicinity of the mine site. The test well, when properly constructed and developed, may be capable of about 0.2 L/S (2 igpm) continuous yield, and up to 5 igpm short term yield. Although this well could be developed to supply the majority of potable needs, it may be more cost effective to derive water from the surface water supply line which will be required to supply the mining needs.

Testing in the vicinity of Crusher Lake indicates a poor chance of locating an infiltration gallery along the lake shores which are bedrock controlled. The end closest to the mine site is overlain by thick peat bog deposits, which could result in very poor water quality to underlying screened collectors.

The most feasible water supply alternative for the Beaver Dam Mine is therefore surface water from either Cameron Flowage, or Crusher Lake. Work is currently underway to develop a water supply from Cameron Flowage upstream of the bog outfall. (Jacques, Whitford and Associates Limited, 1986, Job No. M1292).

5.0 CONCLUSIONS

The results of packer injection testing and mine dewatering operations conducted at the Beaver Dam Mine site indicate that the proposed new gold mine workings should encounter relatively low groundwater inflows. An estimated mine water discharge rate of 6.4 L/S (85 igpm) is predicted for the exploration portal, based on packer testing results and the location of the mine tunnels. All hydrogeologic evidence currently available for the site (test drilling, packer testing, shaft dewatering) suggests a steady-state mine effluent discharge rate in the order of 7.5 to 15 L/S (100 to 200 igpm) for a full scale mine. The majority of the flow will be expected from the shallowest mine horizon. Once this zone has been dewatered and appropriately grouted, long term discharge rates from the remaining deeper horizons should be less than 7 to 10 L/S (90 - 130 igpm).

It is anticipated that there should be no problem in the handling of natural groundwater inflow and process waters used for drilling purposes in this mine. There may be some opportunity to employ recirculation of waters within the mine, thereby reducing the total pumping requirements.

Packer injection testing of existing inclined diamond drill holes penetrating the proposed mine workings indicate an overall geometric mean hydraulic conductivity of 2.7×10^{-8} m/s, ranging from 1×10^{-6} m/s to 3.7×10^{-10} m/s. Bedrock permeability was found to decrease with depth and with bedrock type from quartzite to greywacke to argillite, and was lowest for the deep mineralized ore zones. The Mud Lake Fault zone was found to be of low hydraulic conductivity (2.3×10^{-8} m/s), although somewhat unstable. The highest bedrock K values were associated with the crest and axis of the overturned anticline and shallow bedrock (0-20 m).

The shallow bedrock adjacent to the proposed portal has an apparent hydraulic conductivity of 3.5×10^{-7} m/s, which correlates with the estimated K of 9×10^{-7} m/s for shallow bedrock around Austin Shaft. A pumping test conducted in 4.9 m of silty sand glacial till overburden 150 m from the portal area indicated a K of 2 x 10^{-7} m/s. This suggests that inflows to the portal area during construction should be controllable. Pumping of an old mine shaft discovered adjacent to the portal should aid in the control of shallow groundwater flows.

A dewatering test performed on the Austin Mine workings indicated a steady-state mine discharge rate of 3 L/S (40 igpm). Analysis of the time drawdown data suggests that the majority of this inflow was derived from the shallow zones, and that the deeper portion of the abandoned mine workings below 22 m depth was contributing only small amounts of water. Increasing manganese concentration and a shift in water chemistry towards deeper groundwater characteristics suggest that flow is derived from both surface bog sources overlying the working, but primarily from deeper groundwater. This dewatering test indicates that flow rates from the new mine which will be situated in simular geology and structures should also be low, and results confirm the predictions generated by the packer test data.

Continuous, in-situ monitoring of effluent water quality during the dewatering test has demonstrated that the quality of effluent from the new mine should meet the Metal Mining Liquid Effluent Guidlines with minimal or no treatment required. With the exception of arsenic (0.4 -0.17 mg/L), iron (0.3 - 2.6 mg/L) and manganese (0.3 - 0.38 mg/L), all parameters fall within the Canadian Drinking Water Guidelines. Monitoring has shown that there is a small tendency for acidic drainage within the mine after periods of non-pumping, due to contact with mineralized wall rock however, the buffering capacity of the natural groundwater and the quartzite bedrock tend to neutralize this tendency. Under continuous pumping, the effluent would be expected to be a neutral pH (7.4), moderately alkaline groundwater with up to 3 ppm iron and minor arsenic concentration (0.10 - 0.20 mg/L).

Although suspended solids loads under undisturbed conditions are expected to be low, drilling and blasting would be expected to contribute to suspended solids loading. Given the volumes of water expected, it should be feasible to treat the effluent (if necessary) both in the mine sump and at the surface, prior to its release to the bog area. Monitoring of mine effluent quality will determine treatment requirements. The large bog area will afford significant natural attenuation of suspended material and dissolved metals.

Monitoring of the existing diamond drill holes during dewatering of Austin shaft indicates that some hydraulic interconnection likely occurs between the existing workings and the proposed mine. A total drawdown of 1 m was observed near the portal area during the testing. This interconnection may be due in some part to past mining activity along the Austin lead. It is likely that the Austin workings would eventually be dewatered by the new mine, although flow rates would be expected to be small.

Exploration for groundwater resources in the Beaverdam Mine area indicates a poor probability of development of groundwater resources for mine use. Bedrock aquifers exhibit low transmissivity in the order of 0.5 to 1.0 m^2/d, and drilled wells would be capable of less than 3 igpm. Overburden within 200 m of the mine building is generally too thin to develop reliable dug or screened wells. One test well located on line 2 + 00 west may be capable of 2 igpm. The most promising groundwater development possibility lies in the deep bedrock trench (22 m) developed over Mud Lake Fault, west of the site, however, the area is designated for future exploration activities.

As a result of the above, it was decided to develop surface water supplies from Crusher Lake or Cameron Flowage. It is concluded, based on work done to date, that the proposed Beaver Dam Mine will be relatively "dry" after the shallow drifts have been stabilized, and steady state drawdown has been achieved. Mine discharge waters are not expected to pose a serious threat to the environment and should remain within the Metal Mining Liquid Effluent Guidlines with minimal or no treatment required. The naturally occurring iron, manganese, arsenic and aluminum discharged with the effluent should be effectively removed through passage through the swamp prior to release to Cameron Flowage.

6.0 RECOMMENDATIONS

1. Mine water discharge rates and water chemistry should be monitored on a regular basis to ensure that parameters remain within the MMLEG requirements.

2. Although low steady state flow rates in the order of 7.6 L/S (100 igpm) are anticipated for this mine, water pressures ahead of the stope workings should be measured to ensure that all instantaneous flows of groundwater from undetected fractures are anticipated. Such flows should rapidly decrease to steady state rates after fracture dewatering has occurred.

3. A long term groundwater monitoring program should be established to monitor groundwater levels in the Austin Shaft, and bedrock zones above and around the mine workings during mine development. Such monitoring would provide an assessment of the source of flow into the mine, and the degree of fracture dewatering. To accomplish this, it would be necessary to construct a series of observation wells around the site, or to develop some of the existing diamond drill holes.

4. The existing overburden test well should be retained to monitor overburden hydraulic head variation over the summer season. If head does not drop significantly, it may be feasible to develop this as a dug well for auxiliary uses.

5. The geologic and hydrogeologic nature of the Mud Lake Fault Zone suggests that caution should be exercised during mine excavation in these areas. Although the highly brecciated material exhibits a low hydraulic conductivity, the material is saturated and could collapse into the workings. Standard procedures for mine wall stabilization should be implemented in this area.

6. Consideration should be given to recycling of water within the mine for drilling activities and dust control. This would reduce the volume of sump water requiring disposal, and reduce make-up water requirements.

7. Although initial work suggests that discharge water would not be hazardous, over the life of a mine the discharge quality could vary depending on mining activity and zones encountered. Contingency plans should be prepared for treatment of acidic waters with lime addition or to reduce suspended sediment loads by floccuation should such be found to be needed.

APPENDIX 1

TAKEN FROM REPORT NO. M1285

Hydrogeology

Because of the remoteness of the Beaver Dam site, very few site-specific data regarding groundwater quality or flow are currently available. The nearest residential areas are located along route 224 from Upper Musquodoboit 19 km to the northeast and the Village of Marinette 10 km to the south. No impacts on existing groundwater supplies are anticipated in relation to the proposed mining operation.

The following discussion of regional hydrogeology is based on general knowledge of the hydrogeology of the Meguma Bedrock in the eastern portions of Nova Scotia, for example, Halifax and Guysborough counties. The Beaver Dam mine site is underlain by highly resistate crystalline bedrock comprised of Goldenville Quartzite intruded by Devonian-aged granites.

In Nova Scotia, the predominance of steeply-dipping subvertical fracturing, and bedrock strike perpendicular to regional topographic gradient favors the development of short groundwater flow regimes and vertical permeability greater than horizontal permeability. This results in relatively short distances of flow from areas of recharge to areas of discharge, in the order of 1 to 5 km (Lin, 1975). This suggests that groundwater recharging in the highland region to the south of the area (elevation 170 m) flows across the mine site to discharge into Cameron Flowage on the Killag River at an average gradient of about 2.5 percent.

Groundwater Flow

Groundwater flow in fractured crystalline rock is controlled by secondary permeability and fracturing. Locally, bedrock groundwater flows can be expected to be predominantly south-eastward along the dominant fault trends, with smaller flows in the northeast and east directions (Figure 3.3.) Ground-water flow in the sandy silt glacial till overburden is expected to mirror the topographic surface, with recharge occurring on the basin boundaries and uplands, and discharge to the Killag River watershed.

Drilled wells (45-61 m deep) in quartzite bedrock generally yield from 0.04 to 0.4 L/S (0.5-5 IGPM) (N.S. Strait of Canso Environment Comm. 1975). Yields vary greatly depending on the degree of fracturing of the bedrock. Table 3.5 illustrates the range of transmissivity (T) and safe yield (Q_{20}) for 37 wells drilled in quartzite bedrock in Halifax and Guysborough counties (NSDOE pump test inventory). Geometric mean T is low (0.8 m^2/d) compared to an average of 4.1 m^2/d for Meguma Bedrock in Nova Scotia. Well yields in Guysborough County range from 0.05 to 2.4 L/s (0.7-32 IGPM), averaging 0.22 L/s. Specific capacity averages 0.1 L/s per meter of drawdown, compared to 0.04 L/S/m for Halifax County. Pump test data for Nova Scotia indicate that T generally decreases from Yarmouth to Canso, likely because of decreasing degree of metamophorism and less overall fracturing.

TABLE 3.5: Summary of Pump Test Data for Wells Completed in Goldenville Quartzite, Halifax and Guysborough Counties, Nova Scotia

	Range	Mean X	Mean (G)	SD (X)	N
HALIFAX COUNTY					
Well Depth (m)	15.2 - 137.2	67.1	(68.6)	33.2	31
Transmissivity (m^2/d)	.02 - 14.0	2.1	(0.86)	3.1	31
20-yr-safe yield (L/S)	.015 - 4.2	.53	(0.20)	0.9	31
Specific Capacity (L/S/m)	.001 - .16	.04	(0.035)	0.05	31
GUYSBOROUGH COUNTY					
Well Depth (m)	44.8 - 155.4	99.1	(89.0)	46.6	6
Transmissivity (m^2/d)	0.08 - 11.2	2.5	(0.75)	4.3	6
20 yr-safe yield (L/S)	0.05 - 0.46	0.27	(0.23)	0.89	6
Specific Capacity (L/S/m)	0.001 - 0.06	0.11	(0.01)	0.25	6

x = Arithmetic Mean
G = Geometric Mean

SOURCE: N.S. Department of the Environment, Pump Test Inventory

The presence of a dry (91 meter) well near the mine site, and low well yields for Guysborough County wells tend to support this conclusion.

Preliminary results of a packer testing program conducted on the site also support the low transmissivity of the non-mineralized quartzite bedrock (Jacques, Whitford and Associates Ltd., 1986 in preparation). Packer permeability measurements were carried out in June of 1986 for 56 zones 4.6 m in length, which is representative of the various structural rock features identified in the geologists logs (for example, fault zones, fractures, Anticline axis, ore zones, etc.). Hydraulic conductivity averages 2.7 x 10^{-8} m/s (geometric mean) and ranges from a high of 1 x 10^{-6} m/s in the shallow zones of Mud Lake Fault and the anticline axis, to less then 4 x 10^{-11} m/s in the deep ore zone and unfractured rock. Hydraulic conductivity generally decreases with depth, and is low in the ore zone, likely because of fracture filling by quartz veins. Results of bedrock permeability testing will be reported at a later date.

Notwithstanding the above, experience in other mineralized areas of the province has shown that bedrock T and permeability can be greater for Meguma bedrock intruded by Devonian granites and near fault zones. In the Beaver Dam area, the highest bedrock permeabilities would therefore be expected to occur near the granite contact southwest of the site, and adjacent to the major fault zones.

Measurements of hydraulic head in the various mine shafts around the property indicate bedrock water levels varying from 3 to 4 m below ground surface, and dominant groundwater flow direction to the west and northwest, along the strike of bedrock and topographic gradient. Mine shafts, where groundwater levels approach ground surface, appear to be influenced by surface water drainage into the workings. The 3 m depth to water in the Austin and Whip leads may be indicative of actual piezometric surface for shafts penetrating to about 22 m. The majority of the diamond drill holes exhibited static water levels averaging 0.3 meters below ground surface in the vicinity of the cleared area. In the swamp area, most boreholes penetrating Mud Lake Fault were flowing at ground surface, usually at rates of less than 0.1 L/S. Borehole BD-86-47 was measured at a flow rate of 0.1 L/S (1.3 IGPM). The presence of water in most trenches indicates high water table conditions over most of the site which appears to be a net regional groundwater discharge area.

Conversations with the geologists regarding drilling conditions on site indicated that most of the deep boreholes were making enough water to sustain drilling. Some boreholes exhibited loss of drilling fluid to adjacent holes (BD-85-24, 31, 27) which indicates some cross connection, at least in the shallow zones. Boreholes in the Mud Lake Fault Zone were full of gouge material and highly unstable, and generally exhibited low flows due to clogging, and also resulted in low packer permeability values. The degree of bedrock fracturing appears to increase towards the Austin Shaft end of the baseline; likely a result of tectonic movements associated with the fault zones. The drillers stated that negligible movement of water levels was observed in Austin Shaft during pumpage (0.4 - 4.0 L/S) for drilling purposes. A water well 91 m deep constructed for the temporary mining camp on the hill south of the mine was dry, even after stimulation by blasting.

The above discussions suggest that the bulk bedrock hydraulic conductivity in the vicinity of the mine site is relatively low and that the greatest flows will be expected in the southeast end of the site towards Mud Lake Fault. The variability of fracture permeability and hydraulic characteristics of the shallow zone around the Austin Shaft will be assessed in greater detail upon completion of current field work.

In this region of Nova Scotia, most domestic water supplies are obtained from dug or drilled wells. Dug wells developed in the glacial till overburden appear to be the most common domestic supply, yielding large volumes of good quality water from stratified sands and gravels such as are found at the west side of Sheet Harbour, and 0.08 to 0.8 L/S from quartzite tills such as underlie the area. Higher yields may be encountered if sufficient thicknesses of saturated sand and gravel are encountered on the site. A program of overburden exploration is currently being conducted to evaluate the water-bearing characteristics of thick overburden deposits identified by seismic profiling.

Groundwater Quality

Quality of groundwater from Goldenville quartzite aquifers is generally good (NSDOE Well Water Quality Inventory). The most common domestic water quality complaint is that iron and manganese levels are in excess of the respective drinking water limits of 0.30 mg/L and 0.05 mg/L set for aesthetic reasons (Health and Welfare Canada, 1978). In gold mining districts, arsenic concentrations in excess of the 0.05 mg/L health standard commonly occurs, and is generally believed to be derived from arsenopyrite mineralization associated with vein deposits in the bedrock (Grantham & Jones, 1976; McCurdy 1980, Bottomley 1984). Shallow overburden wells generally exhibit similar trends, without arsenic problems.

To date, groundwater samples from the Beaver Dam area are limited to samples from Austin Shaft collected at depths of 10 m and 21 m below the water surface (Table 3.6). Water is a typical calcium carbonate groundwater of good chemical quality. All parameters are within tolerable limits. Arsenic levels at 0.04 mg/L and iron at 0.3 mg/L are typical of groundwaters in mine areas. The downward drift of pH and upward drift in conductivity suggest a slightly reducing condition, confirmed by later dissolved oxygen measurements of 2.0 ppm. A flowing deep borehole (86-41) and several other deep boreholes also exhibited reducing trends (H_2S odors). Detectable nitrate concentrations are likely to caused by vegetation and timbers in the shaft. Profiles of temperature, electrical conductance and dissolved oxygen were also made for the Austin Shaft (Table 3.7) and shows a slight increase in conductivity (TDS) and decrease in temperature with depth, as would be expected. Groundwater from these mine shafts are remarkably clear and are not expected to be an environmental problem.

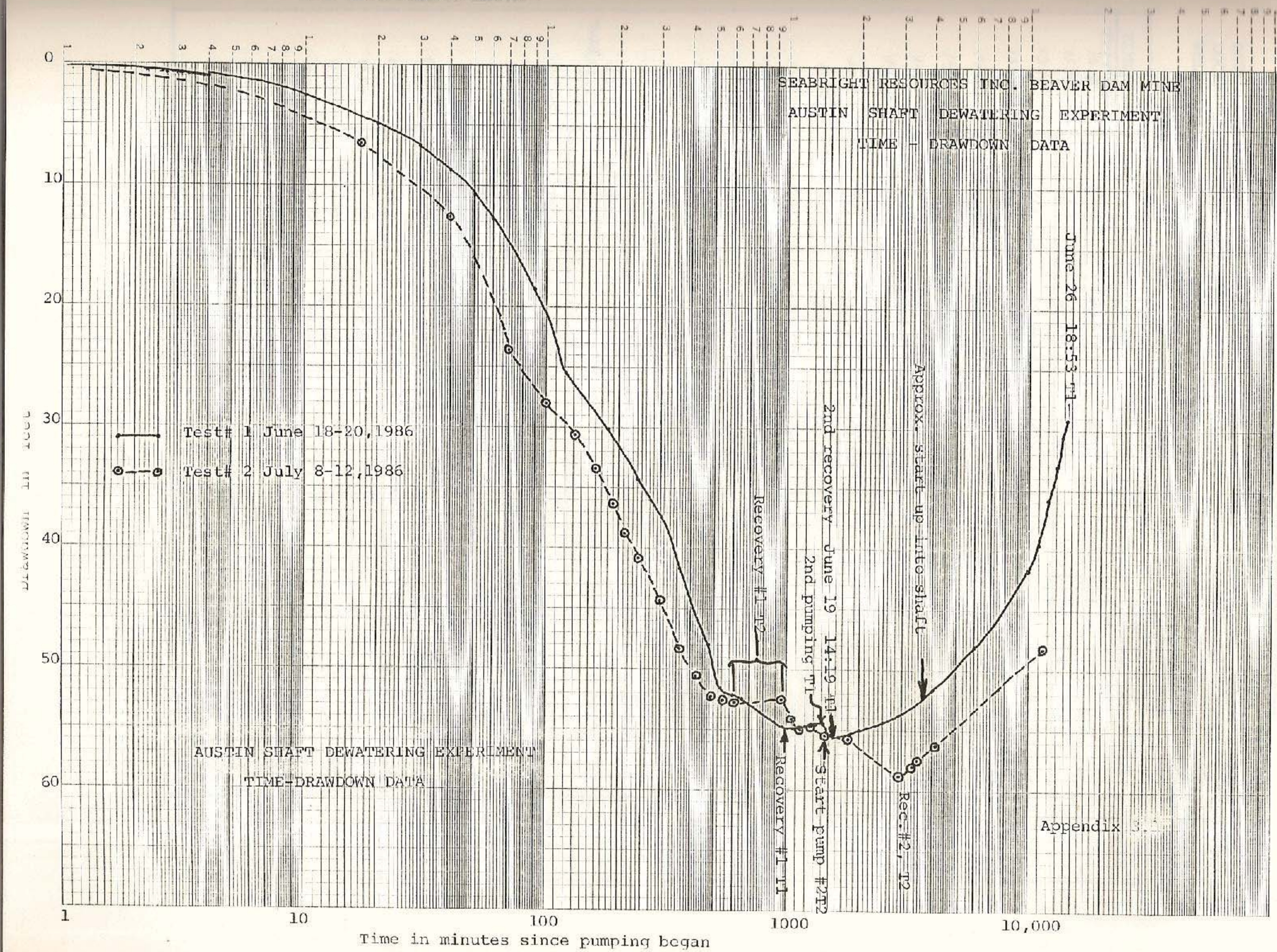
TABLE 3.6: Water Quality Analysis for Austin Shaft, Beaver Dam Mine (May 6,1986)

Depth Below Water Surface		7 metres AU-1	17 metres AU-2
Sodium	mg/L	2.1	2.3
Potassium	mg/L	0.9	0.8
Calcium	mg/L	8.3	9.5
Magnesium	mg/L	1.0	1.1
Hardness ($CaCO_3$)	mg/L	25.0	28.3
Alkalinity ($CaCO_3$)	mg/L	20.3	23.5
Sulfate	mg/L	8.0	8.0
Chloride	mg/L	3.3	3.1
Fluoride	mg/L	<0.1	<0.1
Silica	mg/L	4.8	5.2
Orthophosphate	mg/L	0.02	<0.01
Nitrate + Nitrite	mg/L	0.18	0.13
Ammonia	mg/L	<0.05	<0.05
Arsenic	mg/L	0.04	0.04
Iron	mg/L	0.3	0.32
Manganese	mg/L	<0.01	0.03
Lead (HGA)	mg/L	<0.002	<0.002
Copper	mg/L	<0.01	<0.01
Zinc	mg/L	<0.01	<0.01
Total Dissolved Solids	mg/L	35.0	43.0
Suspended Solids	mg/L	<0.3	<0.3
Color	T.C.U.	5.0	5.0
Turbidity	J.T.U.	1.5	2.3
Conductivity (umho/cm)	umHo/cm	69.0	76.0
pH	units	6.30	6.40
Humic Acid	mg/L	2.0	2.0
Aluminum	mg/L	<0.05	<0.05
Boron	mg/L	<0.02	<0.02
Barium	mg/L	<0.005	<0.005
Beryllium	mg/L	<0.005	<0.005
Chromium	mg/L	<0.01	<0.01
Cobalt	mg/L	<0.01	<0.01
Nickel	mg/L	<0.02	<0.02
Antimony	mg/L	<0.05	<0.05
Selenium	mg/L	<0.1	<0.1
Tin	mg/L	<0.03	<0.03
Vanadium	mg/L	<0.01	<0.01
Mercury	ug/L	<0.05	<0.05
Cadmium-ICP	mg/L	<0.01	<0.01
Field Measurements			
pH	units	6.77	6.80 (downward drift)
Conductivity	umho/cm	47.0	50.0
Temperature	(°C)	5.0	4.2
Dissolved Oxygen	ppm	2.0	2.0 (June 18, 1986)
Odor	TCC	NONE	NONE

TABLE 3.7: Electrical Conductance and Temperature Profile for Austin Shaft, Beaver Dam (May 6, 1986)

Depth Below Reference(m)	Depth Below Water Level(m)	Temperature (°C)	Conductivity uS/cm	Salinity 0/00
3	0	5.9	45	0.0
5	2	5.5	45	0.0
7	4	5.5	47	0.0
9	6	5.4	47	0.0
11	8	5.4	49	0.0
13	10	5.4	49	0.0
15	12	5.4	50	0.0
22	19	4.7	50	0.0

Measurements by YSI Model 33 STC Meter.


SEABRIGHT RESOURCES INC. BEAVER DAM MINE
AUSTIN SHAFT DEWATERING EXPERIMENT
TIME - DRAWDOWN DATA
Test# 1 June 18-20,1986
Test# 2 July 8-12,1986
June 26 18:53 T1
Approx. start up into shaft
2nd recovery June 19 14:19 T1
2nd pumping T1
Recovery #1 T2
Recovery #1 T1
Start pump #2T2
Rec.#2, T2
AUSTIN SHAFT DEWATERING EXPERIMENT
TIME-DRAWDOWN DATA
Drawdown in feet
Time in minutes since pumping began
1
10
100
1000
10,000
0
10
20
30
40
50
60

Appendix 3

JACQUES WHITFORD AND ASSOCIATES LIMITED PUMP TEST REPORT

DATE: JUNE
LOCATION: BEAVERDAM MINE
WELL: AUSTIN SHAFT

HYDRO.: DDH
WEATHER: CLEAR

	DRAWDOWN TEST				RECOVERY TEST		
TIME/DATE	TIME (min.)	FEET BTOC	DRAWDOWN	YIELD (gpm)	RESIDUAL DRAWDOWN	t/t'	SAMPLE
JUNE 18/86 1335	0	12.67	0	500 igpm			
1339	4	13.50	0.83				
1345	10	15.42	2.75				#1
1355	20	17.67	5.00				
1405	30	19.58	6.91				
1415	40	21.50	8.83				
1425	50	23.42	10.75				#2
1435	60	25.25	12.58				
1505	90	31.17	18.50				
1535	120	38.00	25.33				
1635	180	42.67	30.00				
1735	240	46.83	34.16				#3
1835	300	50.17	37.50				
1935	360	54.42	41.75				#4
2135	480	60.67	48.00				
2235	540	62.83	50.16				#5
2335	600	64.75	52.08				
JUNE 19/86 0035	660	65.08	52.41				
0245	780	65.92	53.25				#6
0435	900	67.08	54.41				
0535	960	67.58	54.91				#7
	TURN OFF PUMP		7 hour Recovery (#1)				
0540	965	67.61			54.94	193	
0542	967	67.61			"	138	
0545	970	67.61			"	97	
0549	974	67.61			"	69.5	
0554	979	67.60			54.93	51.5	
0600	985	67.59			54.92	39.4	
0610	995	67.58			54.91	28.4	
0620	1005	67.55			54.88	22.3	
0630	1015	67.53			54.86	18.5	

Appendix 3

JACQUES WHITFORD AND ASSOCIATES LIMITED PUMP TEST REPORT

DATE ______________________ HYDRO. ______________________
LOCATION __________________ WEATHER _____________________
WELL ______________________

	DRAWDOWN TEST				RECOVERY TEST		
TIME/DATE	TIME (min.)	FEET BTOC	DRAWDOWN	YIELD (gpm)	RESIDUAL DRAWDOWN	t/t'	SAMPLE
JUNE 14/86	1025	67.52			54.85	15.8	
0700	1045	67.47			54.80	12.3	
0720	1065	67.45			54.78	10.1	
0740	1085	67.43			54.76	8.7	
0800	1105	67.39			54.72	7.6	
0830	1135	67.34			54.67	6.5	
0900	1165	67.30			54.63	5.7	
0930	1195	67.26			54.59	5.1	
1000	1225	67.22			54.55	4.6	
1030	1255	67.18			54.51	4.3	
1100	1285	67.14			54.47	4.0	
1130	1315	67.11			54.44	3.7	
1200	1345	67.09			54.42	3.5	
1235	1380	67.07			54.40	3.3	
		START PUMPING		500 IGPM			
1247	1392	67.07	54.40				
1249	1394	67.07	54.40				
1252	1397	—	—				
1254	1399	67.13	54.46				
1257	1402	67.15	54.48				
1301	1406	67.19	54.52				#8
1311	1416	67.32	54.65				
1321	1418	67.44	54.77				
1331	1428	67.52	54.85				
1341	1438	67.65	54.98				
1401	1498	67.83	55.16				#9
1417	1513	68.00	55.33				
1417		TURN OFF PUMP		RECOVERY	#2		
1417	0 1513	68.05			55.38	1	
1418	1 1514	68.05			55.38	1485	
1419	2 1515	68.03			〃	743	

JACQUES WHITFORD AND ASSOCIATES LIMITED PUMP TEST REPORT

DATE ______________________

LOCATION ______________________

WELL ______________________

HYDRO. ______________________

WEATHER ______________________

	DRAWDOWN TEST					RECOVERY TEST		
TIME/DATE	TIME (min.)		FEET BTOC	DRAWDOWN	YIELD (gpm)	RESIDUAL DRAWDOWN	t/t'	SAMPLE
	3	1516	68.05			55.38	495	
	4	1517	"			"	372	
	5	1518	"			"	298	
	6	1519	"			"	248	
1433	16	1529	68.02			55.35	94	
1443	26	1539	68.02			55.35	58	
1453	36	1549	67.99			55.32	42	
1503	46	1559	67.99			55.32	33	
1523	66	1579	67.93			55.26	23	
1553	94	1609	67.91			55.24	17	
1615	116	1631	67.85			55.18	14	
1645	146	1661	67.81			55.14	11	
JUNE20/86 1010	1190	2705	66.76			54.09	2.3	
14:23	1443	2958	66.55			53.88	2.0	
JUNE26/86	9543	11,058	52.74			39.47	1.16	
	9843	11,358	51.16			38.49	1.15	
JUNE27/86	10,099	12,314	47.65			34.98	1.14	
JUNE28/86	12,243	13,758	43.09			30.42	1.12	
	12,596	14,111	41.84			29.17	1.11	

JACQUES WHITFORD AND ASSOCIATES LIMITED PUMP TEST REPORT

DATE: JULY 8 - 10, 1986
LOCATION: BEAVER DAM MINE
WELL: AUSTIN SHAFT

HYDRO.: DSM, DAC
WEATHER: CLEAR, WARM
YIELD: 200 USgpm

	DRAWDOWN TEST			RECOVERY TEST			
TIME/DATE	TIME (min.)	FEET BTOC	DRAWDOWN (~~m~~ ft)	FEET BTOC	RESIDUAL DRAWDOWN (m)	t/t'	SAMPLE
JULY 8/86 13:50	0	12.91"					
14:07	17	19.46	6.55				
1430	40	25.71	12.8				
1500	70	36.79	23.88				
1530	100	40.96	28.05				
1600	130	43.71	30.8				#1
1630	160	46.50	33.59				
1700	190	49.25	36.34				
1730	210	51.83	38.92				
1800	240	53.75	40.84				
1900	300	57.38	44.47				
2000	360	61.29	48.38				
2100	420	63.58	50.67				
2200	480	65.17	52.26				
2300	540	65.58	52.67				
2400	600	65.79	52.88 PUMP	SHUT OFF	TILL 0600		
JULY 9, 1986 0600	960	65.21	52.30 START	PUMP	(Recovery 0.58 ft in 6 hr (1"/hr)		
0700	1020	66.19	53.28				
0800	1080	67.12	54.21				
0830	1110	67.50	54.59				
0900	1140	67.79	54.88	PUMP OFF			
1000	1200	67.69	54.78	--			
1100	1260	67.56	54.65	START PUMP	(Recovery .19 ft/2 hr or 1"/hr)		
1200	1320	68.33	55.42	STOP PUMP:	change pumps		#2
1443	1440	68.27	55.36	START	CENTRIFUGAC PUMP		
1500	1500	68.29	55.38	(INITIAL RISE in h	when pump started)		#3
1600	1560	"	"				
1700	1620	"	"				
1800	1680	68.29	"				
1900	1740	68.54	55.63				
2000	1800	68.67	55.76				

DRILLER/YEAR: HOPPER
WELL DEPTH: 72.'
CASING LENGTH: MINE SHAFT

PUMP SETTING: 71' 10"
PUMP TYPE: Centrifugal
SPECIFIC CAPACITY (Q/S): ______

Appendix 3

JACQUES WHITFORD AND ASSOCIATES LIMITED PUMP TEST REPORT

DATE ______________________ HYDRO. ______________________

LOCATION ______________________ WEATHER ______________________

WELL ______________________

	DRAWDOWN TEST				RECOVERY TEST		
TIME/DATE	TIME (min.)	FEET BTOC	DRAWDOWN	YIELD (gpm)	RESIDUAL DRAWDOWN	t/t'	SAMPLE
JULY 9/86 2100	1860	68.88	55.97				
2200	1920	69.08	56.17				
2300	1980	69.29	56.38				
2400	2040	69.58	56.67				
JULY 10/86 0100	2100	69.67	56.76				
0200	2160	69.75	56.84				
0300	2220	69.92	57.01				
0400	2280	70.08	57.17				
0500	2340	70.25	57.34				
0600	2400	70.42	57.51				
0700	2460	70.58	57.67				
0800	2520	70.79	57.88				
0900	2580	70.85	57.94	Reached bottom of drop pipe			
1000	2640	"					#4
1100	2700	"		Pump clogging with debris			
1200	2760	"		[60 igpm] Broke suction @ t = 1130 hrs.			#5
1300	2820	"		[38 igpm]			
1330	2850	"					
1530	2970	"					#6
1630	3030	"					
1830	3150	"		[38 igpm] Pump off; Start recovery			#7

JACQUES WHITFORD AND ASSOCIATES LIMITED PUMP TEST REPORT

DATE JULY 10, 11. 1986
LOCATION BEAVERDAM MINE
WELL AUSTIN SHAFT

HYDRO.
WEATHER

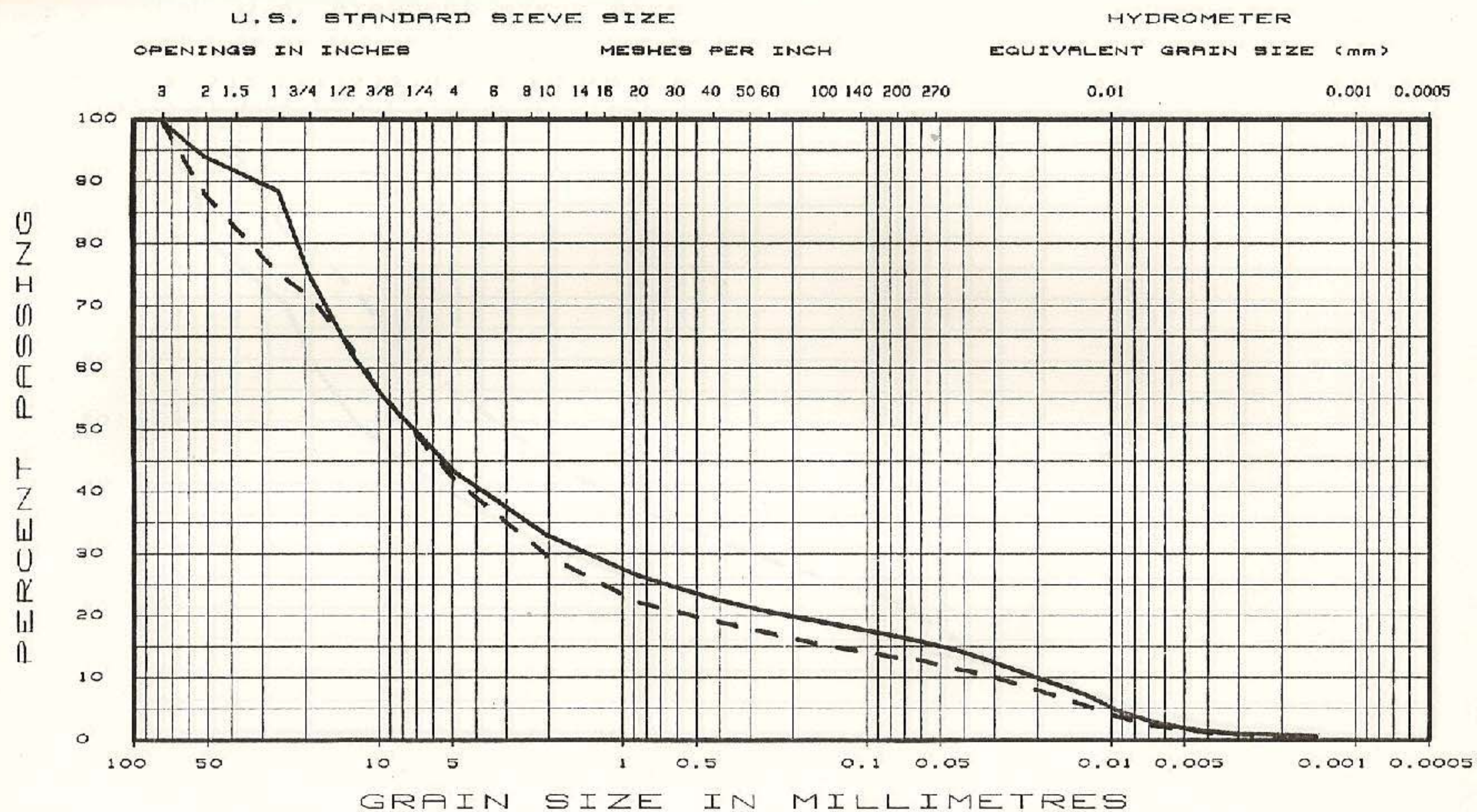
	DRAWDOWN TEST				RECOVERY TEST		
TIME/DATE	TIME (min.)	FEET BTOC	DRAWDOWN +1.5	YIELD (gpm)	RESIDUAL DRAWDOWN	t/t'	SAMPLE
JULY 10, 1986 1830	0	69.83	58.92		58.92		
20:00	30	69.54	56.63		58.63		
21:00	90	69.31	56.40	est. (40)	58.40		
22:00	150	69.08	56.17		58.17		
24:00	270	68.88	55.97		57.97		
JULY 11, 1986 0200	390	68.71	55.80		57.80		
0400	510	68.54	55.63		57.63		
0600	630	68.38	55.47		57.47		
0700	690	68.29	55.38		57.38		
0800	750	68.21	55.30		57.30		
0900	910	68.12	55.21		57.21		
1020	890	68.04	55.13		57.13		
1400	1110	67.75	54.84	(1"/hour)	56.84		
1700	1290	67.54	54.63		56.63		
JULY 12/86							
J							
July 16 @ 1350	8360	59.58	46.67				
1510	8440	59.25	46.34			1.4 min	

* WATER LEVEL MEASURED FROM NOTCH IN FLOOR

* MEASURING POINT ~ 2.0 ft lower than top of drop tube

* NOTE: RECOVERY MEAS. DATUM 1.5 ft lower than for drawdown.

Appendix 3

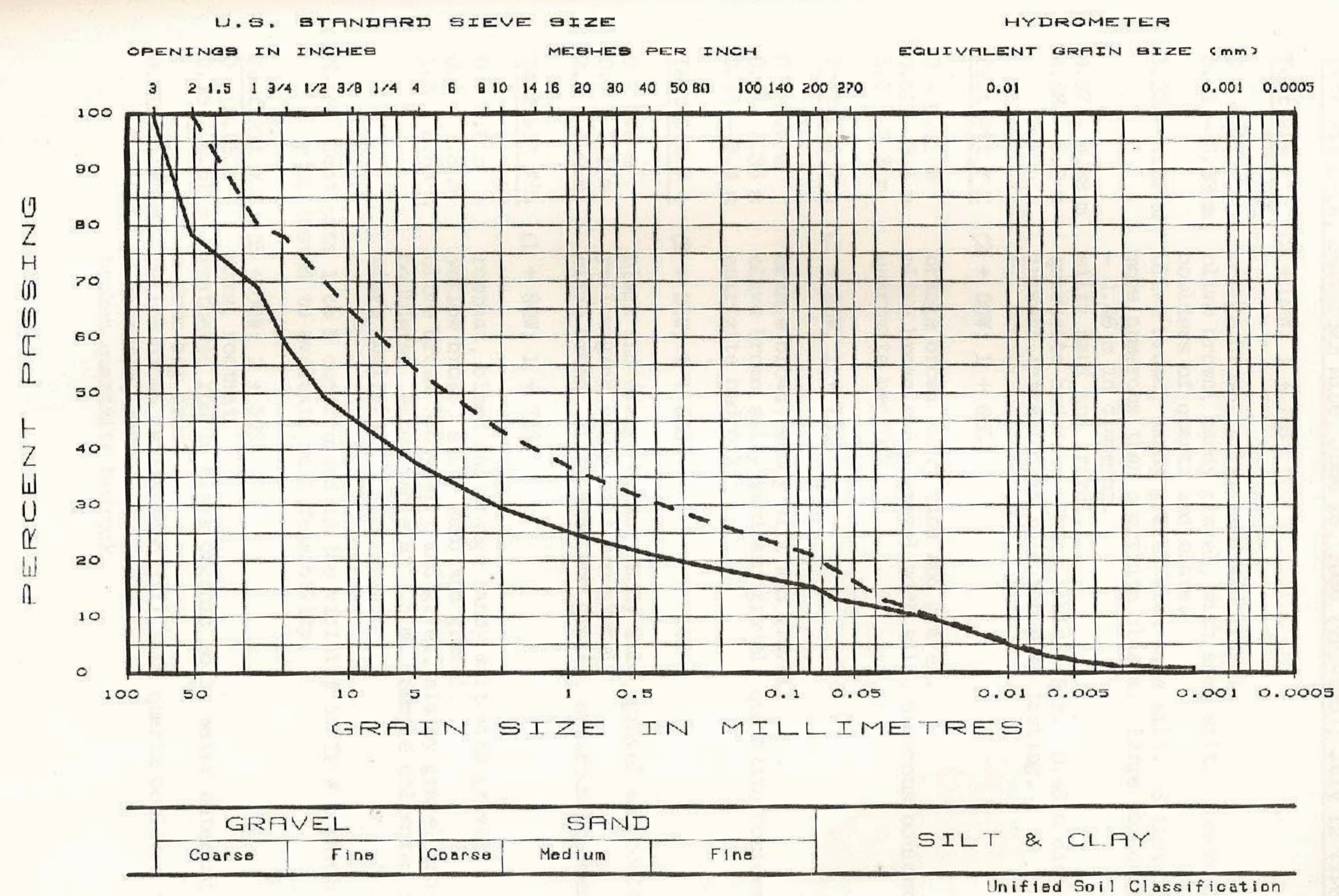


GRAVEL		SAND			SILT & CLAY
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification

	TEST PIT	SAMPLE	DEPTH	DESCRIPTION
———	1	1	0'-5'	Sandy GRAVEL, some silt
— — —	1	2	5'-10'	Sandy GRAVEL, some silt

M1289



	TEST PIT	SAMPLE	DEPTH	DESCRIPTION
———	1	3	10'-15'	Sandy GRAVEL, some silt
– – –	1	4	15'-16'	Sandy GRAVEL, some silt

M1289

APPENDIX 3

Test Pit Logs, Beaverdam Mine, June 25, 1986 (TP1-TP5); July 12 (TP6-TP9)

Test Pit # 1 (2 + 00W; 1 + 75S)

0 - 0.61 m	orange brown, silty sand and gravel
0.61 - 3.33 m	olive brown, sandy gravel, with some silt. Numerous boulders of quartz and slate.
3.33 - 4.57 m	olive brown, sandy gravel with some silt. Slatey clasts more numerous than quartzite clasts. Large boulders 0.15 - 0.46 m in diameter.
4.57 - 4.88 m	silty sand and gravel.
4.88 - 5.0 m	quartzite bedrock. Water table 1.8 m. 0.46 m diameter culvert installed in hole for pump testing.

Test Pit # 2 (2 + 00W; 1 + 65S)

0 - 0.61 m	orange brown silty sand and gravel.
0.61 - 3.3 m	olive brown sandy gravel with silt, numerous boulders.
3.3 - 3.5 m	quartzite bedrock.

Test Pit # 3 (2 + 25W; 1 + 75S)

0 - 0.9 m	orange brown, sandy silt and gravel.
0.9 - 3.35 m	olive brown silty sand and gravel, quartzite boulders.
3.35 - 3.4 m	quartzite bedrock.

Test Pit # 4 (2 + 25W; 1 + 65S)

0 - 0.6 m	black and orange brown, sandy silt, gravel and boulders.
0.6 - 2.1 m	yellow-gray sandy silt and gravel.
2.1 - 4.0 m	olive brown, silty sand and gravel, numerous boulders.

Test Pit # 5 (1 + 80W; 1 + 75S)

0 - 0.6 m	rootmat, black and orange sandy silt with gravel.
0.6 - 1.8 m	yellow brown, silty sand and gravel.
1.8 - 3.35 m	olive brown sandy silt and grvel, slatey gravel and boulders. Water table at 1.5 m. Sample collected for sieve analysis.

Note: Test pits 1 to 5 constructed in the vicinity of TP # 1 which was pump tested to evaluate well feasibility.

Test Pit # 6 (5 + 00W; 2 + 50S)

0 - 0.15 m	moss, rootmat
0.15 - 0.61 m	weathered red to black organic soil, water entering @ 0.61 m from bog area.
0.61 - 1.83 m	yellow brown, silty sand till with quartz boulders to 0.3 m diameter, dense.
	broken quartzite bedrock.

APPENDIX 3
(continued)

Test Pit # 7 (5 + 20W; 2 + 50S)

0 - .15 m	moss, rootmat
.15 - .61 m	reddish brown, silty sand loam, minor quartzite clasts.
.61 - 1.0 m	broken quartzite bedrock, no water.

Test Pit # 8 (5 + 00W; 2 + 75S)

0 - 0.76 m	black, organic peat and muck, strong H_2S odor
0.76 - 1.0 m	black organic silt
1.0 - 1.22 m	broken quartzite bedrock, some water.

Test Pit # 9 (5 + 15 W; 2 + 00S)

0 - 0.15 m	moss, rootmat
0.15 - 1.5 m	yellow brown silty sand loam, becoming more gravelly with depth. Numerous large quartzite boulders indicate proximity to bedrock.
1.5 - 2.0 m	hard quartzite bedrock. No water. Test pit indicates that bedrock ridge can be ripped to about 1.2 m depth by excavator.

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ASSESSMENT OF POTENTIAL OPEN PIT GROUNDWATER INFLOWS
BEAVER DAM GOLDPROJECT
NOVA SCOTIA

Report prepared for:

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Report No: 1501_R01

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George, Orr and Associates (Australia)

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1 INTRODUCTION

Atlantic Gold Corporation is assessing the feasibility of developing an open pit gold mine at their Beaver Dam Project in Nova Scotia, Canada, and are currently preparing documentation for a Bankable Feasibility Study. The proposed open put has dimensions 690 m by 360 m at the crest, and has a maximum depth of 200 m.

This report provides an assessment of potential groundwater inflows to the proposed open pit at the Beaver Dam Project. The assessment is based on previous hydrogeological investigations by Jacques, Whitford and Associates Limited, and the results of recent hydraulic conductivity testing by Stantec Consulting Ltd.

Recommendations for monitoring of groundwater during mining and the periodic assessment of these data are included.

2 PROJECT SETTING

2.1 Location and Topography

The Beaver Dam Project is located in central Nova Scotia about 85 km NE of Halifax and about 25 km from the North Atlantic Ocean. Beaver Dam is about 20 km NE of Atlantic Gold's Touquoy Gold Project (Figure 1)

The project site lies in an area of relatively low local topographic relief at an elevation of around 140 m, with scattered drumlins to 160 m elevation. Regional surface water drainage is predominantly to the south east along several poorly drained stream channels and shallow lakes, and there are several low-lying boggy areas across the site.

Vegetation coverage in and around the project site consists of spruce, fir, and some hardwood. Logging has been conducted in the area, and there has recently been clear felling of timber in the immediate vicinity of the project site.

The proposed open pit adjacent to Cameron Flowage, a stillwater area on the Killag River and a remnant of past logging operations (JWA, 1986a). Cameron Flowage is around 1.2 km long by up to 120 m wide (Figure 2). All surface water generated within the drainage catchment that includes the proposed open pit flows into Cameron Flowage.

There is a shallow sediment settling dam located in the eastern part of the proposed open pit (Figure 2). This dam was used to trap sediment generated by the dewatering of the Seabright underground operations in the mid-1980s before discharging to Cameron Flowage.

2.2 Prior Mining History and Dewatering

The following discussion is mostly adapted from Schofield (2015).

Gold was discovered at Beaver Dam in 1868, with first production recorded in 1871.

Intermittent attempts to develop a mine in the area occurred until 1949, with the property changing ownership several times. Some of these attempts focused on the Austen Shaft which was collared in 1902 and developed initially to a depth of 30 m with crosscuts 19 m north and 12 m south at a depth of 22 m. The southern crosscut was extended to a length of 90 m in 1927, and an incline was sunk to 61 m in 1936 from the southern crosscut.

The Austen Shaft and associated underground workings are within the perimeter of the proposed Beaver Dam open pit.

In 1985 the leases were acquired by Seabright Resources Inc who subsequently conducted a number of exploration programs which delineated an auriferous zone between 20 m and 30 m wide over a strike length of 700 m and depth 600 m. Between 1986 and 1988 Seabright conducted exploration from a new underground development that reached a maximum depth of 105 m and spanned 400 m of strike. All of the Seabright workings are within the perimeter of the proposed open pit, and they are not connected with any of the developments from the Austen Shaft.

No records of rates of long-term mine dewatering during the previous phases of mining and underground exploration have been discovered. There are notations that the Austen Shaft was dewatered on at least six occasions – 1928, 1934, 1954-57, 1965, and twice by Seabright in the late 1980s.

Jacques, Whitford and Associates Limited conducted a hydrogeological investigation at Beaver Dam in 1986 prior to Seabright's underground exploration program (JWA, 1986b). This work included a pumping test to dewater the Austen Shaft and associated workings. The results of this testing program are discussed in Section 3.1.

2.3 Rainfall, Evaporation, and Temperature

Precipitation data are available from the Middle Musquodoboit weather station, 33 km west of the Beaver Dam project site (CRA, 2005).

Precipitation occurs as rain, and during the cooler winter months as snow. Average annual precipitation (including snow as equivalent rainfall) is around 1,400 mm, and this is evenly distributed throughout the year with average monthly precipitation of between 100 mm and 140 mm. Lake evaporation data presented in CRA (2005) indicates evaporation rates are negligible from November to April, and range between

40 mm/month and 110 mm/month from May to October. Annual lake evaporation is around 500 mm, which is about 40% of the annual precipitation.

Average monthly temperatures range between -6°C in January and 18°C in July.

2.4 Geology and Hydrogeology

The Beaver Dam gold deposit is within the Meguma Group, which is a sequence of Cambro-Ordovician sandstones and mudstones that form the southern half of the province of Nova Scotia. The Meguma Group is divided into two stratigraphic units: the basal Goldenville Formation and overlying Halifax Formation. The dominant lithologies are greywacke in the Goldenville Formation and argillite in the Halifax Formation. The Goldenville Formation is at least 5,600 m thick, and the average thickness of the Halifax Formation is 4,400 m.

The Meguma Group sedimentary sequence was uplifted and deformed into a series of tightly folded sub-parallel northeast trending anticlines and synclines during the Arcadian Orogeny. This sequence has been metamorphosed to between greenschist and amphibolite (staurolite) facies, and intruded by granites and minor mafic intrusives.

The Meguma Group sequence, and predominantly the Goldenville Formation, is host to most of the gold mineralisation that has been exploited in Nova Scotia since 1860.

The Beaver Dam Project is within the argillite dominated Moose River Member of the Goldenville Formation (Figure 3). This member also hosts the Touquoy deposit to the SW and Fifteen Mile Stream deposit to the NE (Figure 1).

The Moose River Member is folded into three sub-parallel anticlines at Beaver Dam, and the gold deposit is associated with the southern overturned limb of the central anticline which dips to the north at between 75° and 90°. The sequence at Beaver Dam is sinistrally offset by two northwest trending faults: the Mud Lake Fault and the Cameron Flowage Fault. The Mud Lake Fault is described from drill cores as a 2 m to 3 m zone of gouge within a 10 m to 20 m wide brecciated zone.

The Meguma Group sequence at Beaver Dam is covered by glacial till deposits of varying thickness and occasional shallow peat bogs. The range of grain size of the till materials is large, being from clay to boulder. Regionally the sheet of till deposits has a mean thickness of about 3 m, but locally it can be up to 20 m thick (eg, at drumlin deposits). At Beaver Dam the till sheet is about 5 m thick, and there is evidence of a sediment-filled gully up to 25 m deep which intersects the trace of the Mud Lake Fault.

Groundwater occurs at shallow depths at the Beaver Dam site, and Cameron Flowage is probably an area of groundwater discharge. The bedrock sequence forms a fractured rock aquifer system, and this overlain by a thin aquifer in the till. The degree of hydraulic connection amongst the smaller bedrock fracture systems is probably poor to moderate, and the main zones that are capable of storing and transmitting relatively large amounts of groundwater would be the larger scale faults.

The volume of groundwater stored in the bedrock aquifer is probably small, and this reflects the relatively small primary porosity of these rocks. Some of the larger bedrock structures may be hydraulically connected to surface water bodies which may become sources of aquifer recharge under a mine dewatering scenario.

Descriptions of drilling conditions through the Mud Lake Fault in JWA (1986b) indicate boreholes were quite unstable in this section, and groundwater flows were “low”. The latter comment appears to refer to the groundwater yielding capability of boreholes for the purpose of supplying water for drilling rigs. One borehole, BD-86-47, is noted to be a flowing artesian borehole with measured flow rate of 0.1 L/sec. BD-86-47 is located slightly north of the south east end of Cameron Flowage, and has a total depth of 500 m.

3 PREVIOUS HYDROGEOLOGICAL INVESTIGATIONS

Jacques, Whitford and Associates conducted a hydrogeological investigation at the Beaver Dam site in 1986 prior to the exploration work by Seabright Resources Inc (JWA, 1986b). The objectives of the investigation were to predict the rates of groundwater inflow to the proposed underground exploration development, and the quality of water flowing into the underground. The scope of the investigation included a pumping test to dewater the Austen Shaft, and several single borehole packer tests using some of the diamond core holes. The results of this work are discussed in Sections 3.1 and 3.2.

In 2014, Stantec Consulting Ltd conducted packer testing of one diamond core hole at the Beaver Dam site. The objective of this investigation was to determine the hydraulic conductivity of various parts of the bedrock sequence at Beaver Dam including the Mud Lake Fault. Results of this work are discussed in Section 3.3.

3.1 Austen Shaft Dewatering 1986

This test involved pumping from the Austen Shaft, and monitoring water levels in the shaft during pumping and recovery (JWA, 1986b). The maximum pumping water level that could be achieved during testing was around 22 m. This depth is equivalent to the depths of the crosscuts that were developed off the shaft in 1902.

The first pumping test commenced at 1:35pm on 18 June 1986. The static water level (SWL) in the shaft prior to pumping was noted to be 3.86 m below the datum for the test, which presumably was close to ground level. The pumping rate during the test was

2,275 kL/day (26.3 L/sec), and all of the available drawdown was exhausted after 16 hours of pumping.

A graph of drawdown versus time from this pumping test is presented in Figure 4. There are three linear segments in this drawdown-time graph, with the rate of drawdown tending to decrease at longer times during the test. The linear trends of drawdown versus time indicate that, in this instance. there is a linear relationship between water level and water storage volume in each of the three vertical intervals of the shaft and its associated developments. This also indicates that the rate of pumping during the test was much greater than the rate of groundwater seepage into the shaft and underground developments.

The total volume of water pumped from the Austen Shaft and associated developments in the June 1986 test was 1,520 kL.

A second group of pumping tests was conducted in July 1986. In one of these test pumping occurred until the available drawdown was exhausted, and the pumping rate was then reduced to maintain a steady water level. The final pumping rate of 2.9 L/sec (249 kL/day) was maintained for a period of 5½ hours. Note that this pumping rate can be interpreted as the maximum rate of groundwater seepage into all of the underground voids of the Austen Shaft and associated underground developments which extend to a depth of 61 m.

3.2 Packer Testing 1986

Jacques, Whitford and Associates selected nine existing diamond core holes for conducting single borehole packer injection tests to determine values of formation hydraulic conductivity. Boreholes for testing were selected on the basis of their inclination (near-vertical holes preferred), and the lithology and structure intersected (Mud Lake Fault, ore zones, the anticline axis, greywacke, argillite, and quartzite). Initially sixteen boreholes were selected a possible candidates for testing, however only nine were suitable. Packer test were conducted in 56 intervals within these boreholes. The locations of the boreholes used for packer testing are indicated on Figure 5, and listed in Table 1.

A “straddle” packer consisting of a 4.5 m length of perforated pipe with 1 m long inflatable packers at either end was used in this testing program. The packer assembly was run in and out of the hole on a wireline. Nitrogen gas was used to inflate the packers, and water was injected into the packed-off interval through a high-pressure hose.

Table 1 lists the intervals in each borehole that were tested, the lithology and structure in these intervals, and the values of hydraulic conductivity calculated from the test data by JWA (1986b). All boreholes listed in Table 1 are inclined with dip angles between -60° and -70° at the collars, and the depth intervals are the depths within the borehole, ie these are not vertical depth intervals.

The range of hydraulic conductivity values determined by the 1986 testing program is 3.7 x 10^{10} m/sec and 1.9 x 10^{-6} m/sec. The mean of the set of values is 2.5 x 10^{-7} m/sec, and the geometric mean (approximate median)(1) value is 4.8 x 10^{-8} m/sec.

Five of the 1986 packer tested intervals intersected to Mud Lake Fault. Hydraulic conductivity determined from this group of tests ranges between 1.2 x 10^{-9} m/sec and 1.9 x 10^{-6} m/sec, and the mean and geometric mean values are 3.7 x 10^{-7} m/sec and 1.5 x 10^{-8} m/sec, respectively.

All of the values of hydraulic conductivity determined from the 1986 packer testing program are relatively small, and are not unusual given the geological and structural settings.

3.3 Packer Testing 2014

Stantec Consulting Ltd conducted five packer tests in diamond cored borehole BD14-188 in December 2014 (Stantec, 2015). The location of BD14-188 is indicated on Figure 5.

BD14-188 was selected for packer testing so that the tested intervals included the hanging wall sequence, the Mud Lake Fault, and the foot wall sequence. Five intervals were tested, with test interval lengths ranging between 8 m and 64 m. Results are listed in Table 1.

Stantec note that one of the tested intervals in the hanging wall and both tested intervals in the footwall did not accept any of the injected water. The values of hydraulic conductivity inferred from these three tests are indicated by the “<” character in Table 1.

Hydraulic conductivity calculated from the two successful packer tests conducted in December 2014 are within the range of hydraulic conductivities calculated from the 1986 testing program. The value of K determined by the test of the Mud Lake Fault is 1.0 x 10^{-8} m/sec, which is again within the range of values determined for this structure in the 1986 testing.

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1 The geometric mean value of several hydraulic conductivity results based on similar tests is generally taken to be the best representative large-scale estimate of this parameter for subsequent use in groundwater flow rate calculations.

Stantec note that the intersection of the Mud Lake Fault in BD14-188 had a significantly higher rock mass quality than was anticipated on the basis of cores from adjacent boreholes. The implication is that parts of the Mud Lake Fault have larger hydraulic conductivities than the value determined from this packer test.

The geometric mean value of all of the hydraulic conductivity results from the 1986 and 2014 testing programs is 4.5×10^{-8} m/sec.

4 ESTIMATES OF OPEN PIT GROUNDWATER INFLOW RATES

As groundwater occurs at shallow depths across the Beaver Dam site, groundwater seepage into the proposed open pit will be one issue that will need to be managed basically from the start of mining.

Groundwater can be expected to seep into an open pit developed at the Beaver Dam site through the surficial glacial till deposits, and though fractures and structures in the bedrock. As dewatering progresses and groundwater levels in the vicinity of the open pit are lowered, some surface water bodies which are presently groundwater discharge areas may become areas of groundwater recharge. The main effect of this recharge will be to maintain some of the seepage into the open pit.

4.1 Seepage from Till

Atlantic Gold's Touquoy Project, 20 km SW of Beaver Dam, has similar geological and hydrogeological settings to Beaver Dam, with a thin sheet of surficial glacial till overlying folded and fractured argillite and greywacke. The estimated average groundwater inflow rate into an open pit at Touquoy from the till is 450 kL/day (5.2 L/sec) (Peter Clifton & Associates, 2006). Given the proposed open pits at Touquoy and Beaver Dam have similar crest perimeter lengths, this estimate of groundwater inflow rate from the till can also be applied to the Beaver Dam site.

Some spatial variation in the rates of groundwater inflow from the till must be expected around the crest of the pit. There are likely to be sections of the wall where seepage rates are negligible and other sections where the seepage is noticeable. Some seasonal variation in seepage rates from the till is also expected. The recommended approach for managing groundwater seepage from the till is discussed in Section 5.

4.2 Seepage from Bedrock

The results of extensive packer testing of the bedrock at Beaver Dam did not identified any large-scale permeable units from which large rates of groundwater seepage into an open pit could be expected. The geometric mean (approximate median) value of the entire set of hydraulic conductivity values determined from these tests is 4.5×10^{-8} m/sec. This is a relatively small value of this parameter, however this is consistent with the lithology of the sequence at Beaver Dam apparent from diamond cores.

Some caution is needed when using the results of packer tests conducted in diamond core holes. Packer tests in core holes may underestimate the actual hydraulic conductivity of the tested interval due to blinding, or blocking, of permeable fractures by fine grained drill cuttings or viscous drilling fluid. It is not possible to quantify the magnitude of these effects, and they may not necessarily be a significant factor. The set of hydraulic conductivity results from the tests at Beaver Dam appears reasonable given the lithology and the type of aquifer (fractured bedrock).

One uncertainty is the role of the Mud Lake Fault in groundwater seepage into the proposed Beaver Dam open pit. All of the packer tests which have been conducted in the Mud Lake Fault produced hydraulic conductivity estimates which are not significantly different from the remainder of the tests. However, the Mud Lake Fault is described as a 2 m to 3 m zone of gouge within a 10 m to 20 m wide brecciated zone, and is noted to be associated with borehole instability issues during drilling. The Mud Lake Fault is only known from cores, and it was not intersected by any of the underground developments associated with the Austen Shaft and the Seabright workings.

If the actual hydraulic conductivity of the Mud Lake Fault is larger than indicated by the results of the packer tests, groundwater inflow rates to an open pit at Beaver Dam will be influenced more by the small hydraulic conductivities of the greywacke and argillite sequence. Recommendations for managing groundwater pressures in the Mud Lake Fault are included in Section 5.

Figure 6 is a graph of hydraulic conductivity versus depth based on the results of the packer tests. Only the results of the testing in 1986 have been included in this graph. While there is generally weak correlation between hydraulic conductivity and depth apparent in Figure 6, there is a tendency for the smaller values of K to occur at greater depths. This is an expected trend, and can be explained by slight dilation of fractures at shallower depths.

An estimate of the rate of groundwater inflow through the bedrock to an open pit at Beaver Dam can be made using a model which assumes that all of the flow enters the pit through the north and south walls (ie, the longer walls in the pit – see Figure 2). For a pit wall 800 m long and 100 m deep, and assuming a bulk formation hydraulic conductivity of 4.5×10^{-8} m/sec (the geometric mean of the packer test results) and hydraulic gradient of 1 (a conservative assumption), the estimated rate of groundwater seepage is 311 kL/day. The estimated groundwater seepage rate into the 100 m deep pit from both the north and south walls would thus be 622 kL/day (7.2 L/sec). In deeper sections of the pit, groundwater inflows are expected to be smaller than these values due to the lower formation hydraulic conductivities that tend to occur with increasing depth at Beaver Dam.

It is recommended that a range of groundwater seepage rates from bedrock at Beaver Dam of between 100 kL/day (1.2 L/sec) and 1,000 kL/day (12 L/sec) be used for planning purposes.

5 RECOMMENDATIONS FOR MANAGING GROUNDWATER SEEPAGE

From a mine dewatering perspective there are two groundwater seepage issues at the proposed Beaver Dam open pit that require attention:

- Seepage from the glacial till deposits into the open pit (eg seepage that migrates along the till/bedrock contact)
- Seepage from the bedrock sequence into the open pit and the associated groundwater pressures in the pit walls – this is an important issue that can influence open pit wall stability

The above issues follow from the hydrogeological setting of the site, and different approaches are required to control inflows and seepage from these sources.

5.1 Seepage from Till

The glacial till at Beaver is a sheet of poorly sorted sediment with a fine grained matrix averaging 5 m thick. There is evidence of a sediment-filled gully up to 25 m deep which intersects the trace of the Mud Lake Fault.

Rates of seepage from the till exposed around the perimeter of the open pit will vary, and will primarily be related to the proportion of fine grained matrix material. Larger rates of seepage can be expected where the till is relatively coarse and contains a small proportion of fines.

Seepage rates from the till to the open pit will also vary by small amounts seasonally due to normal seasonal changes in the level of the water table. Seepage rates from the till are expected to be greatest following the spring thaw and during the early summer months.

Where the till consists of relatively coarse grained gravels with a small proportion of fines there is the potential for larger groundwater inflows to occur. Whether these inflow rates are sustained will depend on the lateral extent of the gravel deposits, and the degree of interconnection between the gravels and surface water bodies. This may require further investigation if the risk is considered significant.

The estimated rate of groundwater seepage from the till into an open pit at Beaver Dam 450 kL/day. This is considered to be an average value, with seasonal variations superimposed.

Although the total rate of groundwater seepage from the till into the open pit is not expected to be large, if left unmanaged this could result in erosion, slumping of the till, and possibly water flowing over the crest of the pit. It is recommended that this seepage be intercepted and diverted before it reaches the open pit. This can be achieved with an open drain at the base of the till which is dug a short distance into the top of the bedrock, and one or more sumps at low points in the drain to collect the seepage and pump it from the pit. Because the expect flow rates are relatively small, the cross section area of the drain can safely be of order 1 m^2 and still provide sufficient carrying capacity. The drain may need to be lined where it crosses major structures to prevent recharge occurring to the bedrock groundwater system as this may cause problems for pit wall stability.

Where thicker accumulations of till occur drains and sumps will need to be positioned deeper within the open pit to intercept any seepage.

Figure 7 presents a conceptual design of a drain at the base of the till in an open pit at Beaver Dam. The distance between the edge of the drain and the inner pit crest (ie, bedrock crest) is about 30 m. This is also the recommended length of sub-horizontal drain holes in the pit walls (see Section 5.2).

5.2 Seepage from Bedrock

The ambient water table at Beaver Dam is close to the land surface and the bedrock sequence is saturated. Groundwater will therefore flow into an open pit at Beaver Dam, and dewatering will be required to maintain dry working conditions. Lowering of groundwater pressures in the pit walls will also be required for wall stability purposes, and dewatering of the bedrock sequence exposed in the walls will be important from this perspective. Dewatering facilities will also be needed in the pit to remove surface water that collects after rainfall.

Seepage through the bedrock sequence at Beaver Dam will largely be controlled by geological structures, and will vary around the pit due to variations in the density of joints and fractures, and the occurrence of major faults.

Managing groundwater pressures in the pit walls at Beaver Dam will require groundwater levels to be monitored in piezometers behind the walls, and groundwater pressures in the walls to be dissipated by means of sub-horizontal drain holes. It is recommended that drain holes be located to intersect permeable structures 20 m to 30 m back from the walls. If possible, drain holes should be selectively located in areas where seepage is an obvious issue rather than placing them at regular spacing on every bench of the pit. A greater density of drains may be required to control groundwater pressures within and near the Mud Lake Fault.

Figure 7 presents a conceptual design of pit wall drainage by means of sub-horizontal drain holes. Drains should be about 30 m long, and can be drilled with a blast hole rig. Flows from drains will generally diminish over time, and drains on the higher benches may eventually cease flowing as the mine is developed. Discharge from drains should be directed to a sump either through a series of pipes or channels. Collaring of drain holes may be necessary if large and persistent flow rates are encountered, however in most cases flows are expected to be no greater than a trickle and should diminish over time.

Monitoring of groundwater levels will require piezometers to be constructed at the pit crest, and progressively on some benches as the open pit is developed. Piezometers can be vertical boreholes drilled to a depth of 40 m to 50 m, possibly with a blast hole drilling rig, and cased with 32 mm or 40 mm PVC pipe which has been slotted from 10 m below surface. The annulus outside the slotted casing should be packed with graded sand (~2 mm grain size) to about 3 m above the top of the slots. Slots can be cut with a hacksaw, or machine slotted casing can be used if this is available.

Piezometers located at the pit crest will require the glacial till sequence to be collared to below the till/bedrock contact so that groundwater in the till cannot seep into the borehole. These piezometers should also include annular bentonite clay seals of height about 1 m on top of the sand pack. It may be necessary to modify the design of these piezometers during construction to ensure that the bentonite seal is a few metres below the till/bedrock contact.

All piezometers should be finished with steel surface casing about 0.7 m above ground level, and these casings should be painted bright orange or green so that they are clearly visible. Piezometers should be surveyed to determine locations and reference elevations for measuring water levels against.

For planning purposes, allowance should be made for piezometers at the pit crest to be around 200 m apart, ie there will be nine or ten piezometers around the crest of the proposed Beaver Dam open pit. Transects of piezometers every 50 m vertically down the pit wall should be constructed at every second crest piezometer.

Data from the piezometers will provide profiles of the phreatic surface which will be important for assessing pit wall stability. If access to piezometers over the longer term is uncertain, consideration should be given to equipping these facilities with pressure transducers that connect to logging units at the crest of the pit.

6 REMAINING HYDROGEOLOGICAL ISSUES

Hydrogeological issues at Beaver Dam that may need to be considered are:

- Quality and quantity of any groundwater that may need to be discharged off site, ie in excess of what can be utilised for ore processing
- Groundwater and surface water monitoring programs that may need to be established under statutory requirement for mining operations in Nova Scotia

A possible issue that may need to be considered given the setting is the effect of freezing temperatures on groundwater seepage close to the pit walls. The expansion of water that occurs at temperatures below 4°C and when ice is formed has the potential to cause slight dilation of the rock mass and joints. This process may lead to exfoliation at the pit walls. Whether this will be a significant process in an open pit at Beaver Dam is unclear. Avoiding this condition would require that the wall rocks be completely dewatered, especially close to the face of the pit.

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REFERENCES

CRA, 2005, “Touquoy Mine – Mine Permitting, Hydrologic Information Summary”, consultant report prepared for Atlantic Gold NL by Conestoga-Rovers & Associates, November 2005.

JWA, 1986a, “Environmental Assessment of Gold Mine Development, Beaver Dam, Nova Scotia”, consultant report prepared for Seabright Resources Inc by Jacques, Whitford and Associates Limited and P Lane and Associates Limited (M1285, June 1986).

JWA, 1986b, “Hydrogeological Investigation Beaver Dam Mine”, consultant report prepared for Seabright Resources Inc by Jacques, Whitford and Associates Limited (M1289, July 1986).

Peter Clifton & Associates, 2006, “Hydrogeological Investigations, Touquoy Gold Project, Nova Scotia”, consultant report prepared for Atlantic Gold NL, (0506_R01, September 2006).

Schofield, N, 2015, “Technical Report of the Beaver Sam Gold Project, Halifax County, Nova Scotia”, consultant report prepare for Atlantic Gold Corporation by FSSI Consultants (Aust) Pty Ltd, March 2015.

Stantec, 2015, “Packer Testing – Beaver Dam Project”, letter, Stantec Consulting Ltd to Mr J Morgan, Atlantic Gold Corporation. 23 January 2015.

Westminer, 1989, “Westminer Canada Limited Seabright Operations, Beaver Dam Property Development License 0078, Report of Work and Expenditures for the Period May 1, 1986 to April 30, 1989”, report to the Dept of Mines and Energy, Nova Scotia.

Table 1: Beaver Dam Project Packer Testing Results

Borehole	From	To	Lithology / Structure	K (m/sec)
BD85-005	15.2	19.8	Argillite	5.2×10^{-7}
	19.8	24.4	Argillite	9.0×10^{-8}
	24.4	29	Argillite	1.8×10^{-7}
	50.3	54.9	Greywacke	1.4×10^{-6}
BD85-007	15.2	19.8	Argillite	4.7×10^{-8}
	19.8	24.4	Argillite, Quartzite	1.1×10^{-8}
	24.4	29	Quartzite	8.4×10^{-7}
	56.4	61	Greywacke / Fault	2.0×10^{-9}
	65.5	70.1	Greywacke	5.4×10^{-7}
	88.4	93	Argillite	3.0×10^{-8}
BD85-013	21.6	26.2	Greywacke	2.0×10^{-8}
	25.9	30.5	Greywacke, Quartzite	2.4×10^{-8}
	81.7	86.3	Greywacke, Argillite	5.8×10^{-8}
	86	90.6	Argillite	4.1×10^{-8}
	90.2	94.8	Argillite	2.8×10^{-8}
	94.5	99.1	Argillite	2.5×10^{-8}
	98.8	103.4	Argillite	4.3×10^{-8}
BD85-016	10.6	15.2	Greywacke, Quartzite	8.0×10^{-7}
	15.2	19.8	Quartzite	1.6×10^{-6}
	19.8	24.4	Quartzite	4.9×10^{-8}
	76.2	80.8	Greywacke, Argillite	2.5×10^{-7}
	80.8	85.3	Greywacke, Argillite	3.0×10^{-7}
	85.3	89.9		3.9×10^{-7}
BD85-029	13.7	18.3	Argillite	4.7×10^{-7}
	24.1	28.7	Greywacke	9.9×10^{-8}
	33.5	38.1	Greywacke	9.4×10^{-7}
	39.6	44.2	Greywacke	9.0×10^{-8}
	102.1	106.7	Greywacke, Argillite	4.9×10^{-8}
	106.7	111.3	Greywacke	1.6×10^{-8}
BD85-043	19.8	24.4	Quartzite	8.3×10^{-9}
	24.4	29	Greywacke, Argillite	2.6×10^{-8}

continued…

Table 1 (cont): Beaver Dam Project Packer Testing Results

Borehole	From	To	Lithology / Structure	K (m/sec)
BD85-043 (cont)	47.2	51.8	Greywacke	1.0×10^{-6}
	51.8	56.4	Greywacke	2.3×10^{-7}
	62.5	67.1	Greywacke	2.7×10^{-9}
	67.1	71.6	Greywacke	3.4×10^{-9}
	117.3	121.9	Greywacke	1.0×10^{-9}
	121.9	126.5	Greywacke	7.6×10^{-10}
	126.5	131.1	Greywacke	2.6×10^{-9}
	131.1	135.6	Greywacke, Argillite	1.6×10^{-9}
	135.6	140.2	Argillite	5.5×10^{-10}
	140.2	144.8	Argillite	3.7×10^{-10}
BD85-082	15.2	19.8	Greywacke	3.6×10^{-8}
	19.8	24.4	Greywacke	1.1×10^{-6}
	24.4	29	Quartzite / Fault	1.9×10^{-6}
	30.5	35.1	Greywacke	8.0×10^{-7}
	41.1	45.7	Quartzite	6.1×10^{-7}
	45.7	50.3	Quartzite	4.6×10^{-7}
BD85-083	39.6	44.2	Greywacke / Fault	1.5×10^{-8}
	48.8	53.3	Greywacke / Fault	1.0×10^{-8}
	57.9	62.5	Greywacke / Fault	1.2×10^{-9}
	71.6	76.2	Argillite	7.1×10^{-9}
	80.8	85.3	Greywacke, Argillite	2.7×10^{-8}
BD85-090	19.8	24.4	Quartzite	3.1×10^{-8}
	24.4	29	Greywacke	3.0×10^{-8}
	29	33.5	Greywacke, Quartzite	2.4×10^{-8}
	33.5	38.1	Greywacke, Quartzite	8.1×10^{-8}
BD14-188	12	23	Hanging wall	$<1.0 \times 10^{-8}$
	33	50	Hanging wall	5.0×10^{-9}
	117	125	Fault	1.0×10^{-8}
	147	160	Foot wall	$<2.0 \times 10^{-9}$
	147	210	Foot wall	$<4.0 \times 10^{-10}$

Notes: “K” is hydraulic conductivity
Boreholes with prefix “BD-85” tested in 1986 (JWA, 1986b)
Borehole BD14-188 tested in 2015 (Stantec, 2015)

Appendix F
Wetland Functional Assessment Summary Table

Wetland Functional Assessment Summary Table. Beaver Dam Mine Project

McCallum Environmental Ltd.

Significant Function	WL 1	WL 2	WL 3	WL 4	WL 5	WL 6	WL 7	WL 8	WL 9	WL 10	WL 11	WL 12	WL 13	WL 14	WL 15	WL 16	WL 17
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	M-L	M-L	M	M	M	M	M	M	L	M	M	M	M	M	M	M	M
SF3	H	H	H	H	H	M	M	H	M	H	H	H	H	H	M	H	H
SF4	M	H	H	H	H	H	M	H	M	M	M	H	M	H	H	H	M
SF5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF7	N	SpC, S2S3, S3, S3B, S3S4, S3S4N, S3S4B	N	S2S3	N	N	N	Thr, S3, S3N, S3B, S3S4B	N	S2S3, S3, S3N, S3S4B	N	S3	S3	Thr, SpC	N	S3, S3B, S3S4N, S3S4B	SpC, S3, S3N, S3B, S3S4B
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	NAT	NAT	NAT	NAT	NAT	NAT	MOD	MOD	NAT	NAT	NAT	MOD	NAT	MOD	NAT	NAT
SF14	N	Y	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N
SF15	M	H	H	M	M	H	H	M	H	H	L	H	L	L	M	M	M
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	H	H
SF19	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
SF20	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21	NA	NA	NA	H	NA	NA	NA	H	NA	H	M	NA	M	H	L	NA	H
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	H	H	L	H	M	M	M	H	L	M	H	H	H	M	L	M	H
SF24	H	H	H	H	H	M	M	H	H	H	H	M	H	M	M	H	H
SF25	N	N	N	Leptogium corticola (S2S3)	N	N	N	N	N	N	N	Carex wiegandii (S3)	N	Degelia plumbea (SARA and COSEWIC SpC, NSESA V)	N	N	Degelia plumbea (SARA and COSEWIC SpC, NSESA V)
SF26	N	Y	N	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	N	Y
SF27	N	Boreal Chickadee (S3), Gray Jay (S3), American Robin (S5B, S3N), Greater Yellowlegs (S3B, S3S4M), Pine Siskin (S2S3), Purple Finch (S4S5B, S3S4N), Red-breasted Nuthatch (S3), Red Crossbill (S3S4), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B), Wilson's Snipe (S3B), Yellow-bellied Flycatcher (S3S4B)	N	N	N	N	N	Olive-sided Flycatcher (SARA, COSEWIC, NSESA T, S3B), Gray Jay (S3), American Robin (S5B, S3N), Greater Yellowlegs (S3B, S3S4M), Ruby-crowned Kinglet (S3S4B), Yellow-bellied Flycatcher (S3S4B)	N	Gray Jay (S3), American Robin (S5B, S3N), Pine Siskin (S2S3), Swainson's Thrush (S3S4B), Yellow-bellied Flycatcher (S3S4B)	N	N	N	Olive-sided Flycatcher (SARA, COSEWIC, NSESA T, S3B)	N	Gray Jay (S3), Purple Finch (S4S5B, S3S4N), Ruby-crowned Kinglet (S3S4B), Wilson's Snipe (S3B), Yellow-bellied Flycatcher (S3S4B)	Peregrine Falcon (SARA, COSEWIC SC, NSESA V, SIB), American Robin (S5B, S3N), Greater Yellowlegs (S3B, S3S4M), Northern Harrier (S3S4B), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)
SF28	M	M	M	M	M	M	M	H	M	H	M	M	M	M	M	M	H
SF29	L	L	L	L	L	L	L	M	L	M	L	L	L	L	L	L	M

Notes:

* SF7/SF25/SF27 is considered a red rated function if a species present is listed by SARA or NSESA as Endangered/Threatened/Special Concern; or Ranked by ACCDC as S1.

Birds included in these results are indicative of point count location within or adjacent to wetland, and does not confirm use of the wetland as crucial supporting habitat.

Cells highlighted in red indicate this function is considered to be critical to the watershed or represent a highly degraded watershed. These functions are typically unique or rare or associated with a high risk to the watershed if lost (NSE 2014c).

Unless otherwise stated: H=High; M=Moderate/Medium; L=Low; Y=Yes; N=No; NAT=Natural; MOD=Modified; Smod= Significantly Modified; Thr=Threatened; SpC=Special Concern; End=Endangered

**SF14, SF21 where hydrologically connected features extend beyond PA boundaries, source of a stream/headwater was inferred from Wet Areas Mapping.

[1] Predicted NSE WSS Layer indicates WL64 is a WSS as a result of the presence of the OSFL in 2009. However, 2016 breeding bird surveys did not confirm the presence of the OSFL. See the SAR/SOCI section in the report for additional information.

Wetland Functional Assessment Summary Table. Beaver Dam Mine Project

McCallum Environmental Ltd.

Significant Function	WL 18	WL 19	WL 20	WL 21	WL 22	WL 23	WL 24	WL 25	WL 26	WL 27	WL 28	WL 29	WL 30	WL 31	WL 32	WL 33	WL 34	WL 35	WL 36	WL 37	WL 38	WL 39	WL 40	WL 41	WL 42	WL 43	WL 44	WL 45	WL 46
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	M	M	M	L	L	L	L	L	L	L	L	M-L	L	M-L	L	L	M	M-L	L	L	M-L	M	M	M	M	M	M	M	M
SF3	H	M	M	M	H	H	M	L	H	H	L	H-M	H	H	H	H	M	M	H	M	H	L	H	M	M	H	M	H	H
SF4	H	M	M	M	H	M	M	L	M	M	L	M	H	H	H	H	M	M	M	M	M-L	L	M	M	H	H	H	H	H
SF5	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF7	N	S3N, S3B, S3S4N	N	N	N	N	N	N	N	N	N	End, SpC, Thr, S2S3, S3	N	N	N	S3	N	N	N	N	N	N	N	N	S3, S3N, S3S4B	N	N	N	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	MOD	NAT	MOD	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	MOD	NAT	NAT
SF14	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y
SF15	H	H	L	H	H	H	H	H	H	M	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	M	H	L
SF16	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M
SF19	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF20	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21	NA	NA	M	NA	NA	NA	NA	NA	NA	NA	NA	H	NA	NA	NA	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	H	NA	M
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	L	M	H	M	M	L	H	H	L	M	M	H	H	M	L	H	H	H	H	M	M	H	H	L	H	M	H	M	M
SF24	M	M	M	H	H	H	M	L	H	M	L	H	H	H	H	H	M	M	M	H	H	L	M	H	M	H	M	H	H
SF25	N	N	N	N	N	N	N	N	N	N	N	Erioderma pedicellatum (SARA/COSEWIC/NSESA End)	N	N	N	Carex wiegandii (S3)	N	N	N	N	N	N	N	N	N	N	N	N	N
SF26	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	Y
SF27	N	American Robin (S5B, S3N), Greater Yellowlegs (S3B, S3S4M), Purple Finch (S4S5B, S3S4N)	N	N	N	N	N	N	N	N	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B)	N	N	N	N	N	N	N	N	N	N	N	N	Boreal Chickadee (S3), Gray Jay (S3), American Robin (S5B, S3N), Ruby-crowned Kinglet (S3S4B)	N	N	N	N
SF28	M	M	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF29	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

McCallum Environmental Ltd.

Significant Function	WL 47	WL 48	WL 49	WL 50	WL 51	WL 52	WL 53	WL 54	WL 55	WL 56	WL 57	WL 58	WL 59	WL 60	WL 61	WL 62	WL 63
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	M	M	M	M	M	M	M	L	M	M	M	M	M	M	M	M	L
SF3	M	L	H	H	H	M	H	M	M	M	H-M	H	M	M	H	H	H
SF4	H	M	H	H	H	H	H	M	H	M	M	M	M	M	M	H	M
SF5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N
SF7	N	S3	N	N	Thr, S2S3, S3, S3N	N	Thr, S3, S3S4B	S3, S3N, S3S4B	N	S1, S3, S3B	Thr	N	S2S3, S3, S3N, S3B, S3S4N, S3S4B	N	SpC, S2S3, S3N, S3S4B	N	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	MOD	NAT	NAT	NAT	NAT	NAT	MOD	MOD	MOD	NAT	NAT	MOD	NAT	NAT	NAT	NAT
SF14	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	N
SF15	H	M	H	H	H	M	M	H	H	M	M	H	H	H	M	M	H
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M
SF19	N	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N
SF20	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
SF21	NA	H	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	L	NA	H	L	NA
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	M	H	M	M	H	M	H	M	H	H	H	M	H	M	H	M	M
SF24	M	M	H	H	H	M	M	M	M	M	H	H	M	M	H	H	H
SF25	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF26	N	Y	N	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	N
SF27	N	N	N	N	Olive-sided Flycatcher (SARA, COSEWIC, NSESA T, S3B), Gray Jay (S3), American Robin (S5B, S3N), Pine Siskin (S2S3)	N	Chimney Swift(SARA/COSEWIC T, NSESA E, S2B S1M), Boreal Chickadee (S3), Yellow-bellied Flycatcher (S3S4B)	Gray Jay (S3), American Robin (S5B, S3N), Swainson's Thrush (S3S4B)	N	Gray Jay (S3), Greater Yellowlegs (S3B, S3S4M), Red-breasted Nuthatch (S3)	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B)	N	Gray Jay (S3), American Robin (S5B, S3N), Greater Yellowlegs (S3B, S3S4M), Pine Siskin (S2S3), Purple Finch (S4S5B, S3S4N), Ruby-crowned Kinglet (S3S4B), Spotted Sandpiper (S3S4B), Swainson's Thrush (S3S4B), Wilson's Snipe (S3B)	N	American Robin (S5B, S3N), Swainson's Thrush (S3S4B)	N	N
SF28	M	M	M	M	M	M	M	M	M	H	M	M	H	M	H	M	M
SF29	L	L	L	L	L	L	L	L	L	L	L	L	M	L	M	L	L

Significant Function	WL 64	WL 65	WL 66	WL 67	WL 68	WL 69	WL 70	WL 71	WL 72	WL 73	WL 74	WL 75	WL 76	WL 77	WL 78	WL 79	WL 80	WL 81	WL 82	WL 83	WL 84
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	M	M	M	M	M	M	M	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF3	M	M	H	H	H	H	H	H	H	H	M	H	M	H	H	H	H	H	H	H	L
SF4	M	M	H	H	M	H	M	M	M	H	M	H	M	H	H	M	M	M	H	H	M
SF5	N[1]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF7	S3B, S3S4B	N	Thr, S3, S3N, S3S4B	N	N	N	N	Thr, S3, S3B, S3S4B	Thr, S3, S3B, S3S4B	N	N	N	Thr, S3N, S3S4B	N	N	N	S3	N	N	N	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	MOD	NAT	MOD	NAT	NAT	NAT	NAT	NAT	MOD	MOD	MOD	NAT	MOD	NAT	NAT	MOD	MOD	NAT	NAT	NAT	MOD
SF14	Y	N	Y	N	N	N	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	Y	N
SF15	H	H	M	M	L	H	H	H	M	H	L	H	L	M	H	L	H	H	H	H	H
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	M	H	M	M	M	M	H	H	L	L	L	H	L	L	H	L	H	H	H	M	H
SF19	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
SF20	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
SF21	NA	NA	H	L	M	H	NA	NA	NA	NA	H	NA	H	NA	NA	H	NA	NA	NA	NA	NA
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	H	L	H	H	H	H	M	M	M	H	H	M	H	M	M	M	H	L	M	L	M
SF24	M	M	M	H	H	H	H	H	H	M	M	H	M	M	M	H	M	L	H	H	L
SF25	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	*Listera australis* (S3)	N	N	N	N
SF26	Y	N	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	N	N	Y	N	N	N	N	N
SF27	Northern Goshawk (COSEWIC NAR, S3S4B), Blackpoll Warbler(S3S4B), Greater Yellowlegs (S3B, S3S4M), Swainson's Thrush (S3S4B)	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), American Robin (S5B, S3N), Blackpoll Warbler(S3S4B), Red-breasted Nuthatch (S3), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	N	N	N	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), Gray Jay (S3), Greater Yellowlegs (S3B, S3S4M), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), Gray Jay (S3), Greater Yellowlegs (S3B, S3S4M), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	N	N	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), American Robin (S5B, S3N), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	N	N	N	N	N	N	N	N
SF28	M	M	H	M	H	H	M	M	M	M	M	M	M	M	M	H	M	M	M	M	M
SF29	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

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Significant Function	WL 85	WL 86	WL 87	WL 88	WL 89	WL 90	WL 91	WL 92	WL 93	WL 94	WL 95	WL 96	WL 97	WL 98	WL 99	WL 100	WL 101	WL 102	WL 103	WL 104	WL 105	WL 106	WL 107	WL 108
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF3	L	M	L	H	M	M	H	H	M	M	H	H	H	H	H	H	H	H	M	M	M	M	H	H
SF4	M	M	M	H	M	M	M	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF7	S2S3, S3, S3N, S3S4B	N	N	S2S3, S3, S3N	Thr, S3, S3N, S3S4B	N	N	N	N	N	N	N	N	S3B, S3N, S3S4B	N	N	N	N	N	N	N	N	N	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	NAT	NAT	NAT	NAT	NAT	MOD	NAT	MOD	MOD	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
SF14	N	N	N	N	N	Y	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF15	H	H	H	H	H	M	H	M	H	M	H	H	H	L	H	H	H	H	H	H	H	H	H	H
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF19	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF20	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21	NA	NA	NA	NA	NA	NA	NA	NA	NA	L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	L	L	L	M	M	H	M	M	L	H	M	M	L	M	L	M	M	H	L	L	L	M	L	L
SF24	L	M	L	H	M	M	M	M	M	H	H	M	H	H	H	H	M	M	M	M	M	M	H	H
SF25	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF26	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF27	American Robin (S5B, S3N), Evening Grosbeak (S3S4B, S3N), Pine Siskin (S2S3), Red-breasted Nuthatch (S3), Ruby-crowned Kinglet (S3S4B)	Barn Swallow (COSEWIC T, NSESA E, S3B)	N	Gray Jay (S3), American Robin (S5B, S3N), Pine Siskin (S2S3)	American Robin (S5B, S3N), Red-breasted Nuthatch (S3), Swainson's Thrush (S3S4B)	N	N	N	N	N	N	N	N	American Robin (S5B, S3N), Gray Catbird (S3B), Ruby-crowned Kinglet (S3S4B)	N	N	N	N	N	N	N	N	N	N
SF28	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF29	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

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Significant Function	WL 109	WL 110	WL 111	WL 112	WL 113	WL 114	WL 115	WL 116	WL 117	WL 118	WL 119	WL 120	WL 121	WL 122	WL 123	WL 124	WL 125	WL 126	WL 127	WL 128	WL 129	WL 130	WL 131	WL 132	WL 133
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF3	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF4	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF7	N	S3, S3S4N, S3S4B	N	SpC	S3, S3S4, S3S4B, S3S4N	N	S3	N	N	N	N	N	N	N	N	N	N	N	S3	N	S3, S3S4B	N	N	Thr, S3, S3N, S3S4B	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
SF14	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF15	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF19	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF20	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21	NA	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	M	L	M	M	M	L	M	M	L	M	M	L	L	L	M	M	M	M	M	L	M	L	L	M	L
SF24	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF25	N	N	N	N	N	N	Listera australis (S3)	N	N	N	N	N	N	N	N	N	N	N	Listera australis (S3)	N	Listera australis (S3)	N	N	N	N
SF26	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF27	N	Boreal Chickadee (S3), Purple Finch (S4S5B, S3S4N), Ruby-crowned Kinglet (S3S4B)	N	N	Black-backed Woodpecker (S3S4B), Purple Finch (S4S5B, S3S4N), Red-breasted Nuthatch (S3), Red Crossbill (S3S4), Swainson's Thrush (S3S4B)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Black-backed Woodpecker (S3S4B), Red-breasted Nuthatch (S3)	N	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), Gray Jay (S3), American Robin (S5B, S3N), Black-backed Woodpecker (S3S4B), Red-breasted Nuthatch (S3), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	N
SF28	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF29	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Wetland Functional Assessment Summary Table. Beaver Dam Mine Project

Significant Function	WL 134	WL 135	WL 136	WL 137	WL 138	WL 139	WL 140	WL 141	WL 142	WL 143	WL 144	WL 145	WL 146	WL 147	WL 148	WL 149	WL 150	WL 151	WL 152	WL 153	WL 154
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF3	H	H	H	H	M	H	H	H	H	M	M	M	M	M	M	L	M	M	M	H	M
SF4	H	H	H	H	H	H	H	H	H	M	H	M	M	M	M	M	M	M	M	M	M
SF5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF7	N	S3	S3, S3S4B	S3	N	N	N	N	S3S4B	SpC	N	N	N	S3	Thr, S3, S3N, S3S4B	N	N	S3	N	N	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	NAT	NAT	NAT	MOD	MOD	NAT	MOD	MOD	MOD	MOD	MOD	MOD	NAT	MOD	MOD	MOD	NAT	NAT	NAT	MOD
SF14	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF15	H	M	H	L	H	H	H	H	M	M	M	H	H	H	H	H	H	H	H	H	H
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF19	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF20	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21	NA	NA	NA	M	NA	NA	NA	NA	M	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	M	H	M	M	M	L	L	L	M	H	H	M	H	H	H	H	L	L	M	M	L
SF24	H	H	H	H	M	H	H	M	M	M	M	M	M	M	M	M	L	M	M	H	M
SF25	N	Listera australis (S3)	N	*Listera australis (S3)*	N	N	N	N	N	N	N	N	N	Listera australis (S3)	N	N	N	N	N	N	N
SF26	N	Y	N	Y	N	N	N	N	Y	Y	Y	N	Y	N	N	N	N	N	N	N	Y
SF27	N	N	Ruby-crowned Kinglet (S3S4B)	N	N	N	N	N	Ruby-crowned Kinglet (S3S4B)	Eastern Wood-Pewee (COSEWIC SC, NSESA V, S3S4B)	N	N	N	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), Gray Jay (S3), American Robin (S5B, S3N), Ruby-crowned Kinglet (S3S4B)	N	N	Red-breasted Nuthatch (S3)	N	N	N
SF28	M	M	M	M	M	L	M	L	M	M	M	M	H	M	M	M	L	M	M	M	H
SF29	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Wetland Functional Assessment Summary Table. Beaver Dam Mine Project

Significant Function	WL 155	WL 156	WL 157	WL 158	WL 159	WL 160	WL 161	WL 162	WL 163	WL 164	WL 165	WL 166	WL 167	WL 168	WL 169	WL 170	WL 171	WL 172	WL 173	WL 174	WL 175
SF1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2	H	H-M	H-M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF3	H	H-M	H	M	H	M	H	M	M	H	M	M	H	H	H	H	H	M	H	H	M
SF4	H	H	H	M	H	H	H	H	H	H	M	M	M	M	M	H	H	H	M	M	M
SF5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	N
SF7	N	Thr, S3, S3N, S3S4B, S3S4N	Thr, S3, S3S4, S3S4B	N	N	N	N	N	N	S3S4B	S3, S3S4N	N	N	S3N, S3S4B, S3S4N	N	N	N	N	Thr, S3, S3S4B	N	N
SF8	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13	NAT	NAT	NAT	MOD	NAT	NAT	NAT	NAT	NAT	NAT	MOD	NAT	NAT	NAT	NAT	NAT	NAT	MOD	NAT	NAT	NAT
SF14	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N
SF15	H	H	H	H	L	L	H	H	H	H	M	H	H	H	H	M	L	H	L	L	M
SF16	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF17	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF19	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	Y
SF20	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N
SF21	NA	NA	H	M	M	NA	NA	NA	NA	NA	M	NA	NA	NA	NA	NA	H	NA	M	NA	NA
SF22	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23	M	H	H	H	M	L	M	H	L	M	M	M	M	H	M	M	M	M	M	M	M
SF24	M	M	H	L	M	H	M	H	M	H	M	L	M	H	H	M	H	L	H	H	M
SF25	N	N	*Vaccinium corymbosum (S3S4)*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF26	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	N	Y	N	Y	Y	N
SF27	N	Olive-sided Flycatcher (SARA, COSEWIC, NSESA T, S3B), Gray Jay (S3), American Robin (S5B, S3N), Black-backed Woodpecker (S3S4B), Purple Finch (S4S5B, S3S4N), Red-breasted Nuthatch (S3), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	Olive-sided Flycatcher (SARA, COSEWIC, NSESA T, S3B), Bay-breasted Warbler (S3S4B), Red-breasted Nuthatch (S3)	N	N	N	N	N	N	Northern Harrier (S3S4B), Ruby-crowned Kinglet (S3S4B)	Boreal Chickadee (S3), Purple Finch (S4S5B, S3S4N)	N	N	American Robin (S5B, S3N), Blackpoll Warbler(S3S4B), Purple Finch (S4S5B, S3S4N), Ruby-crowned Kinglet (S3S4B)	N	N	N	N	Canada Warbler (SARA/COSEWIC T, NSESA E, S3S4B), Gray Jay (S3), Black-backed Woodpecker (S3S4B), Ruby-crowned Kinglet (S3S4B), Swainson's Thrush (S3S4B)	N	N
SF28	M	M	H	L	H	H	M	M	M	M	M	L	M	M	M	M	H	L	M	M	M
SF29	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	L	L	L	L

Significant Function	WL 176	WL 177	WL 178	WL 179
SF1	L	L	L	L
SF2	M	M	M	M
SF3	H	M	M	M
SF4	M	M	M	M
SF5	N	N	N	N
SF6	N	N	N	N
SF7	N	S3, S3S4B	N	S3, S3S4B
SF8	N	N	N	N
SF9	N	N	N	N
SF10	N	N	N	N
SF11	N	N	N	N
SF12	N	N	N	N
SF13	NAT	NAT	NAT	NAT
SF14	N	N	N	N
SF15	H	H	H	H
SF16	Y	Y	Y	Y
SF17	L	L	L	L
SF18	H	H	H	H
SF19	Y	N	Y	Y
SF20	N	Y	N	N
SF21	NA	NA	NA	NA
SF22	N	N	N	N
SF23	M	M	M	H
SF24	H	M	M	M
SF25	N	N	N	N
SF26	N	N	N	N
SF27	N	Red-breasted Nuthatch (S3), Ruby-crowned Kinglet (S3S4B), Swainson’s Thrush (S3S4B)	N	Red-breasted Nuthatch (S3), Ruby-crowned Kinglet (S3S4B), Swainson’s Thrush (S3S4B)
SF28	M	M	M	M
SF29	L	L	L	L

Appendix G
Wetland Characterization Table

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	**Shrubs**	**Trees**	**Depth**	**Hydric Soil Indicators**
Mine	WL1.1	Surface Water (A1) High Water Table (A2) Hydrogen Sulphide (C1)	*Carex trisperma* *Osmunda cinnamomea*	*Nemopanthus mucronatus* *Picea mariana*	*Picea mariana* *Acer rubrum*	40-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL1.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Maianthemum trifolium*	*Picea mariana* *Nemopanthus mucronatus*	*Larix laricina* *Picea mariana*	100-0cm Organic	Histosol (A1)
Mine	WL1.3	High Water Table (A2) Water-Stained Leaves (B9) Saturation (A3)	*Carex trisperma* *Cornus canadensis*	*Nemopanthus mucronatus*	*Larix laricina* *Picea mariana*	65-0cm Organic	Histosol (A1)
Mine	WL1.4	High Water Table (A2) Saturation (A3)	*None*	*Nemopanthus mucronatus* *Larix laricina* *Viburnum nudum*	*None*	170-0cm Organic	Histosol (A1)
Mine	WL2.1	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*None*	*Picea mariana* *Larix laricina*	*Larix laricina* *Picea mariana*	45-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL2.2	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Carex atlantica*	*Picea mariana*	*None*	60-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL2.3	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*None*	*Picea mariana* *Larix laricina*	*Larix laricinia*	40-0cm	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL2.4	High Water Table (A2) Saturation (A3) Stunted or Stressed Plants (D1)	*None*	*Picea rubens* *Larix laricina* *Pinus strobus*	*None*	80-0cm Organic	Histosol (A1)
Mine	WL2.5	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Kalmia angustifolia* *Gaultheria hispidula*	*Nemopanthus mucronatus* *Viburnum nudum*	*Larix laricina* *Picea rubens*	100-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL2.6	High Water Table (A2) Saturation (A3)	*Carex trisperma* *Osmunda cinnamomea*	*Nemopanthus mucronatus* *Abies balsamea*	*Abies balsamea* *Picea mariana* *Acer rubrum*	40-0cm Organic	Histosol (A1)
Mine	WL2.7	High Water Table (A2) Saturation (A3)	*Eleocharis tenuis*	*Larix laricina* *Picea rubens* *Juniperus communis*	*Larix laricina*	60-0cm Organic	Histosol (A1)
Mine	WL2.8	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) **Secondary Indicators:** Drainage Patterns (B10)	*Dryopteris campyloptera* *Oxalis montana*	*Abies balsamea*	*Picea rubens*	18-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Moss Trim Lines (B16) Dry-Season Water Table (C2) Geomorphic Position (D2)					
Mine	WL3	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Maianthemum trifolium*	*Abies balsamea* *Gaylussacia baccata*	*Larix laricina* *Acer rubrum*	40-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL4.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Aquatic Fauna (B13) Hydrogen Sulphide (C1)	*None*	*Larix laricina* *Picea mariana* *Alnus incana*	*Larix laricina*	100+cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL4.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Carex trisperma* *Osmunda cinnamomea*	*Picea mariana* *Acer rubrum* *Alnus incana*	*Picea mariana* *Acer rubrum*	100+cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL5	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Picea mariana* *Nemopanthus mucronatus*	*Abies balsamea* *Picea mariana* *Acer rubrum*	50-0cm Organic	Histosol (A1)
Mine	WL6	Saturation (A3) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9)	*Rubus pubescens* *Cornus canadensis*	*Abies balsamea*	*Acer rubrum* *Picea mariana* *Betula papyrifera*	20-0cm Organic	Histosol (A1)
Mine	WL7	Saturation (A3) Algal Mat or Crust (B4) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9)	*Scirpus cyperinus* *Glyceria striata*	*None*	*None*	18-0cm Organic	Histosol (A1)
Mine	WL8.1	High Water Table (A2) Saturation (A3)	*Carex trisperma* *Cornus canadensis*	*Picea mariana* *Abies balsamea*	*Picea mariana*	35-0cm Organic	Histosol (A1)
Mine	WL8.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Aquatic Fauna (B13)	*Carix stricta* *Chamaedaphne calyculata*	*Larix laricina*	*None*	45-0cm Organic	Histosol (A1)
Mine	WL8.3	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex stricta* *Chamaedaphne calyculata* *Myrica gale*	*None*	*Larix laricina* *Acer rubrum* *Picea mariana*	40-0cm Organic	Histosol (A1)
Mine	WL8.4	High Water Table (A2) Saturation (A3)	*Kalmia angustifolia* *Carex trisperma*	*Larix laricina* *Picea mariana*	*Larix laricina* *Picea mariana*	60-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
Mine	WL9	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Sparsely Vegetated Concave Surface (B8) **Secondary Indicators:** Stunted or Stressed Plants (D1)	*Kalmia angustifolia*	*Picea mariana*	*Picea mariana* *Acer rubrum*	10-0cm Organic	Histosol (A1)
Mine	WL10	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex stricta* *Chamaedaphne calyculata*	*Gaylussacia baccata*	*None*	40-0cm Organic	Histosol (A1)
Mine	WL11.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Carex stricta* *Chamaedaphne calyculata*	*Picea mariana* *Viburnum nudum* *Acer rubrum*	*None*	65-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL11.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9)	*Glyceria grandis*	*Alnusincana* *Abies balsamea*	*Acer rubrum* *Picea mariana*	25-0cm Organic	Histosol (A1)
Mine	WL12.1	High Water Table (A2) Saturation (A3)	*Carex trisperma* *Osmunda cinnamomea*	*Abies balsamea* *Acer rubrum* *Picea mariana*	*Acer rubrum*	35-0cm Organic	Histosol (A1)
Mine	WL12.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) **Secondary Indicators:** Drainage Patterns (B10) Stunted or Stressed Plants (D1)	*Carex trisperma* *Osmunda cinnamomea*	*Abies balsamea* *Picea mariana*	*Abies balsamea* *Picea mariana*	35-0cm Organic	Histosol (A1)
Mine	WL13.1	High Water Table (A2) Saturation (A3) Water Marks (B1) Algal Mat or Crust (B4) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Thin Muck Surface (C7)	*Glyceria grandis*	*Picea mariana*	*Larix laricina* *Picea mariana*	80-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL13.2	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Glyceria canadensis* *Carex trisperma*	*Acer rubrum* *Abies balsamea*	*Acer rubrum* *Picea mariana*	40+cm Organic	Histosol (A1) Hydrogen Sulphide (A4)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Water-Stained Leaves (B9) Aquatic Fauna (B13) Hyrdrogen Sulphide Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Geomorphic Position Stunted or Stressed Plants (D1)					
Mine	WL14.1	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Glyceria canadensis* *Osmunda cinnamomea* *Carex trisperma*	*Abies balsamea*	*Picea mariana* *Betula papyrifera*	60-0cm Organic	Histosol (A1)
Mine	WL14.2	High Water Table (A2) Saturation (A3)	*Carex stricta* *Rosa virginiana*	*Viburnum nudum* *Alnus incana*	*Acer rubrum*	40-0cm Organic	Histosol (A1)
Mine	WL14.3	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulfide	*Eriophorum angustifolium* *Chamaedaphne calyculata*	*Viburnum nudum*	*None*	70-0cm Organic	Histosol (A1)
Mine	WL15	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulfide	*Glyceria grandis*	*Acer rubrum* *Larix laricina*	*None*	50-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL16	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex atlantica* *Vaccinium oxycoccos*	*Larix laricina* *Viburnum nudum* *Acer rubrum* *Picea mariana*	*None*	5-0cm Organic	Histosol (A1)
Mine	WL17.1	High Water Table (A2) Saturation (A3)	*Carex stricta* *Carex trisperma*	*Viburnum nudum*	*Larix laricina* *Picea mariana* *Abies balsamea*	35-0cm Organic	Histosol (A1)
Mine	WL17.2	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Juniperus communi* *Grais spp.*	*Larix laricina* *Picea mariana*	*Larix laricina* *Picea mariana*	100+ Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL18	High Water Table (A2) Saturation (A3)	*Carex trisperma* *Gaultheria hispidula*	*Larix laricina* *Picea mariana*	*Larix laricina* *Picea mariana*	35-0cm Organic	Histosol (A1)
Mine	WL19	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex trisperma* *Scirpus cyperinus*	*Acer rubrum* *Betula populifolia*	*None*	20-0cm Organic 0-12cm Mineral	Histic Epipedon (A2)
Mine	WL20	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Osmunda regalis*	*Acer rubrum* *Ilex verticillata* *Alnus incana*	*Acer rubrum* *Larix laricina*	100cm+ Organic	Histosol (A1) Hydrogen Sulphide (A4)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Moss Trim Lines (B16) Drainage Patterns (B10) Dry-Season Water Table (C2) Stunted or Stressed Plants (D1) Geomorphic Positions (D2)					
Mine	WL21	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Geomorphic Positions (D2)	*Cornus canadensis*	*Abies balsamea* *Betula papyrifera cordifolia*	*Abies balsamea* *Betula papyrifera cordifolia*	22-0cm Organic 0-15cm Mineral	Histic Epipedon (A2)
Mine	WL22	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Moss Trim Lines (B16) Geomorphic Positions (D2)	*Ocemena nemoralis* *Cornus canadensis*	*Abies balsamea* *Nemopanthus mucronatus*	*Abies balsamea* *Acer rubrum*	27-0cm Organic	Histic Epipedon (A2)
Mine	WL23	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Geomorphic Positions (D2)	*Carex trisperma*	*Abies balsamea* *Picea mariana* *Betula papyrifera cordifolia*	*Picea mariana* *Abies balsamea*	22-0cm Organic	Histosol (A1)
Mine	WL24	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma*	*Abies balsamea* *Picea mariana*	*Abies balsamea* *Picea mariana*	25-0cm Organic	Histosol (A1)
Mine	WL25	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Moss Trim Lines (B16)	*Carex trisperma* *Osmunda cinnamomea*	*Abies balsamea* *Acer rubrum*	*Abies balsamea* *Picea mariana*	46-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Dry-Season Water Table (C2) Stunted or Stressed Plants (D1) Geomorphic Positions (D2)					
Mine	WL26	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Water Marks (B1) Algal Mat or Crust (B4) Secondary Indicators: Dry-Season Water Table (C2) Geomorphic Positions (D2)	*Osmunda cinnamomea*	*Dead fall*	*Dead fall*	id Assessm	Histosol (A1)
Mine	WL27	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Water-Stained Leaves (B9)	*Glyceria striata*	*Acer rubrum* *Abies balsamea*	*Acer rubrum* *Abies balsamea* *Picea mariana*	20-0cm Organic 0-10 Mineral	Histic Epipedon (A2)
Mine	WL28	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Stunted or Stressed Plants (D1) Geomorphic Positions (D2)	*Rubus hispidus* *Carex trisperma*	*Picea mariana* *Betula papyrifera cordifolia*	*Pinus strobus*	42-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL29.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Nemopanthus mucronatus*	*Acer rubrum* *Larix laricina* *Picea mariana*	35-0cm Organic	Histosol (A1)
Mine	WL29.2	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda regalis*	*Nemopanthus mucronatus* *Gaylussacia baccata*	*Acer rubrum* *Larix laricina*	45-0cm Organic	Histosol (A1)
Mine	WL29.3	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Rhynchospora alba*	*Nemopanthus mucronatus* *Larix laricina*	*Larix laricina*	45-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL29.4	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea* *Carex trisperma*	*Picea mariana* *Abies balsamea*	*Abies balsamea* *Picea mariana*	60-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL29.5	High Water Table (A2) Saturation (A3)	*Kalmia angustifolium*	*Nemopanthus mucronatus* *Picea mariana*	*Larix laricina* *Picea mariana*	35-0cm Organic	Histosol (A1)
Mine	WL29.6	Surface Water (A1) High Water Table (A2)	*Rhynchospora alba* *Chamaedaphne calyculata*	*None*	*None*	50-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Water-Stained Leaves (B9) Aquatic Fauna (B13)					
Mine	WL30	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Cornus canadensis* *Gaultheria hispidula*	*Abies balsamea* *Picea mariana*	*Picea rubens*	25-0cm Organic	Histosol (A1)
Mine	WL31	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1)	*Osmunda cinnamomea* *Maianthemum canadense*	*Nemopanthus mucronatus* *Picea mariana*	*Picea mariana*	65-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL32	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Dry-Season Water Table (C2) Stunted or Stressed Plants (D1) Geomorphic Positions (D2) Shallow Aquitard (D3)	*Maianthemum trifolium*	*Abies balsamea*	*Picea mariana* *Abies balsamea*	22-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL33	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Stunted or Stressed Plants (D1) Geomorphic Positions (D2)	*Osmunda cinnamomea* *Carex trisperma* *Cornus canadensis*	*Abies balsamea* *Nemopanthus mucronatus*	*Abies balsamea* *Picea mariana*	40+cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL34	High Water Table (A2) Saturation (A3) Iron Deposits (B5) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Stunted or Stressed Plants (D1) Geomorphic Positions (D2) Drainage Patterns (B10) Moss Trim Lines (B16) Dry-Season Water Table (C2)	*Carex trisperma* *Fragaria virginiama*	*Abies balsamea* *Betula alleghaniensis*	*Abies balsamea*	40+cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL35	High Water Table (A2)	*Osmunda cinnamomea*	*Abies balsamea*	*Picea mariana*	42-0cm	Histosol (A1)

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FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Dry-Season Water Table (C2) Moss Trim Lines (B16) Geomorphic Position (D2)	*Carex trisperma*		*Abies balsamea*	Organic	
Mine	WL36	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Dry-Season Water Table (C2) Geomorphic Position (D2)	*Osmunda cinnamomea*	*Abies balsamea* *Acer rubrum*	*Abies balsamea* *Picea mariana*	32-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL37	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Geomorphic Position (D2)	*Oclemena accuminata* *Oclemena nemoralis*	*Betula papyrifera cordifolia* *Betula alleghaniensis*	*Betula papyrifera cordifolia*	28-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL38	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Dry-Season Water Table (C2) Geomorphic Positions (D2) Stunted or Stressed Plants (D1)	*Thelypteris simulata*	*Abies balsamea* *Ilex verticillata* *Picea mariana*	*Abies balsamea* *Picea mariana*	58-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL39	High Water Table (A2) Water-Stained Leaves (B9) Saturation (A3)	*Osmunda cinnamomea* *Carex trisperma*	*Abies balsamea*	*Acer rubrum* *Picea mariana* *Abies balsamea*	48-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL40	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Dry-Season Water Table (C2) Geomorphic Positions (D2)	*Osmunda cinnamomea*	*Abies balsamea* *Picea mariana*	*Abies balsamea* *Picea mariana*	100+cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL41	High Water Table (A2) Saturation (A3)	*Carex stricta*	*Alnus incana*	*None*	45-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Water Marks (B1) Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Secondary Indicators: Drainage Patterns (B10) Stunted or Stressed Plants (D1)					
Mine	WL42	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1)	*Carix canescens* *Carex stricta*	*Abies balsamea* *Larix laricina*	*Betula cordifolia* *Picea rubens* *Picea mariana*	20-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL43	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Geomorphic Positions (D2)	*None*	*Picea rubens* *Nemopanthus mucronatus*	*Betula papyrifera* *Picea rubens*	15-0cm Organic	Histosol (A1)
Mine	WL44	High Water Table (A2) Saturation (A3) Drift Deposits (B3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Thelypteris simulata*	*Abies balsamea* *Nemopanthus mucronatus*	*Acer rubrum* *Picea rubens* *Picea mariana*	20-0cm Organic	Histosol (A1)
Mine	WL45	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Stunted or Stressed Plants (D1)	*Nemopanthus mucronatus*	*Abies balsamea* *Picea mariana*	*Picea mariana*	60-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL46	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Aquatic Fauna (B13) Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Geomorphic Positions (D2)	*Rubus canadensis* *Glyceria canadensis*	*Acer rubrum* *Betula papyrifera cordifolia*	*Abies balsamea* *Acer rubrum*	22-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL47	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Calamagrostis canadensis* *Iris versicolor*	*Rapid assessment*	*None*	id Assessm	Histosol (A1)

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FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Water Marks (B1) Sediment Deposits (B2) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Aquatic Fauna (B13) Secondary Indicators: Drainage Patterns (B10) Stunted or Stressed Plants (D1) Geomorphic Positions (D2)					
Mine	WL48.1	Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Secondary Indicators: Drainage Patterns (B10) Stunted or Stressed Plants (D1) Geomorphic Positions (D2)	*Rubus hispidus*	*None*	*Acer rubrum*	60-0cm Organic	Histosol (A1)
Mine	WL48.2	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Geomorphic Positions (D2)	*Osmunda cinnamomea* *Carex trisperma* *Rubus hispidus*	*Picea mariana* *Betula cordifolia* *Abies balsamea*	*Picea mariana*	55-0cm Organic	Histosol (A1)
Mine	WL49	Surface Water (A1) High Water Table (A2) Saturation (A3) Sparsely Vegetated Concave Surface (B8) Secondary Indicators: Drainage Patterns (B10) Geomorphic Positions (D2)	*Carex trisperma*	*None*	*Abies balsamea*	50-0cm Organic	Histosol (A1)
Mine	WL50	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Geomorphic Positions (D2)	*Osmunda cinnamomea*	*Abies balsamea* *Nemopanthus mucronatus*	*None*	40+cm Organic	Histosol (A1)
Mine	WL51	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators:	*None*	*Pinus strobus* *Abies balsamea*	*Betula cordifolia* *Picea rubens*	55-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Drainage Patterns (B10) Geomorphic Positions (D2)					
Mine	WL52	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Drift Deposits (B3) Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Aquatic Fauna (B13) Secondary Indicators: Drainage Patterns (B10) Geomorphic Positions (D2) Stunted or Stressed Plants (D1)	*Viola cucullata* *Glyceria striata*	*Abies balsamea*	*Picea rubens*	22-0cm Organic	Histosol (A1)
Mine	WL53	Surface Water (A1) High Water Table (A2) Saturation (A3) Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Secondary Indicators: Drainage Patterns (B10) Geomorphic Positions (D2)	*Osmunda cinnamomea* *Glyceria striata*	*Acer rubrum* *Picea mariana*	*None*	40-0cm Organic	Histosol (A1)
Mine	WL54	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Water-Stained Leaves (B9) Hydrogen Sulphide (C1) Secondary Indicators: Geomorphic Positions (D2)	*Carex trisperma* *Osmunda cinnamomea* *Kalmia angustifolia*	*Acer rubrum* *Betula cordifolia* *Abies balsamea*	*Picea mariana* *Picea rubrum*	60-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL55	High Water Table (A2) Saturation (A3) Water Marks (B1) Algal Mat or Crust (B4) Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Secondary Indicators:	*Scirpus cyperinus*	*Salix pyrifolia* *Acer rubrum* *Spiraea tomentosa*	*Acer rubrum* *Abies balsamea*	30-0cm Organic	Histosol (A1)

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FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Drainage Patterns (B10) Stunted or Stressed Plants (D1) Geomorphic Positions (D2)					
Mine	WL56.1	Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Drainage Patterns (B10)	*Dryopteris intermedia* *Rubus hispidus* *Carex trisperma*	*Abies balsamea* *Acer rubrum* *Larix laricina*	*Larix laricina*	80-0cm Organic	Histosol (A1)
Mine	WL56.2	High Water Table (A2) Saturation (A3) Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Secondary Indicators: Surface Soil Cracks (B6) Geomorphic Position (D2) Drainage Patterns (B10)	*Juncus effusus*	*Larix laricina* *Betula papyrifera* *Alnus incana*	*Betula papyrifera*	5-0cm Organic 0-20cm Mineral	Depleted Matrix (F3)
Mine	WL56.3	High Water Table (A2) Saturation (A3) Hydrogen Sulphide (C1) Water-Stained Leaves (B9)	*Kalmia angustifolium*	*Picea mariana*	*Picea mariana*	100cm+ Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL57.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Aquatic Fauna (B13) Hydrogen Sulphide (C1) Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Stunted or Stressed Plants (D1) Geomorphic Positions (D2)	*Osmunda cinnamanea* *Carex trisperma*	*Nemopanthus mucronatus*	*Acer rubum* *Picea mariana* *Abies balsamea*	50+ Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL57.2	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Microtopographical Relief (D4)	*Osmunda cinnamanea* *Cornus canadensis*	*Abies balsamea*	*Abies balsamea*	18-0cm Organic	Histosol (A1)
Mine	WL57.3	Surface Water (A1) High Water Table (A2)	*Carex leptalia* *Osmunda cinnamanea*	*Betula alleghaniensis*	*None*	10-0cm Organic	Hydrogen Sulphide (A4) Depleted Matrix (F3)

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FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Iron Deposits (B5) Thin Muck Surface (C7) Water-Stained Leaves (B9) Aquatic Fauna (B13) Hydrogen Sulphide (C1) Presence of Reduced Iron (C4) Secondary Indicators: Drainage Patterns (B10) Moss Trim Lines (B16) Dry-Season Water Table (C2) Microtopographical Relief (D4)	*Glyceria striata*			0-12cm Mineral	Histic Epipedon (A2)
Mine	WL58	High Water Table (A2) Saturation (A3) Water Marks (B1) Thin Muck Surface (C7) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Secondary Indicators: Drainage Patterns (B10) Geomorphic Positions (D2) Microtopographical Relief (D4)	*Thelypteris simulata*	*Abies balsamea*	*Acer rubrum*	3-0cm Organic 0-18cm Mineral	Depleted Matrix (F3) Histic Epipedon (A2)
Mine	WL59	Surface Water (A1) High Water Table (A2) Saturation (A3) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Aquatic Fauna (B13) Iron Deposits (B5) Hydrogen Sulphide (C1) Secondary Indicators: Drainage Patterns (B10) Stunted or Stressed Plants (D1)	*None*	*Picea mariana* *Viburnum nudum* *Acer rubrum*	*Picea mariana* *Larix laricina*	30-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL60	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Moss Trim Lines (B16) Dry-Season Water Table (C2) Geomorphic Positions (D2)	*Scirpus cyperinus*	*Picea rubens*	*Picea rubens* *Picea mariana*	24-0cm Organic 0-12cm Mineral	Histic Epipedon (A2)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
Mine	WL61.1	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9) Secondary Indicators: Drainage Patterns (B10)	*Osmunda regalis*	*Acer rubrum*	*Acer rubrum*	20-0cm Organic	Histosol (A1)
Mine	WL61.2	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex stricta*	*Alnus incana*	*Acer rubrum*	40-0cm Organic	Histosol (A1) Hydrogen Sulphide (A4)
Mine	WL61.3	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Osmunda regalis* *Oclemena nemoralis*	*Acer rubrum* *Alnus incana*	*Acer rubrum* *Larix laricina*	5-0cm Organic 0-15cm Mineral	Depleted Matrix (F3)
Mine	WL62	High Water Table (A2) Saturation (A3) Water Marks (B1) Water-Stained Leaves (B9)	*Osmunda regalis*	*Abies balsamea*	*Larix laricina*	16-0cm Organic	Histosol (A1)
Mine	WL63	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Theypteris noveboracensis* *Carex trisperma*	*Abies balsamea* *Nemopanthus mucronatus* *Viburnum nudum*	*Picea mariana* *Acer rubrum* *Abies balsamea*	23-0cm Organic	Histosol (A1)
Haul Road	WL64.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Water-Stained Leaves (B9)	*Carex trisperma* *Thelypteris noveboracensis*	*Betula alleghaniensis*	*Abies balsamea*	20-0cm Organic	Histosol (A1)
Haul Road	WL64.2	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex trisperma* *Glyceria grandis*	*Abies balsamea*	*Abies balsamea* *Larix laricina*	15-0cm Organic 0-5cm Silt Clay	Histic Epipedon (A2)
Haul Road	WL65	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex echinata*	*Abies balsamea*	*None*	5-0cm Organic 0-15cm Mineral	Histic Epipedon (A2)
Haul Road	WL66.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Mark Marks (B1)	*Carex echinata* *Carex magellanica* *Dulichium arundinaceum*	*None*	*None*	120-0cm Organic	Histosol (A1)
Haul Road	WL66.2	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Thelypteris noveboracensis*	*Abies balsamea* *Alnus viridis* *Betula alleghaniensis*	*Abies balsamea*	25-0cm Organic	Histosol (A1)
Haul Road	WL66.3	High Water Table (A2)	*Glyceria grandis*	*Larix laricina*	*None*	65-0cm	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3)		*Alnus incana*		Organic	
Haul Road	WL67.1	High Water Table (A2) Saturation (A3)	*Chamaedaphne calyculata*	*Picea mariana* *Larix laricina*	*None*	73-0cm Organic	Histosol (A1)
Haul Road	WL67.2	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Viburnum nudum* *Nemopanthus mucronatus*	*Acer rubrum* *Larix laricina* *Abies balsamea*	32-0cm Organic	Histosol (A1)
Haul Road	WL68	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex stricta*	*Spiraea alba* *Rhododendron canadense* *Myrica gale*	*Acer rubrum* *Larix laricina*	72-0cm Organic	Histosol (A1)
Haul Road	WL69	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex stricta*	*Myrica gale*	*None*	100-0cm Organic	Histosol (A1)
Haul Road	WL70	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Scirpus cyperinus*	*Acer rubrum* *Alnus incana*	*Acer rubrum*	28-0cm Organic	Histosol (A1)
Haul Road	WL71	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Glyceria grandis* *Trientalis borealis*	*Abies balsamea* *Betula alleghaniensis* *Picea rubens*	*Betula alleghaniensis*	16-0cm Organic 0-11cm Mineral	Histic Epipedon (A2)
Haul Road	WL72	High Water Table (A2) Saturation (A3)	*Glyceria grandis* *Carex crinita*	*Acer rubrum*	*Acer rubrum*	40-0cm Organic 0-7cm Sandy Loam	Histic Epipedon (A2)
Haul Road	WL73.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma* *Glyceria grandis*	*Alnus incana* *Nemopanthus mucronatus*	*Abies balsamea* *Acer rubrum*	58-0cm Organic	Histosol (A1)
Haul Road	WL73.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Maianthemum trifolium*	*Kalmia angustifolia* *Alnus incana*	*Larix laricina*	36-0cm Organic	Histosol (A1)
Haul Road	WL74.1	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Rubus hispidus* *Carex folliculata*	*Abies balsamea*	*Acer rubrum* *Abies balsamea*	35-0cm Organic	Histosol (A1)
Haul Road	WL74.2	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Glyceria grandis*	*None*	*Acer rubrum*	10-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Water Marks (B1) Water-Stained Leaves (B9)					
Haul Road	WL75	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Phegopteris connectilis*	*Abies balsamea* *Nemopanthus mucronatus*	*Picea rubens* *Acer rubrum* *Abies balsamea*	60-0cm Organic	Histosol (A1) Hydrogen Sulfide (A4)
Haul Road	WL76.1	Surface Water (A1) High Water Table (A2) Saturation (A3) Sparsely Vegetated Concave Surface (B8)	*Lycopus uniflorus*	*Abies balsamea* *Alnus incana*	*Acer rubrum* *Picea mariana*	70-0cm Organic	Histosol (A1) Hydrogen Sulfide (A4)
Haul Road	WL76.2	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex canescens* *Calamagrostis canadensis*	*Alnus incana* *Acer rubrum*	*Picea rubens*	50-0cm Organic	Histosol (A1)
Haul Road	WL77	High Water Table (A2) Saturation (A3) Hydrogen Sulfide Odor (C1)	*Carex stricta* *Rubus pubsescens*	*Betula papyrifera* *Alnus incana*	*Picea mariana* *Acer rubrum*	28-0cm Organic	Histosol (A1)
Haul Road	WL78	High Water Table (A2) Saturation (A3) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9)	*Glyceria melicaria* *Carex echinata*	*Picea rubens*	*Picea rubens* *Acer rubrum*	25-0cm Organic	Histosol (A1)
Haul Road	WL79	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex gynandra* *Coptis trifolia*	*Abies balsamea* *Nemopanthus mucronatus*	*Abies balsamea* *Picea mariana*	20-0cm Organic	Histosol (A1)
Haul Road	WL80	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Maianthemum trifolium*	*Viburnum nudum* *Picea mariana*	*Picea mariana* *Larix laricina*	36-0cm Organic	Histosol (A1)
Haul Road	WL81	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Glyceria grandis*	*Alnus incana*	*None*	17-0cm Organic	Histosol (A1)
Haul Road	WL82	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Glyceria grandis* *Lycopus uniflorus*	*Abies balsamea* *Acer rubrum*	*Abies balsamea*	20-0 Organic 0-5cm Clay	Histosol (A1) Histic Epipedon (A2)
Haul Road	WL83	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1)	*Acer rubrum* *Lycopus uniflorus*	*Betula alleghaniensis*	*Betula alleghaniensis* *Abies balsamea*	23-0cm Organic	Histosol (A1)
Haul Road	WL84	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Rubus hispidus* *Scirpus cyperinus*	*Acer rubrum* *Betula allegheinsis*	*None*	35-0cm Organic	Histosol (A1)
Haul Road	WL85	High Water Table (A2)	*Carex crinita*	*Abies balsamea*	*None*	15-0cm	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3)	*Scirpus cyperinus*	*Alnus incana*		Organic	
Haul Road	WL86	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Maianthemum trifolium*	*Betula alleghaniensis*	*Abies balsamea*	40-0cm Organic	Histosol (A1)
Haul Road	WL87	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex trisperma* *Scirpus cyperinus*	*Abies balsamea*	*None*	22-0cm Organic	Histosol (A1)
Haul Road	WL88	High Water Table (A2) Saturation (A3)	*Rubus hispidus* *Carex trisperma*	*Betula papyrifera* *Picea rubens*	*None*	25-0cm Organic	Histosol (A1)
Haul Road	WL89	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea*	*Acer rubrum* *Abies balsamea* *Nemopanthus mucronatus*	*Abies balsamea* *Picea rubens*	25-0cm Organic	Histosol (A1)
Haul Road	WL90	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Calamagrostis canadensis* *Carex trisperma*	*Abies balsamea* *Nemopanthus mucronatus*	*Abies balsamea* *Acer rubrum*	60-0cm Organic	Histosol (A1)
Haul Road	WL91	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Kalmia angustifolia* *Cornus canadensis* *Osmunda cinnamomea* *Vaccinium myrtilloides*	*Alnus incana*	*Acer rubrum* *Larix laricina*	20-0cm Organic	Histosol (A1)
Haul Road	WL92	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Cornus canadensis*	*Picea mariana* *Abies balsamea*	*Acer rubrum* *Picea mariana*	30-0cm Organic	Histosol (A1)
Haul Road	WL93	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Scirpus cyperinus*	*Alnus incana*	*None*	10-0cm Organic 0-22cm Mineral	Histosol (A1)
Haul Road	WL94	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex trisperma* *Cornus canadensis*	*Abies balsamea* *Picea mariana*	*Picea mariana* *Acer rubrum*	20-0cm Organic	Histosol (A1)
Haul Road	WL95	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Dryopteris cristata*	*Virburnum nudum* *Abies balsamea*	*Acer rubrum* *Abies balsamea*	25-0cm Organic	Histosol (A1)
Haul Road	WL96	High Water Table (A2) Saturation (A3)	*Carex trisperma* *Rubus hispidus*	*Betulaa populifolia*	*Acer rubrum* *Abies balsamea* *Picea mariana*	24-0cm Organic	Histosol (A1)
Haul Road	WL97	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Lycopus uniflorus*	*Abies balsamea* *Acer rubrum*	*Abies balsamea*	42-0cm Organic	Histosol (A1)

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FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	**Shrubs**	**Trees**	**Depth**	**Hydric Soil Indicators**
Haul Road	WL98	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Oxalis montana* *Phegopteris connectilis*	*Alnus incana*	*Abies balsamea* *Acer rubrum*	25-0cm Organic	Histosol (A1)
Haul Road	WL99	Surface Water (A1) Water Marks (B1) Water-Stained Leaves (B9)	*Kalmia angustifolia* *Dennstaedtia punctilobula*	*Abies balsamea*	*Abies balsamea* *Picea rubens*	23-0cm Organic 0-3cm Sandy Loam	Histosol (A1)
Haul Road	WL100	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Nemopanthus mucrantus* *Kalmia angustifolia* *Betula papyrifera*	*None*	68-0cm Organic	Histosol (A1)
Haul Road	WL101	Saturation (A3)	*Carex trisperma* *Osmunda cinnamomea*	*Betula populifolia* *Acer rubrum* *Abies balsamea*	*Abies balsamea* *Acer rubrum*	20-0cm Organic	Histosol (A1)
Haul Road	WL102.1	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Cornus canadensis* *Osmunda cinnamomea*	*Ledum groenlandicum*	*Acer rubens* *Picea mariana*	75-0cm Organic	Histosol (A1)
Haul Road	WL102.2	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Thelypteris noveboracensis*	*Picea rubens* *Abies balsamea*	*Abies balsamea* *Picea rubens*	82-0cm Organic	Histosol (A1)
Haul Road	WL103	High Water Table (A2)	*Cornus canadensis* *Kalmia angustifolia*	*Picea mariana* *Betula papyrifera*	*None*	45-0cm Organic	Histosol (A1)
Haul Road	WL104	Saturation (A3) Stunted or Stressed Plants (D1)	*Rubus hispidus* *Cornus canadensis* *Gaultheria hispidula*	*Abies balsamea* *Acer rubrum*	*None*	35-0cm Organic	Histosol (A1)
Haul Road	WL105	High Water Table (A2)	*Osmunda cinnamomea* *Carex trisperma*	*Populus tremuloides* *Betula papyrifera*	*None*	46-0cm Organic	Histosol (A1)
Haul Road	WL106	Water-Stained Leaves (B9)	*Kalmia angustifolia*	*Viburdnum nudum* *Betula papyrifera*	*None*	25-0cm Organic	Histosol (A1)
Haul Road	WL107	Saturation (A3) Drainage Patterns (B10) Stunted or Stressed Plants (D1)	*Coptis trifolia* *Oxalis montana*	*Picea rubens*	*Abies balsamea*	26-0cm Organic	Histosol (A1)
Haul Road	WL108	Saturation (A3) Drainage Patterns (B10) Stunted or Stressed Plants (D1)	*Rubus hispidus* *Osmunda cinnamomea*	*Betula papyrifera* *Abies balsamea*	*None*	26-0cm Organic	Histosol (A1)
Haul Road	WL109	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea*	*Nemopanthus mucronatus*	*Picea rubens* *Abies balsamea* *Acer rubrum*	15-0cm Organic	Histosol (A1)
Haul Road	WL110	Surface Water (A1) High Water Table (A2)	*Carex trisperma* *Kalmia angustifolia*	*Abies balsamea* *Picea mariana*	*None*	100-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Water Marks (B1) Water-Stained Leaves (B9)					
Haul Road	WL111	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Acer rubrum* *Oxalis montana*	*Picea rubrum* *Abies balsamea*	*Abies balsamea* *Picea mariana* *Acer rubrum*	130-0cm Organic	Histosol (A1)
Haul Road	WL112	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma* *Coptis trifolia*	*Abies balsamea*	*Abies balsamea* *Picea mariana* *Acer rubrum*	68-0cm Organic	Histosol (A1)
Haul Road	WL113	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Carex trisperma*	*Abies balsamea* *Picea mariana*	*Abies balsamea* *Acer rubrum*	32-0cm Organic	Histosol (A1)
Haul Road	WL114	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Carex trisperma*	*Abies balsamea*	*Abies balsamea* *Picea rubens*	68-0cm Organic	Histosol (A1)
Haul Road	WL115	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Gaylussacia baccata* *Osmunda cinnamomea*	*Picea rubens* *Picea mariana*	*Acer rubrum* *Picea mariana*	67-0cm Organic	Histosol (A1)
Haul Road	WL116	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Cornus canadensis* *Kalmia augustifolia*	*Picea mariana*	*Picea mariana* *Abies balsamea*	38-0cm Organic	Histosol (A1)
Haul Road	WL117	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Ledum groenlandicum* *Nemopanthus mucronatus* *Coptis trifolia* *Kalmia angustifolia*	*Nemopanthus mucronatus* *Picea mariana*	*Abies balsamea* *Larix laricina*	40-0cm Organic	Histosol (A1)
Haul Road	WL118	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea*	*Abies balsamea* *Nemopanthus mucronatus*	*Picea mariana*	87-0cm Organic	Histosol (A1)
Haul Road	WL119	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Kalmia angustifolia* *Vaccinium angustifolium* *Gaylussacia baccata*	*Abies balsamea* *Gaylussacia baccata*	*Abies balsamea*	66-0cm Organic	Histosol (A1)
Haul Road	WL120	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Kalmia angustifolia* *Cornus canadensis* *Carex trisperma*	*Picea rubens* *Picea mariana*	*None*	55-0cm Organic	Histosol (A1)
Haul Road	WL121	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Cornus canadensis* *Vaccinium angustifolium*	*Abies balsamea* *Nemopanthus mucronatus*	*Abies balsamea*	45-0cm Organic	Histosol (A1)
Haul Road	WL122	High Water Table (A2)	*Osmunda cinnamomea*	*Abies balsamea*	*Picea mariana*	63-0cm	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3)			*Abies balsamea*	Organic	
Haul Road	WL123	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Nemopanthus mucronatus* *Abies balsamea*	*Picea mariana* *Acer rubrum*	125-0cm Organic	Histosol (A1)
Haul Road	WL124	High Water Table (A2) Saturation (A3)	*Dennstaedtia punctilobula*	*Abies balsamea*	*Picea mariana* *Acer rubrum*	90-0cm Organic	Histosol (A1)
Haul Road	WL125	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea* *Picea mariana*	*Abies balsamea*	*Abies balsamea* *Acer rubrum*	60-0cm Organic	Histosol (A1)
Haul Road	WL126	Saturation (A3)	*Kalmia angustifolia*	*Nemopanthus mucronatus* *Abies balsamea*	*Abies balsamea*	45-0cm Organic	Histosol (A1)
Haul Road	WL127	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea*	*Picea mariana* *Nemopanthus mucronatus*	*Picea mariana*	80-0cm Organic	Histosol (A1)
Haul Road	WL128	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Carex trisperma* *Gaylussacia baccata*	*Picea mariana* *Acer rubrum*	*None*	100-0cm Organic	Histosol (A1)
Haul Road	WL129	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Ledum groenlandicum*	*Picea mariana*	*Acer rubrum*	100-0cm Organic	Histosol (A1)
Haul Road	WL130	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Maianthemum trifolium* *Osmunda cinnamomea*	*Picea mariana* *Abies balsamea*	*Picea mariana*	120-0cm Organic	Histosol (A1)
Haul Road	WL131	Surface Water (A1) High Water Table (A2) Saturation (A3) Hydrogen Sulfide Odor (C1)	*Phegopteris connectilis*	*Picea mariana* *Nemopanthus mucronatus*	*Picea mariana* *Acer rubrum*	75-0cm Organic	Histosol (A1)
Haul Road	WL132	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Cornus canadensis*	*Nemopanthus mucronatus* *Picea mariana*	*Picea mariana* *Acer rubrum*	95-0cm Organic	Histosol (A1)
Haul Road	WL133	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma* *Osmunda cinnamomea*	*Kalmia angustifolia* *Ledum groenlandicum* *Nemopanthus mucronata*	*None*	22-0cm Organic	Histosol (A1)
Haul Road	WL134	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1)	*Osmunda cinnamomea* *Carex trisperma*	*Abies balsamea* *Picea mariana*	*Abies balsamea* *Acer rubrum*	125-0cm Organic	Histosol (A1)
Haul Road	WL135	High Water Table (A2)	*Osmunda cinnamomea*	*Acer rubrum*	*None*	68-0cm	Histosol (A1)

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FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Water-Stained Leaves (B9)		*Pinus strobus* *Picea mariana*		Organic	
Haul Road	WL136	High Water Table (A2) Saturation (A3)	*Thelypteris noveboracensis*	*Acer balsamea* *Acer rubrum*	*Abies balsamea* *Picea rubens*	23-0cm Organic	Histosol (A1)
Haul Road	WL137	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea* *Thelypteris noveboracensis*	*Picea rubens* *Ilex verticillata*	*Acer rubrum* *Picea rubens*	62-0cm Organic	Histosol (A1)
Haul Road	WL138	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1)	*Vaccinium oxycoccos*	*Acer rubrum*	*None*	10-0cm Organic	Histosol (A1)
Haul Road	WL139	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Abies balsamea* *Picea mariana*	*None*	65-0cm Organic	Histosol (A1)
Haul Road	WL140	High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Ledum groenlandicum* *Coptis trifolium* *Kalmia angustifolia*	*Nemopanthus mucronatus* *Acer rubrum*	*Abies balsamea* *Larix laricina*	20-0cm Organic	Histosol (A1)
Haul Road	WL141	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Ledum groenlandicum* *Rhododendron canadense*	*Abies balsamea* *Picea mariana*	*None*	18-0cm Organic	Histosol (A1)
Haul Road	WL142	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Ledum groenlandicum* *Carex projecta*	*Acer rubrum* *Ledum groenlandicum*	*None*	26-0cm Organic	Histosol (A1)
Haul Road	WL143.1	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Ledum groenlandicum* *Carex projecta*	*Acer rubrum*	*Picea mariana*	65-0cm Organic	Histosol (A1)
Haul Road	WL143.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Sparsely Vegetated Concave Surface (B8) Water-Stained Leaves (B9) Thick Muck Surface (C7)	*Oxalis montana* *Thelypteris noveboracensis*	*Betula alleghaniensis* *Abies balsamea* *Picea rubrum*	*Acer rubrum* *Abies balsamea*	18-0cm Organic	Histosol (A1)
Haul Road	WL144	Surface Water (A1) High Water Table (A2) Saturation (A3) Stunted or Stressed Plants (D1)	*Carex projecta*	*Picea mariana* *Larix laricina*	*None*	55-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
Haul Road	WL145	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Vaccinium oxycoccos* *Maianthemum trifolium*	*Picea mariana*	*None*	45-0cm Organic	Histosol (A1)
Haul Road	WL146.1	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Drosera rotundifolia* *Carex canescens* *Dulichium arundinaceum*	*None*	*None*	120-0cm Organic	Histosol (A1)
Haul Road	WL146.2	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1)	*Lycopus uniflorus* *Triadenum virginicum*	*Abies balsamea*	*Abies balsamea* *Acer rubrum*	45-0cm Organic	Histosol (A1)
Haul Road	WL147.1	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Vaccinium macrocarpon* *Vaccinium oxycoccos* *Carex magellanica*	*None*	*None*	50-0cm Organic	Histosol (A1)
Haul Road	WL147.2	High Water Table (A2) Saturation (A3)	*Carex trisperma*	*Acer rubrum*	*Larix laricina* *Abies balsamea*	50-0cm Organic	Histosol (A1)
Haul Road	WL148	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1)	*Chamaedaphne calyculata* *Vaccinium oxycoccos*	*Picea mariana*	*None*	45-0cm Organic	Histosol (A1)
Haul Road	WL149	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Scirpus cyperinus* *Carex trisperma* *Carex magellanica*	*Larix laricina* *Picea mariana*	*None*	65-0cm Organic	Histosol (A1)
Haul Road	WL150	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Rhododendron canadense* *Scirpuus cyperinus*	*None*	*None*	5-0cm Organic 0-20cm Sandy Clay	Histic Epipedon (A2)
Haul Road	WL151	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1)	*Kalmia angustifolia* *Carex trisperma*	*Picea mariana*	*None*	120-0cm Organic	Histosol (A1)
Haul Road	WL152	High Water Table (A2) Saturation (A3)	*Scirpus cyperinus* *Juncus canadensis* *Carex trisperma*	*Acer rubrum* *Picea mariana*	*Picea mariana* *Larix laricina*	40-0cm Organic	Histosol (A1)
Haul Road	WL153	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Maianthemum trifolium*	*Acer rubrum* *Larix laricina*	*None*	65-0cm Organic	Histosol (A1)
Haul Road	WL154	Surface Water (A1) High Water Table (A2)	*Chamaedaphne calyculata* *Dulichium arundinaceum*	*None*	*None*	65-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3)					
Haul Road	WL155	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea*	*Abies balsamea* *Picea mariana*	*Abies balsamea* *Acer rubrum* *Picea mariana*	20-0cm Organic	Histosol (A1)
Haul Road	WL156	High Water Table (A2) Saturation (A3)	*Ledum groenlandicum*	*Nemopanthus mucronatus* *Viburnum nudum*	*None*	65-0cm Organic	Histosol (A1)
Haul Road	WL157.1	High Water Table (A2) Saturation (A3)	*Carex stricta*	*Alnus incana* *Acer rubrum*	*Acer rubrum*	50-0cm Organic	Histosol (A1)
Haul Road	WL157.2	High Water Table (A2) Saturation (A3)	*Rubus pubescens* *Carex folliculata*	*Alnus incana*	*Acer rubrum* *Abies balsamea*	20-0cm Organic 0-5cm Mineral	Histic Epipedon (A2)
Haul Road	WL158	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Juncus effuses* *Carex echinata*	*Larix laricina*	*None*	20-0cm Organic 0-10cm Mineral	Histic Epipedon (A2)
Haul Road	WL159	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma*	*Abies balsamea* *Viburnum nudum*	*Betula populifolia* *Acer rubrum* *Picea mariana*	20-0cm Organic 0-5cm Mineral	Histic Epipedon (A2) Depleted Matrix (F3)
Haul Road	WL160	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Chamaedaphne calyculata* *Glyceria canadensis* *Vaccinium macrocarpon*	*Picea rubens* *Acer rubrum*	*None*	20-0cm Organic	Histosol (A1)
Haul Road	WL161	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea* *Ledum groenlandicum* *Carex trisperma*	*Nemopanthus mucronatus* *Picea mariana*	*Picea mariana* *Betula papyrifera*	30-0cm Organic	Histosol (A1)
Haul Road	WL162	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Eleocharis ovata*	*Alnus incana* *Picea mariana*	*Picea mariana* *Acer rubrum*	25-0cm Organic	Histosol (A1)
Haul Road	WL163	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma*	*Picea mariana* *Acer rubrum*	*None (Clear cut)*	5-0cm Organic 0-20cm Mineral	Histic Epipedon (A2)
Haul Road	WL164	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Nemopanthus mucronatus* *Ledum groenlandicum*	*Abies balsamea* *Nemopanthus mucronatus*	*Acer rubrum* *Larix laricina* *Picea mariana*	45-0cm Organic	Histosol (A1)
Haul Road	WL165	Surface Water (A1) High Water Table (A2)	*Cornus canadensis* *Trientalis borealis*	*Alnus incana* *Abies balsamea*	*Acer rubrum* *Abies balsamea*	3-0cm Organic	Histic Epipedon (A2)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Water-Stained Leaves (B9)	*Carex trisperma*			0-50cm Mineral	
Haul Road	WL166	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Carex projecta* *Vaccinium macrocarpon*	*Alnus incana* *Acer rubrum*	*None*	40-0cm Organic	Histosol (A1)
Haul Road	WL167	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Osmunda cinnamomea*	*Picea mariana* *Abies balsamea*	*Picea mariana* *Abies balsamea*	50-0cm Organic	Histosol (A1)
Haul Road	WL168	Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Drift Deposits (B3) Sparsely Vegetated Concave Surface (B8) Aquatic Fauna (B13)	*Myrica gale*	*Acer rubrum*	*None*	100-0cm Organic	Histosol (A1)
Haul Road	WL169	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea*	*Nemopanthus mucronatus* *Picea mariana*	*Abies balsamea* *Acer rubrum*	10-0cm Organic 0-5cm Mineral	Histic Epipedon (A2)
Haul Road	WL170	High Water Table (A2) Saturation (A3)	*Osmunda cinnamomea* *Thelypteris noveboracensis*	*Abies balsamea* *Alnus incana* *Picea mariana*	*Acer rubrum* *Picea mariana*	30-0cm Organic	Histosol (A1)
Haul Road	WL171	Surface Water (A1) High Water Table (A2) Saturation (A3) Sediment Deposits (B2) Thin Muck Surface (C7) Stunted or Stressed Plants (D1)	*Coptis trifolia*	*Alnus incana*	*Acer rubrum* *Betula alleghaniensis* *Picea rubens*	17-0cm Organic	Histosol (A1)
Haul Road	WL172	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Solidago canadensis*	*Alnus incana* *Betula populifolia* *Picea mariana*	*Abies balsamea* *Betula populifolia* *Picea mariana*	5-0cm Organic 0-40cm Mineral	Histic Epipedon (A2) Depleted Matrix (F3)
Haul Road	WL173	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Galium pallustre* *Calamagrotis canadensis* *Juncus effusus* *Onoclea sensibilis*	*Alnus incana* *Abies balsamea*	*Picea mariana* *Betula populifolia* *Picea mariana*	40-0cm Organic	Histosol (A1)
Haul Road	WL174	Surface Water (A1) High Water Table (A2)	*Cornus canadensis* *Osmunda cinamomea*	*Pices mariana* *Abies balsamea*	*Acer rubrum* *Abies balsamea*	17-0cm Organic	Histosol (A1)

FOOTPRINT	WETLAND ID*	SURFACE HYDROLOGY	DOMINANT VEGETATION			HYDRIC SOILS	
			Herbs	Shrubs	Trees	Depth	Hydric Soil Indicators
		Saturation (A3) Water-Stained Leaves (B9)			*Picea mariana*		
Haul Road	WL175	Surface Water (A1) High Water Table (A2) Saturation (A3)	*Osmunda claytoniana* *Osmunda cinamomea* *Thelypteris noveboracensis*	*Abies balsamea* *Alnus incana*	*None*	40-0cm Organic	Histosol (A1)
Haul Road	WL176	High Water Table (A2) Water-Stained Leaves (B9) Sparsely Vegetated Concave Surface (B8)	*Carex trisperma* *Carex stricta*	*Betula populifolia* *Abies balsamea*	*Acer rubrum* *Abies balsamea*	4-0cm Organic 0-5cm Mineral	Histic Epipedon (A2) Depleted Matrix (F3)
Haul Road	WL177	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Glyceria canadensis*	*Alnus incana*	*None*	7-0cm Organic	Histosol (A1)
Haul Road	WL178	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Linnea borealis* *Rubus hispidus*	*Alnus incana* *Picea rubens*	*Larix larcina* *Picea rubens* *Betula papyrifera*	80+ cm Organic	Histosol (A1)
Haul Road	WL179	Surface Water (A1) High Water Table (A2) Saturation (A3) Water-Stained Leaves (B9)	*Maianthemum canadensis*	*Alnus incana* *Acer rubrum*	*Picea mariana* *Acer rubrum*	50-0cm Organic	Histosol (A1)

Notes
* Wetland complex: data has been divided into separate vegetated communities which represents the variation in wetland characteristics.

Appendix H
Photographic Log of Watercourses and Fish Habitat

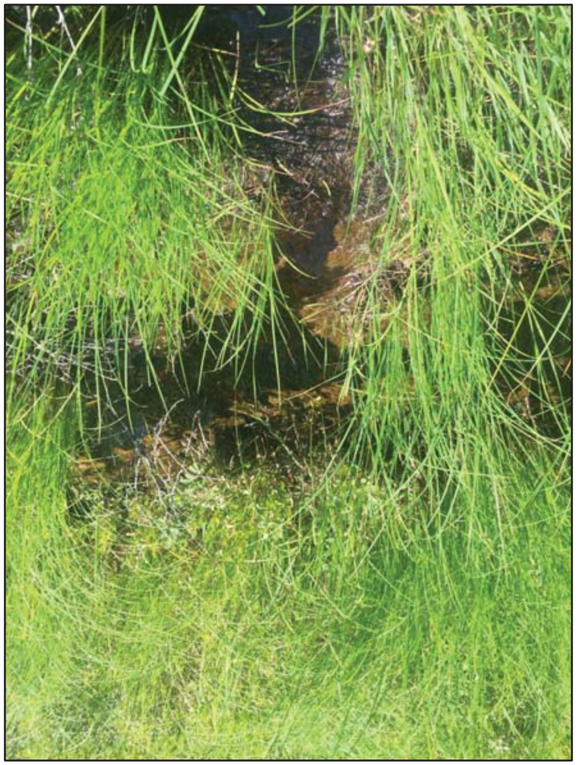

PHOTO 1 - WATERCOURSE 4

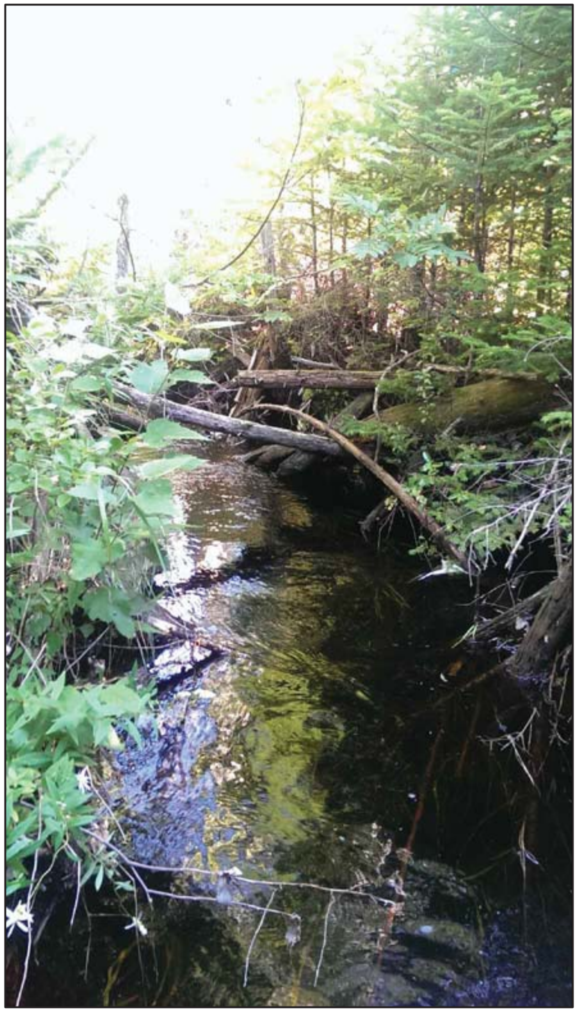

PHOTO 2 - WATERCOURSE 5 NEAR WETLAND 2

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H1

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA001.dwg

PHOTO 3 - WATERCOURSE 5 NEAR WETLAND 14

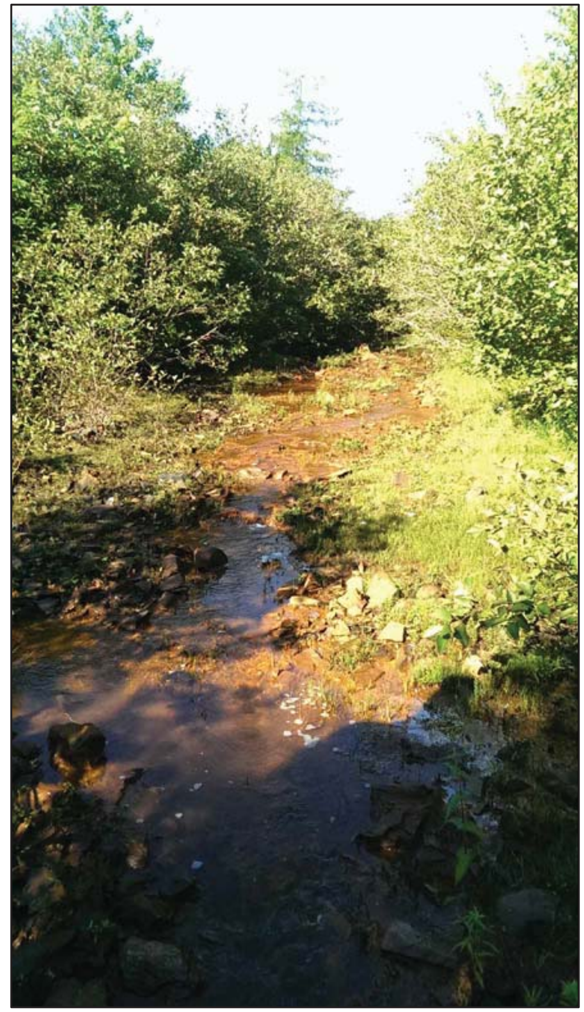

PHOTO 4 - WATERCOURSE 12

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H2

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA002.dwg

PHOTO 5 - WATERCOURSE 13

PHOTO 6 - WATERCOURSE 14

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H3

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA003.dwg

PHOTO 7 - CAMERON FLOWAGE

PHOTO 8 - MUD LAKE

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H4

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA004.dwg

PHOTO 9 - CRUSHER LAKE

PHOTO 10 - WATERCOURSE A

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FIGURE H5

PHOTO 11 - WATERCOURSE B

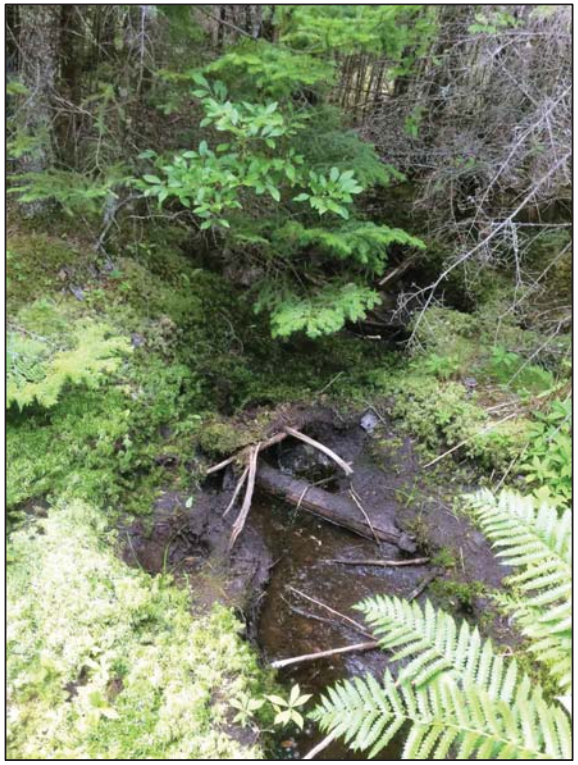

PHOTO 12 - WATERCOURSE D

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H6

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA006.dwg

PHOTO 13 - WATERCOURSE E

PHOTO 14 - WATERCOURSE L

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H7

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA007.dwg

PHOTO 15 - WATERCOURSE J

PHOTO 16 - WATERCOURSE H

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H8

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA008.dwg

PHOTO 17 - WATERCOURSE N - WEST RIVER SHEET HARBOUR

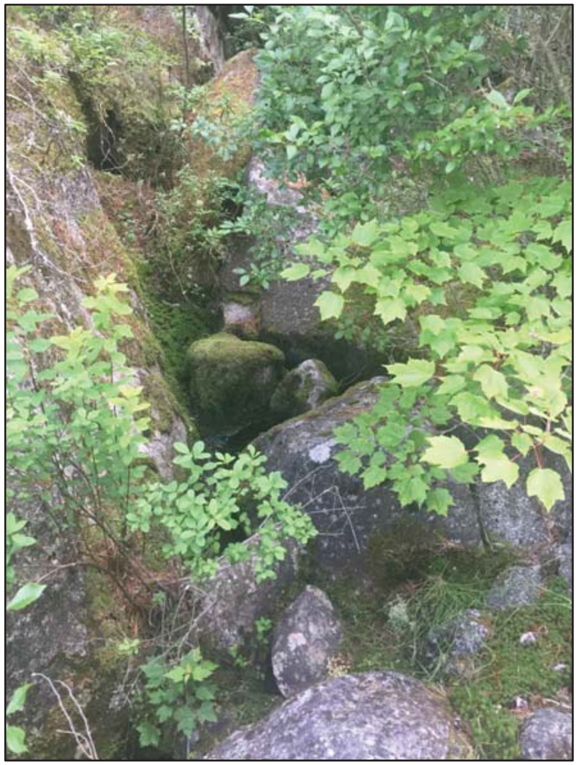

PHOTO 18 - WATERCOURSE Q

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H9

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA009.dwg

PHOTO 19 - WATERCOURSE T

PHOTO 20 - WATERCOURSE V

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H10

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA010.dwg

PHOTO 21 - WATERCOURSE O

PHOTO 22 - WATERCOURSE AD - MORGAN RIVER

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H11

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA011.dwg

PHOTO 23 - WATERCOURSE AA

PHOTO 24 - WATERCOURSE W

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H12

PHOTO 25 - WATERCOURSE AH

PHOTO 26 - WATERCOURSE AE

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H13

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA013.dwg

PHOTO 27 - WATERCOURSE AG

PHOTO 28 - WATERCOURSE 4 INLET TO WETLAND 13

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H14

PHOTO 29 - WATERCOURSE 4 OUTLET FROM WETLAND 13

PHOTO 30 - WATERCOURSE 5 INSIDE WETLAND 17

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H15

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA015.dwg

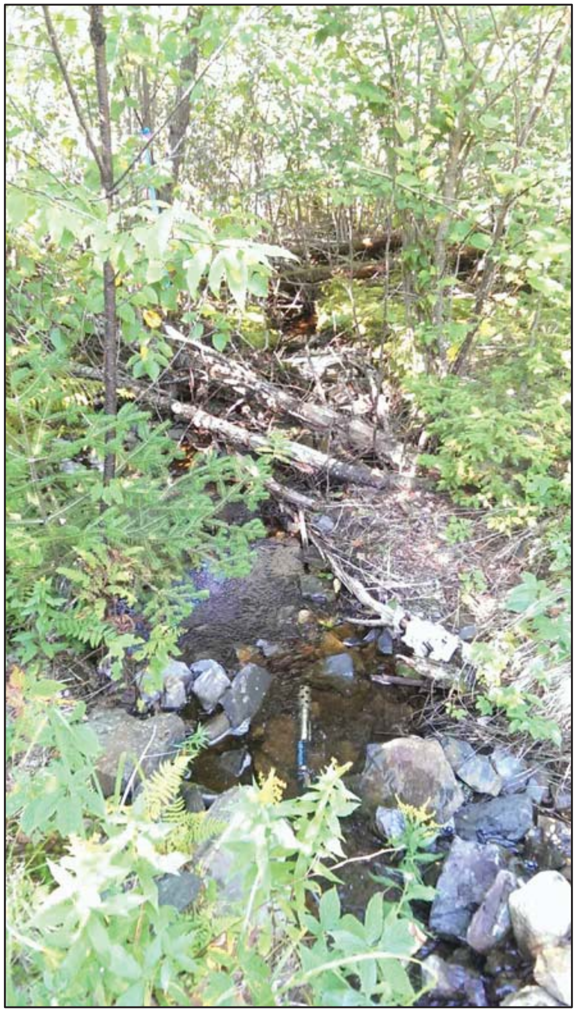

PHOTO 31 - WATERCOURSE 3 IN WETLAND 20

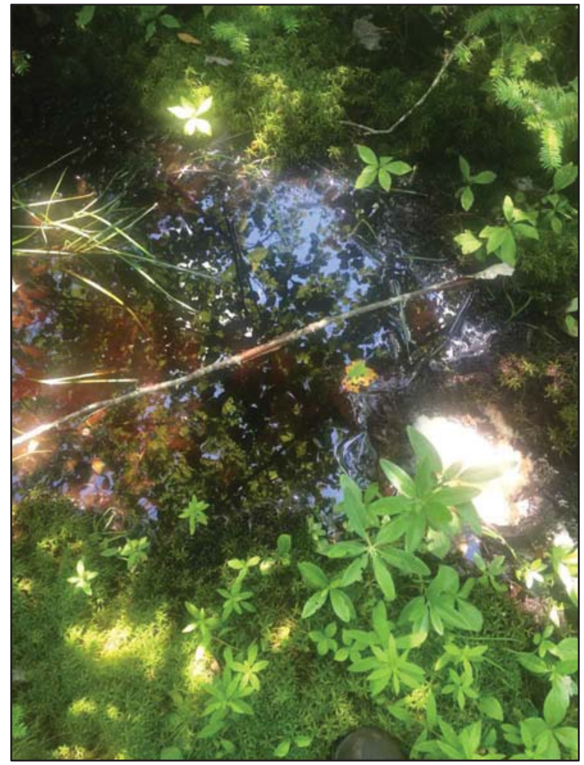

PHOTO 32 - WATERCOURSE 10 IN WETLAND 29

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H16

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA016.dwg

PHOTO 33 - WATERCOURSE 11 IN WETLAND 29

PHOTO 34 - WATERCOURSE 11 IN WETLAND 33

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H17

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA017.dwg

PHOTO 35 - WATERCOURSE 5 IN WETLAND 44
(IMPOUNDED BY BEAVER ACTIVITY)

PHOTO 36 - WATERCOURSE 12 INLET INTO
WETLAND 56

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H18

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA018.dwg

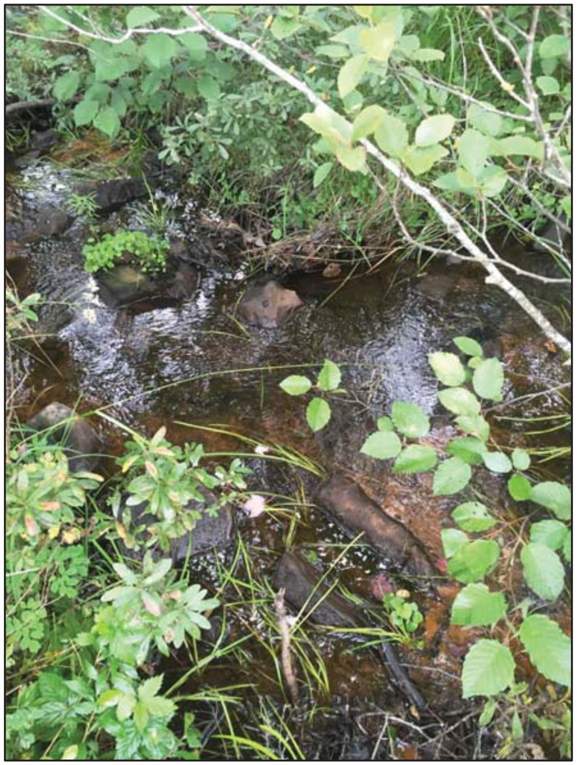

PHOTO 37 - WATERCOURSE 13 IN WETLAND 61

PHOTO 38 - WATERCOURSE A IN WETLAND 64

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H19

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA019.dwg

PHOTO 39 - WATERCOURSE B IN WETLAND 66

PHOTO 40 - WATERCOURSE E IN WETLAND 73

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H20

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA020.dwg

PHOTO 41 - WATERCOURSE F IN WETLAND 74

PHOTO 42 - WATERCOURSE G IN WETLAND 76

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H21

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA021.dwg

PHOTO 43 - WATERCOURSE Z IN WETLAND 146

PHOTO 44 - WATERCOURSE 154

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

FIGURE H22

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA022.dwg

PHOTO 45 - WATERCOURSE AA IN WETLAND 159

PHOTO 46 - WATERCOURSE AA IN WETLAND 160

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PHOTOGRAPHIC LOG OF WATERCOURSES AND FISH HABITAT

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FIGURE H23

CAD File: I:\Drafting\6-chars\08----\0886--\088664\088664-REPORTS\088664-Rpt-4\088664-20(004)GN-DA023.dwg

Appendix I
Priority Species List

Priority Species List. Beaver Dam Mine Project

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Birds						
Botaurus lentiginosus	American Bittern				S3S4B	Preferred habitats of the American Bittern include freshwater wetlands with tall emergent vegetation. In Nova Scotia, it occurs widely in most regions, but is scarce on the Atlantic slope and Cape Breton Island, where marshes are few and relatively infertile.
Turdus migratorius	American Robin				S5B, S3N	American Robins are common across the continent in gardens, parks, yards, golf courses, fields, pastures, tundra, as well as deciduous woodlands, pine forests, shrublands, and forests regenerating after fires or logging.
Icterus galbula	Baltimore Oriole				S2S3B	The Baltimore Oriole is an adaptable species (found breeding in diverse habitats), but typically favors woodland edge (especially riparian) and open areas with scattered trees; strong preference for deciduous over coniferous trees. During spring and fall migration, it is found in variety of habitats, but generally favors open woodlands, woodland margins, hedgerows, and urban parks.
Dendroica castanea	Bay-breasted Warbler				S3S4B	The Bay-breasted is one of the less widespread warblers, breeding in a narrow band across the closed boreal forests from northeast British Columbia to western Newfoundland, and south just into the U.S.A. Although during migrations and while foraging it is often seen in mixed stands, this bird nests only in conifers. Reaching highest densities in Balsam Fir forest infested with spruce budworm.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Picoides arcticus	Black-backed Woodpecker				S3S4	In the Maritimes, the Black-backed Woodpecker is widely but thinly distributed in conifer forests throughout, becoming more common farther north. The Black-backed Woodpecker is very local in southwest Nova Scotia. These birds forage on trees damaged by forest insects, especially bark beetles, and their characteristic flaking-off bark fragments in search of food can be an aid in detecting them. Nests here are often in quite open situations, such as cut-over areas, open Jack Pine stands, and the edges of woodland gardens.
Poecile hudsonica	Boreal Chickadee				S3	The Boreal Chickadee prefers conifer, and especially spruce, forests across the northern regions of Canada. Boreal Chickadees are found in all parts of the Maritimes. Most are residents, but some wander after breeding season.
Dendroica tigrina	Cape May Warbler				S2B	In summer, the Cape May Warbler is found in northern conifer forests. One of several warbler species that attain high densities during spruce budworm outbreaks, but is more usual in mature spruces than in Balsam Fir stands. Activity is mostly at the tops of tall spruces. Rarely observed in the southwest of Nova Scotia due to unsuitable habitat.
Wilsonia canadensis	Canada Warbler	T	T	Endangered	S3S4B	In Nova Scotia, the Canada Warbler has only been found sparsely on Cape Breton Island and in the extreme southwest of the province. They are less predictable from habitat than most warblers, they are usually found in dense understory vegetation of mature to mid-aged mixed forest, most closely associated with broad-leafed trees and shrubs, but with conifers usually present too.
Chordeiles minor	Common Nighthawk	T	T	Threatened	S2S3B	Common Nighthawks nest on sparsely vegetated or bare ground in open "wastelands" such as pine barrens, forest cut-overs, or burns, and secondarily on flat roofs of buildings.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Sialia sialis	Eastern Bluebird		NAR		S3B	The Eastern Bluebird nests in woodpecker holes, as well as nest-boxes. They forage in open areas of low vegetation with scattered trees for nesting.
Tyrannus tyrannus	Eastern Kingbird				S3B	In its breeding range, the Eastern Kingbird uses open environments; usually breeds in fields with scattered shrubs and trees, orchards, along shelterbelts, and especially along woodland edges in forested regions. A "savannah species", but given suitable nest sites and perches, will nest in many other habitats—e.g., desert riparian, quaking aspen (Populus tremuloides) parkland, recently burned forest, beaver ponds, golf courses and forested river valleys, and urban environments with tall trees and scattered open spaces. Also, appears drawn to water; often nests densely in trees that overhang water or in dead, standing snags surrounded by water.
Coccothraustes vespertinus	Evening Grosbeak				S3S4B, S3N	Evening Grosbeaks breed in mature and second-growth coniferous forests of northern North America and the Rocky Mountains, including spruce-fir, pine-oak, pinyon-juniper, and aspen forests. Less commonly, they nest in deciduous woodlands, parks, and orchards. They breed as far south as Mexico at 5,000–10,000 feet of elevation in pine and pine-oak woodlands. In winter Evening Grosbeaks live in coniferous forest and deciduous forest as well as in urban and suburban areas. When wintering in urban environments they are most abundant in small woodlots near bird feeders.
Dumetella carolinensis	Gray Catbird				S3	The gray catbird inhabits shrubbery in both upland and river-edge situations, mostly in areas where tree cover is of broad-leafed species. The Maritimes are at the northeast edge of its range, and catbirds are nearly absent in upland areas of Cape Breton Island, as well as in regions with extensive conifer forest cover.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Perisoreus canadensis	Gray Jay				S3	The Gray Jay breeds in boreal regions and occurs year-round in the conifer forests. These birds are found all over the Maritimes except where extensive conifer forests are lacking. They seldom leave the spruce and fir forests where they nest.
Tringa melanoleuca	Greater Yellowlegs				S3B, S3S4M	During migration, the Greater Yellowlegs is a familiar sight in salt marshes and around ponds and rivers, but their breeding habitat is very different. Yellowlegs breed in wooded bogs and muskegs access the boreal forest from northern British Columbia and Mackenzie to Labrador, Newfoundland and eastern Nova Scotia.
Charadrius vociferus	Killdeer				S3B	Killdeer are found throughout Nova Scotia, but scarce on the Atlantic slope and on Cape Breton Island. Breed in farmlands, gravel pits, forest clear-cut areas, and open lands along the coast.
Accipiter gentilis	Northern Goshawk		NAR		S3S4	Though it is more generally found in the boreal forest region, likely because less often disturbed there, the Northern Goshawk is also widespread in more temperate habitats. It nests in most forest types found throughout its geographic range. In eastern deciduous forests, Goshawks prefer nesting in mature, mixed hardwood–hemlock stands of birch (Betula sp.), beech (Fagus sp.), maple (Acer sp.), and Eastern Hemlock. Found scattered throughout the forests of the Maritimes. Hunts in diverse habitats ranging from open-sage steppes to dense forests, including riparian areas.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Mimus polyglottos	Northern Mockingbird				S1B	The Northern Mockingbird uses open habitats with scattered shrubs and small trees. In the East, typical habitats are parkland, cultivated lands, and early successional habitat at low elevations. Throughout its range found in suburban and urban habitats such as gardens and cemeteries, especially favoring mowed lawns adjacent to bare areas (e.g. concrete, asphalt, and sidewalks) with access to shrubs or hedges for cover and nesting. Absent from the interior of all forested habitat but frequents forest edge. Found in the same habitat year-round.
Contopus cooperi	Olive-sided Flycatcher	T	T	Threatened	S3B	The Olive-sided Flycatcher is found in open woodlands and other places where scattered trees remain after cutting or fire in forested regions. Found throughout the Maritimes, but not abundantly.
Vireo philadelphicus	Philadelphia Vireo				S2?B	This Philadelphia Vireo is found mainly in broad-leafed trees, in pure or mixed woods, but it sings and forages more often in young stands and in the sub-canopy. Breeding has never been proven in Nova Scotia.
Pinicola enucleator	Pine Grosbeak				S2S3B, SN5	In the Maritimes, the Pine Grosbeak approaches the southern limit of its range, they are found generally in Nova Scotia. In general, they avoid warmer, hardwood-dominated regions.
Carduelis pinus	Pine Siskin				S2S3	The Pine Siskin is primarily found in open coniferous forests. Also breeds in ornamental conifers in parks, cemeteries, and the like, and in mixed coniferous-deciduous and even deciduous tree associations. May forage in trees, shrubs, and grassy areas.
Haemorhous purpureus	Purple Finch				S4S5B, S3S4N	Purple Finches are mostly found in moist, cool conifer forests. They are also found in mixed forests along streams and in tree-lined suburbs.
Sitta canadensis	Red-breasted Nuthatch				S3	Red-breasted Nuthatches live mainly in deciduous woods and in coniferous forests.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Loxia curvirostra	Red Crossbill				S3S4	Red Crossbills are found in mature coniferous forests.
Pheucticus ludovicianus	Rose-breasted Grosbeak				S2S3B	Rose-breasted Grosbeaks use a wide variety of habitats, including deciduous and mixed wooded uplands and lowlands; often at shrubby ecotones at the edge of woods at streams, ponds, marshes, roads, or pastures. Commonly uses second-growth woodlands and well-vegetated suburban areas, parks, gardens, and orchards. Exhibits a preference for mesic woodlands, swamp forests, riparian corridors; avoids dry oak (Quercus spp.) woodlands. Uses a wide variety of habitats during spring and fall migration.
Regulus calendula	Ruby-crowned Kinglet				S3S4B	Ruby-crowned Kinglets prefer spruce-fir forests, however they also live in mixed wood forests, isolated trees in meadows, coniferous and deciduous forests, mountain-shrub habitat, and floodplain forests of oak, pine, spruce or aspen.
Euphagus carolinus	Rusty Blackbird	SC	SC	Endangered	S2B	Rusty Blackbirds use wet coniferous and mixed forests from northern edge of tundra southward to beginning of deciduous forests and grasslands. Frequents fens, alder (Alnus)–willow (Salix) bogs, muskegs, beaver ponds, and other openings in the forest such as swampy shores along lakes and streams. Exceptionally, on Cape Breton Island, Nova Scotia, drier sites such as pasture edges are used. During spring and fall migration, it forages in stubble, pasture, plowed fields, and edges of swamps. Fall migrants also frequent wooded areas, particularly for roosting. Occasionally roosts on the ground in open fields.
Catharus ustulatus	Swainson's Thrush				S3S4B	Swainson's Thrush are predominantly found in closed-canopy forests. Breeding habitat includes deciduous and coniferous forests.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Vermivora peregrina	Tennessee Warbler				S3S4B	In its breeding range, the Tennessee Warbler is associated with Boreal zone in deciduous, mixed, and coniferous forests from near sea level to 450 m. Associated with open areas that contain grasses, dense shrubs, and scattered clumps of young deciduous trees.
Empidonax traillii	Willow Flycatcher				S2B	In general, the Willow Flycatcher prefers moist, shrubby areas, often with standing or running water. During spring and fall migration, it uses areas similar to its breeding habitat.
Gallinago delicata	Wilson's Snipe				S3B	The Wilson's Snipe breeds in sedge bogs, fens, willow (Salix spp.) and alder (Alnus spp.) swamps, and marshy edges of ponds, rivers, and brooks. Requires soft organic soil rich in food organisms just below surface, with clumps of vegetation offering both cover and good view of approaching predators. Avoids marshes with tall, dense vegetation (cattails [Typha], reeds [Phragmites], etc.). In Canada, they use four primary types of breeding habitat: sedge bogs, fens, swamps, and pond and river edges. During spring and fall migration, they use marshes (including cattails), swamps, wet meadows, wet pastures, wet fallow fields, and marshy edges of streams and ditches. As during the breeding season, they require wet organic soils rich in food with clumps of cover.
Wilsonia pusilla	Wilson's Warbler				S3B	Western montane, northern, and northeastern populations of Wilson's Warbler are restricted to mesic shrub thickets of riparian habitats, edges of beaver ponds, lakes, bogs, and overgrown clear-cuts of montane and boreal zone; may reach into alpine zone. During spring and fall migration, occurs in most deciduous shrub habitats, but primarily riparian shrub understory. Also, found in most other woodlands, suburban habitats, agricultural areas, desert scrub, and montane forests.

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Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Empidonax flaviventris	Yellow-bellied Flycatcher				S3S4B	The Yellow-bellied Flycatcher is a characteristic breeding bird of Canadian boreal conifer forests and peatlands. It nests in typically cool, moist conifer or mixed forests, bogs, swamps, and muskegs; landscapes often flat or poorly drained. Breeding habitat is usually well stratified, with open canopy, saplings and seedlings, shrubs, and abundant, thick moss cover. Shade is provided by conifer trees and saplings, as well as layers of shrubs, ferns, and herbs; undergrowth is usually dense.
Other Vertebrates						
Perimyotis subflavus	Eastern Pipistrelle	E	E	Endangered	S1	Prefers partly open country with large trees and woodland edges. Avoids deep woods and open fields. Probably roosts in the summer in tree foliage and occasionally in buildings; may use cave as night roost between foraging forays. Usually hibernates in caves and mines with high humidity. Generally, maternity colonies utilize manmade structures or tree cavities; often in open sites that would not be tolerated by most other bats.
Lasiurus borealis	Eastern Red Bat				S1	The Eastern Red Bat lives in forests, forest edges and hedgerows. It roosts among foliage, usually in deciduous trees, but it will sometimes roost in coniferous trees.
Lasiurus cinereus	Hoary Bat				S1	Hoary Bats are thought to be rare in Nova Scotia. Insectivorous, migratory. Poorly understood. Authorities disagree as to the bat's preference for coniferous versus broadleaf trees. Hoary Bats are thought to prefer trees at the edge of clearings, but have been found in trees in heavy forests, open wooded glades, and shade trees along urban streets and in city parks.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Myotis lucifugus	Little Brown Myotis	E	E	Endangered	S1	For Little Brown Myotis, the maternity colonies often exist in warm sites that facilitate pup growth rates, such as attics of buildings and under bridges, in rock crevices, or in cavities of canopy trees in forests. Males roost during daytime in a wide variety of structures, including buildings and bridges (mainly M. lucifugus), rock crevices, behind flaking bark, and within tree cavities, often at many different sites during the summer. Myotis species generally roost in tall, large-diameter snags that are in the early to middle stages of decay and located in open areas within mature-over mature forest. Myotis lucifugus congregates in caves and abandoned mines used for hibernation through the winter. About 16 hibernation sites are known in Nova Scotia.
Sorex maritimensis	Maritime Shrew				S3	The Maritime Shrew is most often found in marshes and wet meadows. It is only found in two provinces in Canada: New Brunswick and Nova Scotia.
Alces americanus	Mainland Moose			Endangered	S1	Mainland Moose are herbivores who live in boreal and mixed-wood forests. They are often found where there is an abundance of food (twigs, stems, and foliage of young deciduous trees and shrubs). In spring, islands and peninsulas are often used by cows when giving birth. In summer, access to wetlands (and aquatic vegetation) is important.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Myotis septentrionalis	Northern Long-eared Myotis	E	E	Endangered	S1	The Northern Long-eared Bat is found in many regions of Canada. Although there are numerous records of its presence in eastern Canada and the United States, it has only been recorded sporadically in the west. This bat has two habitats: a winter hibernation habitat as well as a summer roosting and foraging habitat. The Northern Long-eared Bat hibernates in caves or abandoned mines during the cold winter months. During the summer months, the bats commonly use crevices behind peeling bark or cavities in partially-decayed trees as summer day roosts. Within thick forests, summer activity may be focused along watercourses and small ponds.
Microtus chrotorrhinus	Rock Vole				S2	Optimal habitat for the Rock Vole is ferns/mossy debris near flowing water in coniferous forests. It also occupies deciduous forest/spruce clear cuts (mainly recent cuts), forest ecotones, grassy balds near forest, and sterile-looking rocky road fills. Occupies shallow burrows and runways. Nests probably are placed under logs or in similar protected sites. They are made of moss with a lining of grass and have multiple entrance tunnels. Breeding season is from March to mid-October.
Lasionycteris noctivagans	Silver-haired Bat				S1	Scarce in eastern Canada. During the summer months, Silver-haired Bats are found in forested habitats, particularly coniferous woodlands, adjacent to aquatic habitats like ponds, lakes and streams. Both sexes fly south between the middle of August and early October.
Chelydra serpentina	Snapping Turtle	SC	SC	Vulnerable	S3	southern New Brunswick and parts of mainland Nova Scotia in ponds, lakes, slow-moving streams and sometimes in brackish water if these water bodies have soft mud bottoms and abundant aquatic vegetation.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Glyptemys insculpta	Wood Turtle	T	T	Threatened	S2	Habitat destruction and fragmentation due to intense development and accompanying stream alterations are serious problems in the southeastern portion of the Wood Turtle's range. Protection of wooded stream corridors, nesting, feeding, basking, and overwintering sites, and an upland buffer would be necessary to include in preserve design
						Lives along permanent streams during much of each year, but in summer may roam widely overland and can be found in a variety of terrestrial habitats adjacent to streams, from deciduous woods, cultivated fields, and woodland bogs, to marshy pastures. Use of woodland bogs and marshy fields is most common in the northern part of the range.
Fish						
Anguilla rostrata	American Eel		T		S5	The American Eel moves from salt water into fresh water when quite young and spend their adult life in fresh water returning to spawn in tropical oceans up to several decades later. Widely distributed in freshwaters, estuaries and coastal marine waters connected to the Atlantic Ocean. Although small streams may be critical to the persistence of eels in a watershed, they may use these streams only once or twice a year, while moving to and from more preferred habitats.
Salmo salar	Atlantic Salmon – Southern Uplands Population		E		S2	Found in freshwater rivers and streams that are clear, cool, and well oxygenated, with gravel, cobble, or boulder bottoms.
Rhinichthys atratulus	Blacknose Dace				S3	The Blacknose Dace is common in cool, clear, gravel bottom rivers and streams, however it can survive in slow moving or stagnant waters.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Culaea inconstans	Brook Stickleback				S3	This species generally occupies cool, clear, heavily weeded, spring-fed creeks, small rivers, lakes, and ponds, usually in shallow, quiet to flowing pools and backwaters over sand or mud. Sometimes it burrows into soft bottoms. Occasionally this fish can be found in brackish water. In a lake in Manitoba, adults were most abundant at the outer margin of emergent vegetation (Moodie 1986). Eggs are deposited in a nest made of plant material by the male just above the bottom in shallow water.
Invertebrates						
Euphydryas phaeton	Baltimore Checkerspot				S3	Found in fresh-water marshes, wet roadsides and meadows. Larvae found feeding on Turtlehead (Chelone glabra) and has been reported to feed on Beardtongue (Penstemon digitalis).
Amblyscirtes vialis	Common Roadside-Skipper				S2	Found in trails, roads in wooded areas and often near streams. Larvae are found feeding off of a variety of grass species.
Polygonia progne	Grey Comma				S3S4	Found in woods and aspen parklands. Larvae found feeding on currants and gooseberries (Ribes sp.) and sometimes Elm (Ulmus sp.).
Danaus plexippus	Monarch	SC	SC		S2B	Almost anywhere during the spring (northward) migration; near the larval foodplains during the breeding season; in the fall commonly near the coast, often in large numbers, all heading south. Larvae are found feeding on the following Milkweed species: Common Milkweed (Ascelpias syriaca) and Swamp Milkweed (A. incarnata), neither of which are abundant plants in Nova Scotia. Common Milkweed is very common in lower Saint John river valley (NB) and possibly north central Nova Scotia.
Pieris oleracea	Mustard White				S2	Found in deciduous woods and bogs. Larvae feed off of various plants belonging to the Brassicaceae (mustard) family.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Lethe anthedon	Northern Pearly-Eye				S3	Found in moist woods and dominated by graminoids in the herbaceous layer of forests. Larvae feed off of woodland grasses such as Bearded Shortgrass (Brachyelytrum erectum) and False Melic Grass (Schizachne purpurascens).
Amblyscirtes hegon	Pepper and Salt Skipper				S2	Found on the edges of forests and streams. Larvae found feeding on a variety of grass species.
Gomphus ventricosus	Skillet Clubtail	E	E		S1	In the Northeast, the larvae inhabit large rivers where they burrow in the soft mud of deep pools.
Satyrium liparops	Striped Hairstreak				S3	Found in deciduous forest edges, gardens and roadsides. Larvae found feeding off of members of the Rosaceae family such as plum and cherries (Prunus spp.). Occurrences with Oak (Quercus spp.), Willow (Salix spp.) and Blueberry (Vaccinium spp.).
Alasmidonta undulata	Triangle Floater				S2S3	Frequently found in stream and rivers in sand and gravel substrates.
Vascular Plants						
Isoetes acadiensis	Acadian Quillwort				S3	In water up to depth of 1m, bordering lakes, ponds or along rivers, infrequent but scattered through province.
Rhamnus alnifolia	Alder-leaved Buckthorn				S3	Grows in wooded swamps or bogs, meadows or alluvial soils in the alkaline regions, in Hants, Cumberland and Inverness Counties.
Vaccinium uliginosum	Alpine Bilberry				S3	Wide tolerance of moisture and fertility, but generally acidic soils in Halifax, Digby & Cape Breton.
Barbarea orthoceras	American Yellow Rocket				S1	Alpine or subalpine zones, shores of rivers or lakes, talus and rocky slopes.
Polypodium appalachianum	Appalachian Polypody				S3?	Cliffs and rocky slopes, distribution unclear.
Viola sagittata	Arrow-Leaved Violet				S3S4	Sterile woods, clearing and fields, common from Yarmouth to Halifax and Hants Counties.
Viola sagittata var. ovata	Arrow-Leaved Violet				S3S4	Sterile woods, clearing and fields, common from Yarmouth to Halifax and Hants Counties.
Salix serissima	Autumn Willow				S1	Fens (calcium-rich wetlands), meadows and fields, swamps.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Geranium bicknellii	Bicknell's Crane's-bill				S3	Colonizes recently burned or cleared land; recently exposed lakeshores, Sporadic from southern counties to central Nova Scotia.
Fraxinus nigra	Black Ash			Threatened	S1S2	Typical habitat includes poorly drained soils and swampy woods.
Polygala sanguinea	Blood Milkwort				S2S3	Prefers acidic or run-out soil as found in fallow fields or brushlands, scattered through central portion of province.
Caulophyllum thalictroides	Blue Cohosh				S2	Shade-tolerant, restricted to river floodplain deciduous forests. A wide and patchy distribution over northern portion of the province from Annapolis River to River Denys in Cape Breton.
Carex tribuloides	Blunt Broom Sedge				S3?	Found in wet forest soils and swales. Collected from Kings and Queens counties to Cape Breton.
Carex tribuloides var. tribuloides	Blunt Broom Sedge				S3?	Found in wet forest soils and swales.
Galium obtusum ssp. obtusum	Blunt-leaved Bedstraw				S2S3	Swamps, swampy grounds, wet areas of prairies, wet woods and thickets, roadside ditches.
Potamogeton obtusifolius	Blunt-leaved Pondweed				S3	Ponds, pools, lakes and sluggish streams often over deep mucky substrate. Northern from Cumberland Co., to northern Cape Breton.
Betula pumila var. renifolia	Bog Birch				S1?	Bogs and meadows amongst alders.
Betula pumila var. pumila	Bog Birch				S2S3	Bogs and meadows amongst alders.
Salix pedicellaris	Bog Willow				S2	Grows in acidic substrate as in bogs; nutrient-rich marshes and in sphagnous lacustrine habitats.
Symphyotrichum boreale	Boreal Aster				S2?	Lacustrine gravels, streamsides and edges of peatlands. Scattered from Yarmouth to Cape Breton and uncommon.
Bromus latiglumis	Broad-Glumed Brome				S1	Floodplain (river or stream floodplains), forests, shores of rivers or lakes.
Anemone canadensis	Canada Anemone				S2	In thickets, meadows and stony shores. Grows in alluvial soils in calcareous regions.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Potentilla canadensis	Canada Cinquefoil				S2S3	Found on dry rock barrens and other open areas in Yarmouth, Halifax, Kings, Shelburne and Hants Co.
Potentilla canadensis var. canadensis	Canada Cinquefoil				S2S3	Found on dry rock barrens and other open areas in Yarmouth, Halifax, Kings, Shelburne and Hants Co.
Piptatherum canadense	Canada Rice Grass				S2	Grows in dry sandy soils. Local and scattered from Shelburne to Halifax and Colchester counties.
Polygonum careyi	Carey's Smartweed				S1	Anthropogenic (man-made or disturbed habitats), meadows and fields, shores of rivers or lakes.
Sisyrinchium fuscatum	Coastal Plain Blue-eyed-grass				S1	Grows on sandy soils. Collected only from western counties.
Eupatorium dubium	Coastal Plain Joe-pye-weed				S2	Found in wet meadows, damp thickets, shores, and along the roadside. It grows best in full sun but can also grow in semi-shade and enjoys grows well-drained soil that is moisture retentive.
Galium aparine	Common Bedstraw				S2S3	Pastures, fields, ditches and streamsides. Very common throughout.
Humulus lupulus var. lupuloides	Common Hop				S1?	Anthropogenic (man-made or disturbed habitats), floodplain (river or stream floodplains), forests, shrublands or thickets.
Botrychium lunaria	Common Moonwort				S1	Open slopes. Sand or gravel; shores and meadows. Basic soils. Known from Conrad's Beach, Halifax County and from New Campbellton and Indian Brook in northern Cape Breton.
Equisetum hyemale	Common Scouring-rush				S3S4	Grows in sandy, gravelly soil, on banks or in low areas; often in calcareous regions. Scattered, mostly from Digby County, through the Annapolis Valley, northward to Cape Breton.
Equisetum hyemale var. affine	Common Scouring-rush				S3S4	Grows in sandy, gravelly soil, on banks or in low areas; often in calcareous regions. Scattered, mostly from Digby County, through the Annapolis Valley, northward to Cape Breton.

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Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Cardamine pratensis var. angustifolia	Cuckoo Flower				S1	Moist soil as in meadows, damp fields and other low ground. Scattered in the province, frequent along the Annapolis River and even spreading into roadsides ditches, north to Cape Breton.
Ranunculus sceleratus	Cursed Buttercup				S1S2	Anthropogenic (man-made or disturbed habitats), fresh tidal marshes or flats, marshes, swamps.
Ranunculus sceleratus var. sceleratus	Cursed Buttercup				S1S2	Anthropogenic (man-made or disturbed habitats), fresh tidal marshes or flats, marshes, swamps.
Rudbeckia laciniata	Cut-Leaved Coneflower				S1S2	Floodplain (river or stream floodplains), forests, shores of rivers or lakes, swamps, wetland margins (edges of wetlands).
Rudbeckia laciniata var. gaspereauensis	Cut-Leaved Coneflower				S1S2	Floodplain (river or stream floodplains), forests, shores of rivers or lakes, swamps, wetland margins (edges of wetlands).
Hypericum dissimulatum	Disguised St John's-wort				S2S3	Wet mucky soils in lacustrine habitats; historically collected from Digby to Halifax Co. with a single specimen from each of Pictou and Guysborough counties.
Goodyera pubescens	Downy Rattlesnake-Plantain				S2	Forms large colonies in woodlands and thickets; Only recently discovered in Nova Scotia (1963) and so far known from Queens, Kings, Annapolis, Hants and Halifax counties.
Epilobium strictum	Downy Willowherb				S3	Bogs and other peatlands; Scattered throughout Cape Breton, infrequent elsewhere.
Arabis drummondii	Drummond's Rockcress				S2	Cliff or talus slope.
Juncus dudleyi	Dudley's Rush				S3	A habitat generalist; known from Annapolis, Hants and Lunenburg counties.
Vaccinium caespitosum	Dwarf Bilberry				S3	Cliff or talus slope, disturbed sites, field meadow.
Vaccinium caespitosum var. caespitosum	Dwarf Bilberry				S3	Cliff or talus slope, disturbed sites, field meadow.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Pilea pumila	Dwarf Clearweed				S1	Usually grows in cool shady habitats as found on forested slopes of maple-beech, in the centre of the province. So far, only known from West Branch, Pictou Co.; Little River, near Brookfield, Halifax Co.; and along the Herbert River, Hants Co. at Woodville.
Pilea pumila var. pumila	Dwarf Clearweed				S1	Usually grows in cool shady habitats as found on forested slopes of maple-beech, in the centre of the province. So far, only known from West Branch, Pictou Co.; Little River, near Brookfield, Halifax Co.; and along the Herbert River, Hants Co. at Woodville.
Baccharis halimifolia	Eastern Baccharis		T	Threatened	S1	Anthropogenic (man-made or disturbed habitats), brackish or salt marshes and flats, coastal beaches (sea beaches), marshes.
Sisyrinchium atlanticum	Eastern Blue-Eyed-Grass				S3S4	Found in damp peat, sandy soils that are poorly drained. Common from Yarmouth and Shelburne counties east to Lunenberg Co. Scattered elsewhere.
Solidago latissimifolia	Elliott's Goldenrod				S3S4	Clearings, thickets and bogs, swales and lakeshores. Common in Yarmouth Co., east to Halifax Co.
Carex vacillans	Estuarine Sedge				S1S3	Brackish or salt marshes and flats, intertidal, subtidal or open ocean, shores of rivers or lakes.
Panicum dichotomiflorum var. puritanorum	Fall Panic Grass				S1?	Anthropogenic (man-made or disturbed habitats), shores of rivers or lakes.
Myriophyllum farwellii	Farwell's Water Milfoil				S2	Ponds and slow-flowing fresh water. Scattered across the mainland.
Carex foenea	Fernald's Hay Sedge				S3?	Preferred habitat is dry and sandy soils as on barrens. Scattered from Yarmouth to northern Cape Breton.
Potamogeton zosteriformis	Flat-stemmed Pondweed				S2S3	Lacustrine (in lakes or ponds), riverine (in rivers or streams).
Stellaria crassifolia and var. crassifolia	Fleshy Stitchwort				S1	Frequents pond edges and wet seepy slopes.
Trichostema dichotomum	Forked Bluecurls				S1	Anthropogenic (man-made or disturbed habitats), grassland, meadows and fields, sandplains and barrens.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Carex alopecoidea	Foxtail Sedge				S1	Anthropogenic (man-made or disturbed habitats), floodplain (river or stream floodplains), forests, marshes.
Ranunculus gmelinii+	Gmelin's Water Buttercup				S3	Riverine (in rivers or streams), swamps.
Zizia aurea	Golden Alexanders				S1	Meadows, shores, thickets and even wooded swamps. Occasionally reported: Pomquet and South River, Antigonish Co., Upper Musquodoboit, Halifax Co.
Veratrum viride	Green False Hellebore				S1	Open moist meadows. Found once in the meadow along the stream at the Kentville Research Station and to be expected elsewhere. This is possibly native.
Carex viridula var. elatior	Greenish Sedge				S1	Crins of alkaline, lime-rich soils.
Minuartia groenlandica	Greenland Stitchwort				S3	Granite ledges, crevices and gravels, coastal headlands. Halifax and Lunenburg counties; French Mountain, Inverness County. Recently collected from White's Cove, Digby Co.
Lycopodium sabinifolium	Ground-Fir				S3?	Alpine or subalpine zones, anthropogenic (man-made or disturbed habitats), meadows and fields.
Carex haydenii	Hayden's Sedge				S1	Marshes, meadows and fields, shores of rivers or lakes.
Cyperus lupulinus and ssp. macilentus	Hop Flatsedge				S1	Anthropogenic (man-made or disturbed habitats), grassland, meadows and fields.
Carex grisea	Inflated Narrow-leaved Sedge				S1	Floodplain (river or stream floodplains), forests.
Botrychium lanceolatum var. angustisegmentum	Lance-Leaf Grape-Fern				S2S3	Fertile soils on woodland hillsides.
Carex lapponica	Lapland Sedge				S1?	Sphagnum bogs, wet, nutrient-poor areas, mostly lowlands
Platanthera grandiflora	Large Purple Fringed Orchid				S3	Favours wet meadows and riparian habitats - More often found in north-central Nova Scotia. Infrequent in southwestern NS.
Hypericum majus	Large St John's-wort				S2	Wet or dry open soil. Widely scattered locations. Until recently, only known from Halifax area and Big Baddeck, Victoria County, and thought to be historic.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Carex adusta	Lesser Brown Sedge				S2S3	Found in dry, open forest or recent clearings on acidic, gravelly soils. Most frequent after fire - Scattered and not common, from Kejimkujik National Park to Cumberland Co.; northern Cape Breton. Recently collected from Williams Lake area of Halifax Co.
Carex granularis	Limestone Meadow Sedge				S1	Anthropogenic (man-made or disturbed habitats), meadows and fields, shores of rivers or lakes, wetland margins (edges of wetlands).
Schizaea pusilla	Little Curlygrass Fern				S3	Sphagnous wet areas, upper peaty lakeshores and undrained depressions. Scattered throughout the Atlantic counties and frequent in the northern plateau of Cape Breton.
Rhinanthus minor ssp. groenlandicus	Little Yellow Rattle				S1	Alpine or subalpine zones, anthropogenic (man-made or disturbed habitats), meadows and fields, mountain summits and plateaus, talus and rocky slopes
Liparis loeselii	Loesel's Twayblade				S3S4	Anthropogenic (man-made or disturbed habitats), fens (calcium-rich wetlands), lacustrine (in lakes or ponds), meadows and fields, shores of rivers or lakes.
Stellaria longifolia and var. longifolia	Long-leaved Starwort				S2	Damp grassy habitats, in sandy or mucky soils. Locally abundant along the Salmon River at Truro and Kemptown, Colchester Co.; along the Musquodoboit and Stewiacke rivers; Isle Haute.
Equisetum palustre	Marsh Horsetail				S1	Of wetlands, marshes and swamps. A single collection each from Kings County and Halifax Co.
Proserpinaca palustris	Marsh Mermaidweed				S3	Lakeshore fens and streamsides.
Hordeum brachyantherum and ssp. brachyantherum	Meadow Barley				S1	Anthropogenic (man-made or disturbed habitats).
Betula michauxii	Michaux's Dwarf Birch				S2	Limited to peat bogs. Scattered localities from Brier Island, Digby Co., east to Guysborough, Cape Breton and Inverness counties.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Amelanchier nantucketensis	Nantucket Serviceberry				S1	Found in disturbed habitats such as roadsides, fields, sandplains, riparian meadows and barrens. Its NS distribution is limited to Cumberland, Shelburne and Halifax counties. No collection for the Halifax Co. locality.
Trisetum spicatum	Narrow False Oats				S3S4	Grows in rocky soils on outcrops, cliffs, streamsides. Found on Cape Blomidon, Cape d'Or and scattered from Halifax and Hants counties to northern Cape Breton.
Allium burdickii	Narrow-Leaved Wild Leek				S1?	Rich deciduous woodlands, wooded bluffs, wooded areas along rivers and streams, and cemetery prairies
Saxifraga cernua	Nodding Saxifrage				S1	Alpine or subalpine zones, cliffs, balds, or ledges.
Ophioglossum pusillum	Northern Adder's-tongue				S2S3	Sterile soils, swamps and sandy or cobbly lakeshores. Known from Yarmouth and Digby Counties; scattered east to Halifax and Amherst; a single Cape Breton record from George River.
Betula borealis	Northern Birch				S2	Bogs and wooded swamps.
Viola nephrophylla	Northern Bog Violet				S2	Cool, mossy sites: bogs, streamsides and wet woods. Rare in Shelburne Co., Colchester and Cumberland counties northward. Generally, a northern ranging species within NS.
Lycopodium complanatum	Northern Clubmoss				S3S4	Open woodlands, thickets, heathland and rocky slopes;
Geocaulon lividum	Northern Comandra				S3	Damp sands and other sterile soils, especially in acid or peaty sites. Disjunct sites in Halifax, Kings and Cumberland counties; widespread but local in Cape Breton.
Thalictrum venulosum	Northern Meadow-rue				S1	Shores of rivers or lakes.
Spiraea septentrionalis	Northern Meadowsweet				S1?	Open, moist areas
Vaccinium ovalifolium	Oval-leaved Bilberry				S1	Sterile and dry soils in barrens, thickets and coniferous woods
Eleocharis ovata	Ovate Spikerush				S2?	Grows on muddy streamsides, streambeds and lakeshores, often in subsiding water.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Torreyochloa pallida var. pallida	Pale False Manna Grass				S1	Lacustrine (in lakes or ponds), riverine (in rivers or streams), swamps.
Platanthera flava var. herbiola	Pale Green Orchid				S2	Anthropogenic (man-made or disturbed habitats), floodplain (river or stream floodplains), forest edges, forests, fresh tidal marshes or flats, grassland, meadows and fields, riverine (in rivers or streams), shrublands or thickets, swamps, wetland margins (edges of wetlands), woodlands.
Impatiens pallida	Pale Jewelweed				S2	Alluvial soils as along intervales and in thickets. Uncommon from Kings Co,.Isle Haute, to northern Cape Breton and more frequent eastward.
Hieracium paniculatum	Panicled Hawkweed				S3	Mixed forest on dryish soils, especially oak. Occasional from Yarmouth east to Kings and Halifax counties. Common about Kentville and at Kejimkujik.
Rumex persicarioides	Peach-leaved Dock				S2?	Anthropogenic (man-made or disturbed habitats), brackish or salt marshes and flats, coastal beaches (sea beaches), meadows and fields.
Ranunculus pensylvanicus	Pennsylvania Buttercup				S1	Anthropogenic (man-made or disturbed habitats), marshes, shores of rivers or lakes, swamps.
Erigeron philadelphicus	Philadelphia Fleabane				S2	Habitats include fields, meadows and springy slopes. Not common, scattered stations from Digby and Cumberland counties to central Cape Breton.
Erigeron philadelphicus var. philadelphicus	Philadelphia Fleabane				S2	Habitats include fields, meadows and springy slopes. Not common, scattered stations from Digby and Cumberland counties to central Cape Breton.
Empetrum eamesii ssp. atropurpureum	Pink Crowberry				S2S3	Barrens, beach or coastal shore, bog, exposed rock or sand, headland
Empetrum eamesii ssp. eamesii	Pink Crowberry				S2S3	Barrens, beach or coastal shore, bog, exposed rock or sand, headland
Empetrum eamesii	Pink Crowberry				S3	Barrens, beach or coastal shore, bog, exposed rock or sand, headland
Pyrola asarifolia and ssp. asarifolia	Pink Pyrola				S3	Found in moist and riparian forests and in swamps dominated by northern white-cedar (Thuja occidentalis).

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Carex plantaginea	Plantain-Leaved Sedge				S1	Forests.
Rosa acicularis and ssp. sayi	Prickly Rose				S1	Cliffs, balds, or ledges, ridges or ledges. Inhabits areas of calcareous rock or rich sediments.
Festuca prolifera	Proliferous Fescue				S1S2	Alpine or subalpine zones, cliffs, balds, or ledges, talus and rocky slopes.
Crataegus submollis	Quebec Hawthorn				S1?	edges of fields and thickets, Antigonish and Lunenburg Co. to Cape Breton.
Fraxinus pennsylvanica	Red Ash				S1	Floodplain (river or stream floodplains), forests, shores of rivers or lakes, swamps.
Lachnanthes caroliniana	Redroot	SC	SC	Vulnerable	S2	Shores of rivers or lakes.
Eleocharis erythropoda	Red-stemmed Spikerush				S1	Fens (calcium-rich wetlands), marshes, shores of rivers or lakes, wetland margins (edges of wetlands).
Crataegus robinsonii	Robinson's Hawthorn				S1?	Prairie, meadows, fields.
Carex rosea	Rosy Sedge				S3	Grows in dry soils beneath deciduous forests and thickets. Common from Annapolis Co. to northern Cape Breton.
Hieracium scabrum var. leucocaule	Rough Hawkweed				S1	Usually in poor soils in pastures, fields and fallow sites. Common throughout.
Plantago rugelii	Rugel's Plantain				S2S3	Anthropogenic (man-made or disturbed habitats), grassland, meadows and fields.
Plantago rugelii var. rugelii	Rugel's Plantain				S2S3	Anthropogenic (man-made or disturbed habitats), grassland, meadows and fields.
Cypripedium reginae	Showy Lady's-Slipper				S2	Bog, swamp. Widely scattered localities in province
Salix sericea	Silky Willow				S2	LOake or pond shore, riparian zones. Rare only reported from western NS. Parr Lake and Lake Fanning, Yarmouth Co.; Queens and Lunenburg counties to Halifax County
Eriophorum gracile and var. gracile	Slender Cottongrass				S2	Wet peat and inundated shores. Scattered eastward from Annapolis and Halifax counties.
Agalinis paupercula	Small-flowered Agalinis				S1	Meadows and fields, shores of rivers or lakes, wetland margins.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Limosella australis	Southern Mudwort				S3	Beach or coastal shore, coastal island, lake or pond shore, river or stream. Yarmouth, Shelburne, Queens and Cumberland counties; Sable Island; Cape Breton and likely elsewhere.
Listera australis	Southern Twayblade				S3	Bog, mixed wood forest, swamps. Scattered from Shelburne, to Halifax, to Kings to Cape Breton counties.
Potamogeton pulcher	Spotted Pondweed			Vulnerable	S2S3	Aquatic perennial herb that grows in standing water. Yarmouth, Queens and Halifax Counties, reported in Digby Co.
Halenia deflexa ssp. brentoniana	Spurred Gentian				S1?	Forest edge, forests, meadows and fields
Asclepias incarnata ssp. pulchra	Swamp Milkweed				S3?	Rocky soils along lakeshores, marshes, streamsides or peatland edges. Infrequently found from Yarmouth to Cape Breton.
Veronica serpyllifolia ssp. humifusa	Thyme-Leaved Speedwell				S2S3	Moist soils, fields and roadsides. Common throughout.
Panicum tuckermanii	Tuckerman's Panic Grass				S3S4	Meadows and fields, shores of rivers and lakes.
Equisetum variegatum and var. variegatum	Variegated Horsetail				S3	Wetlands or wet seeps. Wide ranging in NS, with disjunct localities: Halifax County, Cumberland Co., Victoria Co.
Symphyotrichum undulatum	Wavy-leaved Aster				S2	Edges of fields and forests. Lunenburg Co. Queens, Hants, Kings and Halifax counties
Carex peckii	White-Tinged Sedge				S2?	Fry or mesic slopes, mixed deciduous forests, rocky outcrops, old quarries. King's Co., Rhodes Co., Lunenburg Co. Halifax and the Pennants area.
Lysimachia quadrifolia	Whorled Yellow Loosestrife				S1	Disturbed habitat, grassland, woodlands
Vallisneria americana	Wild Celery				S2	Ponds, lakes, and quiet streams at depths of 1 to 4 m. Colchester Co., Halifax Co., Cumberland Co. Reported from Northern Cape Breton.
Allium schoenoprasum and var. sibiricum	Wild Chives				S2	Disturbed habitats, floodplain, meadows and fields, ridges or ledges, shores of rivers and lakes.

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Allium tricoccum	Wild Leek				S1	Hardwood forest, intervale
Juncus subcaudatus	Woods-Rush				S3	Conifer woods and spruce swamps, where substrate is soggy. Yarmouth to Kings and Halifax Counties. Richmond County
Juncus subcaudatus var. planisepalus	Woods-Rush				S3	Conifer woods and spruce swamps, where substrate is soggy. Yarmouth to Kings, Halifax Counties and Richmond County.
Dichanthelium acuminatum var. lindheimeri	Woolly Panic Grass				S1?	Open sites and sandy soils. Widespread and common.
Bartonia virginica	Yellow Bartonia				S3	Dry barrens, sandy or peaty soils, bogs, lakeshores. Common in southwestern counties becoming scarcer eat to Annapolis and Halifax; St. Peter's area of Cape Breton
Cypripedium parviflorum	Yellow Lady's-slipper				S2S3	Occasionally under mixed deciduous trees
Utricularia ochroleuca	Yellowish-white Bladderwort				S1	Rooted free floating plant
Lichens						
Cladina stygia	Black-footed Reindeer Lichen				S2S3	Most frequent in peatlands, particularly treeless bogs
Anzia colpodes	Black-foam Lichen				S3	This species occurs on the bark of hardwoods, and more rarely conifers, in humid forested habitats throughout temperate eastern North America.
Leptogium corticola	Blistered Jellyskin Lichen				S2S3	This lichen species is widespread and grows on the bases of hardwoods and occasionally on rocks in moist woods.
Collema furfuraceum	Blistered Tarpaper Lichen				S3	On bark of hardwood and sometimes coniferous trees, especially in old forests
Degelia plumbea	Blue Felt Lichen		SC	Vulnerable	S2	Mature forests within varying moisture regimes. Typically located in hardwood stands, with Red maple, Sugar maple, or Yellow Birch.

Priority Species List. Beaver Dam Mine Project

Scientific Name	Common Name	SARA[i]	COSEWIC[ii]	NSESA[iii]	SRank[iv]	Habitat Requirements
Erioderma pedicellatum (Atlantic pop.)	Boreal Felt Lichen - Atlantic pop.	E	E	Endangered	S1S2	Mature to over mature Balsam Fir trees in open softwood forests with little to no regenerating understory. Typically, though not necessarily found in or near wetlands or wetland margins.
Physconia detersa	Bottlebrush Frost Lichen				S2S3	On bark and wood; occasionally on rock
Erioderma mollissimum	Graceful Felt Lichen	E	E	Endangered	S1S2	Mature to over mature Balsam Fir trees in open softwood forests with little to no regenerating understory. Typically, though not necessarily found in or near wetlands or wetland margins.
Sticta fuliginosa	Peppered Moon Lichen				S3	Grows on mossy bark
Fuscopannaria leucosticte	Rimmed Shingles Lichen				S1S2	On bark or occasionally rocks often among mosses.

[i] Government of Canada. 2015. Species at Risk Public Registry. Accessed online, 11 December 2015. https://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

[ii] Government of Canada. 2015. Committee on the Status of Endangered Wildlife in Canada. Accessed online, 11 December 2015. http://www.cosewic.gc.ca/eng/sct5/index_e.cfm

[iii] Province of Nova Scotia. 2015. Categorized List of Species at Risk made under Section 12 of the Endangered Species Act S.N.S. 1998, c. 11, N.S. Reg. 21/2015 (March 26, 2013). Accessed online, 11 December 2015. https://www.novascotia.ca/just/regulations/regs/eslist.htm

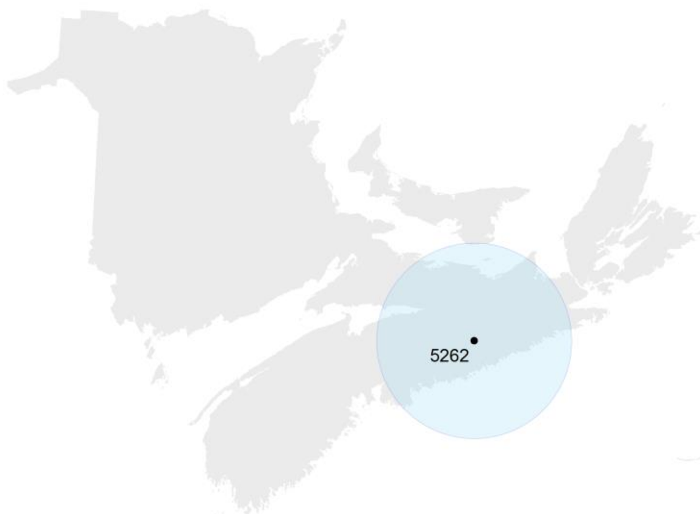
[iv] Atlantic Canada Conservation Data Centre. 2015. Status Ranks. Accessed online, 11 December 2015. http://accdc.com/en/ranks.html

Appendix J
Documented Priority Species (ACCDC and NS Communities, Culture, & Heritage)

DATA REPORT 5262: Marinette, NS

Prepared 8 September 2014
by J. Churchill, Data Manager

CONTENTS OF REPORT



Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) 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 ACCDC 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 ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC 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 ACCDC 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
MarinetteNS_5262ob.xls	All Rare and legally protected *Flora and Fauna* within 5 km of your study area
MarinetteNS_5262ob100km.xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area

1.2 RESTRICTIONS

The ACCDC 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 ACCDC 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 ACCDC 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) ACCDC 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) ACCDC 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 ACCDC data response.

1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

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

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney, Botanist, Executive Director (effective 10 June, 2014)
Tel: (506) 364-2658
sblaney@mta.ca

Animals (Fauna)
John Klymko, Zoologist
Tel: (506) 364-2660
jklymko@mta.ca

Plant Communities
Sarah Robinson , Community Ecologist
Tel: (506) 364-2664
srobinson@mta.ca

Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
jlchurchill@mta.ca

Billing
Cindy Spicer
Tel: (506) 364-2665
cspicer@mta.ca

Questions on the biology of Federal Species at Risk can be directed to ACCDC: (506) 364-2657, 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 Stewart Lusk, Natural Resources: (506) 453-7110.

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 Sherman Boates, NSDNR: (902) 679-6146. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NSDNR Regional Biologist:

Western: Duncan Bayne
(902) 648-3536
baynedz@gov.ns.ca

Western: Donald Sam
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samdx@gov.ns.ca

Central: Shavonne Meyer
(902) 893-6353
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Central: Kimberly George
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Eastern: Mark Pulsifer
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pulsifmd@gov.ns.ca

Eastern: Donald Anderson
(902) 295-3949
andersdg@gov.ns.ca

Eastern: Terry Power
(902) 563-3370
powertd@gov.ns.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Rosemary Curley, PEI Dept. of Agriculture and Forestry: (902) 368-4807.

2.0 RARE AND ENDANGERED SPECIES

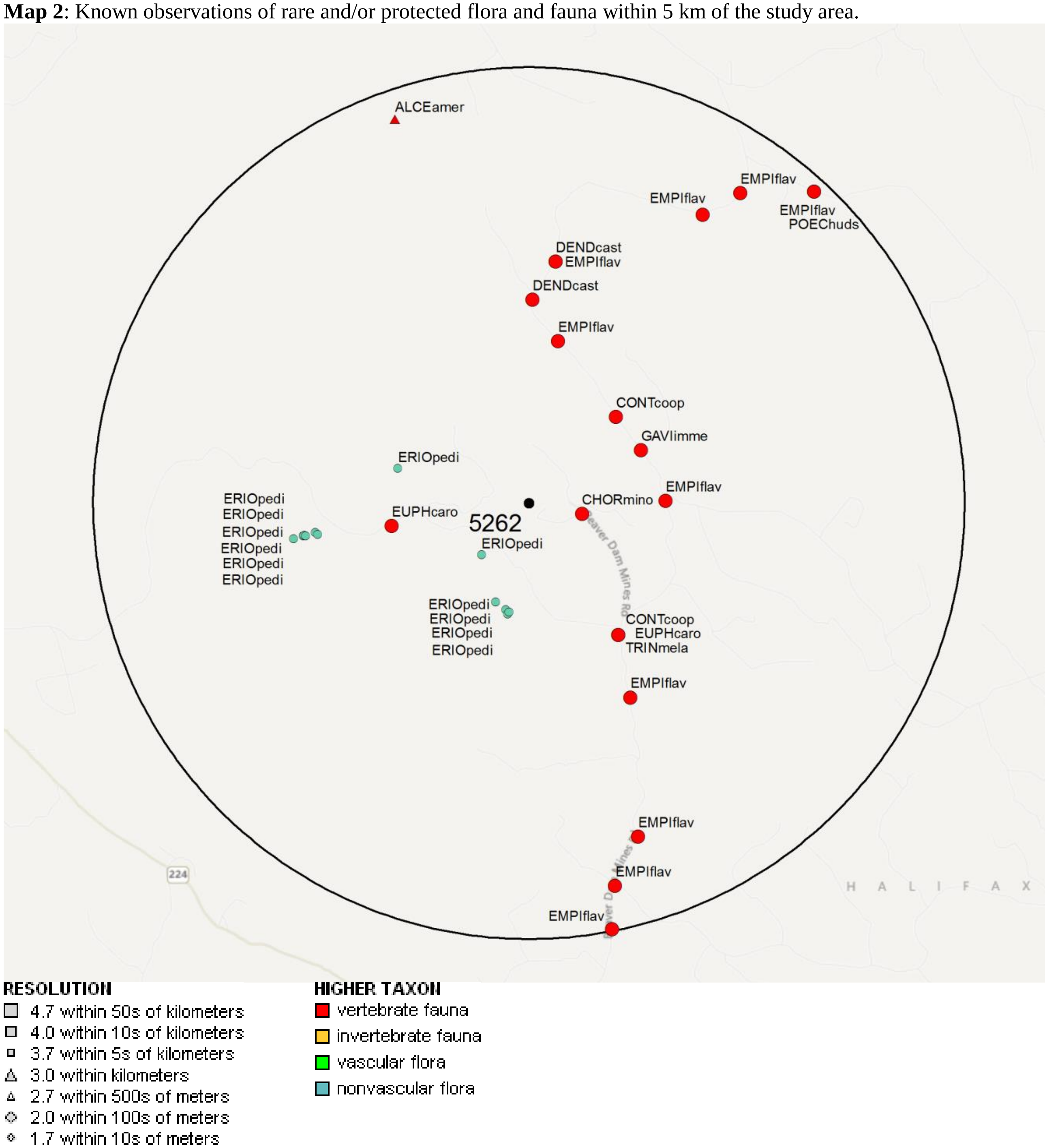
2.1 FLORA

A 5 km buffer around the study area contains no records of vascular, 14 records of 1 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

A 5 km buffer around the study area contains 28 records of 9 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 5 km of the study area.

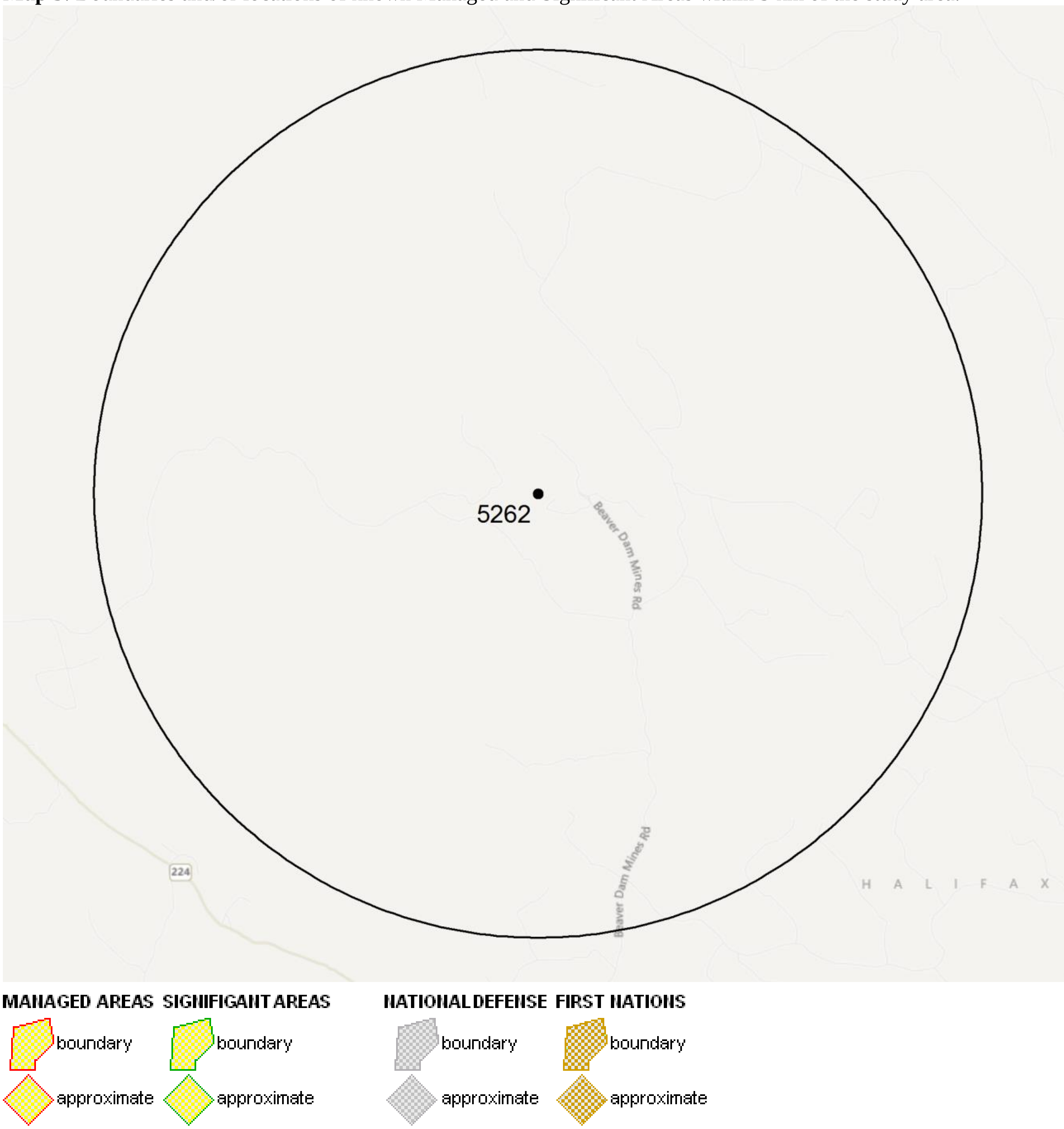


3.0 SPECIAL AREAS

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 no biologically significant sites in the vicinity of the study area (Map 3)

Map 3: Boundaries and/or locations of known Managed and Significant Areas within 5 km of the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa within the 5 km-buffered 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. [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1S2	1 At Risk	14	0.8 ± 0.01

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Gavia immer*	Common Loon	Not At Risk			S3B,S4N	2 May Be At Risk	1	1.4 ± 0.15
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2S3B	2 May Be At Risk	2	1.6 ± 0.15
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	3	0.6 ± 0.15
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B	1 At Risk	4	1.8 ± 0.15
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	2	4.7 ± 0.5
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S5M	3 Sensitive	3	1.8 ± 0.15
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	10	2.5 ± 0.15
A	*Poecile hudsonica*	Boreal Chickadee				S3	3 Sensitive	1	4.8 ± 0.15
A	*Dendroica castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	2	2.3 ± 0.15

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.

Nova Scotia

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within 5 km of Study Site?
Fraxinus nigra	Black Ash		Threatened	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Emydoidea blandingii	*Blanding's Turtle - Nova Scotia pop.*	Endangered	Vulnerable	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Vulnerable	No
Bat Hibernaculum			[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 NS Endangered Species Act.

4.4 SOURCE BIBLIOGRAPHY

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

# recs	CITATION
26	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
10	Neily, T.M. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.
2	Benjamin, L.K. 2009. Boreal Felt Lichen, Mountain Avens, Orchid and other recent records. Nova Scotia Dept Natural Resources, 105 recs.
2	Benjamin, L.K. 2012. NSDNR fieldwork & consultant reports 2008-2012. Nova Scotia Dept Natural Resources, 196 recs.
1	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
1	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 15757 records of 114 vertebrate and 924 records of 65 invertebrate fauna; 3145 records of 269 vascular, 467 records of 30 nonvascular flora (attached: *ob100km.xls).

Rare and/or endangered taxa within the 100 km-buffered 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.

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Myotis lucifugus*	Little Brown Myotis	Endangered		Endangered	S1	1 At Risk	35	31.6 ± 0.5
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered		Endangered	S1	1 At Risk	4	31.8 ± 0.15
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered		Endangered	S1	1 At Risk	5	57.0 ± 0.2
A	*Morone saxatilis pop. 2*	Striped Bass- Bay of Fundy pop.	Endangered			S1	2 May Be At Risk	2	56.2 ± 0.5
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	774	28.5 ± 0.5
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	56	34.0 ± 0.5
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered		S2	2 May Be At Risk	18	34.9 ± 0.5
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered		Endangered	S2S3M	1 At Risk	101	51.9 ± 0.5
A	*Colinus virginianus*	Northern Bobwhite	Endangered	Endangered				1	47.1 ± 0.15
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S1?	2 May Be At Risk	2	53.3 ± 0.5
A	*Caprimulgus vociferus*	Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	11	37.0 ± 7.07
A	*Hylocichla mustelina*	Wood Thrush	Threatened			S1B	5 Undetermined	35	22.6 ± 0.15
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	202	16.6 ± 1.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B	1 At Risk	137	5.7 ± 7.07
A	*Hirundo rustica*	Barn Swallow	Threatened		Endangered	S3B	1 At Risk	731	5.7 ± 7.07
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	633	5.7 ± 7.07
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	339	0.6 ± 0.15
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B	1 At Risk	723	1.4 ± 0.15
A	*Riparia riparia*	Bank Swallow	Threatened			S3B	2 May Be At Risk	282	16.0 ± 7.07
A	*Dolichonyx oryzivorus*	Bobolink	Threatened		Vulnerable	S3S4B	3 Sensitive	390	18.7 ± 0.15
A	*Anguilla rostrata*	American Eel	Threatened			S5	4 Secure	5	45.8 ± 0.5
A	*Morone saxatilis pop. 1*	Striped Bass- Southern Gulf of St Lawrence pop.	Special Concern			S1	2 May Be At Risk	1	89.2 ± 1.0
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B	3 Sensitive	2	66.2 ± 0.15
A	*Passerculus sandwichensis princeps*	Savannah Sparrow princeps ssp	Special Concern	Special Concern		S1B	3 Sensitive	3	32.0 ± 0.15
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	71.4 ± 0.1
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2	2 May Be At Risk	8	54.7 ± 7.07
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	21	30.9 ± 2.45
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2S3B	2 May Be At Risk	226	1.6 ± 0.15
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	66	15.4 ± 0.1
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Vulnerable	S3S4B	3 Sensitive	490	8.5 ± 7.07
A	*Tryngites subruficollis*	Buff-breasted Sandpiper	Special Concern			SNA	8 Accidental	2	63.9 ± 0.5
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S1	3 Sensitive	2	90.7 ± 0.2
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B,SNAN	5 Undetermined	4	54.5 ± 0.15
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	7	68.2 ± 7.07
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S1B	5 Undetermined	13	39.7 ± 7.07
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		1	22.9 ± 100.0
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	25	51.4 ± 5.0
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	244	25.6 ± 7.07
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	41	27.1 ± 7.07
A	*Gavia immer*	Common Loon	Not At Risk			S3B,S4N	2 May Be At Risk	599	1.4 ± 0.15

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	92	5.7 ± 7.07
A	*Puma concolor pop. 1*	Cougar - Eastern pop.	Data Deficient			SH	5 Undetermined	69	6.0 ± 1.0
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	26	4.7 ± 0.5
A	*Lasiurus cinereus*	Hoary Bat				S1	2 May Be At Risk	2	58.7 ± 0.5
A	*Toxostoma rufum*	Brown Thrasher				S1?B	5 Undetermined	12	54.7 ± 7.07
A	*Vireo gilvus*	Warbling Vireo				S1?B	5 Undetermined	17	30.4 ± 7.07
A	*Tringa solitaria*	Solitary Sandpiper				S1?B,S4S5M	4 Secure	11	58.8 ± 0.5
A	*Larus delawarensis*	Ring-billed Gull				S1?B,S5N	4 Secure	5	28.7 ± 7.07
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	2 May Be At Risk	1	97.9 ± 7.07
A	*Gallinula chloropus*	Common Moorhen				S1B	5 Undetermined	6	69.9 ± 7.07
A	*Progne subis*	Purple Martin				S1B	2 May Be At Risk	3	53.7 ± 7.07
A	*Fratercula arctica*	Atlantic Puffin				S1B,S4S5N	3 Sensitive	2	36.8 ± 7.07
A	*Calidris minutilla*	Least Sandpiper				S1B,S5M	4 Secure	296	51.9 ± 0.5
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1S2	5 Undetermined	4	53.7 ± 7.07
A	*Passerina cyanea*	Indigo Bunting				S1S2B	5 Undetermined	9	53.7 ± 7.07
A	*Eremophila alpestris*	Horned Lark				S1S2B,S4N	4 Secure	4	28.7 ± 7.07
A	*Charadrius semipalmatus*	Semipalmated Plover				S1S2B,S5M	4 Secure	464	51.9 ± 0.5
A	*Asio otus*	Long-eared Owl				S2	2 May Be At Risk	32	29.4 ± 0.15
A	*Salmo salar*	Atlantic Salmon				S2	2 May Be At Risk	73	6.2 ± 0.5
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	27	6.4 ± 7.07
A	*Anas acuta*	Northern Pintail				S2B	2 May Be At Risk	11	53.7 ± 7.07
A	*Anas clypeata*	Northern Shoveler				S2B	2 May Be At Risk	6	49.1 ± 7.07
A	*Anas strepera*	Gadwall				S2B	2 May Be At Risk	21	37.9 ± 0.15
A	*Rallus limicola*	Virginia Rail				S2B	5 Undetermined	26	56.8 ± 7.07
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	20	37.0 ± 7.07
A	*Myiarchus crinitus*	Great Crested Flycatcher				S2B	2 May Be At Risk	14	55.0 ± 7.07
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	13	30.3 ± 7.07
A	*Rissa tridactyla*	Black-legged Kittiwake				S2B,S4S5N	3 Sensitive	1	71.4 ± 0.15
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	108	5.7 ± 7.07
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	8	47.1 ± 0.15
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	516	25.6 ± 7.07
A	*Pooecetes gramineus*	Vesper Sparrow				S2S3B	2 May Be At Risk	23	46.6 ± 7.07
A	*Molothrus ater*	Brown-headed Cowbird				S2S3B	4 Secure	80	17.2 ± 7.07
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	43	24.0 ± 7.07
A	*Phalaropus lobatus*	Red-necked Phalarope				S2S3M	3 Sensitive	3	71.5 ± 0.5
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	1	78.0 ± 0.5
A	*Phalacrocorax carbo*	Great Cormorant				S3	3 Sensitive	78	28.7 ± 7.07
A	*Poecile hudsonica*	Boreal Chickadee				S3	3 Sensitive	585	4.8 ± 0.15
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3?B	2 May Be At Risk	78	17.2 ± 7.07
A	*Dendroica tigrina*	Cape May Warbler				S3?B	3 Sensitive	112	6.4 ± 7.07
A	*Pinicola enucleator*	Pine Grosbeak				S3?B,S5N	2 May Be At Risk	114	5.7 ± 7.07
A	*Podilymbus podiceps*	Pied-billed Grebe				S3B	3 Sensitive	90	30.3 ± 7.07
A	*Anas discors*	Blue-winged Teal				S3B	2 May Be At Risk	93	14.5 ± 7.07
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	57	27.2 ± 0.5
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S3B	2 May Be At Risk	208	22.1 ± 7.07
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	314	5.7 ± 7.07
A	*Mimus polyglottos*	Northern Mockingbird				S3B	4 Secure	23	54.7 ± 7.07
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S5M	3 Sensitive	466	1.8 ± 0.15
A	*Mergus serrator*	Red-breasted Merganser				S3B,S5N	4 Secure	70	28.7 ± 7.07
A	*Larus argentatus*	Herring Gull				S3B,S5N	4 Secure	4	94.8 ± 7.07
A	*Pluvialis dominica*	American Golden-Plover				S3M	3 Sensitive	52	58.1 ± 0.5
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S3M	3 Sensitive	52	51.9 ± 0.5
A	*Limosa haemastica*	Hudsonian Godwit				S3M	3 Sensitive	28	63.9 ± 0.5
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	425	51.9 ± 0.5
A	*Calidris maritima*	Purple Sandpiper				S3N	3 Sensitive	24	35.4 ± 12.9
A	*Cepphus grylle*	Black Guillemot				S3S4	4 Secure	57	28.7 ± 7.07

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A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	143	5.7 ± 7.07
A	*Perisoreus canadensis*	Gray Jay				S3S4	3 Sensitive	405	5.7 ± 7.07
A	*Cardinalis cardinalis*	Northern Cardinal				S3S4	4 Secure	38	44.7 ± 7.07
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	223	15.0 ± 7.07
A	*Charadrius vociferus*	Killdeer				S3S4B	3 Sensitive	395	15.8 ± 7.07
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	525	5.7 ± 7.07
A	*Gallinago delicata*	Wilson's Snipe				S3S4B	3 Sensitive	401	5.7 ± 7.07
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	550	1.6 ± 0.15
A	*Sayornis phoebe*	Eastern Phoebe				S3S4B	3 Sensitive	159	29.7 ± 7.07
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	3 Sensitive	171	16.0 ± 7.07
A	*Vermivora peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	281	5.7 ± 7.07
A	*Dendroica castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	391	2.3 ± 0.15
A	*Dendroica striata*	Blackpoll Warbler				S3S4B	3 Sensitive	97	5.7 ± 7.07
A	*Wilsonia pusilla*	Wilson's Warbler				S3S4B	3 Sensitive	77	14.5 ± 7.07
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3S4B	3 Sensitive	290	20.4 ± 7.07
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	78	25.6 ± 7.07
A	*Carduelis pinus*	Pine Siskin				S3S4B,S5N	3 Sensitive	311	5.7 ± 7.07
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	1	95.4 ± 12.1
I	*Gomphus ventricosus*	Skillet Clubtail	Endangered	Endangered		S1	2 May Be At Risk	2	65.5 ± 0.5
I	*Barnea truncata*	Atlantic Mud-piddock	Threatened					1	90.9 ± 1.0
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	17	50.5 ± 0.1
I	*Danaus plexippus*	Monarch	Special Concern	Special Concern		S2B	3 Sensitive	57	27.9 ± 0.3
I	*Lycaena hyllus*	Bronze Copper				S1	4 Secure	5	69.9 ± 1.0
I	*Satyrium acadica*	Acadian Hairstreak				S1	5 Undetermined	6	68.5 ± 1.0
I	*Plebejus saepiolus*	Greenish Blue				S1	1 At Risk	1	85.4 ± 1.0
I	*Polygonia satyrus*	Satyr Comma				S1	3 Sensitive	2	86.4 ± 1.0
I	*Polygonia gracilis*	Hoary Comma				S1	3 Sensitive	2	54.0 ± 1.0
I	*Oeneis jutta*	Jutta Arctic				S1	2 May Be At Risk	6	60.9 ± 0.01
I	*Ophiogomphus mainensis*	Maine Snaketail				S1	2 May Be At Risk	2	26.2 ± 0.05
I	*Neurocordulia michaeli*	Broadtailed Shadowdragon				S1		26	26.8 ± 0.05
I	*Somatochlora brevicincta*	Quebec Emerald				S1	2 May Be At Risk	1	60.0 ± 0.1
I	*Somatochlora franklini*	Delicate Emerald				S1	3 Sensitive	1	91.8 ± 1.0
I	*Williamsonia fletcheri*	Ebony Boghaunter				S1	2 May Be At Risk	4	96.9 ± 0.5
I	*Coenagrion resolutum*	Taiga Bluet				S1	2 May Be At Risk	2	74.2 ± 0.1
I	*Enallagma signatum*	Orange Bluet				S1	2 May Be At Risk	3	73.7 ± 0.1
I	*Callophrys lanoraieensis*	Bog Elfin				S1S2	2 May Be At Risk	6	27.1 ± 0.01
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	9	54.0 ± 1.0
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S1S2	2 May Be At Risk	18	45.6 ± 0.5
I	*Somatochlora kennedyi*	Kennedy's Emerald				S1S2	2 May Be At Risk	3	78.1 ± 1.0
I	*Stylurus scudderi*	Zebra Clubtail				S1S2	2 May Be At Risk	4	45.6 ± 0.5
I	*Thorybes pylades*	Northern Cloudywing				S2	3 Sensitive	14	40.6 ± 0.01
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S2	4 Secure	22	23.3 ± 0.5
I	*Amblyscirtes vialis*	Common Roadside-Skipper				S2	4 Secure	12	14.2 ± 0.5
I	*Pieris oleracea*	Mustard White				S2	3 Sensitive	53	18.9 ± 0.01
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	10	74.3 ± 0.01
I	*Satyrium calanus*	Banded Hairstreak				S2	5 Undetermined	9	71.0 ± 1.0
I	*Satyrium calanus falacer*	Banded Hairstreak				S2	1 At Risk	2	85.7 ± 0.5
I	*Callophrys henrici*	Henry's Elfin				S2	4 Secure	15	29.9 ± 0.01
I	*Callophrys niphon*	Eastern Pine Elfin				S2	4 Secure	15	75.1 ± 1.0
I	*Boloria chariclea*	Arctic Fritillary				S2	3 Sensitive	3	71.0 ± 1.0
I	*Polygonia comma*	Eastern Comma				S2	1 At Risk	8	83.2 ± 1.0
I	*Aglais milberti*	Milbert's Tortoiseshell				S2	4 Secure	7	68.1 ± 1.0
I	*Gomphus descriptus*	Harpoon Clubtail				S2	3 Sensitive	1	99.6 ± 1.0
I	*Epitheca princeps*	Prince Baskettail				S2	3 Sensitive	9	68.0 ± 0.05
I	*Somatochlora forcipata*	Forcipate Emerald				S2	2 May Be At Risk	3	78.1 ± 1.0
I	*Lampsilis radiata*	Eastern Lampmussel				S2	3 Sensitive	40	36.1 ± 0.1
I	*Pantala hymenaea*	Spot-Winged Glider				S2B	3 Sensitive	7	51.5 ± 1.0

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I	*Erynnis juvenalis*	Juvenal's Duskywing				S2S3	4 Secure	32	71.0 ± 1.0
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	24	17.4 ± 0.1
I	*Hesperia comma*	Common Branded Skipper				S3	4 Secure	34	25.9 ± 1.0
I	*Satyrium liparops*	Striped Hairstreak				S3	5 Undetermined	5	28.5 ± 0.2
I	*Satyrium liparops strigosum*	Striped Hairstreak				S3	3 Sensitive	2	85.7 ± 0.5
I	*Euphydryas phaeton*	Baltimore Checkerspot				S3	4 Secure	20	23.2 ± 0.5
I	*Polygonia faunus*	Green Comma				S3	4 Secure	15	27.4 ± 0.01
I	*Lethe anthedon*	Northern Pearly-Eye				S3	4 Secure	51	15.2 ± 7.07
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3	4 Secure	32	36.0 ± 0.05
I	*Ophiogomphus carolus*	Riffle Snaketail				S3	4 Secure	25	39.8 ± 1.0
I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	12	45.9 ± 1.0
I	*Aeshna constricta*	Lance-Tipped Darner				S3	4 Secure	17	44.1 ± 1.0
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	7	40.5 ± 1.0
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	3	80.0 ± 1.0
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	12	59.7 ± 1.0
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	13	62.0 ± 0.5
I	*Sympetrum danae*	Black Meadowhawk				S3	3 Sensitive	5	62.3 ± 1.0
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	2	43.3 ± 0.01
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	105	28.5 ± 0.2
I	*Vanessa virginiensis*	American Lady				S3B	8 Accidental	1	99.0 ± 0.01
I	*Feniseca tarquinius*	Harvester				S3S4	4 Secure	45	53.1 ± 1.0
I	*Callophrys polios*	Hoary Elfin				S3S4	4 Secure	17	71.4 ± 1.0
I	*Speyeria cybele*	Great Spangled Fritillary				S3S4	4 Secure	1	66.8 ± 5.0
I	*Speyeria cybele cybele*	Great Spangled Fritillary				S3S4	4 Secure	1	67.8 ± 0.01
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3S4	4 Secure	13	53.4 ± 100.0
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	22	23.4 ± 10.0
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered		Endangered	S1S2	2 May Be At Risk	5	16.4 ± 0.1
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1S2	1 At Risk	360	0.8 ± 0.01
N	*Fissidens exilis*	Pygmy Pocket Moss	Special Concern			S1?	1 At Risk	1	97.3 ± 1.5
N	*Sclerophora peronella (Nova Scotia pop.)*	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		3	20.1 ± 0.01
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S2	4 Secure	33	13.4 ± 0.01
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	6	34.5 ± 0.01
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1	2 May Be At Risk	1	90.2 ± 0.1
N	*Bryohaplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1		1	66.8 ± 5.0
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S1S2	2 May Be At Risk	3	5.9 ± 0.01
N	*Leptogium subtile*	Appressed Jellyskin Lichen				S1S3	3 Sensitive	1	22.2 ± 0.01
N	*Eurhynchium hians*	Light Beaked Moss				S2?	3 Sensitive	2	38.1 ± 25.0
N	*Paludella squarrosa*	Tufted Fen Moss				S2?	3 Sensitive	1	98.1 ± 0.1
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	1	75.1 ± 3.0
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2?	3 Sensitive	1	37.7 ± 2.0
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S2?	3 Sensitive	1	85.2 ± 0.01
N	*Zygodon conoideus*	a Moss				S2?	3 Sensitive	1	21.3 ± 5.0
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	1	80.3 ± 5.0
N	*Sphagnum wulfianum*	Wulf's Peat Moss				S2S3	3 Sensitive	7	52.9 ± 0.01
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2S3	3 Sensitive	1	37.7 ± 2.0
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S2S3	3 Sensitive	1	84.2 ± 0.5
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S2S3	3 Sensitive	3	23.6 ± 0.1
N	*Leptogium teretiusculum*	Beaded Jellyskin Lichen				S2S3	3 Sensitive	2	39.7 ± 0.01
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S2S3	3 Sensitive	13	7.8 ± 0.01
N	*Physconia detersa*	Bottlebrush Frost Lichen				S2S3	3 Sensitive	1	17.8 ± 0.01
N	*Peltigera collina*	Tree Pelt Lichen				S2S3	3 Sensitive	1	28.3 ± 0.1
N	*Usnea flammea*	Coastal Bushy Beard Lichen				S2S3	3 Sensitive	1	93.4 ± 1.0
N	*Anzia colpodes*	Black-foam Lichen				S3?	3 Sensitive	2	17.8 ± 0.01
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3?	3 Sensitive	10	13.4 ± 0.01

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N	*Nephroma bellum*	Naked Kidney Lichen				S3?	3 Sensitive	1	31.1 ± 0.01
N	*Collema furfuraceum*	Blistered Tarpaper Lichen				S3?	3 Sensitive	2	13.4 ± 0.01
P	*Juglans cinerea*	Butternut	Endangered	Endangered		SNA	7 Exotic	1	95.1 ± 0.01
P	*Bartonia paniculata ssp. paniculata*	Branched Bartonia	Threatened	Threatened		SNA		1	16.0 ± 10.0
P	*Liatris spicata*	Dense Blazing Star	Threatened	Threatened				1	82.2 ± 0.03
P	*Clethra alnifolia*	Coast Pepper-Bush	Special Concern	Special Concern	Vulnerable	S1	3 Sensitive	2	81.1 ± 0.1
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	7	89.6 ± 0.05
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	3	50.4 ± 7.07
P	*Helianthemum canadense*	Long-branched Frostweed			Endangered	S1	1 At Risk	2	96.4 ± 1.6
P	*Cypripedium arietinum*	Ram's-Head Lady's-Slipper			Endangered	S1	1 At Risk	8	97.3 ± 0.01
P	*Angelica lucida*	Seaside Angelica				S1	2 May Be At Risk	1	98.4 ± 0.5
P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	7	52.6 ± 0.01
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	41	19.3 ± 1.0
P	*Antennaria parlinii*	a Pussytoes				S1	2 May Be At Risk	4	69.9 ± 0.01
P	*Bidens hyperborea*	Estuary Beggarticks				S1	2 May Be At Risk	1	90.7 ± 1.0
P	*Ageratina altissima*	White Snakeroot				S1	2 May Be At Risk	2	90.5 ± 7.07
P	*Cardamine maxima*	Large Toothwort				S1	2 May Be At Risk	1	64.6 ± 0.01
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	2 May Be At Risk	8	45.4 ± 0.01
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	2 May Be At Risk	1	75.0 ± 7.07
P	*Suaeda maritima ssp. richii*	White Sea-blite				S1	5 Undetermined	2	95.3 ± 1.0
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	2 May Be At Risk	6	66.0 ± 7.07
P	*Hypericum majus*	Large St John's-wort				S1	2 May Be At Risk	2	79.9 ± 0.01
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S1	2 May Be At Risk	5	63.2 ± 1.2
P	*Desmodium canadense*	Canada Tick-trefoil				S1	2 May Be At Risk	20	48.7 ± 0.01
P	*Desmodium glutinosum*	Large Tick-Trefoil				S1	2 May Be At Risk	3	96.3 ± 0.01
P	*Ribes americanum*	Wild Black Currant				S1	5 Undetermined	2	55.3 ± 5.0
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1	2 May Be At Risk	1	45.7 ± 0.9
P	*Fraxinus pennsylvanica*	Red Ash				S1	2 May Be At Risk	3	89.2 ± 5.0
P	*Polygala polygama*	Racemed Milkwort				S1	5 Undetermined	1	82.8 ± 1.0
P	*Polygonum careyi*	Carey's Smartweed				S1	5 Undetermined	1	40.8 ± 3.0
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	1	84.4 ± 1.0
P	*Ranunculus pensylvanicus*	Pennsylvania Buttercup				S1	2 May Be At Risk	1	94.6 ± 0.01
P	*Galium aparine*	Common Bedstraw				S1	7 Exotic	4	41.6 ± 0.3
P	*Dirca palustris*	Eastern Leatherwood				S1	2 May Be At Risk	8	56.8 ± 7.07
P	*Pilea pumila*	Dwarf Clearweed				S1	2 May Be At Risk	4	45.6 ± 0.01
P	*Viola canadensis*	Canada Violet				S1	0.1 Extirpated	1	50.4 ± 7.07
P	*Carex alopecoidea*	Foxtail Sedge				S1	2 May Be At Risk	2	97.1 ± 0.5
P	*Carex garberi*	Garber's Sedge				S1	2 May Be At Risk	4	47.1 ± 0.01
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	2	56.6 ± 1.0
P	*Carex pellita*	Woolly Sedge				S1	2 May Be At Risk	10	17.2 ± 10.0
P	*Carex plantaginea*	Plantain-Leaved Sedge				S1	2 May Be At Risk	3	28.3 ± 0.01
P	*Carex tincta*	Tinged Sedge				S1	2 May Be At Risk	2	97.1 ± 1.0
P	*Carex tuckermanii*	Tuckerman's Sedge				S1	2 May Be At Risk	12	59.8 ± 0.05
P	*Carex viridula ssp. brachyrrhyncha*	Greenish Sedge				S1	2 May Be At Risk	3	32.0 ± 0.3
P	*Carex wiegandii*	Wiegand's Sedge				S1	2 May Be At Risk	2	40.8 ± 2.0
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	5	86.9 ± 0.01
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	10	68.6 ± 0.7
P	*Scirpus pedicellatus*	Stalked Bulrush				S1	5 Undetermined	5	31.0 ± 0.01
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	2	58.8 ± 7.07
P	*Juncus vaseyi*	Vasey Rush				S1	2 May Be At Risk	1	47.7 ± 0.02
P	*Allium tricoccum*	Wild Leek				S1	2 May Be At Risk	8	51.9 ± 0.5
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	28	26.6 ± 0.01
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1	2 May Be At Risk	19	28.6 ± 0.01
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	17	28.6 ± 0.01
P	*Elymus hystrix var. bigeloviana*	Spreading Wild Rye				S1	2 May Be At Risk	8	41.2 ± 1.6
P	*Festuca subverticillata*	Nodding Fescue				S1	2 May Be At Risk	2	71.4 ± 1.0
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	2 May Be At Risk	1	57.7 ± 5.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2 May Be At Risk	6	57.1 ± 1.0
P	*Botrychium lunaria*	Common Moonwort				S1	2 May Be At Risk	3	68.3 ± 2.0
P	*Hieracium kalmii var. fasciculatum*	Kalm's Hawkweed				S1?	5 Undetermined	2	67.5 ± 1.0
P	*Solidago hispida*	Hairy Goldenrod				S1?	2 May Be At Risk	2	19.8 ± 7.07
P	*Atriplex acadiensis*	Maritime Saltbush				S1?	5 Undetermined	2	54.1 ± 0.5
P	*Chenopodium rubrum*	Red Pigweed				S1?	2 May Be At Risk	5	34.4 ± 2.0
P	*Suaeda rolandii*	Roland's Sea-Blite				S1?	2 May Be At Risk	1	99.6 ± 2.0
P	*Crataegus robinsonii*	Robinson's Hawthorn				S1?	5 Undetermined	3	55.3 ± 5.0
P	*Crataegus submollis*	Quebec Hawthorn				S1?	5 Undetermined	6	66.8 ± 7.07
P	*Dichanthelium acuminatum var. lindheimeri*	Woolly Panic Grass				S1?	5 Undetermined	1	57.0 ± 0.05
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1S2	1 At Risk	6	53.7 ± 0.2
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	5	50.6 ± 5.0
P	*Hepatica nobilis var. obtusa*	Round-lobed Hepatica				S1S2	2 May Be At Risk	24	30.7 ± 1.5
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	20	78.2 ± 0.5
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S1S2	3 Sensitive	3	36.5 ± 0.1
P	*Carex bebbii*	Bebb's Sedge				S1S2	2 May Be At Risk	9	49.5 ± 0.01
P	*Carex pensylvanica*	Pennsylvania Sedge				S1S2	5 Undetermined	1	66.9 ± 0.05
P	*Carex tenera*	Tender Sedge				S1S2	3 Sensitive	6	53.9 ± 1.5
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	4	65.9 ± 1.0
P	*Najas gracillima*	Thread-Like Naiad				S1S2	2 May Be At Risk	2	95.5 ± 0.45
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S1S2	4 Secure	7	52.4 ± 0.1
P	*Sparganium hyperboreum*	Northern Burreed				S1S2	3 Sensitive	2	87.7 ± 0.1
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	1	97.1 ± 0.5
P	*Huperzia selago*	Northern Firmoss				S1S3	5 Undetermined	5	61.0 ± 5.0
P	*Huperzia appalachiana*	Appalachian Fir-Clubmoss				S1S3	5 Undetermined	1	83.8 ± 1.0
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	2	53.6 ± 5.0
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	2 May Be At Risk	12	40.8 ± 0.01
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	3	17.6 ± 5.0
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2	3 Sensitive	3	53.0 ± 0.5
P	*Lactuca hirsuta var. sanguinea*	Hairy Lettuce				S2	3 Sensitive	1	58.5 ± 7.07
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S2	5 Undetermined	8	43.6 ± 7.07
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2	3 Sensitive	14	28.0 ± 7.07
P	*Symphyotrichum undulatum*	Wavy-leaved Aster				S2	3 Sensitive	2	84.4 ± 7.07
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	2	72.2 ± 7.07
P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	44	25.6 ± 0.01
P	*Betula michauxii*	Michaux's Dwarf Birch				S2	3 Sensitive	22	13.6 ± 0.5
P	*Arabis drummondii*	Drummond's Rockcress				S2	3 Sensitive	6	48.5 ± 0.03
P	*Minuartia groenlandica*	Greenland Stitchwort				S2	3 Sensitive	21	44.6 ± 7.07
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	5	30.6 ± 0.1
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	11	80.6 ± 7.07
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2	3 Sensitive	49	40.8 ± 0.01
P	*Shepherdia canadensis*	Soapberry				S2	3 Sensitive	1	97.8 ± 7.07
P	*Vaccinium boreale*	Northern Blueberry				S2	2 May Be At Risk	3	38.4 ± 0.01
P	*Vaccinium caespitosum*	Dwarf Bilberry				S2	3 Sensitive	55	26.1 ± 0.01
P	*Vaccinium uliginosum*	Alpine Bilberry				S2	3 Sensitive	3	88.5 ± 1.0
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	9	27.2 ± 0.1
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	3	29.0 ± 0.01
P	*Oenothera fruticosa ssp. glauca*	Narrow-leaved Evening Primrose				S2	5 Undetermined	4	51.9 ± 7.07
P	*Polygonum arifolium*	Halberd-leaved Tearthumb				S2	3 Sensitive	3	97.5 ± 0.5
P	*Plantago rugelii*	Rugel's Plantain				S2	5 Undetermined	7	30.9 ± 0.03
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	16	27.2 ± 1.0
P	*Samolus valerandi ssp. parviflorus*	Seaside Brookweed				S2	3 Sensitive	5	81.3 ± 5.0
P	*Pyrola minor*	Lesser Pyrola				S2	3 Sensitive	1	66.1 ± 0.01
P	*Anemone canadensis*	Canada Anemone				S2	2 May Be At Risk	1	97.8 ± 7.07
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	16	27.3 ± 0.1
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	22	50.6 ± 0.01

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	*Anemone virginiana var. virginiana*	Virginia Anemone				S2	3 Sensitive	2	52.7 ± 7.07
P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	1	68.4 ± 0.1
P	*Galium boreale*	Northern Bedstraw				S2	2 May Be At Risk	2	94.3 ± 5.0
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	10	29.3 ± 0.01
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	35	18.6 ± 1.5
P	*Salix sericea*	Silky Willow				S2	2 May Be At Risk	1	68.4 ± 1.0
P	*Comandra umbellata*	Bastard's Toadflax				S2	2 May Be At Risk	10	94.6 ± 5.0
P	*Parnassia palustris var. parviflora*	Marsh Grass-of-Parnassus				S2	2 May Be At Risk	1	88.7 ± 1.5
P	*Tiarella cordifolia*	Heart-leaved Foamflower				S2	3 Sensitive	217	28.9 ± 5.0
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	8	19.2 ± 1.0
P	*Carex atlantica ssp. capillacea*	Atlantic Sedge				S2	5 Undetermined	10	44.5 ± 0.01
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	1	95.7 ± 0.01
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	2	65.9 ± 0.1
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	3	66.3 ± 0.05
P	*Eriophorum gracile*	Slender Cottongrass				S2	3 Sensitive	4	54.3 ± 10.0
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	4	44.6 ± 7.07
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	1	58.0 ± 7.07
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	4	74.9 ± 7.07
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	13	19.3 ± 1.0
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2	2 May Be At Risk	4	51.2 ± 1.0
P	*Listera australis*	Southern Twayblade				S2	2 May Be At Risk	84	22.8 ± 0.01
P	*Platanthera blephariglottis*	White Fringed Orchid				S2	3 Sensitive	1	98.2 ± 5.0
P	*Platanthera flava var. flava*	Southern Rein Orchid				S2	3 Sensitive	1	51.9 ± 7.07
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	11	62.3 ± 1.0
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	22	48.5 ± 0.02
P	*Piptatherum canadense*	Canada Rice Grass				S2	3 Sensitive	8	40.8 ± 3.0
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	2	52.8 ± 5.0
P	*Asplenium trichomanes-ramosum*	Green Spleenwort				S2	3 Sensitive	1	94.1 ± 7.07
P	*Dryopteris fragrans var. remotiuscula*	Fragrant Wood Fern				S2	3 Sensitive	4	57.7 ± 7.07
P	*Woodsia glabella*	Smooth Cliff Fern				S2	3 Sensitive	1	84.4 ± 1.0
P	*Equisetum pratense*	Meadow Horsetail				S2	3 Sensitive	10	46.1 ± 0.01
P	*Hieracium kalmii*	Kalm's Hawkweed				S2?	5 Undetermined	7	65.1 ± 1.0
P	*Hieracium kalmii var. kalmii*	Kalm's Hawkweed				S2?	5 Undetermined	2	65.3 ± 5.0
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	3	58.0 ± 7.07
P	*Ceratophyllum echinatum*	Prickly Hornwort				S2?	2 May Be At Risk	2	30.0 ± 0.01
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	4	63.6 ± 1.0
P	*Carex houghtoniana*	Houghton's Sedge				S2?	3 Sensitive	1	47.4 ± 1.2
P	*Carex peckii*	White-Tinged Sedge				S2?	2 May Be At Risk	2	57.7 ± 0.1
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	4	63.2 ± 0.5
P	*Juncus canadensis*	Canada Rush				S2?	3 Sensitive	1	98.2 ± 5.0
P	*Juncus dudleyi*	Dudley's Rush				S2?	3 Sensitive	37	15.8 ± 1.0
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2?	3 Sensitive	4	48.4 ± 0.03
P	*Fraxinus nigra*	Black Ash			Threatened	S2S3	3 Sensitive	51	26.9 ± 0.01
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S2S3	5 Undetermined	5	32.9 ± 1.0
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2S3	3 Sensitive	9	33.2 ± 3.5
P	*Honckenya peploides ssp. robusta*	Seabeach Sandwort				S2S3	3 Sensitive	1	99.6 ± 5.0
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	26	31.7 ± 0.2
P	*Suaeda calceoliformis*	Horned Sea-blite				S2S3	4 Secure	4	66.7 ± 2.5
P	*Hypericum dissimulatum*	Disguised St John's-wort				S2S3	3 Sensitive	3	78.2 ± 0.5
P	*Empetrum eamesii ssp. atropurpureum*	Pink Crowberry				S2S3	3 Sensitive	4	80.5 ± 7.07
P	*Empetrum eamesii ssp. eamesii*	Pink Crowberry				S2S3	3 Sensitive	5	80.5 ± 7.07
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	1	57.8 ± 1.0
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	4	22.8 ± 5.0
P	*Polygala sanguinea*	Blood Milkwort				S2S3	3 Sensitive	13	30.4 ± 5.0
P	*Polygonum buxiforme*	Small's Knotweed				S2S3	5 Undetermined	3	58.0 ± 7.07
P	*Salix pellita*	Satiny Willow				S2S3	5 Undetermined	4	36.8 ± 0.3
P	*Veronica serpyllifolia ssp. humifusa*	Thyme-Leaved Speedwell				S2S3	3 Sensitive	1	37.9 ± 0.01

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	7	39.4 ± 7.07
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	37	26.7 ± 0.01
P	*Carex swanii*	Swan's Sedge				S2S3	3 Sensitive	2	75.7 ± 0.5
P	*Eleocharis olivacea*	Yellow Spikerush				S2S3	3 Sensitive	6	32.4 ± 0.01
P	*Juncus filiformis*	Thread Rush				S2S3	3 Sensitive	1	98.2 ± 5.0
P	*Lilium canadense*	Canada Lily				S2S3	3 Sensitive	92	25.7 ± 0.01
P	*Coeloglossum viride var. virescens*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	1	89.7 ± 0.05
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	18	50.4 ± 0.25
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S2S3	3 Sensitive	6	66.8 ± 0.5
P	*Alopecurus aequalis*	Short-awned Foxtail				S2S3	3 Sensitive	11	51.1 ± 1.0
P	*Panicum tuckermanii*	Tuckerman's Panic Grass				S2S3	3 Sensitive	3	95.0 ± 0.01
P	*Poa glauca*	Glaucous Blue Grass				S2S3	3 Sensitive	1	96.3 ± 1.0
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S2S3	3 Sensitive	8	59.8 ± 0.5
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2S3	2 May Be At Risk	5	56.9 ± 1.5
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S2S3	3 Sensitive	13	16.8 ± 7.07
P	*Botrychium lanceolatum var. angustisegmentum*	Lance-Leaf Grape-Fern				S2S3	3 Sensitive	5	40.0 ± 5.0
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	2	52.2 ± 0.1
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	4	65.1 ± 7.07
P	*Asclepias incarnata*	Swamp Milkweed				S3	4 Secure	40	17.2 ± 7.07
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	11	66.0 ± 1.0
P	*Hieracium paniculatum*	Panicled Hawkweed				S3	4 Secure	6	56.9 ± 0.01
P	*Megalodonta beckii*	Water Beggarticks				S3	3 Sensitive	11	37.0 ± 10.0
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	25	48.0 ± 0.1
P	*Xanthium strumarium var. canadense*	Rough Cocklebur				S3	4 Secure	2	99.2 ± 3.5
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	34	30.1 ± 0.01
P	*Stellaria longifolia*	Long-leaved Starwort				S3	3 Sensitive	12	27.9 ± 0.01
P	*Viburnum edule*	Squashberry				S3	3 Sensitive	2	59.3 ± 0.01
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	76	80.6 ± 7.07
P	*Vaccinium corymbosum*	Highbush Blueberry				S3	4 Secure	2	80.2 ± 0.01
P	*Chamaesyce polygonifolia*	Seaside Spurge				S3	4 Secure	5	73.5 ± 2.5
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	23	68.4 ± 7.07
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	1	97.7 ± 2.0
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	11	19.8 ± 1.0
P	*Proserpinaca palustris var. crebra*	Marsh Mermaidweed				S3	4 Secure	19	29.2 ± 0.01
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3	3 Sensitive	3	19.7 ± 1.0
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	12	59.1 ± 5.0
P	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	3	54.5 ± 5.0
P	*Polygonum pensylvanicum*	Pennsylvania Smartweed				S3	4 Secure	12	18.5 ± 1.0
P	*Polygonum scandens*	Climbing False Buckwheat				S3	3 Sensitive	29	27.9 ± 0.1
P	*Moneses uniflora*	One-flowered Wintergreen				S3	4 Secure	1	98.9 ± 3.5
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	8	41.2 ± 0.01
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	28	19.5 ± 5.0
P	*Rhamnus alnifolia*	Alder-leaved Buckthorn				S3	3 Sensitive	17	18.6 ± 1.0
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	75	25.7 ± 0.01
P	*Rosa palustris*	Swamp Rose				S3	4 Secure	25	29.0 ± 0.01
P	*Salix petiolaris*	Meadow Willow				S3	4 Secure	18	27.6 ± 0.01
P	*Geocaulon lividum*	Northern Comandra				S3	3 Sensitive	2	22.1 ± 5.0
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3	4 Secure	2	77.6 ± 0.01
P	*Limosella australis*	Southern Mudwort				S3	3 Sensitive	4	39.0 ± 5.0
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	28	26.6 ± 0.01
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	85	45.4 ± 0.01
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	19	62.1 ± 0.1
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	20	27.9 ± 0.01
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	18	36.7 ± 0.01
P	*Eleocharis nitida*	Quill Spikerush				S3	4 Secure	1	84.6 ± 5.0
P	*Schoenoplectus americanus*	Olney's Bulrush				S3	3 Sensitive	2	76.1 ± 5.0

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	*Juncus subcaudatus var. planisepalus*	Woods-Rush				S3	3 Sensitive	11	19.7 ± 1.0
P	*Corallorhiza trifida*	Early Coralroot				S3	4 Secure	20	53.2 ± 0.5
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	93	29.0 ± 0.01
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	2	89.0 ± 0.01
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	18	54.3 ± 0.01
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3	4 Secure	156	40.6 ± 0.01
P	*Sparganium natans*	Small Burreed				S3	4 Secure	9	30.4 ± 0.01
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	23	42.9 ± 0.01
P	*Isoetes acadiensis*	Acadian Quillwort				S3	3 Sensitive	4	56.1 ± 14.0
P	*Botrychium dissectum*	Cut-leaved Moonwort				S3	4 Secure	4	40.1 ± 1.0
P	*Schizaea pusilla*	Little Curlygrass Fern				S3	4 Secure	5	55.1 ± 1.0
P	*Amelanchier stolonifera*	Running Serviceberry				S3?	4 Secure	2	67.9 ± 2.0
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3?	4 Secure	8	29.3 ± 0.01
P	*Carex tribuloides*	Blunt Broom Sedge				S3?	4 Secure	4	58.1 ± 5.0
P	*Carex foenea*	Fernald's Hay Sedge				S3?	4 Secure	10	44.6 ± 0.01
P	*Elodea canadensis*	Canada Waterweed				S3?	4 Secure	3	63.2 ± 0.3
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3?	3 Sensitive	9	42.3 ± 1.0
P	*Lycopodium sabinifolium*	Ground-Fir				S3?	4 Secure	3	58.3 ± 1.0
P	*Lycopodium sitchense*	Sitka Clubmoss				S3?	4 Secure	2	55.3 ± 1.0
P	*Polypodium appalachianum*	Appalachian Polypody				S3?	5 Undetermined	10	23.8 ± 0.01
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3S4	4 Secure	1	32.5 ± 0.01
P	*Pseudognaphalium obtusifolium*	Eastern Cudweed				S3S4	4 Secure	3	62.9 ± 3.5
P	*Atriplex franktonii*	Frankton's Saltbush				S3S4	4 Secure	1	86.0 ± 2.5
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	5	29.3 ± 0.01
P	*Utricularia gibba*	Humped Bladderwort				S3S4	4 Secure	4	34.0 ± 0.1
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	85	25.7 ± 5.0
P	*Polygonum robustius*	Stout Smartweed				S3S4	4 Secure	6	29.9 ± 0.01
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	5	32.0 ± 2.0
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3S4	4 Secure	13	49.0 ± 0.01
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	4 Secure	3	79.1 ± 0.01
P	*Eleocharis obtusa*	Blunt Spikerush				S3S4	4 Secure	1	98.2 ± 3.5
P	*Eriophorum chamissonis*	Russet Cotton-Grass				S3S4	4 Secure	2	48.0 ± 5.0
P	*Sisyrinchium angustifolium*	Narrow-leaved Blue-eyed-grass				S3S4	4 Secure	57	26.1 ± 0.01
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	3 Sensitive	1	79.9 ± 0.01
P	*Juncus nodosus*	Knotted Rush				S3S4	4 Secure	1	98.9 ± 3.5
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	3	38.2 ± 0.01
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	2	70.1 ± 5.0
P	*Dichanthelium spretum*	Eaton's Witchgrass				S3S4	4 Secure	1	63.6 ± 0.5
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	10	48.1 ± 0.03
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	86	23.7 ± 0.01
P	*Equisetum hyemale var. affine*	Common Scouring-rush				S3S4	4 Secure	31	46.4 ± 0.1
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	43	49.1 ± 0.01
P	*Lycopodium complanatum*	Northern Clubmoss				S3S4	4 Secure	4	33.1 ± 0.16
P	*Lycopodiella appressa*	Southern Bog Clubmoss				S3S4	4 Secure	4	31.3 ± 1.0
P	*Solidago simplex var. randii*	Sticky Goldenrod				SH	0.1 Extirpated	1	57.5 ± 1.0

5.1 SOURCE BIBLIOGRAPHY (100 km)

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

# recs	CITATION
8825	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
2627	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
2284	Morrison, Guy. 2011. Maritime Shorebird Survey (MSS) database. Canadian Wildlife Service, Ottawa, 15939 surveys. 86171 recs.

# recs	CITATION
458	Blaney, C.S.; Mazerolle, D.M. 2010. Fieldwork 2010. Atlantic Canada Conservation Data Centre. Sackville NB, 15508 recs.
402	Amirault, D.L. & Stewart, J. 2007. Piping Plover Database 1894-2006. Canadian Wildlife Service, Sackville, 3344 recs, 1228 new.
354	Blaney, C.S.; Mazerolle, D.M. 2012. Fieldwork 2012. Atlantic Canada Conservation Data Centre, 13,278 recs.
350	Benjamin, L.K. (compiler). 2012. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 4965 recs.
257	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
248	Klymko, J.J.D. 2014. Maritimes Butterfly Atlas, 2012 submissions. Atlantic Canada Conservation Data Centre, 8552 records.
245	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
227	Blaney, C.S.; Mazerolle, D.M.; Hill, N.M. 2011. Nova Scotia Crown Share Land Legacy Trust Fieldwork. Atlantic Canada Conservation Data Centre, 5022 recs.
227	Newell, R.E. 2000. E.C. Smith Herbarium Database. Acadia University, Wolfville NS, 7139 recs.
222	Blaney, C.S & Spicer, C.D.; Popma, T.M.; Basquill, S.P. 2003. Vascular Plant Surveys of Northumberland Strait Rivers & Amherst Area Peatlands. Nova Scotia Museum Research Grant, 501 recs.
220	Neily, T.M. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.
213	LaPaix, R.W.; Crowell, M.J.; MacDonald, M. 2011. Stantec rare plant records, 2010-11. Stantec Consulting, 334 recs.
207	Hicks, Andrew. 2009. Coastal Waterfowl Surveys Database, 2000-08. Canadian Wildlife Service, Sackville, 46488 recs (11149 non-zero).
170	Bryson, I. 2013. Nova Scotia rare plant records. CBCL Ltd., 180 records.
162	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.
155	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia. , 181 records.
152	Newell, R. E. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University. 2013.
150	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
144	Scott, F.W. 2002. Nova Scotia Herpetofauna Atlas Database. Acadia University, Wolfville NS, 8856 recs.
120	Blaney, C.S.; Mazerolle, D.M. 2011. Fieldwork 2011. Atlantic Canada Conservation Data Centre. Sackville NB.
115	Wilhelm, S.I. et al. 2011. Colonial Waterbird Database. Canadian Wildlife Service, Sackville, 2698 sites, 9718 recs (8192 obs).
113	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
96	Klymko, J.J.D. 2012. Maritimes Butterfly Atlas, 2010 and 2011 records. Atlantic Canada Conservation Data Centre, 6318 recs.
92	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
86	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.
69	Scott, Fred W. 1998. Updated Status Report on the Cougar (Puma Concolor couguar) [Eastern population]. Committee on the Status of Endangered Wildlife in Canada, 298 recs.
67	Amirault, D.L. & McKnight, J. 2003. Piping Plover Database 1991-2003. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
65	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
65	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
65	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.
49	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.
49	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
46	Nova Scotia Nature Trust. 2013. Nova Scotia Nature Trust 2013 Species records. Nova Scotia Nature Trust, 95 recs.
45	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
43	Benjamin, L.K. 2012. NSDNR fieldwork & consultant reports 2008-2012. Nova Scotia Dept Natural Resources, 196 recs.
42	Blaney, C.S.; Spicer, C.D.; Popma, T.M.; Hanel, C. 2002. Fieldwork 2002. Atlantic Canada Conservation Data Centre. Sackville NB, 2252 recs.
37	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2013. Atlantic Canada Conservation Data Centre Fieldwork 2013. Atlantic Canada Conservation Data Centre, 9000+ recs.
34	Cameron, R.P. 2011. Lichen observations, 2011. Nova Scotia Environment & Labour, 731 recs.
33	Neily, T.H. 2010. Erioderma Pedicellatum records 2005-09. Mersey Tobiatic Research Institute, 67 recs.
32	Cameron, R.P. 2009. Cyanolichen database. Nova Scotia Environment & Labour, 1724 recs.
30	Popma, T.M. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 113 recs.
28	Pepper, Chris. 2012. Observations of breeding Canada Warbler's along the Eastern Shore, NS. Pers. comm. to S. Blaney, Jan. 20, 28 recs.
27	Cameron, R.P. 2013. 2013 rare species field data. Nova Scotia Department of Environment, 71 recs.
26	Blaney, C.S.; Mazerolle, D.M.; Oberndorfer, E. 2007. Fieldwork 2007. Atlantic Canada Conservation Data Centre. Sackville NB, 13770 recs.
23	Benjamin, L.K. 2011. NSDNR fieldwork & consultant reports 1997, 2009-10. Nova Scotia Dept Natural Resources, 85 recs.
22	Belliveau, A. 2013. Rare species records from Nova Scotia. Mersey Tobeatic Research Institute, 296 records. 296 recs.
19	Powell, B.C. 1967. Female sexual cycles of Chrysemy spicta & Clemmys insculpta in Nova Scotia. Can. Field-Nat., 81:134-139. 26 recs.
19	Pulsifer, M.D. 2002. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 369 recs.
18	Neily, T.H. 2012. 2012 Erioderma pedicellatum records in Nova Scotia.
17	Basquill, S.P. 2012. 2012 rare vascular plant field data. Nova Scotia Department of Natural Resources, 37 recs.
16	Klymko, J.J.D.; Robinson, S.L. 2012. 2012 field data. Atlantic Canada Conservation Data Centre, 447 recs.
15	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
15	Belliveau, A.G. 2014. Plant Records from Southern and Central Nova Scotia. Atlantic Canada Conservation Data Centre, 919 recs.
15	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
15	Gilhen, J. 1984. Amphibians & Reptiles of Nova Scotia, 1st Ed. Nova Scotia Museum, 164pp.
15	Robinson, S.L. 2011. 2011 ND dune survey field data. Atlantic Canada Conservation Data Centre, 2715 recs.
14	Blaney, C.S.; Mazerolle, D.M. 2008. Fieldwork 2008. Atlantic Canada Conservation Data Centre. Sackville NB, 13343 recs.
13	Archibald, D.R. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 213 recs.

# recs	CITATION
13	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
12	Neily, T.H. 2013. Email communication to Sean Blaney regarding Listera australis observations made from 2007 to 2011 in Nova Scotia. , 50.
11	Cameron, R.P. 2012. Rob Cameron 2012 vascular plant data. NS Department of Environment, 30 recs.
11	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
11	Hall, R.A. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 189 recs.
10	Benjamin, L.K. (compiler). 2002. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 32 spp, 683 recs.
9	Cameron, R.P. 2005. Erioderma pedicellatum unpublished data. NS Dept of Environment, 9 recs.
9	Cameron, R.P. 2006. Erioderma pedicellatum 2006 field data. NS Dept of Environment, 9 recs.
8	Hall, R.A. 2001. S.. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 178 recs.
8	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.
8	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.
7	Benjamin, L.K. 2009. Boreal Felt Lichen, Mountain Avens, Orchid and other recent records. Nova Scotia Dept Natural Resources, 105 recs.
7	Cameron, B. 2006. Hepatica americana Survey at Scotia Mine Site in Gays River, and Discovery of Three Yellow-listed Species. Conestoga-Rovers and Associates, (a consulting firm), october 25. 7 recs.
6	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.
6	Hall, R. 2008. Rare plant records in old fieldbook notes from Truro area. Pers. comm. to C.S. Blaney. 6 recs, 6 recs.
6	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
6	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
5	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
5	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
5	Blaney, C.S.; Spicer, C.D.; Mazerolle, D.M. 2005. Fieldwork 2005. Atlantic Canada Conservation Data Centre. Sackville NB, 2333 recs.
5	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.
5	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.
5	Erskine, D. 1960. The plants of Prince Edward Island, 1st Ed. Research Branch, Agriculture Canada, Ottawa., Publication 1088. 1238 recs.
5	Plissner, J.H. & Haig, S.M. 1997. 1996 International piping plover census. US Geological Survey, Corvallis OR, 231 pp.
5	Whittam, R.M. 1997. Status Report on the Roseate Tern (Sterna dougallii) in Canada. Committee on the Status of Endangered Wildlife in Canada, 5 recs.
4	Blaney, C.S. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 1042 recs.
4	Bredin, K.A. 2002. NS Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centere, 30 recs.
4	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
4	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
4	Clayden, S.R. 2005. Confidential supplement to Status Report on Ghost Antler Lichen (Pseudevernia cladonia). Committee on the Status of Endangered Wildlife in Canada, 27 recs.
4	Frittaion, C. 2012. NSNT 2012 Field Observations. Nova Scotia Nature Trust, Pers comm. to S. Blaney Feb. 7, 34 recs.
4	O'Neil, S. 1998. Atlantic Salmon: Eastern Shore Nova Scotia SFA 20. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-10. 4 recs.
3	Benjamin, L.K. 2006. Cypripedium arietinum. Pers. comm. to D. Mazerolle. 9 recs, 9 recs.
3	Blaney, C.S. Miscellaneous specimens received by ACCDC (botany). Various persons. 2001-08.
3	Blaney, C.S.; Spicer, C.D.; Rothfels, C. 2004. Fieldwork 2004. Atlantic Canada Conservation Data Centre. Sackville NB, 1343 recs.
3	Cameron, R.P. 2012. Additional rare plant records, 2009. , 7 recs.
3	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
3	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
3	LaPaix, R.; Parker, M. 2013. email to Sean Blaney regarding Listera australis observations near Kearney Lake. East Coast Aquatics, 2.
3	WIlliams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
2	Basquill, S.P. 2009. 2009 field observations. Nova Scotia Dept of Natural Resources.
2	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
2	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
2	Hill, N. 2003. Floerkea proserpinacoides at Heatherdale, Antigonish Co. 2002. , Pers. comm. to C.S. Blaney. 2 recs.
2	Macaulay, M. Notes on newly discovered Hepatica nobilis var. obtusa population in Cumberland Co. NS. Pers. comm. to S. Blaney, 1 rec.
2	Neily, T.H.; Smith, C.; Whitman, E. 2011. NCC Logging Lake (Halifax Co. NS) properties baseline survey data. Nature Conservancy of Canada, 2 recs.
2	Robinson, S.L. 2014. 2013 Field Data. Atlantic Canada Conservation Data Centre.
2	Sabine, D.L. 2013. Dwaine Sabine butterfly records, 2009 and earlier.
2	Sollows, M.C,. 2008. NBM Science Collections databases: mammals. New Brunswick Museum, Saint John NB, download Jan. 2008, 4983 recs.
2	Standley, L.A. 2002. Carex haydenii in Nova Scotia. , Pers. comm. to C.S. Blaney. 4 recs.
2	Whittam, R.M. et al. 1998. Country Island Tern Restoration Project. Canadian Wildlife Service, Sackville, 2 recs.
1	Amirault, D.L. 1997-2000. Unpublished files. Canadian Wildlife Service, Sackville, 470 recs.
1	Amiro, Peter G. 1998. Atlantic Salmon: Inner Bay of Fundy SFA 22 & part of SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-12. 4 recs.
1	Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
1	Basquill, S.P. 2011. Field observations & specimen collections, 2010. Nova Scotia Department of Natural Resources, Pers. comm. , 8 Recs.
1	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
1	Benedict, B. Connell Herbarium Specimens, Digital photos. University New Brunswick, Fredericton. 2005.

# recs	CITATION
1	Boyne, A.W. & Grecian, V.D. 1999. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 23 recs.
1	Clayden, S.R. 2006. Pseudevernia cladonia records. NB Museum. Pers. comm. to S. Blaney, Dec, 4 recs.
1	Daury, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (Bucephala islandica) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
1	Dibblee, R.L. 1999. PEI Cormorant Survey. Prince Edward Island Fisheries, Aquaculture & Environment, 1p. 21 recs.
1	Doubt, J. 2013. Email to Sean Blaney with Nova Scotia records of Fissidens exilis at Canadian Museum of Nature. pers. comm., 3 records.
1	Jacques Whitford Ltd. 2003. Cananda Lily location. Pers. Comm. to S. Blaney. 2pp, 1 rec, 1 rec.
1	Lautenschlager, R.A. 2010. Miscellaneous observations reported to ACCDC (zoology). Pers. comm. from various persons, 2 recs.
1	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
1	Neily, P.D. Plant Specimens. Nova Scotia Dept Natural Resources, Truro. 2006.
1	Neily, T.H. & Anderson, F. 2011. Lichen observations from NRC site at Sandy Cove. , 97.
1	Porter, K. 2013. 2013 rare and non-rare vascular plant field data. St. Mary's University, 57 recs.
1	Robinson, C.B. 1907. Early intervale flora of eastern Nova Scotia. Transactions of the Nova Scotia Institute of Science, 10:502-506. 1 rec.
1	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	Speers, L. 2008. Butterflies of Canada database: New Brunswick 1897-1999. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 2048 recs.
1	Stewart, J.I. 2010. Peregrine Falcon Surveys in New Brunswick, 2002-09. Canadian Wildlife Service, Sackville, 58 recs.
1	Whittam, R.M. 2000. Senecio pseudoarnica on Country Island. , Pers. comm. to S. Gerriets. 1 rec.

DATA REPORT 5559: Mooseland, NS

Prepared 3 June 2016
by J. Churchill, Data Manager

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) 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 ACCDC 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 ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC 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 ACCDC 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
MooselandNs_5559ob.xls	All Rare and legally protected *Flora and Fauna* within 5 km of your study area
MooselandNs_5559ob100km.xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area

1.2 RESTRICTIONS

The ACCDC 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 ACCDC 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 ACCDC 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) ACCDC 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) ACCDC 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 ACCDC data response.

1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

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

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney, Senior Scientist, Executive Director
Tel: (506) 364-2658
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Animals (Fauna)
John Klymko, Zoologist
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James Churchill, Data Manager
Tel: (902) 679-6146
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Billing
Jean Breau
Tel: (506) 364-2657
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Questions on the biology of Federal Species at Risk can be directed to ACCDC: (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 Stewart Lusk, Natural Resources: (506) 453-7110.

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 Sherman Boates, NSDNR: (902) 679-6146. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NSDNR Regional Biologist:

Western: Duncan Bayne
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Eastern: Terry Power
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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

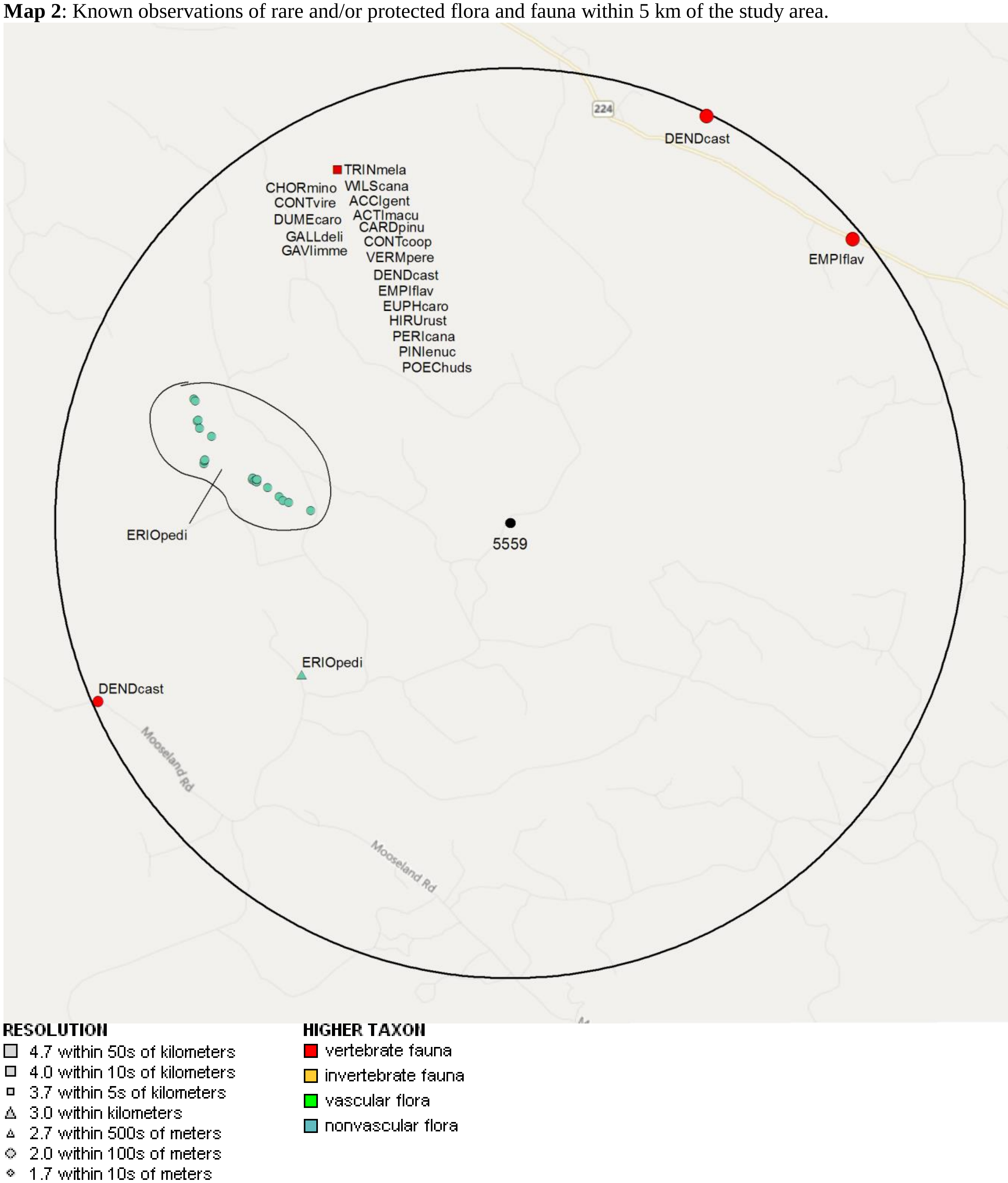
2.1 FLORA

A 5 km buffer around the study area contains no records of vascular, 25 records of 1 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

A 5 km buffer around the study area contains 45 records of 19 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 5 km of the study area.

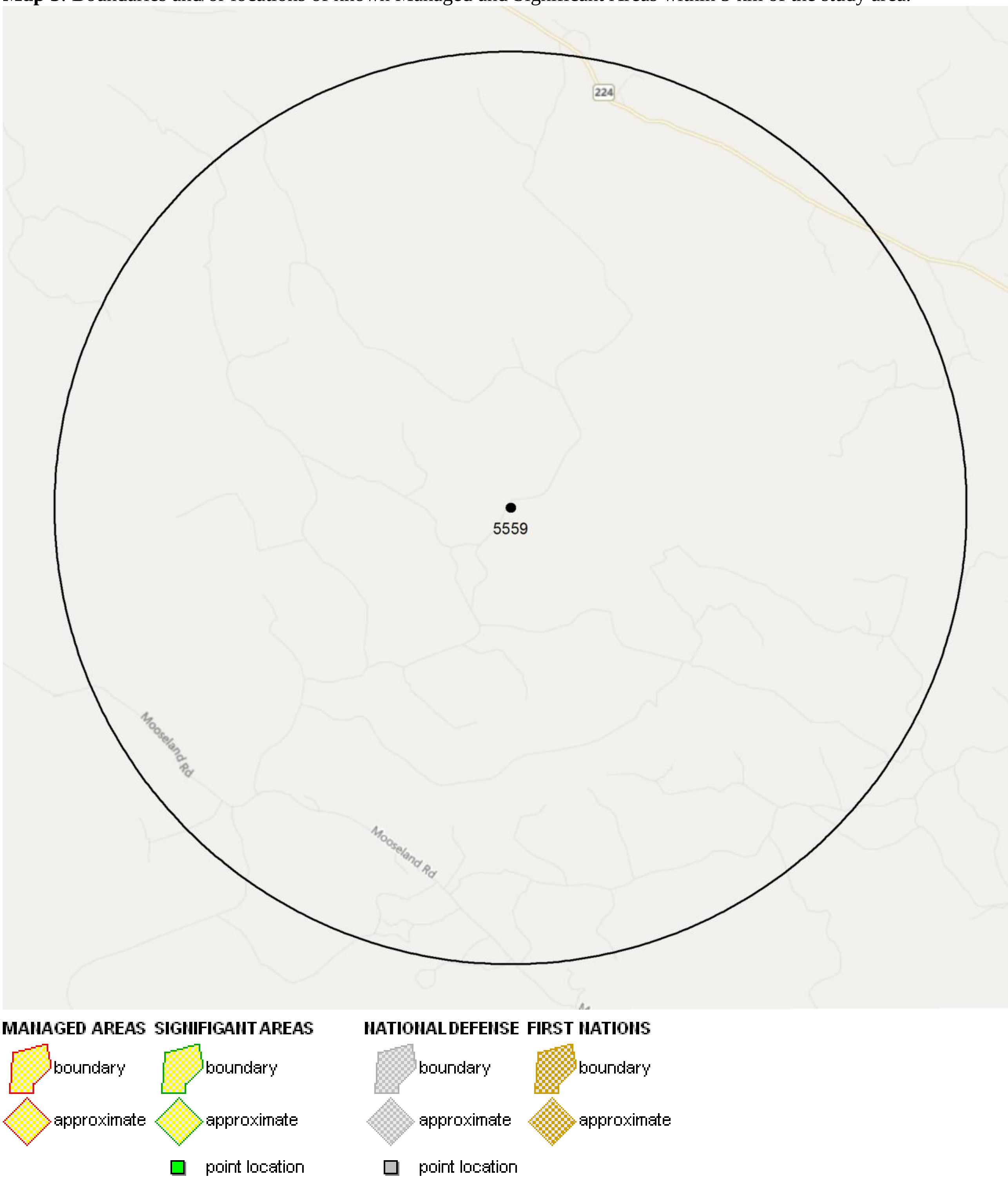


3.0 SPECIAL AREAS

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 no biologically significant sites in the vicinity of the study area (Map)

Map 3: Boundaries and/or locations of known Managed and Significant Areas within 5 km of the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the 5 km-buffered 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	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1S2	1 At Risk	25	2.2 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2S3B	2 May Be At Risk	3	4.3 ± 7.0
A	*Poecile hudsonica*	Boreal Chickadee				S3	3 Sensitive	4	4.3 ± 7.0
A	*Pinicola enucleator*	Pine Grosbeak				S3?B,S5N	2 May Be At Risk	2	4.3 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Threatened		Endangered	S3B	1 At Risk	3	4.3 ± 7.0
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	2	4.3 ± 7.0
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	2	4.3 ± 7.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B	1 At Risk	2	4.3 ± 7.0
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	1	4.3 ± 7.0
A	*Gavia immer*	Common Loon	Not At Risk			S3B,S4N	2 May Be At Risk	2	4.3 ± 7.0
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S5M	3 Sensitive	4	4.3 ± 7.0
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	1	4.3 ± 7.0
A	*Perisoreus canadensis*	Gray Jay				S3S4	3 Sensitive	2	4.3 ± 7.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Vulnerable	S3S4B	3 Sensitive	1	4.3 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	2	4.3 ± 7.0
A	*Gallinago delicata*	Wilson's Snipe				S3S4B	3 Sensitive	1	4.3 ± 7.0
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	4	4.3 ± 7.0
A	*Vermivora peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	2	4.3 ± 7.0
A	*Dendroica castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	6	4.3 ± 7.0
A	*Carduelis pinus*	Pine Siskin				S3S4B,S5N	3 Sensitive	1	4.3 ± 7.0

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 a 5 km buffer of your study area are indicated below with "YES".

Nova Scotia

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within 5 km of Study Site?
Fraxinus nigra	Black Ash		Threatened	No
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 ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
28	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
24	Neily, T.H. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.
16	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
1	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
1	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia. , 181 records.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 14766 records of 110 vertebrate and 727 records of 54 invertebrate fauna; 3569 records of 253 vascular, 518 records of 52 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. 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	38	21.7 ± 0.0	NS
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	5	21.9 ± 0.0	NS
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	7	51.8 ± 0.0	NS
A	*Alces americanus*	Moose			Endangered	S1	1 At Risk	26	14.1 ± 0.0	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S1?	2 May Be At Risk	2	50.8 ± 0.0	NS
A	*Caprimulgus vociferus*	Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	10	32.1 ± 7.0	NS
A	*Toxostoma rufum*	Brown Thrasher				S1?B	5 Undetermined	9	60.7 ± 7.0	NS
A	*Vireo gilvus*	Warbling Vireo				S1?B	5 Undetermined	16	20.0 ± 7.0	NS
A	*Tringa solitaria*	Solitary Sandpiper				S1?B,S4S5M	4 Secure	10	25.3 ± 0.0	NS
A	*Larus delawarensis*	Ring-billed Gull				S1?B,S5N	4 Secure	4	21.6 ± 0.0	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B,SNAN	5 Undetermined	4	63.5 ± 0.0	NS
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	570	22.3 ± 0.0	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	58	26.8 ± 0.0	NS
A	*Morone saxatilis pop. 2*	Striped Bass- Bay of Fundy pop.	Endangered			S1B	2 May Be At Risk	2	51.0 ± 0.0	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened			S1B	5 Undetermined	32	13.4 ± 7.0	NS
A	*Passerculus sandwichensis princeps*	Savannah Sparrow princeps ssp	Special Concern	Special Concern		S1B	3 Sensitive	3	26.6 ± 0.0	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	5 Undetermined	7	66.3 ± 7.0	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S1B	5 Undetermined	13	32.5 ± 7.0	NS
A	*Gallinula chloropus*	Common Moorhen				S1B	5 Undetermined	5	77.1 ± 7.0	NS
A	*Progne subis*	Purple Martin				S1B	2 May Be At Risk	3	58.2 ± 7.0	NS
A	*Fratercula arctica*	Atlantic Puffin				S1B,S4S5N	3 Sensitive	2	38.6 ± 7.0	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S5M	4 Secure	287	42.0 ± 0.0	NS
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	81.3 ± 0.0	NS
A	*Morone saxatilis pop. 1*	Striped Bass- Southern Gulf of St Lawrence pop.	Special Concern			S1N	2 May Be At Risk	1	99.2 ± 1.0	NS
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern		S1S2	2 May Be At Risk	8	64.4 ± 7.0	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1S2	5 Undetermined	4	58.2 ± 7.0	NS
A	*Passerina cyanea*	Indigo Bunting				S1S2B	5 Undetermined	7	53.7 ± 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	*Eremophila alpestris*	Horned Lark				S1S2B,S4N	4 Secure	4	24.2 ± 7.0	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1S2B,S5M	4 Secure	431	23.5 ± 0.0	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered		S2	2 May Be At Risk	19	40.2 ± 0.0	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	201	23.4 ± 1.0	NS
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	2	92.0 ± 5.0	NS
A	*Asio otus*	Long-eared Owl				S2	2 May Be At Risk	28	20.0 ± 7.0	NS
A	*Salmo salar*	Atlantic Salmon				S2	2 May Be At Risk	71	8.1 ± 0.0	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B	5 Undetermined	26	5.6 ± 0.0	NS
A	*Anas acuta*	Northern Pintail				S2B	2 May Be At Risk	9	53.7 ± 7.0	NS
A	*Anas clypeata*	Northern Shoveler				S2B	2 May Be At Risk	5	42.3 ± 7.0	NS
A	*Anas strepera*	Gadwall				S2B	2 May Be At Risk	19	27.5 ± 0.0	NS
A	*Rallus limicola*	Virginia Rail				S2B	5 Undetermined	24	53.7 ± 7.0	NS
A	*Empidonax traillii*	Willow Flycatcher				S2B	3 Sensitive	19	32.1 ± 7.0	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S2B	2 May Be At Risk	13	57.1 ± 7.0	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B	5 Undetermined	15	32.4 ± 7.0	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S2B,S4S5N	3 Sensitive	1	76.3 ± 0.0	NS
A	*Bucephala clangula*	Common Goldeneye				S2B,S5N	4 Secure	111	16.1 ± 7.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	31	27.0 ± 0.0	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		1	17.0 ± 100.0	NS
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B	1 At Risk	137	16.1 ± 7.0	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2S3B	2 May Be At Risk	220	4.3 ± 7.0	NS
A	*Cathartes aura*	Turkey Vulture				S2S3B	3 Sensitive	10	42.5 ± 0.0	NS
A	*Tringa semipalmata*	Willet				S2S3B	2 May Be At Risk	445	18.0 ± 7.0	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S2S3B	2 May Be At Risk	22	54.3 ± 7.0	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2S3B	4 Secure	74	18.3 ± 7.0	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B	2 May Be At Risk	41	28.4 ± 7.0	NS
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered		Endangered	S2S3M	1 At Risk	97	42.0 ± 0.0	NS
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S2S3M	3 Sensitive	3	62.1 ± 0.0	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	3 Sensitive	1	68.3 ± 0.0	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	67	14.8 ± 0.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	4 Secure	26	55.2 ± 5.0	NS
A	*Phalacrocorax carbo*	Great Cormorant				S3	3 Sensitive	53	24.2 ± 7.0	NS
A	*Poecile hudsonica*	Boreal Chickadee				S3	3 Sensitive	547	4.3 ± 7.0	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3?B	2 May Be At Risk	71	13.4 ± 7.0	NS
A	*Dendroica tigrina*	Cape May Warbler				S3?B	3 Sensitive	112	9.0 ± 7.0	NS
A	*Pinicola enucleator*	Pine Grosbeak				S3?B,S5N	2 May Be At Risk	115	4.3 ± 7.0	NS
A	*Hirundo rustica*	Barn Swallow	Threatened		Endangered	S3B	1 At Risk	700	4.3 ± 7.0	NS
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	600	4.3 ± 7.0	NS
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	344	4.3 ± 7.0	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B	1 At Risk	682	4.3 ± 7.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened			S3B	2 May Be At Risk	251	18.0 ± 7.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	225	18.0 ± 7.0	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	40	22.2 ± 7.0	NS
A	*Podilymbus podiceps*	Pied-billed Grebe				S3B	3 Sensitive	84	32.1 ± 7.0	NS
A	*Anas discors*	Blue-winged Teal				S3B	2 May Be At Risk	77	18.5 ± 7.0	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	2 May Be At Risk	53	21.4 ± 0.0	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S3B	2 May Be At Risk	197	18.0 ± 7.0	NS
A	*Dumetella carolinensis*	Gray Catbird				S3B	2 May Be At Risk	303	4.3 ± 7.0	NS
A	*Mimus polyglottos*	Northern Mockingbird				S3B	4 Secure	21	55.3 ± 7.0	NS
A	*Gavia immer*	Common Loon	Not At Risk			S3B,S4N	2 May Be At Risk	623	4.3 ± 7.0	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S5M	3 Sensitive	441	4.3 ± 7.0	NS
A	*Mergus serrator*	Red-breasted Merganser				S3B,S5N	4 Secure	63	20.0 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Pluvialis dominica*	American Golden-Plover				S3M	3 Sensitive	48	48.3 ± 0.0	NS
A	*Numenius phaeopus hudsonicus*	Hudsonian Whimbrel				S3M	3 Sensitive	49	27.7 ± 0.0	NS
A	*Limosa haemastica*	Hudsonian Godwit				S3M	3 Sensitive	25	54.0 ± 0.0	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	3 Sensitive	390	42.0 ± 0.0	NS
A	*Calidris maritima*	Purple Sandpiper				S3N	3 Sensitive	28	25.9 ± 12.0	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	4 Secure	86	4.3 ± 7.0	NS
A	*Cepphus grylle*	Black Guillemot				S3S4	4 Secure	51	23.7 ± 2.0	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3 Sensitive	149	12.5 ± 7.0	NS
A	*Perisoreus canadensis*	Gray Jay				S3S4	3 Sensitive	416	4.3 ± 7.0	NS
A	*Cardinalis cardinalis*	Northern Cardinal				S3S4	4 Secure	37	54.3 ± 7.0	NS
A	*Dolichonyx oryzivorus*	Bobolink	Threatened		Vulnerable	S3S4B	3 Sensitive	350	22.2 ± 0.0	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Vulnerable	S3S4B	3 Sensitive	473	4.3 ± 7.0	NS
A	*Botaurus lentiginosus*	American Bittern				S3S4B	3 Sensitive	210	19.1 ± 7.0	NS
A	*Charadrius vociferus*	Killdeer				S3S4B	3 Sensitive	350	10.2 ± 7.0	NS
A	*Actitis macularius*	Spotted Sandpiper				S3S4B	3 Sensitive	462	4.3 ± 7.0	NS
A	*Gallinago delicata*	Wilson's Snipe				S3S4B	3 Sensitive	370	4.3 ± 7.0	NS
A	*Empidonax flaviventris*	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	535	4.3 ± 7.0	NS
A	*Sayornis phoebe*	Eastern Phoebe				S3S4B	3 Sensitive	153	32.4 ± 7.0	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	3 Sensitive	165	18.3 ± 7.0	NS
A	*Vermivora peregrina*	Tennessee Warbler				S3S4B	3 Sensitive	280	4.3 ± 7.0	NS
A	*Dendroica castanea*	Bay-breasted Warbler				S3S4B	3 Sensitive	382	4.3 ± 7.0	NS
A	*Dendroica striata*	Blackpoll Warbler				S3S4B	3 Sensitive	102	16.1 ± 7.0	NS
A	*Wilsonia pusilla*	Wilson's Warbler				S3S4B	3 Sensitive	74	13.4 ± 7.0	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3S4B	3 Sensitive	270	16.2 ± 7.0	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B	4 Secure	81	18.0 ± 7.0	NS
A	*Carduelis pinus*	Pine Siskin				S3S4B,S5N	3 Sensitive	308	4.3 ± 7.0	NS
A	*Anguilla rostrata*	American Eel	Threatened			S5	4 Secure	7	38.1 ± 0.0	NS
A	*Leucophaeus atricilla*	Laughing Gull				SHB	4 Secure	1	30.1 ± 0.0	NS
A	*Morus bassanus*	Northern Gannet				SHB,S5M	4 Secure	2	27.8 ± 0.0	NS
A	*Tryngites subruficollis*	Buff-breasted Sandpiper	Special Concern			SNA	8 Accidental	2	54.0 ± 0.0	NS
A	*Colinus virginianus*	Northern Bobwhite	Endangered	Endangered				1	42.5 ± 0.0	NS
I	*Gomphus ventricosus*	Skillet Clubtail	Endangered			S1	2 May Be At Risk	2	59.3 ± 0.0	NS
I	*Barnea truncata*	Atlantic Mud-piddock	Threatened			S1	1 At Risk	1	91.0 ± 1.0	NS
I	*Satyrium acadica*	Acadian Hairstreak				S1	5 Undetermined	6	78.0 ± 1.0	NS
I	*Neurocordulia michaeli*	Broadtailed Shadowdragon				S1		26	37.3 ± 0.0	NS
I	*Somatochlora brevicincta*	Quebec Emerald				S1	2 May Be At Risk	1	50.6 ± 0.0	NS
I	*Polygonia comma*	Eastern Comma				S1?	1 At Risk	8	74.3 ± 1.0	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	3 Sensitive	2	77.5 ± 1.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	15	47.8 ± 1.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S1S2	4 Secure	9	56.9 ± 1.0	NS
I	*Somatochlora kennedyi*	Kennedy's Emerald				S1S2	2 May Be At Risk	3	68.8 ± 1.0	NS
I	*Coenagrion resolutum*	Taiga Bluet				S1S2	2 May Be At Risk	2	67.4 ± 1.0	NS
I	*Stylurus scudderi*	Zebra Clubtail				S1S2	2 May Be At Risk	4	39.0 ± 0.0	NS
I	*Lycaena hyllus*	Bronze Copper				S2	4 Secure	4	63.6 ± 1.0	NS
I	*Lycaena dospassosi*	Salt Marsh Copper				S2	1 At Risk	9	83.6 ± 0.0	NS
I	*Satyrium calanus*	Banded Hairstreak				S2	5 Undetermined	9	71.7 ± 5.0	NS
I	*Satyrium calanus falacer*	Banded Hairstreak				S2	1 At Risk	2	76.7 ± 0.0	NS
I	*Boloria chariclea*	Arctic Fritillary				S2	3 Sensitive	3	73.2 ± 1.0	NS
I	*Aglais milberti*	Milbert's Tortoiseshell				S2	4 Secure	7	59.1 ± 1.0	NS
I	*Epitheca princeps*	Prince Baskettail				S2	3 Sensitive	7	61.9 ± 0.0	NS
I	*Enallagma signatum*	Orange Bluet				S2	2 May Be At Risk	3	66.9 ± 0.0	NS
I	*Lampsilis radiata*	Eastern Lampmussel				S2	3 Sensitive	34	36.4 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	3 Sensitive	7	59.1 ± 1.0	NS
I	*Danaus plexippus*	Monarch	Special Concern	Special Concern		S2B	3 Sensitive	59	23.7 ± 0.0	NS
I	*Thorybes pylades*	Northern Cloudywing				S2S3	3 Sensitive	14	50.9 ± 0.0	NS
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S2S3	4 Secure	22	19.4 ± 0.0	NS
I	*Satyrium liparops*	Striped Hairstreak				S2S3	5 Undetermined	5	24.2 ± 0.0	NS
I	*Satyrium liparops strigosum*	Striped Hairstreak				S2S3	3 Sensitive	2	76.7 ± 0.0	NS
I	*Euphydryas phaeton*	Baltimore Checkerspot				S2S3	4 Secure	19	22.3 ± 0.0	NS
I	*Ophiogomphus aspersus*	Brook Snaketail				S2S3	2 May Be At Risk	2	98.4 ± 0.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S2S3	2 May Be At Risk	14	35.4 ± 0.0	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S2S3	2 May Be At Risk	56	39.0 ± 0.0	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S2S3	2 May Be At Risk	3	68.8 ± 1.0	NS
I	*Somatochlora franklini*	Delicate Emerald				S2S3	3 Sensitive	1	85.8 ± 1.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	4 Secure	24	21.5 ± 0.0	NS
I	*Callophrys henrici*	Henry's Elfin				S3	4 Secure	17	25.8 ± 0.0	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	2 May Be At Risk	6	33.1 ± 0.0	NS
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	12	56.9 ± 1.0	NS
I	*Polygonia faunus*	Green Comma				S3	4 Secure	15	37.7 ± 0.0	NS
I	*Oeneis jutta*	Jutta Arctic				S3	2 May Be At Risk	6	70.2 ± 0.0	NS
I	*Aeshna clepsydra*	Mottled Darner				S3	4 Secure	12	42.6 ± 1.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3	4 Secure	18	34.8 ± 1.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3	3 Sensitive	10	44.6 ± 1.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3 Sensitive	3	71.3 ± 1.0	NS
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3	4 Secure	12	49.8 ± 1.0	NS
I	*Nannothemis bella*	Elfin Skimmer				S3	4 Secure	13	52.3 ± 0.0	NS
I	*Sympetrum danae*	Black Meadowhawk				S3	3 Sensitive	4	71.4 ± 1.0	NS
I	*Enallagma vernale*	Vernal Bluet				S3	5 Undetermined	5	47.1 ± 0.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3	4 Secure	2	49.4 ± 0.0	NS
I	*Polygonia interrogationis*	Question Mark				S3B	4 Secure	105	24.2 ± 0.0	NS
I	*Erynnis juvenalis*	Juvenal's Duskywing				S3S4	4 Secure	34	65.5 ± 0.0	NS
I	*Amblyscirtes vialis*	Common Roadside-Skipper				S3S4	4 Secure	12	13.3 ± 0.0	NS
I	*Polygonia progne*	Grey Comma				S3S4	4 Secure	22	23.0 ± 0.0	NS
I	*Lanthus parvulus*	Northern Pygmy Clubtail				S3S4	4 Secure	33	45.8 ± 0.0	NS
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern			SNR	3 Sensitive	1	88.8 ± 0.0	NS
N	*Aloina brevirostris*	Short-Beaked Rigid Screw Moss				S1		1	98.5 ± 2.0	NS
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1	2 May Be At Risk	3	93.8 ± 0.0	NS
N	*Bryohaplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1		1	67.3 ± 5.0	NS
N	*Fissidens exilis*	Pygmy Pocket Moss	Special Concern			S1?	1 At Risk	1	92.7 ± 1.0	NS
N	*Sclerophora peronella (Nova Scotia pop.)*	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		9	8.5 ± 0.0	NS
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered		Endangered	S1S2	2 May Be At Risk	5	6.0 ± 0.0	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1S2	1 At Risk	360	2.2 ± 0.0	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened			S1S2	2 May Be At Risk	2	43.5 ± 1.0	NS
N	*Fuscopannaria leucosticta*	Rimmed Shingles Lichen				S1S2	2 May Be At Risk	4	7.7 ± 0.0	NS
N	*Leptogium subtile*	Appressed Jellyskin Lichen				S1S3	3 Sensitive	1	28.2 ± 0.0	NS
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S2	4 Secure	33	6.0 ± 0.0	NS

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N	*Anacamptodon splachnoides*	a Moss				S2?	3 Sensitive	1	74.6 ± 30.0	NS
N	*Anomodon viticulosus*	a Moss				S2?	3 Sensitive	1	96.6 ± 5.0	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	3 Sensitive	3	58.3 ± 2.0	NS
N	*Aulacomnium heterostichum*	One-sided Groove Moss				S2?	3 Sensitive	1	98.5 ± 2.0	NS
N	*Bryum algovicum*	a Moss				S2?	3 Sensitive	1	98.5 ± 2.0	NS
N	*Ditrichum rhynchostegium*	a Moss				S2?	3 Sensitive	1	78.7 ± 1.0	NS
N	*Eurhynchium hians*	Light Beaked Moss				S2?	3 Sensitive	2	33.0 ± 25.0	NS
N	*Fissidens taxifolius*	Yew-leaved Pocket Moss				S2?	3 Sensitive	1	98.5 ± 2.0	NS
N	*Anomodon tristis*	a Moss				S2?	3 Sensitive	2	26.3 ± 15.0	NS
N	*Kiaeria starkei*	Starke's Fork Moss				S2?	3 Sensitive	1	32.1 ± 10.0	NS
N	*Paludella squarrosa*	Tufted Fen Moss				S2?	3 Sensitive	2	93.3 ± 0.0	NS
N	*Saelania glaucescens*	Blue Dew Moss				S2?	3 Sensitive	1	81.2 ± 0.0	NS
N	*Sematophyllum demissum*	a Moss				S2?	3 Sensitive	1	67.6 ± 2.0	NS
N	*Sematophyllum marylandicum*	a Moss				S2?	3 Sensitive	2	64.1 ± 6.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2?	3 Sensitive	1	27.3 ± 2.0	NS
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S2?	3 Sensitive	1	88.4 ± 0.0	NS
N	*Zygodon conoideus*	a Moss				S2?	3 Sensitive	1	20.4 ± 5.0	NS
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				S2?	3 Sensitive	1	23.9 ± 0.0	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	3 Sensitive	2	71.5 ± 5.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	6	24.5 ± 0.0	NS
N	*Calliergon giganteum*	Giant Spear Moss				S2S3	3 Sensitive	1	93.9 ± 3.0	NS
N	*Ephemerum serratum*	a Moss				S2S3	3 Sensitive	1	87.8 ± 3.0	NS
N	*Leucodon andrewsianus*	a Moss				S2S3	3 Sensitive	6	23.9 ± 0.0	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S2S3	3 Sensitive	1	81.2 ± 0.0	NS
N	*Pleuridium subulatum*	a Moss				S2S3	3 Sensitive	1	72.3 ± 10.0	NS
N	*Tortula truncata*	a Moss				S2S3	3 Sensitive	1	38.3 ± 300.0	NS
N	*Sphagnum wulfianum*	Wulf's Peat Moss				S2S3	3 Sensitive	10	13.4 ± 0.0	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S2S3	3 Sensitive	1	27.3 ± 2.0	NS
N	*Limprichtia revolvens*	a Moss				S2S3	3 Sensitive	1	93.3 ± 0.0	NS
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S2S3	3 Sensitive	1	75.2 ± 0.0	NS
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S2S3	3 Sensitive	3	15.7 ± 0.0	NS
N	*Leptogium teretiusculum*	Beaded Jellyskin Lichen				S2S3	3 Sensitive	2	49.7 ± 0.0	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S2S3	3 Sensitive	13	6.3 ± 0.0	NS
N	*Physconia detersa*	Bottlebrush Frost Lichen				S2S3	3 Sensitive	1	8.5 ± 0.0	NS
N	*Peltigera collina*	Tree Pelt Lichen				S2S3	3 Sensitive	4	20.9 ± 0.0	NS
N	*Cladina stygia*	Black-footed Reindeer Lichen				S2S3	3 Sensitive	2	9.7 ± 0.0	NS
N	*Usnea flammea*	Coastal Bushy Beard Lichen				S2S3	3 Sensitive	1	83.6 ± 1.0	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened			S3?	3 Sensitive	2	8.5 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3?	3 Sensitive	11	6.0 ± 0.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3?	3 Sensitive	1	38.4 ± 0.0	NS
N	*Collema furfuraceum*	Blistered Tarpaper Lichen				S3?	3 Sensitive	2	23.8 ± 0.0	NS
P	*Clethra alnifolia*	Coast Pepper-Bush	Special Concern	Special Concern	Vulnerable	S1	1 At Risk	2	71.8 ± 0.0	NS
P	*Helianthemum canadense*	Long-branched Frostweed			Endangered	S1	1 At Risk	2	88.2 ± 1.0	NS
P	*Cypripedium arietinum*	Ram's-Head Lady's-Slipper			Endangered	S1	1 At Risk	56	95.6 ± 2.0	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S1	1 At Risk	7	56.6 ± 0.0	NS

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P	*Sanicula odorata*	Clustered Sanicle				S1	2 May Be At Risk	7	61.9 ± 0.0	NS
P	*Zizia aurea*	Golden Alexanders				S1	2 May Be At Risk	41	21.4 ± 1.0	NS
P	*Antennaria parlinii*	a Pussytoes				S1	2 May Be At Risk	6	73.2 ± 7.0	NS
P	*Cynoglossum virginianum var. boreale*	Wild Comfrey				S1	2 May Be At Risk	3	99.5 ± 1.0	NS
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	2 May Be At Risk	8	47.1 ± 0.0	NS
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	2 May Be At Risk	1	75.9 ± 7.0	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	2 May Be At Risk	5	76.1 ± 7.0	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S1	2 May Be At Risk	20	54.2 ± 0.0	NS
P	*Desmodium glutinosum*	Large Tick-Trefoil				S1	2 May Be At Risk	4	91.8 ± 0.0	NS
P	*Ribes americanum*	Wild Black Currant				S1	5 Undetermined	3	58.1 ± 5.0	NS
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1	2 May Be At Risk	1	40.4 ± 0.0	NS
P	*Fraxinus pennsylvanica*	Red Ash				S1	2 May Be At Risk	3	83.0 ± 5.0	NS
P	*Polygala polygama*	Racemed Milkwort				S1	5 Undetermined	1	73.9 ± 1.0	NS
P	*Polygonum careyi*	Carey's Smartweed				S1	5 Undetermined	1	40.5 ± 3.0	NS
P	*Montia fontana*	Water Blinks				S1	2 May Be At Risk	1	75.3 ± 1.0	NS
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	5 Undetermined	1	93.5 ± 0.0	NS
P	*Ranunculus pensylvanicus*	Pennsylvania Buttercup				S1	2 May Be At Risk	1	98.2 ± 0.0	NS
P	*Salix myrtillifolia*	Blueberry Willow				S1	2 May Be At Risk	1	31.3 ± 0.0	NS
P	*Salix serissima*	Autumn Willow				S1	2 May Be At Risk	1	31.3 ± 0.0	NS
P	*Dirca palustris*	Eastern Leatherwood				S1	2 May Be At Risk	14	53.4 ± 1.0	NS
P	*Boehmeria cylindrica*	Small-spike False-nettle				S1	2 May Be At Risk	2	52.7 ± 0.0	NS
P	*Pilea pumila*	Dwarf Clearweed				S1	2 May Be At Risk	4	47.3 ± 0.0	NS
P	*Carex garberi*	Garber's Sedge				S1	2 May Be At Risk	4	53.1 ± 0.0	NS
P	*Carex gynocrates*	Northern Bog Sedge				S1	2 May Be At Risk	2	31.3 ± 0.0	NS
P	*Carex haydenii*	Hayden's Sedge				S1	2 May Be At Risk	2	59.5 ± 1.0	NS
P	*Carex pellita*	Woolly Sedge				S1	2 May Be At Risk	10	18.3 ± 10.0	NS
P	*Carex plantaginea*	Plantain-Leaved Sedge				S1	2 May Be At Risk	3	35.9 ± 0.0	NS
P	*Carex viridula var. saxilittoralis*	Greenish Sedge				S1	2 May Be At Risk	4	25.0 ± 0.0	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	6	96.8 ± 0.0	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	3	78.4 ± 0.0	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2 May Be At Risk	2	67.3 ± 7.0	NS
P	*Juncus vaseyi*	Vasey Rush				S1	2 May Be At Risk	1	52.7 ± 0.0	NS
P	*Allium tricoccum*	Wild Leek				S1	2 May Be At Risk	8	58.0 ± 0.0	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S1	2 May Be At Risk	28	32.4 ± 0.0	NS
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1	2 May Be At Risk	19	31.8 ± 0.0	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S1	2 May Be At Risk	17	31.8 ± 0.0	NS
P	*Elymus hystrix var. bigeloviana*	Spreading Wild Rye				S1	2 May Be At Risk	10	46.5 ± 1.0	NS
P	*Festuca subverticillata*	Nodding Fescue				S1	2 May Be At Risk	2	69.9 ± 1.0	NS
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	2 May Be At Risk	1	62.0 ± 5.0	NS
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2 May Be At Risk	7	59.8 ± 1.0	NS
P	*Botrychium lunaria*	Common Moonwort				S1	2 May Be At Risk	3	58.6 ± 2.0	NS
P	*Selaginella rupestris*	Rock Spikemoss				S1	2 May Be At Risk	1	98.8 ± 0.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	2 May Be At Risk	2	30.0 ± 7.0	NS
P	*Suaeda rolandii*	Roland's Sea-Blite				S1?	2 May Be At Risk	2	99.1 ± 2.0	NS
P	*Crataegus robinsonii*	Robinson's Hawthorn				S1?	5 Undetermined	3	58.1 ± 5.0	NS
P	*Crataegus submollis*	Quebec Hawthorn				S1?	5 Undetermined	7	62.0 ± 7.0	NS
P	*Carex pensylvanica*	Pennsylvania Sedge				S1?	2 May Be At Risk	1	59.9 ± 0.0	NS

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P	*Dichanthelium acuminatum var. lindheimeri*	Woolly Panic Grass				S1?	5 Undetermined	1	67.0 ± 0.0	NS
P	*Fraxinus nigra*	Black Ash			Threatened	S1S2	1 At Risk	64	30.8 ± 0.0	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	8	49.0 ± 7.0	NS
P	*Chenopodium rubrum*	Red Pigweed				S1S2	2 May Be At Risk	4	25.6 ± 2.0	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	3 Sensitive	5	54.9 ± 5.0	NS
P	*Hepatica nobilis var. obtusa*	Round-lobed Hepatica				S1S2	2 May Be At Risk	23	31.2 ± 1.0	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S1S2	2 May Be At Risk	20	68.6 ± 0.0	NS
P	*Parnassia palustris var. parviflora*	Marsh Grass-of-Parnassus				S1S2	2 May Be At Risk	1	99.1 ± 1.0	NS
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S1S2	3 Sensitive	5	38.2 ± 0.0	NS
P	*Juncus greenei*	Greene's Rush				S1S2	2 May Be At Risk	4	65.0 ± 1.0	NS
P	*Sparganium hyperboreum*	Northern Burreed				S1S2	3 Sensitive	1	94.0 ± 0.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5 Undetermined	2	32.3 ± 0.0	NS
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	6	91.5 ± 0.0	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2	3 Sensitive	2	54.3 ± 7.0	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S2	3 Sensitive	2	61.7 ± 5.0	NS
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	2 May Be At Risk	17	51.1 ± 0.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2	3 Sensitive	3	21.1 ± 1.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2	3 Sensitive	3	55.8 ± 0.0	NS
P	*Lactuca hirsuta var. sanguinea*	Hairy Lettuce				S2	3 Sensitive	1	49.4 ± 7.0	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S2	3 Sensitive	23	23.9 ± 0.0	NS
P	*Symphyotrichum undulatum*	Wavy-leaved Aster				S2	3 Sensitive	5	76.5 ± 7.0	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S2	3 Sensitive	15	29.1 ± 3.0	NS
P	*Impatiens pallida*	Pale Jewelweed				S2	3 Sensitive	1	81.0 ± 7.0	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2	2 May Be At Risk	52	32.4 ± 0.0	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S2	3 Sensitive	22	13.2 ± 0.0	NS
P	*Arabis drummondii*	Drummond's Rockcress				S2	3 Sensitive	6	53.3 ± 0.0	NS
P	*Cardamine parviflora var. arenicola*	Small-flowered Bittercress				S2	3 Sensitive	4	25.5 ± 0.0	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2	3 Sensitive	5	20.2 ± 0.0	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	11	29.3 ± 0.0	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	3 Sensitive	11	71.3 ± 2.0	NS
P	*Hypericum majus*	Large St John's-wort				S2	3 Sensitive	2	71.7 ± 7.0	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2	3 Sensitive	9	31.2 ± 0.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S2	3 Sensitive	3	32.4 ± 0.0	NS
P	*Oenothera fruticosa ssp. glauca*	Narrow-leaved Evening Primrose				S2	5 Undetermined	4	58.2 ± 7.0	NS
P	*Rumex salicifolius var. mexicanus*	Triangular-valve Dock				S2	3 Sensitive	2	41.0 ± 0.0	NS
P	*Primula mistassinica*	Mistassini Primrose				S2	3 Sensitive	16	31.1 ± 1.0	NS
P	*Anemone canadensis*	Canada Anemone				S2	2 May Be At Risk	1	92.1 ± 7.0	NS
P	*Anemone quinquefolia*	Wood Anemone				S2	3 Sensitive	17	31.3 ± 0.0	NS
P	*Anemone virginiana*	Virginia Anemone				S2	3 Sensitive	19	54.9 ± 0.0	NS
P	*Anemone virginiana var. virginiana*	Virginia Anemone				S2	3 Sensitive	2	53.9 ± 7.0	NS

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P	*Caltha palustris*	Yellow Marsh Marigold				S2	3 Sensitive	1	78.7 ± 0.0	NS
P	*Galium boreale*	Northern Bedstraw				S2	2 May Be At Risk	2	96.8 ± 5.0	NS
P	*Galium labradoricum*	Labrador Bedstraw				S2	3 Sensitive	34	30.8 ± 0.0	NS
P	*Salix pedicellaris*	Bog Willow				S2	3 Sensitive	35	20.5 ± 1.0	NS
P	*Salix sericea*	Silky Willow				S2	2 May Be At Risk	1	62.2 ± 1.0	NS
P	*Tiarella cordifolia*	Heart-leaved Foamflower				S2	3 Sensitive	217	29.6 ± 5.0	NS
P	*Agalinis maritima*	Saltmarsh Agalinis				S2	3 Sensitive	1	68.8 ± 0.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S2	3 Sensitive	8	21.4 ± 1.0	NS
P	*Carex bebbii*	Bebb's Sedge				S2	3 Sensitive	9	54.3 ± 0.0	NS
P	*Carex castanea*	Chestnut Sedge				S2	2 May Be At Risk	3	31.3 ± 0.0	NS
P	*Carex comosa*	Bearded Sedge				S2	3 Sensitive	2	67.9 ± 0.0	NS
P	*Carex hystericina*	Porcupine Sedge				S2	2 May Be At Risk	1	86.2 ± 0.0	NS
P	*Carex tenera*	Tender Sedge				S2	3 Sensitive	6	62.2 ± 1.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S2	3 Sensitive	22	68.7 ± 0.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2	3 Sensitive	4	55.3 ± 7.0	NS
P	*Vallisneria americana*	Wild Celery				S2	2 May Be At Risk	4	35.7 ± 7.0	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S2	2 May Be At Risk	1	60.7 ± 7.0	NS
P	*Lilium canadense*	Canada Lily				S2	2 May Be At Risk	97	32.7 ± 0.0	NS
P	*Najas gracillima*	Thread-Like Naiad				S2	3 Sensitive	2	89.9 ± 0.0	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	3 Sensitive	7	73.7 ± 7.0	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	2 May Be At Risk	27	21.4 ± 1.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2	3 Sensitive	7	46.2 ± 1.0	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S2	5 Undetermined	8	58.2 ± 7.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	3 Sensitive	11	66.6 ± 1.0	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	2 May Be At Risk	23	50.8 ± 1.0	NS
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	4	53.3 ± 0.0	NS
P	*Piptatherum canadense*	Canada Rice Grass				S2	3 Sensitive	8	40.5 ± 3.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2	2 May Be At Risk	2	56.0 ± 5.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	2 May Be At Risk	5	65.3 ± 1.0	NS
P	*Asplenium trichomanes-ramosum*	Green Spleenwort				S2	3 Sensitive	1	96.2 ± 7.0	NS
P	*Dryopteris fragrans var. remotiuscula*	Fragrant Wood Fern				S2	3 Sensitive	4	62.6 ± 7.0	NS
P	*Woodsia glabella*	Smooth Cliff Fern				S2	3 Sensitive	1	86.4 ± 1.0	NS
P	*Symphyotrichum boreale*	Boreal Aster				S2?	3 Sensitive	3	60.7 ± 7.0	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	5 Undetermined	2	72.8 ± 1.0	NS
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	2	73.5 ± 1.0	NS
P	*Carex peckii*	White-Tinged Sedge				S2?	2 May Be At Risk	4	46.3 ± 0.0	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2?	3 Sensitive	5	69.4 ± 0.0	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2?	3 Sensitive	7	33.9 ± 0.0	NS
P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S2S3	3 Sensitive	3	20.6 ± 2.0	NS
P	*Sagina nodosa*	Knotted Pearlwort				S2S3	4 Secure	38	24.7 ± 0.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2S3	4 Secure	7	23.8 ± 0.0	NS
P	*Ceratophyllum echinatum*	Prickly Hornwort				S2S3	3 Sensitive	2	32.8 ± 0.0	NS
P	*Hypericum dissimulatum*	Disguised St John's-wort				S2S3	3 Sensitive	3	70.6 ± 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	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	82	51.1 ± 0.0	NS
P	*Shepherdia canadensis*	Soapberry				S2S3	3 Sensitive	19	92.1 ± 7.0	NS
P	*Empetrum eamesii ssp. atropurpureum*	Pink Crowberry				S2S3	3 Sensitive	4	71.5 ± 7.0	NS
P	*Empetrum eamesii ssp. eamesii*	Pink Crowberry				S2S3	3 Sensitive	5	71.5 ± 7.0	NS
P	*Chamaesyce polygonifolia*	Seaside Spurge				S2S3	3 Sensitive	1	83.9 ± 2.0	NS
P	*Halenia deflexa*	Spurred Gentian				S2S3	3 Sensitive	4	64.5 ± 1.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	3 Sensitive	4	16.9 ± 5.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S2S3	3 Sensitive	16	33.4 ± 5.0	NS
P	*Polygonum buxiforme*	Small's Knotweed				S2S3	5 Undetermined	3	60.7 ± 7.0	NS
P	*Plantago rugelii*	Rugel's Plantain				S2S3	4 Secure	7	34.3 ± 0.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3 Sensitive	1	61.5 ± 5.0	NS
P	*Galium aparine*	Common Bedstraw				S2S3	3 Sensitive	17	22.1 ± 0.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3 Sensitive	3	38.5 ± 0.0	NS
P	*Veronica serpyllifolia ssp. humifusa*	Thyme-Leaved Speedwell				S2S3	3 Sensitive	1	47.5 ± 0.0	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	3 Sensitive	7	39.8 ± 7.0	NS
P	*Carex hirtifolia*	Pubescent Sedge				S2S3	3 Sensitive	47	31.0 ± 4.0	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	3 Sensitive	1	46.8 ± 1.0	NS
P	*Carex swanii*	Swan's Sedge				S2S3	3 Sensitive	2	66.7 ± 0.0	NS
P	*Eleocharis olivacea*	Yellow Spikerush				S2S3	3 Sensitive	6	35.4 ± 0.0	NS
P	*Elodea canadensis*	Canada Waterweed				S2S3	4 Secure	5	52.9 ± 0.0	NS
P	*Coeloglossum viride var. virescens*	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	1	90.9 ± 0.0	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S2S3	3 Sensitive	124	60.8 ± 0.0	NS
P	*Poa glauca*	Glaucous Blue Grass				S2S3	3 Sensitive	1	91.8 ± 1.0	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S2S3	3 Sensitive	13	6.4 ± 7.0	NS
P	*Botrychium lanceolatum var. angustisegmentum*	Lance-Leaf Grape-Fern				S2S3	3 Sensitive	4	38.5 ± 5.0	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3 Sensitive	2	42.0 ± 0.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	4	55.3 ± 7.0	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	4 Secure	1	35.0 ± 0.0	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	3 Sensitive	19	65.1 ± 0.0	NS
P	*Hieracium paniculatum*	Panicled Hawkweed				S3	4 Secure	6	64.1 ± 0.0	NS
P	*Megalodonta beckii*	Water Beggarticks				S3	4 Secure	12	35.5 ± 5.0	NS
P	*Packera paupercula*	Balsam Groundsel				S3	4 Secure	36	53.1 ± 0.0	NS
P	*Campanula aparinoides*	Marsh Bellflower				S3	3 Sensitive	34	32.9 ± 0.0	NS
P	*Minuartia groenlandica*	Greenland Stitchwort				S3	3 Sensitive	21	35.7 ± 7.0	NS
P	*Viburnum edule*	Squashberry				S3	3 Sensitive	2	67.0 ± 0.0	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	3 Sensitive	78	71.7 ± 7.0	NS
P	*Vaccinium boreale*	Northern Blueberry				S3	3 Sensitive	3	28.1 ± 0.0	NS
P	*Vaccinium caespitosum*	Dwarf Bilberry				S3	4 Secure	55	36.4 ± 0.0	NS
P	*Vaccinium uliginosum*	Alpine Bilberry				S3	3 Sensitive	3	78.8 ± 1.0	NS
P	*Bartonia virginica*	Yellow Bartonia				S3	4 Secure	24	62.2 ± 7.0	NS
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4 Secure	10	21.0 ± 1.0	NS
P	*Proserpinaca palustris var. crebra*	Marsh Mermaidweed				S3	4 Secure	25	29.4 ± 2.0	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3	4 Secure	3	28.9 ± 1.0	NS
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	8	49.9 ± 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	*Epilobium strictum*	Downy Willowherb				S3	3 Sensitive	2	55.6 ± 0.0	NS
P	*Polygonum pensylvanicum*	Pennsylvania Smartweed				S3	4 Secure	13	26.4 ± 1.0	NS
P	*Polygonum scandens*	Climbing False Buckwheat				S3	3 Sensitive	29	30.9 ± 0.0	NS
P	*Samolus valerandi ssp. parviflorus*	Seaside Brookweed				S3	3 Sensitive	7	72.5 ± 5.0	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3	4 Secure	8	35.7 ± 50.0	NS
P	*Pyrola minor*	Lesser Pyrola				S3	3 Sensitive	1	73.1 ± 0.0	NS
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	24	21.4 ± 5.0	NS
P	*Rhamnus alnifolia*	Alder-leaved Buckthorn				S3	4 Secure	51	19.5 ± 1.0	NS
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	102	31.4 ± 5.0	NS
P	*Salix petiolaris*	Meadow Willow				S3	4 Secure	18	30.4 ± 0.0	NS
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	2	21.0 ± 5.0	NS
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3	4 Secure	4	69.2 ± 0.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	6	28.7 ± 5.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	4 Secure	14	58.7 ± 0.0	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	3 Sensitive	33	33.7 ± 0.0	NS
P	*Verbena hastata*	Blue Vervain				S3	4 Secure	107	47.1 ± 0.0	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	3 Sensitive	6	61.7 ± 0.0	NS
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	34	30.8 ± 0.0	NS
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	22	38.5 ± 0.0	NS
P	*Carex wiegandii*	Wiegand's Sedge				S3	3 Sensitive	2	39.2 ± 2.0	NS
P	*Eleocharis nitida*	Quill Spikerush				S3	4 Secure	1	80.3 ± 5.0	NS
P	*Juncus subcaudatus var. planisepalus*	Woods-Rush				S3	3 Sensitive	12	19.1 ± 1.0	NS
P	*Juncus dudleyi*	Dudley's Rush				S3	4 Secure	40	22.2 ± 1.0	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3	3 Sensitive	2	23.9 ± 0.0	NS
P	*Listera australis*	Southern Twayblade				S3	4 Secure	83	29.1 ± 0.0	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	4 Secure	96	31.5 ± 0.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	4 Secure	4	90.6 ± 0.0	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	4 Secure	17	60.7 ± 7.0	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3	4 Secure	7	72.2 ± 0.0	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3	4 Secure	10	54.9 ± 1.0	NS
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3	4 Secure	158	44.6 ± 4.0	NS
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	8	69.7 ± 0.0	NS
P	*Sparganium natans*	Small Burreed				S3	4 Secure	10	29.1 ± 1.0	NS
P	*Equisetum pratense*	Meadow Horsetail				S3	3 Sensitive	10	47.7 ± 0.0	NS
P	*Equisetum variegatum*	Variegated Horsetail				S3	4 Secure	23	37.4 ± 0.0	NS
P	*Isoetes acadiensis*	Acadian Quillwort				S3	3 Sensitive	4	51.5 ± 14.0	NS
P	*Huperzia appalachiana*	Appalachian Fir-Clubmoss				S3	3 Sensitive	6	65.4 ± 5.0	NS
P	*Botrychium dissectum*	Cut-leaved Moonwort				S3	4 Secure	4	49.8 ± 1.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S3	4 Secure	5	45.7 ± 1.0	NS
P	*Asclepias incarnata ssp. pulchra*	Swamp Milkweed				S3?	5 Undetermined	33	29.1 ± 1.0	NS
P	*Polygonum amphibium var. emersum*	Water Smartweed				S3?	5 Undetermined	1	51.1 ± 0.0	NS
P	*Amelanchier stolonifera*	Running Serviceberry				S3?	4 Secure	3	23.8 ± 0.0	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3?	4 Secure	8	31.3 ± 0.0	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3?	4 Secure	5	65.6 ± 0.0	NS
P	*Carex foenea*	Fernald's Hay Sedge				S3?	4 Secure	11	35.5 ± 0.0	NS
P	*Triglochin gaspensis*	Gasp├⌐ Arrowgrass				S3?	5 Undetermined	21	23.3 ± 0.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3?	3 Sensitive	9	52.3 ± 1.0	NS
P	*Lycopodium*	Ground-Fir				S3?	4 Secure	4	62.8 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	sabinifolium									
P	*Lycopodium sitchense*	Sitka Clubmoss				S3?	4 Secure	2	61.5 ± 5.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3?	5 Undetermined	10	29.1 ± 0.0	NS
P	*Atriplex franktonii*	Frankton's Saltbush				S3S4	4 Secure	1	93.5 ± 2.0	NS
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	7	23.7 ± 0.0	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	4 Secure	2	72.2 ± 0.0	NS
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	5	32.8 ± 0.0	NS
P	*Sanguinaria canadensis*	Bloodroot				S3S4	4 Secure	113	29.6 ± 5.0	NS
P	*Polygonum fowleri*	Fowler's Knotweed				S3S4	4 Secure	3	23.8 ± 0.0	NS
P	*Rumex maritimus*	Sea-Side Dock				S3S4		5	25.5 ± 0.0	NS
P	*Rumex maritimus var. fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	12	25.0 ± 2.0	NS
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	4 Secure	47	29.0 ± 0.0	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	4 Secure	5	70.8 ± 0.0	NS
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	5	24.5 ± 0.0	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	4 Secure	2	53.0 ± 0.0	NS
P	*Luzula parviflora*	Small-flowered Woodrush				S3S4	4 Secure	3	47.7 ± 0.0	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	4 Secure	3	62.8 ± 5.0	NS
P	*Panicum tuckermanii*	Tuckerman's Panic Grass				S3S4	4 Secure	3	91.3 ± 0.0	NS
P	*Trisetum spicatum*	Narrow False Oats				S3S4	4 Secure	10	53.1 ± 0.0	NS
P	*Cystopteris bulbifera*	Bulblet Bladder Fern				S3S4	4 Secure	68	28.9 ± 0.0	NS
P	*Equisetum hyemale var. affine*	Common Scouring-rush				S3S4	4 Secure	26	42.1 ± 0.0	NS
P	*Equisetum scirpoides*	Dwarf Scouring-Rush				S3S4	4 Secure	43	45.7 ± 0.0	NS
P	*Lycopodium complanatum*	Northern Clubmoss				S3S4	4 Secure	5	24.5 ± 0.0	NS
P	*Solidago simplex var. randii*	Sticky Goldenrod				SH	0.1 Extirpated	1	62.3 ± 1.0	NS
P	*Viola canadensis*	Canada Violet				SH	0.1 Extirpated	1	54.3 ± 7.0	NS
P	*Juglans cinerea*	Butternut	Endangered	Endangered		SNA	7 Exotic	1	90.2 ± 0.0	NS
P	*Liatris spicata*	Dense Blazing Star	Threatened	Threatened		SNA		1	73.1 ± 0.0	NS
P	*Bartonia paniculata ssp. paniculata*	Branched Bartonia	Threatened	Threatened		SNA		1	24.0 ± 10.0	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

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

# recs	CITATION
8400	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
2454	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
2068	Morrison, Guy. 2011. Maritime Shorebird Survey (MSS) database. Canadian Wildlife Service, Ottawa, 15939 surveys. 86171 recs.
520	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2014. Atlantic Canada Conservation Data Centre Fieldwork 2014. Atlantic Canada Conservation Data Centre, # recs.
406	Blaney, C.S.; Mazerolle, D.M. 2010. Fieldwork 2010. Atlantic Canada Conservation Data Centre. Sackville NB, 15508 recs.
313	Amirault, D.L. & Stewart, J. 2007. Piping Plover Database 1894-2006. Canadian Wildlife Service, Sackville, 3344 recs, 1228 new.
309	Benjamin, L.K. (compiler). 2012. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 4965 recs.
282	Blaney, C.S.; Mazerolle, D.M. 2012. Fieldwork 2012. Atlantic Canada Conservation Data Centre, 13,278 recs.
233	Newell, R.E. 2000. E.C. Smith Herbarium Database. Acadia University, Wolfville NS, 7139 recs.
232	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
220	Neily, T.H. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.

# recs	CITATION
217	Blaney, C.S & Spicer, C.D.; Popma, T.M.; Basquill, S.P. 2003. Vascular Plant Surveys of Northumberland Strait Rivers & Amherst Area Peatlands. Nova Scotia Museum Research Grant, 501 recs.
213	Hicks, Andrew. 2009. Coastal Waterfowl Surveys Database, 2000-08. Canadian Wildlife Service, Sackville, 46488 recs (11149 non-zero).
208	LaPaix, R.W.; Crowell, M.J.; MacDonald, M. 2011. Stantec rare plant records, 2010-11. Stantec Consulting, 334 recs.
182	Blaney, C.S.; Mazerolle, D.M.; Hill, N.M. 2011. Nova Scotia Crown Share Land Legacy Trust Fieldwork. Atlantic Canada Conservation Data Centre, 5022 recs.
170	Bryson, I. 2013. Nova Scotia rare plant records. CBCL Ltd., 180 records.
166	Klymko, J.J.D. 2014. Maritimes Butterfly Atlas, 2012 submissions. Atlantic Canada Conservation Data Centre, 8552 records.
165	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
162	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.
154	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia. , 181 records.
146	Newell, R. E. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University. 2013.
142	Scott, F.W. 2002. Nova Scotia Herpetofauna Atlas Database. Acadia University, Wolfville NS, 8856 recs.
128	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
119	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
117	Blaney, C.S.; Mazerolle, D.M. 2011. Fieldwork 2011. Atlantic Canada Conservation Data Centre. Sackville NB.
116	Cameron, E. 2008. Canadian Gypsum Co. survey 2007-08. Conestoga-Rovers & Assoc., 623 recs.
93	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
93	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.
92	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
87	Wilhelm, S.I. et al. 2011. Colonial Waterbird Database. Canadian Wildlife Service, Sackville, 2698 sites, 9718 recs (8192 obs).
65	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
60	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.
53	Klymko, J.J.D. 2012. Maritimes Butterfly Atlas, 2010 and 2011 records. Atlantic Canada Conservation Data Centre, 6318 recs.
52	Porter, C.J.M. 2014. Field work data 2007-2014. Nova Scotia Nature Trust, 96 recs.
48	Nova Scotia Nature Trust. 2013. Nova Scotia Nature Trust 2013 Species records. Nova Scotia Nature Trust, 95 recs.
47	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
44	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
41	Amirault, D.L. & McKnight, J. 2003. Piping Plover Database 1991-2003. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
38	Blaney, C.S.; Spicer, C.D.; Popma, T.M.; Hanel, C. 2002. Fieldwork 2002. Atlantic Canada Conservation Data Centre. Sackville NB, 2252 recs.
37	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2013. Atlantic Canada Conservation Data Centre Fieldwork 2013. Atlantic Canada Conservation Data Centre, 9000+ recs.
34	Cameron, R.P. 2011. Lichen observations, 2011. Nova Scotia Environment & Labour, 731 recs.
33	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.
33	Neily, T.H. 2010. Erioderma Pedicellatum records 2005-09. Mersey Tobiatic Research Institute, 67 recs.
32	Belland, R.J. Maritimes moss records from various herbarium databases. 2014.
32	Cameron, R.P. 2009. Cyanolichen database. Nova Scotia Environment & Labour, 1724 recs.
29	Popma, T.M. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 113 recs.
28	Cameron, R.P. 2013. 2013 rare species field data. Nova Scotia Department of Environment, 71 recs.
28	Pepper, Chris. 2012. Observations of breeding Canada Warbler's along the Eastern Shore, NS. Pers. comm. to S. Blaney, Jan. 20, 28 recs.
25	Blaney, C.S.; Spicer, C.D.; Rothfels, C. 2004. Fieldwork 2004. Atlantic Canada Conservation Data Centre. Sackville NB, 1343 recs.
25	Cameron, R.P. 2014. 2013-14 rare species field data. Nova Scotia Department of Environment, 35 recs.
24	Belliveau, A. 2013. Rare species records from Nova Scotia. Mersey Tobeatic Research Institute, 296 records. 296 recs.
23	Benjamin, L.K. 2011. NSDNR fieldwork & consultant reports 1997, 2009-10. Nova Scotia Dept Natural Resources, 85 recs.
22	Belliveau, A.G. 2014. Plant Records from Southern and Central Nova Scotia. Atlantic Canada Conservation Data Centre, 919 recs.
20	Blaney, C.S.; Mazerolle, D.M.; Oberndorfer, E. 2007. Fieldwork 2007. Atlantic Canada Conservation Data Centre. Sackville NB, 13770 recs.
19	Benjamin, L.K. 2012. NSDNR fieldwork & consultant reports 2008-2012. Nova Scotia Dept Natural Resources, 196 recs.
19	Powell, B.C. 1967. Female sexual cycles of Chrysemy spicta & Clemmys insculpta in Nova Scotia. Can. Field-Nat., 81:134-139. 26 recs.
18	Neily, T.H. 2012. 2012 Erioderma pedicellatum records in Nova Scotia.
18	Pulsifer, M.D. 2002. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 369 recs.
17	Robinson, S.L. 2014. 2013 Field Data. Atlantic Canada Conservation Data Centre.
16	Klymko, J.J.D.; Robinson, S.L. 2012. 2012 field data. Atlantic Canada Conservation Data Centre, 447 recs.
15	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
15	Gilhen, J. 1984. Amphibians & Reptiles of Nova Scotia, 1st Ed. Nova Scotia Museum, 164pp.
14	Blaney, C.S.; Mazerolle, D.M. 2008. Fieldwork 2008. Atlantic Canada Conservation Data Centre. Sackville NB, 13343 recs.
14	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
14	Robinson, S.L. 2015. 2014 field data.
13	Archibald, D.R. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 213 recs.
13	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
13	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
13	Nova Scotia Nature Trust. 2014. Ladyslipper records from Saint Croix Nova Scotia, JLC Ed. Nova Scotia Nature Trust.

# recs	CITATION
12	Basquill, S.P. 2012. 2012 rare vascular plant field data. Nova Scotia Department of Natural Resources, 37 recs.
12	Neily, T.H. 2013. Email communication to Sean Blaney regarding Listera australis observations made from 2007 to 2011 in Nova Scotia. , 50.
11	Cameron, R.P. 2012. Rob Cameron 2012 vascular plant data. NS Department of Environment, 30 recs.
9	Benjamin, L.K. (compiler). 2002. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 32 spp, 683 recs.
9	Cameron, R.P. 2005. Erioderma pedicellatum unpublished data. NS Dept of Environment, 9 recs.
9	Cameron, R.P. 2006. Erioderma pedicellatum 2006 field data. NS Dept of Environment, 9 recs.
9	Hall, R.A. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 189 recs.
8	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
8	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.
7	Cameron, B. 2006. Hepatica americana Survey at Scotia Mine Site in Gays River, and Discovery of Three Yellow-listed Species. Conestoga-Rovers and Associates, (a consulting firm), october 25. 7 recs.
6	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.
6	Hall, R. 2008. Rare plant records in old fieldbook notes from Truro area. Pers. comm. to C.S. Blaney. 6 recs, 6 recs.
6	Hall, R.A. 2001. S.. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 178 recs.
6	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
6	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
5	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
5	Benjamin, L.K. 2009. Boreal Felt Lichen, Mountain Avens, Orchid and other recent records. Nova Scotia Dept Natural Resources, 105 recs.
5	Blaney, C.S.; Spicer, C.D.; Mazerolle, D.M. 2005. Fieldwork 2005. Atlantic Canada Conservation Data Centre. Sackville NB, 2333 recs.
5	Cameron, R.P. 2012. Additional rare plant records, 2009. , 7 recs.
5	Towell, C. 2014. 2014 Northern Goshawk and Common Nighthawk email reports, NS. NS Department of Natural Resources.
5	Whittam, R.M. 1997. Status Report on the Roseate Tern (Sterna dougallii) in Canada. Committee on the Status of Endangered Wildlife in Canada, 5 recs.
4	Benjamin, L.K. 2006. Cypripedium arietinum. Pers. comm. to D. Mazerolle. 9 recs, 9 recs.
4	Blaney, C.S. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 1042 recs.
4	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
4	Boyne, A.W. & Grecian, V.D. 1999. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 23 recs.
4	Bredin, K.A. 2002. NS Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centere, 30 recs.
4	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
4	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
4	Clayden, S.R. 2005. Confidential supplement to Status Report on Ghost Antler Lichen (Pseudevernia cladonia). Committee on the Status of Endangered Wildlife in Canada, 27 recs.
4	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.
4	Frittaion, C. 2012. NSNT 2012 Field Observations. Nova Scotia Nature Trust, Pers comm. to S. Blaney Feb. 7, 34 recs.
4	Klymko, J.J.D.; Robinson, S.L. 2014. 2013 field data. Atlantic Canada Conservation Data Centre.
4	O'Neil, S. 1998. Atlantic Salmon: Eastern Shore Nova Scotia SFA 20. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-10. 4 recs.
3	Blaney, C.S. Miscellaneous specimens received by ACCDC (botany). Various persons. 2001-08.
3	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
3	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
3	LaPaix, R.; Parker, M. 2013. email to Sean Blaney regarding Listera australis observations near Kearney Lake. East Coast Aquatics, 2.
3	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.
3	WIlliams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
2	Basquill, S.P. 2009. 2009 field observations. Nova Scotia Dept of Natural Resources.
2	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
2	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
2	Munro, M. 2003. Caulophyllum thalictroides & Carex hirtifolia at Herbert River, Brooklyn, NS. , Pers. comm. to C.S. Blaney. 2 recs.
2	Neily, T.H.; Smith, C.; Whitman, E. 2011. NCC Logging Lake (Halifax Co. NS) properties baseline survey data. Nature Conservancy of Canada, 2 recs.
2	Plissner, J.H. & Haig, S.M. 1997. 1996 International piping plover census. US Geological Survey, Corvallis OR, 231 pp.
2	Porter, K. 2013. 2013 rare and non-rare vascular plant field data. St. Mary's University, 57 recs.
2	Robinson, S.L. 2011. 2011 ND dune survey field data. Atlantic Canada Conservation Data Centre, 2715 recs.
2	Sabine, D.L. 2013. Dwaine Sabine butterfly records, 2009 and earlier.
2	Sollows, M.C,. 2008. NBM Science Collections databases: mammals. New Brunswick Museum, Saint John NB, download Jan. 2008, 4983 recs.
2	Standley, L.A. 2002. Carex haydenii in Nova Scotia. , Pers. comm. to C.S. Blaney. 4 recs.
2	Whittam, R.M. et al. 1998. Country Island Tern Restoration Project. Canadian Wildlife Service, Sackville, 2 recs.
1	Amiro, Peter G. 1998. Atlantic Salmon: Inner Bay of Fundy SFA 22 & part of SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-12. 4 recs.
1	Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
1	Basquill, S. P. 2008. Nova Scotia Dept of Natural Resources.
1	Basquill, S.P. 2011. Field observations & specimen collections, 2010. Nova Scotia Department of Natural Resources, Pers. comm. , 8 Recs.
1	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
1	Benedict, B. Connell Herbarium Specimens, Digital photos. University New Brunswick, Fredericton. 2005.
1	Bruce, J. 2014. 2014 Wood Turtle email report, Nine Mile River, NS. NS Department of Natural Resources.

# recs	CITATION
1	Clayden, S.R. 2006. Pseudevernia cladonia records. NB Museum. Pers. comm. to S. Blaney, Dec, 4 recs.
1	Crowell, A. 2004. Cypripedium arietinum in Weir Brook, Hants Co. Pers. comm. to S. Blaney, 1 rec.
1	Daury, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (Bucephala islandica) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
1	Doubt, J. 2013. Email to Sean Blaney with Nova Scotia records of Fissidens exilis at Canadian Museum of Nature. pers. comm., 3 records.
1	Jacques Whitford Ltd. 2003. Cananda Lily location. Pers. Comm. to S. Blaney. 2pp, 1 rec, 1 rec.
1	Klymko, J.J.D. 2012. Insect field work & submissions. Atlantic Canada Conservation Data Centre, 852 recs.
1	Lautenschlager, R.A. 2010. Miscellaneous observations reported to ACCDC (zoology). Pers. comm. from various persons, 2 recs.
1	MacKinnon, D.; Wright, P.; Smith, D. 2014. 2014 Common Tern email report, Eastern Passage, NS. NS Department of Environment.
1	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
1	Neily, P.D. Plant Specimens. Nova Scotia Dept Natural Resources, Truro. 2006.
1	Neily, T.H. & Anderson, F. 2011. Lichen observations from NRC site at Sandy Cove. , 97.
1	Nelly, T.H. 2006. Cypripedium arietinum in Hants Co. Pers. comm. to C.S. Blaney. 22 recs, 22 recs.
1	Newell, R.B.; Sam, D. 2014. 2014 Bloodroot personal communication report, Antigonish, NS. NS Department of Natural Resources.
1	Robinson, C.B. 1907. Early intervale flora of eastern Nova Scotia. Transactions of the Nova Scotia Institute of Science, 10:502-506. 1 rec.
1	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	Speers, L. 2008. Butterflies of Canada database: New Brunswick 1897-1999. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 2048 recs.
1	Whittam, R.M. 2000. Senecio pseudoarnica on Country Island. , Pers. comm. to S. Gerriets. 1 rec.
1	Wilson, G. 2013. 2013 Snapping Turtle email report, Wentworth, NS. Pers. comm.

NOVA SCOTIA

Communities, Culture & Heritage

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April 21, 2015

Melanie MacDonald
McCallum Environmental Ltd.
135, 2 Bluewater Road
Bedford Nova Scotia
B4B 1G7

Dear Ms. MacDonald:

RE: Environmental Screening 15-03-30a
Beaver Dam Gold Mine

Further to your request of March 30, 2015 staff at Communities, Culture and Heritage has reviewed their files for reference to the presence of natural resources in the study area. Please be aware that the information is not comprehensive, and may include varying degrees of accuracy with respect to the precise location and condition of natural resources.

It should be noted that the amount and degree of disturbance from previous developments could have a significant role in establishing the presence, absence or condition of natural resources in this area.

Botany

Staff has reviewed the records for plant species-at-risk. The following plants are known from the vicinity of Tent and Kent Lakes in the Beaver Dam area listed and should be considered prior to any development of the site or access roads. Presence or absence of these or any species at risk encountered should be stated in the reports generated.

Betula michauxii (provincially Yellow listed)
Bidens beckii (provincially Yellow listed)
Cypridpedium reginae (provincially Orange listed)
Potamogeton zosteriiformis (provincially Yellow listed)
Rhamnus alnifolia (provincially Orange listed)
Viola nephrophylla (provincially Yellow listed)
Zizia aurea (provincially Orange listed)

The presence/absence of the above species should be determined when identification is certain and the results should be stated in the final report.

Zoology

Staff has reviewed the zoological records for species of concern for the site indicated. There are no records for the foot-printed site. However, there are records and reports of the following species with conservation concern in the area.

There are nesting records or probable nesting records for the following bird species of concern in the immediate area:

Blue-winged Teal
Common Nighthawk
Spotted Sandpiper
Greater Yellowlegs
Common Loon
Gray Jay
Pine Siskin
Barn Swallow
Tree Swallow
Rusty Blackbird
Boreal Chickadee
Bay-breasted Warbler
Cape May Warbler
Canada Warbler
Ruby-crowned Kinglet
Golden-crowned Kinglet
Olive-sided Flycatcher
Yellow-bellied Flycatcher
Black-backed Woodpecker

If you have any questions, please contact me at 424-6475.

Sincerely,

<Original signed by>

Sean Weseloh-McKeane
Coordinator, Special Places

Enclosure

Appendix K
Master Plant List

Latin Name	Common Name	Indicator Status	S-Rank
Abies balsamea	Balsam Fir	FAC	S5
Acer rubrum	Red Maple	FAC	S5
Agrostis capillaris	Brown Top	FAC	SE
Agrostis gigantea	Black Bentgrass	FAC	SNA
Agrostis perennans	Perennial Bentgrass	FAC	S5
Agrostis scabra	Rough Bentgrass	FAC	S5
Agrostis stolonifera	Spreading Bentgrass	FACW	S5
Alnus incana	Speckled Alder	FACW	S5
Alnus viridis	Green Alder	FACU	S5
Amelanchier laevis	Serviceberry	FAC	S5
Anaphalis margaritacea	Pearly Everlasting	UPL	S5
Andromeda polifolia	Bog Rosemary	OBL	S5
Aralia hispida	Bristly Sasparilla	UPL	S5
Aralia nudicaulis	Wild Sarsaparilla	FAC	S5
Arethusa bulbosa	Dragon's Mouth	OBL	S4
Athyrium filix-femina	Common Lady Fern	FAC	S5
Bartonia paniculata	Branched Bartonia	OBL	S4S5
Betula alleghaniensis	Yellow Birch	FAC	S5
Betula papyrifera	Paper Birch	FACU	S5
Betula papyrifera cordifolia	Heart-Leaved Paper Birch	FACU	S5
Betula populifolia	Gray Birch	FAC	S5
Calamagrostis canadensis	Bluejoint Reed Grass	FACW	S4S5
Calamagrostis pickeringii	Pickering's Bluejoint	OBL	S5
Calla palustris	Wild Calla	OBL	S4
Calopogon tuberosus	Tuberous Grass Pink	FACW+	S4
Carex arctata	Drooping Woodland Sedge	FAC	S5
Carex atlantica ssp. atlantica	Atlantic Sedge	FACW+	S4
Carex billingsii	Billing's sedge	OBL	S4
Carex brunnescens	Brownish Sedge	FAC	S5
Carex buxbaumii	Buxsbaum's Sedge	OBL	S4
Carex canescens	Silvery Sedge	OBL	S5
Carex crawfordii	Cawford Sedge	FAC	S5
Carex crinita	Fringed Sedge	OBL	S5
Carex debilis	White Edge Sedge	FAC	S5
Carex disperma	Two-seeded Sedge	FACW	S5
Carex echinata	Star Sedge	OBL	S5
Carex exilis	Coastal Sedge	OBL	S4
Carex folliculata	Northern Long Sedge	OBL	S5
Carex gracillima	Graceful Sedge	FAC	S4S5
Carex gynandra	Nodding Sedge	FACW	S5

Latin Name	Common Name	Indicator Status	S-Rank
Carex intumescens	Bladder Sedge	FAC	S5
Carex lasiocarpa	Slender Sedge	OBL	S5
Carex leptalea	Bristly Stalk Sedge	FACW+	S5
Carex lurida	Sallow Sedge	OBL	S5
Carex magellanica	Boreal Bog Sedge	OBL	S5
Carex novae-angliae	New-England Sedge	FACU	S5
Carex oligosperma	Few-Seeded Sedge	OBL	S5
Carex pauciflora	Few-Flowered Sedge	OBL	S4
Carex projecta	Necklace Sedge	FACW	S5
Carex scoparia	Broom Sedge	FAC	S5
Carex stipata	Awl-fruited Sedge	OBL	S5
Carex stricta	Tussock's Sedge	OBL	S5
Carex trisperma	Three-seeded Sedge	OBL	S4?
Carex umbellata	Hidden Sedge	UPL	S5
Carex utriculata	Bear Sedge	OBL	S5
Carex viridula	Little Green Sedge	OBL	S5
Carex wiegandii	Wiegand's Sedge	OBL	S3
Carex echinata	Little Prickly Sedge	OBL	S5
Centaurea nigra	Black Knapweed	SNA	SE
Chamaedaphne calyculata	Leatherleaf	OBL	S5
Chelone glabra	Turtlehead	FACW+	S5
Circaea alpina	Small Enchanter's Nightshade	FAC	S5
Cladium mariscoides	Twigrush	OBL	S5
Clintonia borealis	Yellow Bluebead Lily	FAC	S5
Comarum palustre	Marsh Cinquefoil	OBL	S5
Coptis trifolia	Goldthread	FAC	S5
Cornus canadensis	Bunchberry	FAC	S5
Corylus cornuta	Beaked Hazel	FAC	S5
Cypripedium acaule	Pink Lady's-Slippers	FAC	S5
Danthonia compressa	Flattened Oat Grass	FACU	S5
Danthonia spicata	Poverty Oat Grass	FACU	S5
Dennstaedtia punctilobula	Hay-scented Fern	FAC	S5
Dicanthelium acuminatum	Panic Grass	FAC	S5
Dichanthelium boreale	Northern Panic Grass	FACW	S5
Diervilla lonicera	Northern Bush Honeysuckle	FACU	S5
Doellingeria umbellata	Hairy Flat-top White Aster	FAC	S5
Drosera intermedia	Spoon-Leaved Sundew	OBL	S5
Drosera rotundifolia	Round-leaved Sundew	OBL	SNR
Dryopteris campyloptera	Mountain Wood Fern	FAC	S5
Dryopteris carthusiana	Spinulose Wood Fern	FAC	S5

Latin Name	Common Name	Indicator Status	S-Rank
Dryopteris cristata	Crested Wood Fern	FACW	S5
Dryopteris intermedia	Evergreen Wood Fern	FAC	S5
Dulichium arundinaceum	Three-Way Sedge	OBL	S5
Eleocharis acicularis	Needle Spikerush	OBL	S5
Eleocharis palustris	Common Spikerush	OBL	S5
Eleocharis robbinsii	Robbin's Spikerush	OBL	S4
Eleocharis tenuis	Slender Spikerush	FACW	S5
Empetrum nigrum	Black Crowberry	FAC	S5
Epigaea repens	Trailing Arbutus	FACU	S5
Epilobium leptophyllum	Bog Willowherb	FACW+	S5
Epilobium palustre	Marsh Willowherb	OBL	S5
Equisetum arvense	Field Horsetail	FAC	S5
Equisetum fluviatile	Water Horsetail	OBL	S5
Equisetum sylvaticum	Woodland Horsetail	FAC	S5
Erechtites hieracifolia	Fireweed	FAC	S5
Eriocaulon aquaticum	White Buttons	OBL	S5
Eriophorum angustifolium	Narrow-leaved Cottongrass	OBL	S5
Eriophorum tenellum	Rough Cottongrass	OBL	S4S5
Eriophorum vaginatum	Tussock Cottongrass	OBL	S5
Eriophorum virginicum	Tawny Cottongrass	OBL	S5
Eupatorium perfoliatum	Common Boneset	FACW	S5
Euphrasia officinalis	European Eyebright	FAC	S5
Eurybia radula	Low Rough Aster	OBL	S5
Euthamia graminifolia	Grass-leaved Goldenrod	FAC	S5
Fallopia japonica	Japanese Knotweed	FACU	SNA
Fragaria virginiana	Wild Strawberry	FAC	S5
Fraxinus americana	White Ash	FAC	S5
Galium asprellum	Rough Bedstraw	OBL	S5
Galium palustre	Common Marsh Bedstraw	FACW+	S5
Galium tinctorium	Stiff-Marsh Bedstraw	OBL	S5
Gaultheria hispidula	Creeping Snowberry	FAC	S5
Gaultheria procumbens	Eastern Teaberry	FAC	S5
Gaylussacia baccata	Black Huckleberry	FAC	S5
Gaylussacia bigeloviana	Dwarf Huckleberry	OBL	S5
Gaylussacia dumosa	Bog Huckleberry	OBL	S5
Glyceria borealis	Small Floating Mannagrass	OBL	S5
Glyceria canadensis	Canada Manna Grass	FACW	S5
Glyceria grandis	Common Tall Manna Grass	OBL	S4S5
Glyceria laxa	Northern Manna Grass	OBL	S4?
Glyceria melicaria	Slender Manna-grass	OBL	S4

Latin Name	Common Name	Indicator Status	S-Rank
Glyceria striata	Fowl Manna Grass	FACW	S5
Goodyera repens	Dwarf Rattlesnake Plantain	FAC	S3
Gratiola aurea	Golden Pert	OBL	S5
Hieracium lachenalii	Common hawkweed	UPL	SE
Hieracium pilosella	Mouse-eared hawkweed	UPL	SE
Hieracium piloselloides	Tall hawkweed	FACU	SE
Huperzia lucidulum	Shining Clubmoss	UPL	S5
Hydrocotyle americana	American Marsh Pennywort	OBL	S5
Hypericum boreale	Northern St. John's-Wort	OBL	S5
Hypericum canadense	Canada St. John's-Wort	FACW	S5
Hypericum ellipticum	Pale St. John's-wort	OBL	S5
Hypericum perforatum	St. John's-Wort	FAC	SE
Ilex verticillata	Common Winterberry	FACW+	S5
Iris versicolor	Harlequin Blue Flag	FACW+	S5
Juncus balticus	Baltic Rush	FACW	S5
Juncus brevicaudatus	Narrow Panicled Rush	OBL	S5
Juncus canadensis	Canada Rush	OBL	S5
Juncus effusus	Soft Rush	FACW	S5
Juncus filiformis	Thread Rush	OBL	S5
Juncus militaris	Military Rush	OBL	S5
Juncus pelocarpus	Bog Rush	OBL	S5
Juncus tenuis	Slender Rush	FAC	S5
Juniperus communis	Common Juniper	FAC	S5
Kalmia angustifolia	Sheep Laurel	FAC	S5
Kalmia polifolia	Pale Bog Laurel	OBL	S5
Lactuca canadensis	Canada lettuce	UPL	S5
Larix laricina	Larch	FAC	S5
Ledum groenlandicum	Common Labrador Tea	FACW+	S5
Leersia oryzoides	Rice Cutgrass	OBL	S5
Linnaea borealis	Northern Twinflower	FAC	S5
Listera australis	Southern Twayblade	OBL	S3
Listera cordata	Heart-Leaved Twayblade	FACW	S4
Lonicera canadensis	Canada Fly Honeysuckle	FAC	S5
Lonicera villosa	Mountain Fly Honeysuckle	FACW	S4S5
Luzula multiflora	Common Woodrush	FACU	S5
Lycopodiella inundata	Bog Clubmoss	FACW+	S5
Lycopodium annotinum	Stiff Clubmoss	FAC	S5
Lycopodium clavatum	Running Pine	FAC	S5
Lycopodium obscurum	Tree Clubmoss	FACU	S4S5
Lycopus americanus	American Bugleweed	OBL	S5

Latin Name	Common Name	Indicator Status	S-Rank
Lycopus uniflorus	Northern Bugleweed	OBL	S5
Lysimachia terrestris	Swamp Yellow Loosestrife	FACW+	S5
Maianthemum canadense	False Lily-of-the-valley	FAC	S5
Maianthemum trifolium	Three-leaved False Solomon's Seal	OBL	S5
Mitchella repens	Partridgeberry	FACU	S5
Moneses uniflora	One-flowered Wintergreen	FAC	S5
Monotropa hypopithys	Pinesap	FACU	S4
Monotropa uniflora	Indian Pipe	FACU	S4
Muhlenbergia uniflora	Bog Muhly	FACW	S5
Myrica gale	Sweet Gale	OBL	S5
Myrica pensylvanica	Northern Bayberry	FAC	S5
Nemopanthus mucronatus	Mountain Holly	FAC	S5
Nymphaea odorata	American Waterlily	OBL	S5
Oclemena acuminata	Whorled Wood Aster	FACU	S5
Oclemena nemoralis	Bog Aster	OBL	S5
Oclemena x blakei	a hybrid White Panicled American-Aster	FACW	S4S5
Onoclea sensibilis	Sensitive Fern	FACW	S5
Orthilia secunda	One-sided Wintergreen	FAC	S5
Osmunda cinnamomea	Cinnamon Fern	FAC	S5
Osmunda claytoniana	Interrupted Fern	FAC	S5
Osmunda regalis	Royal Fern	OBL	S5
Oxalis montana	Common Wood Sorrel	FAC	S5
Persicaria sagittata	Arrow-leaved Smartweed	OBL	S5
Phegopteris connectilis	Northern Beech Fern	FAC	S5
Phleum pratense	Common Timothy	FAC	SNA
Photinia melanocarpa	Black Chokeberry	FACW	S5
Photinia pyrifolia	Red Chokeberry	FACW	S4
Picea glauca	White Spruce	FAC	S5
Picea mariana	Black Spruce	FACW	S5
Picea rubens	Red Spruce	FAC	S5
Pinus strobus	Eastern White Pine	FAC	S5
Platanthera clavellata	Small Green Woodland Orchid	FACW	S5
Poa compressa	Canada Bluegrass	FACW	SE
Pogonia ophioglossoides	Rose Pogonia	OBL	S4
Polypodium apalachianum	Appalachian Polypody	UPL	S3?
Pontedaria cordata	Pickerel Weed	OBL	S5
Populus grandidentata	Large-toothed Aspen	FACU-	S5
Populus tremuloides	Trembling Aspen	FAC	S5
Potamogeton pusillus	Small Pondweed	OBL	S5
Potentilla simplex	Old Field Cinquefoil	UPL	S5

Latin Name	Common Name	Indicator Status	S-Rank
Prenanthes trifoliolata	Three-leaved Rattlesnakeroot	FACU	S5
Prunus pensylvanica	Pin Cherry	FACU	S5
Prunus viriginana	Chokecherry	FAC	S5
Pteridium aquilinum	Bracken Fern	FACU	S5
Radiola linoides	Allseed	FACU	SNA
Ranunculus acris	Common Buttercup	FAC	SNA
Rhododendron canadense	Rhodora	FAC	S5
Rhynchospora alba	White Beakrush	OBL	S5
Rhynchospora capitellata	Small-headed Beakrush	FACW+	S4
Rhynchospora fusca	Brown Beakrush	OBL	S5
Ribes glandulosum	Skunk Currant	FAC	S5
Ribes lacustre	Bristly Black Currant	FACW	S5
Ribes triste	Swamp Red Currant	FACW+	S4
Rosa nitida	Shining Rose	OBL	S4
Rosa palustris	Swamp Rose	OBL	S4
Rosa virginiana	Virginia Rose	FAC	S5
Rubus alleghaniensis	Blackberry	FACU	S5
Rubus canadensis	Smooth Blackberry	FACU	S5
Rubus chamaemorus	Cloudberry	OBL	S4
Rubus hispidus	Bristly Dewberry	FACW	S5
Rubus ideaus	Red Raspberry	FAC	S5
Rubus pensylvanicus	Pennsylvania Blackberry	FACU	S4
Rubus pubescens	Dwarf Red Raspberry	FAC	S5
Rubus setosus	Small Bristleberry	FACW	S4?
Rumex acetosella	Sheep Sorrel	FACU	SNA
Salix bebbiana	Bebb's Willow	FAC	S5
Salix discolor	Pussy Willow	FAC	S5
Salix pyrifolia	Balsam Willow	FACW	S5
Sarracenia purpurea	Northern Pitcher Plant	OBL	S5
Scheuchzeria palustris	Podgrass	OBL	S4S5
Schoenoplectus subterminalis	Water Bulrush	OBL	S5
Scirpus atrocinctus	Black-girdled Bulrush	FACW	S5
Scirpus cyperinus	Common Woolly Bulrush	FACW	S5
Scirpus microcarpus	Small-fruited Bulrush	OBL	S5
Scirpus cyperinus	Cottongrass Bulrush	OBL	S5
Sium suave	Common Water Parsnip	OBL	S5
Solidago canadensis	Canada Goldenrod	FAC	S5
Solidago gigantea	Giant Goldenrod	FAC	S5
Solidago nemoralis	Field Goldenrod	UPL	S4S5
Solidago puberula	Downy Goldenrod	UPL	S5

Latin Name	Common Name	Indicator Status	S-Rank
Solidago rugosa	Rough-stemmed Goldenrod	FAC	S5
Solidago uliginosa	Northern Bog Goldenrod	OBL	S5
Solidago rugosa	Rough-Leaf Goldenrod	FAC	S5
Sorbus americana	American Mountain Ash	FAC	S5
Sparganium americanum	American Burreed	OBL	S5
Sparganium angustifolium	American Burred	OBL	S5
Sparganium fluctuans	Floating Burreed	OBL	S4
Sphagnum capilifolium	sphagnum moss	OBL	S5
Sphagnum fuscum	sphagnum moss	OBL	S5
Sphagnum girgensohnii	sphagnum moss	OBL	S5
Sphagnum macrophyllum	Largeleaf Sphagnum	OBL	S4
Sphagnum magellanicum	sphagnum moss	OBL	S5
Spiraea alba	White Meadowsweet	FAC	S5
Spiraea tomentosa	Steeplebush	FAC	S5
Spiranthes cernua	Nodding Ladies' Tresses	FACW	S5
Spiranthes romanzoffiana	Hooded Ladies'-tresses	OBL	S4
Symphyotrichum lateriflorum	Calico Aster	FAC	S5
Symphyotrichum novi-belgii	New Belgium American-Aster	FAC	S5
Symphyotrichum puniceum	Swamp Aster	OBL	S5
Taxus canadensis	Canada Yew	FAC	S5
Thalictrum pubescens	Tall Meadow Rue	FACW	S5
Thelypteris noveboracensis	New York Fern	FAC	S5
Thelypteris palustris	Eastern Marsh Fern	OBL	S5
Thelypteris simulata	Bog Fern	OBL	S4S5
Triadenum virginicum	Virginia St John's-wort	OBL	S5
Trichophorum cespitosum	Tufted Clubrush	OBL	S5
Tridenum fraseri	Marsh-St. John's wort	OBL	S5
Trientalis borealis	Northern Starflower	FAC	S5
Trifolium dubium	Suckling Clover	UPL	SE
Trillium undulatum	Painted Trillium	FAC	S5
Tussilago farfara	Coltsfoot	FAC	SE
Typha latifolia	Broad-leaved Cat-tail	OBL	S5
Utricularia geminiscapa	Twin-stemmed Bladderwort	OBL	S4
Utricularia cornuta	Horned Bladder-wort	OBL	S5
Utricularia intermedia	Flatleaf Bladderwort	OBL	S5
Utricularia macrorhiza	Flatleaf Bladderwort	OBL	S5
Utricularia purpurea	Eastern Purple Bladderwort	OBL	S5
Utricularia vulgaris	Common Bladderwort	OBL	S5
Vaccinium angustifolium	Late Low-bush Blueberry	FAC	S5
Vaccinium corymbosum	High-bush Blueberry	FACW+	S3S4

Latin Name	Common Name	Indicator Status	S-Rank
Vaccinium macrocarpon	Large Cranberry	FACW+	S5
Vaccinium myrtilloides	Velvet-leaved Blueberry	FAC	S5
Vaccinium oxycoccos	Small Cranberry	OBL	S5
Vaccinium vitis-idaea ssp. minus	Mountain Cranberry	FAC	S5
Vaccinium angustifolium	Late Lowbush Blueberry	FAC	S5
Vaccinium macrocarpon	Large Cranberry	FACW+	S5
Vaccinium myrtilloides	Velvetleaf Blueberry	FAC	S5
Veronica officinalis	Common Speedwell	FACU	S5
Viburnum lantanoides	Hobblebush	FAC	S5
Viburnum nudum	Northern Wild Raisin	FAC	S5
Viola cucullata	Marsh Blue Violet	FAC	S5
Viola lanceolata	Lance-leaf Violet	OBL	S5
Viola macloskeyi	Small White Violet	FACW	S5
Viola renifolia	Kidney-leaved White Violet	FAC	S4

Note: Species names in red are Priority Species.

Appendix L
Maritime Breeding Bird Atlas Data Summaries

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Species list for square 20NQ17 (number of entries returned: 73)

Region	Square	Species	Breeding Evidence				Point Counts			
			Max BE	Categ	#Sq	Atlasser Name	#PC	%PC	Abun	#Sq
20	20NQ17	Canada Goose	H	POSS	1	2 participants				
20	20NQ17	American Black Duck	FY	CONF	1	Chris M Pepper				
20	20NQ17	Mallard	FY	CONF	1	Chris M Pepper				
20	20NQ17	Ring-necked Duck	P	PROB	1	Chris M Pepper				
20	20NQ17	Hooded Merganser	P	PROB	1	Chris M Pepper				
20	20NQ17	Common Merganser	FY	CONF	1	Chris M Pepper				
20	20NQ17	Ruffed Grouse	S	POSS	1	Chris M Pepper				
20	20NQ17	Spruce Grouse	FY	CONF	1	Harry Brennan				
20	20NQ17	Common Loon	P	PROB	1	Chris M Pepper				
20	20NQ17	Northern Harrier	P	PROB	1	Chris M Pepper				
20	20NQ17	Broad-winged Hawk	H	POSS	1	Chris M Pepper				
20	20NQ17	Greater Yellowlegs	H	POSS	1	Chris M Pepper				
20	20NQ17	American Woodcock	S	POSS	1	Patricia L Chalmers				
20	20NQ17	Great Horned Owl	S	POSS	1	4 participants				
20	20NQ17	Barred Owl	P	PROB	1	2 participants				
20	20NQ17	Northern Saw-whet Owl	S	POSS	1	4 participants				
20	20NQ17	Common Nighthawk	DD	CONF	1	Chris M Pepper				
20	20NQ17	Ruby-throated Hummingbird	H	POSS	1	Chris M Pepper				
20	20NQ17	Belted Kingfisher	H	POSS	1	2 participants				
20	20NQ17	Yellow-bellied Sapsucker	H	POSS	1	Chris M Pepper				
20	20NQ17	Downy Woodpecker	CF	CONF	1	Chris M Pepper				
20	20NQ17	Hairy Woodpecker	H	POSS	1	Chris M Pepper				
20	20NQ17	Northern Flicker	FY	CONF	1	Chris M Pepper				
20	20NQ17	Pileated Woodpecker	H	POSS	1	Chris M Pepper				
20	20NQ17	Merlin	H	POSS	1	Chris M Pepper				
20	20NQ17	Olive-sided Flycatcher	S	POSS	1	Chris M Pepper				
20	20NQ17	Eastern Wood-Pewee	S	POSS	1	Chris M Pepper				
20	20NQ17	Yellow-bellied Flycatcher	T	PROB	1	Chris M Pepper				
20	20NQ17	Alder Flycatcher	S	POSS	1	Chris M Pepper				
20	20NQ17	Least Flycatcher	A	PROB	1	Chris M Pepper				
20	20NQ17	Blue-headed Vireo	CF	CONF	1	Chris M Pepper				
20	20NQ17	Red-eyed Vireo	S	POSS	1	Chris M Pepper				
20	20NQ17	Gray Jay	FY	CONF	1	Chris M Pepper				
20	20NQ17	Blue Jay	S	POSS	1	Chris M Pepper				
20	20NQ17	American Crow	H	POSS	1	Chris M Pepper				

20	20NQ17	Tree Swallow	FS	CONF	1	Chris M Pepper				
20	20NQ17	Barn Swallow	NY	CONF	1	Chris M Pepper				
20	20NQ17	Black-capped Chickadee	FY	CONF	1	Chris M Pepper				
20	20NQ17	Boreal Chickadee	P	PROB	1	Chris M Pepper				
20	20NQ17	Winter Wren	S	POSS	1	Chris M Pepper				
20	20NQ17	Golden-crowned Kinglet	P	PROB	1	Chris M Pepper				
20	20NQ17	Ruby-crowned Kinglet	CF	CONF	1	Chris M Pepper				
20	20NQ17	Swainson's Thrush	FY	CONF	1	Chris M Pepper				
20	20NQ17	Hermit Thrush	FY	CONF	1	Chris M Pepper				
20	20NQ17	American Robin	H	POSS	1	Chris M Pepper				
20	20NQ17	European Starling	FY	CONF	1	Chris M Pepper				
20	20NQ17	Cedar Waxwing	P	PROB	1	Chris M Pepper				
20	20NQ17	Ovenbird	FY	CONF	1	Chris M Pepper				
20	20NQ17	Black-and-white Warbler	S	POSS	1	Chris M Pepper				
20	20NQ17	Nashville Warbler	S	POSS	1	Chris M Pepper				
20	20NQ17	Common Yellowthroat	CF	CONF	1	Chris M Pepper				
20	20NQ17	American Redstart	P	PROB	1	Chris M Pepper				
20	20NQ17	Northern Parula	S	POSS	1	Chris M Pepper				
20	20NQ17	Magnolia Warbler	S	POSS	1	Chris M Pepper				
20	20NQ17	Bay-breasted Warbler	P	PROB	1	Chris M Pepper				
20	20NQ17	Blackburnian Warbler	S	POSS	1	Chris M Pepper				
20	20NQ17	Yellow Warbler	S	POSS	1	Chris M Pepper				
20	20NQ17	Palm Warbler	CF	CONF	1	Chris M Pepper				
20	20NQ17	Yellow-rumped Warbler	CF	CONF	1	Chris M Pepper				
20	20NQ17	Black-throated Green Warbler	CF	CONF	1	Chris M Pepper				
20	20NQ17	Canada Warbler	T	PROB	1	Chris M Pepper				
20	20NQ17	Chipping Sparrow	H	POSS	1	Chris M Pepper				
20	20NQ17	Savannah Sparrow	CF	CONF	1	Chris M Pepper				
20	20NQ17	Song Sparrow	S	POSS	1	Chris M Pepper				
20	20NQ17	Lincoln's Sparrow	CF	CONF	1	Chris M Pepper				
20	20NQ17	Swamp Sparrow	FY	CONF	1	Chris M Pepper				
20	20NQ17	White-throated Sparrow	FY	CONF	1	Chris M Pepper				
20	20NQ17	Dark-eyed Junco	FY	CONF	1	Chris M Pepper				
20	20NQ17	Red-winged Blackbird	S	POSS	1	Chris M Pepper				
20	20NQ17	Common Grackle	P	PROB	1	Chris M Pepper				
20	20NQ17	Pine Grosbeak	P	PROB	1	Chris M Pepper				
20	20NQ17	Purple Finch	S	POSS	1	Chris M Pepper				
20	20NQ17	American Goldfinch	P	PROB	1	Chris M Pepper				

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Species list for square 20NQ18 (number of entries returned: 82)

Region	Square	Species	Breeding Evidence				Point Counts			
			Max BE	Categ	#Sq	Atlasser Name	#PC	%PC	Abun	#Sq
20	20NQ18	Canada Goose	FY	CONF	1	Jim A Elliott				
20	20NQ18	Wood Duck	H	POSS	1	Jim A Elliott				
20	20NQ18	American Black Duck	FY	CONF	1	Jim A Elliott				
20	20NQ18	Green-winged Teal	P	PROB	1	Jim A Elliott				
20	20NQ18	Ring-necked Duck	FY	CONF	1	2 participants				
20	20NQ18	Hooded Merganser	FY	CONF	1	Jim A Elliott				
20	20NQ18	Common Merganser	H	POSS	1	Jim A Elliott				
20	20NQ18	Ruffed Grouse	FY	CONF	1	Jim A Elliott				
20	20NQ18	Spruce Grouse	H	POSS	1	Jim A Elliott				
20	20NQ18	Common Loon	NE	CONF	1	Jim A Elliott				
20	20NQ18	Northern Harrier	FY	CONF	1	Jim A Elliott				
20	20NQ18	Northern Goshawk	FY	CONF	1	Jim A Elliott				
20	20NQ18	Red-tailed Hawk	T	PROB	1	Jim A Elliott				
20	20NQ18	Spotted Sandpiper	FY	CONF	1	Jim A Elliott				
20	20NQ18	Greater Yellowlegs	FY	CONF	1	Jim A Elliott				
20	20NQ18	Wilson's Snipe	H	POSS	1	Doug Ross Archibald				
20	20NQ18	American Woodcock	DD	CONF	1	Jim A Elliott				
20	20NQ18	Mourning Dove	S	POSS	1	Jim A Elliott				
20	20NQ18	Great Horned Owl	FY	CONF	1	Jim A Elliott				
20	20NQ18	Barred Owl	FY	CONF	1	Jim A Elliott				
20	20NQ18	Northern Saw-whet Owl	S	POSS	1	2 participants				
20	20NQ18	Common Nighthawk	P	PROB	1	Chris M Pepper				
20	20NQ18	Ruby-throated Hummingbird	FY	CONF	1	Jim A Elliott				
20	20NQ18	Belted Kingfisher	FY	CONF	1	Jim A Elliott				
20	20NQ18	Downy Woodpecker	H	POSS	1	Jim A Elliott				
20	20NQ18	Hairy Woodpecker	NY	CONF	1	Jim A Elliott				
20	20NQ18	Northern Flicker	FY	CONF	1	Jim A Elliott				
20	20NQ18	Pileated Woodpecker	T	PROB	1	Jim A Elliott				
20	20NQ18	American Kestrel	FY	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Merlin	NY	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Olive-sided Flycatcher	T	PROB	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Eastern Wood-Pewee	S	POSS	1	Jim A Elliott				
20	20NQ18	Yellow-bellied Flycatcher	CF	CONF	1	Jim A Elliott	3	18.75	0.1875	1
20	20NQ18	Alder Flycatcher	T	PROB	1	Jim A Elliott	5	31.25	0.3125	1
20	20NQ18	Least Flycatcher	T	PROB	1	Jim A Elliott	2	12.5	0.125	1

20	20NQ18	Blue-headed Vireo	CF	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Red-eyed Vireo	NY	CONF	1	Jim A Elliott	10	62.5	0.625	1
20	20NQ18	Gray Jay	FY	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Blue Jay	H	POSS	1	Jim A Elliott				
20	20NQ18	American Crow	FY	CONF	1	Jim A Elliott	4	25.0	0.25	1
20	20NQ18	Common Raven	FY	CONF	1	Jim A Elliott				
20	20NQ18	Tree Swallow	AE	CONF	1	Jim A Elliott				
20	20NQ18	Barn Swallow	NY	CONF	1	Jim A Elliott				
20	20NQ18	Black-capped Chickadee	CF	CONF	1	Jim A Elliott	2	12.5	0.125	1
20	20NQ18	Boreal Chickadee	CF	CONF	1	Jim A Elliott				
20	20NQ18	Red-breasted Nuthatch	FY	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Winter Wren	FY	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Golden-crowned Kinglet	CF	CONF	1	Chris M Pepper				
20	20NQ18	Ruby-crowned Kinglet	CF	CONF	1	Jim A Elliott	6	37.5	0.375	1
20	20NQ18	Swainson's Thrush	FY	CONF	1	Jim A Elliott	7	43.75	0.5	1
20	20NQ18	Hermit Thrush	FY	CONF	1	Jim A Elliott	2	12.5	0.125	1
20	20NQ18	American Robin	FY	CONF	1	Jim A Elliott	3	18.75	0.1875	1
20	20NQ18	Gray Catbird	T	PROB	1	Jim A Elliott				
20	20NQ18	European Starling	FY	CONF	1	Jim A Elliott				
20	20NQ18	Cedar Waxwing	T	PROB	1	Jim A Elliott				
20	20NQ18	Ovenbird	CF	CONF	1	Jim A Elliott	2	12.5	0.125	1
20	20NQ18	Northern Waterthrush	T	PROB	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Black-and-white Warbler	CF	CONF	1	Jim A Elliott	2	12.5	0.125	1
20	20NQ18	Tennessee Warbler	T	PROB	1	2 participants				
20	20NQ18	Nashville Warbler	T	PROB	1	Jim A Elliott				
20	20NQ18	Common Yellowthroat	FY	CONF	1	Jim A Elliott	6	37.5	0.4375	1
20	20NQ18	American Redstart	CF	CONF	1	Jim A Elliott	4	25.0	0.25	1
20	20NQ18	Northern Parula	FY	CONF	1	Jim A Elliott	3	18.75	0.1875	1
20	20NQ18	Magnolia Warbler	FY	CONF	1	Jim A Elliott	13	81.25	0.875	1
20	20NQ18	Bay-breasted Warbler	D	PROB	1	Chris M Pepper	1	6.25	0.0625	1
20	20NQ18	Blackburnian Warbler	T	PROB	1	Jim A Elliott				
20	20NQ18	Black-throated Blue Warbler	T	PROB	1	Jim A Elliott	1	6.25	0.125	1
20	20NQ18	Palm Warbler	CF	CONF	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Yellow-rumped Warbler	FY	CONF	1	Jim A Elliott	5	31.25	0.375	1
20	20NQ18	Black-throated Green Warbler	CF	CONF	1	Jim A Elliott	7	43.75	0.4375	1
20	20NQ18	Song Sparrow	CF	CONF	1	Jim A Elliott				
20	20NQ18	Lincoln's Sparrow	FY	CONF	1	2 participants				
20	20NQ18	Swamp Sparrow	NY	CONF	1	Jim A Elliott				
20	20NQ18	White-throated Sparrow	FY	CONF	1	Jim A Elliott	13	81.25	0.875	1

20	20NQ18	Dark-eyed Junco	FY	CONF	1	Jim A Elliott	7	43.75	0.625	1
20	20NQ18	Red-winged Blackbird	S	POSS	1	Jim A Elliott				
20	20NQ18	Common Grackle	T	PROB	1	Jim A Elliott	1	6.25	0.0625	1
20	20NQ18	Pine Grosbeak	T	PROB	1	Jim A Elliott				
20	20NQ18	Purple Finch	P	PROB	1	Jim A Elliott				
20	20NQ18	White-winged Crossbill	FY	CONF	1	Jim A Elliott				
20	20NQ18	Pine Siskin	H	POSS	1	Jim A Elliott				
20	20NQ18	American Goldfinch	T	PROB	1	Jim A Elliott	1	6.25	0.125	1

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Species list for square 20NQ28 (number of entries returned: 69)

Region	Square	Species	Breeding Evidence				Point Counts			
			Max BE	Categ	#Sq	Atlasser Name	#PC	%PC	Abun	#Sq
20	20NQ28	American Black Duck	FY	CONF	1	Jim A Elliott				
20	20NQ28	Green-winged Teal	FY	CONF	1	Jim A Elliott				
20	20NQ28	Ring-necked Duck	T	PROB	1	Jim A Elliott				
20	20NQ28	Hooded Merganser	FY	CONF	1	Jim A Elliott				
20	20NQ28	Ruffed Grouse	H	POSS	1	Jim A Elliott				
20	20NQ28	Spruce Grouse	H	POSS	1	Jim A Elliott				
20	20NQ28	Osprey	H	POSS	1	Jim A Elliott				
20	20NQ28	Sharp-shinned Hawk	AE	CONF	1	Fulton L. Lavender				
20	20NQ28	Northern Goshawk	H	POSS	1	Jim A Elliott				
20	20NQ28	Red-tailed Hawk	T	PROB	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Spotted Sandpiper	FY	CONF	1	Jim A Elliott				
20	20NQ28	Greater Yellowlegs	A	PROB	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Wilson's Snipe	D	PROB	1	Jim A Elliott				
20	20NQ28	American Woodcock	D	PROB	1	Jim A Elliott				
20	20NQ28	Great Horned Owl	T	PROB	1	Jim A Elliott				
20	20NQ28	Barred Owl	S	POSS	1	2 participants				
20	20NQ28	Northern Saw-whet Owl	H	POSS	1	Doug Ross Archibald				
20	20NQ28	Ruby-throated Hummingbird	H	POSS	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Belted Kingfisher	P	PROB	1	Jim A Elliott				
20	20NQ28	Yellow-bellied Sapsucker	H	POSS	1	Jim A Elliott				
20	20NQ28	Northern Flicker	FY	CONF	1	2 participants	1	5.88	0.0588	1
20	20NQ28	Pileated Woodpecker	S	POSS	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Merlin	FY	CONF	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Olive-sided Flycatcher	T	PROB	1	Jim A Elliott	2	11.76	0.1176	1
20	20NQ28	Yellow-bellied Flycatcher	T	PROB	1	Jim A Elliott	7	41.18	0.4118	1
20	20NQ28	Alder Flycatcher	S	POSS	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Least Flycatcher	T	PROB	1	Jim A Elliott	6	35.29	0.5294	1
20	20NQ28	Blue-headed Vireo	T	PROB	1	Jim A Elliott	2	11.76	0.1176	1
20	20NQ28	Philadelphia Vireo	T	PROB	1	Jim A Elliott				
20	20NQ28	Red-eyed Vireo	T	PROB	1	Jim A Elliott	4	23.53	0.2941	1
20	20NQ28	Common Raven	P	PROB	1	Jim A Elliott				
20	20NQ28	Tree Swallow	FY	CONF	1	Jim A Elliott				
20	20NQ28	Black-capped Chickadee	FY	CONF	1	Jim A Elliott	3	17.65	0.2353	1
20	20NQ28	Red-breasted Nuthatch	S	POSS	1	Jim A Elliott				

20	20NQ28	Winter Wren	T	PROB	1	Jim A Elliott	5	29.41	0.2941	1
20	20NQ28	Golden-crowned Kinglet	S	POSS	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Ruby-crowned Kinglet	T	PROB	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Swainson's Thrush	CF	CONF	1	Jim A Elliott	5	29.41	0.3529	1
20	20NQ28	Hermit Thrush	T	PROB	1	Jim A Elliott	3	17.65	0.1765	1
20	20NQ28	American Robin	CF	CONF	1	Jim A Elliott	3	17.65	0.1765	1
20	20NQ28	Gray Catbird	S	POSS	1	Jim A Elliott				
20	20NQ28	Cedar Waxwing	T	PROB	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Ovenbird	T	PROB	1	Jim A Elliott				
20	20NQ28	Northern Waterthrush	S	POSS	1	Jim A Elliott				
20	20NQ28	Black-and-white Warbler	T	PROB	1	Jim A Elliott	4	23.53	0.2941	1
20	20NQ28	Tennessee Warbler	S	POSS	1	Jim A Elliott				
20	20NQ28	Mourning Warbler	S	POSS	1	Jim A Elliott				
20	20NQ28	Common Yellowthroat	FY	CONF	1	Jim A Elliott	8	47.06	0.4706	1
20	20NQ28	American Redstart	T	PROB	1	Jim A Elliott	6	35.29	0.3529	1
20	20NQ28	Cape May Warbler	S	POSS	1	Jim A Elliott				
20	20NQ28	Northern Parula	T	PROB	1	Jim A Elliott	2	11.76	0.1765	1
20	20NQ28	Magnolia Warbler	FY	CONF	1	2 participants	8	47.06	0.5882	1
20	20NQ28	Bay-breasted Warbler	T	PROB	1	Jim A Elliott	2	11.76	0.1176	1
20	20NQ28	Blackburnian Warbler	T	PROB	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Black-throated Blue Warbler	T	PROB	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Palm Warbler	FY	CONF	1	2 participants	2	11.76	0.1765	1
20	20NQ28	Yellow-rumped Warbler	CF	CONF	1	Jim A Elliott	3	17.65	0.2353	1
20	20NQ28	Black-throated Green Warbler	T	PROB	1	Jim A Elliott	7	41.18	0.5294	1
20	20NQ28	Canada Warbler	S	POSS	1	Jim A Elliott	1	5.88	0.0588	1
20	20NQ28	Song Sparrow	T	PROB	1	Jim A Elliott				
20	20NQ28	Swamp Sparrow	FY	CONF	1	2 participants				
20	20NQ28	White-throated Sparrow	FY	CONF	1	Jim A Elliott	10	58.82	0.5882	1
20	20NQ28	Dark-eyed Junco	FY	CONF	1	2 participants	8	47.06	0.4706	1
20	20NQ28	Red-winged Blackbird	H	POSS	1	Jim A Elliott				
20	20NQ28	Rusty Blackbird	FY	CONF	1	Jim A Elliott				
20	20NQ28	Common Grackle	P	PROB	1	Jim A Elliott				
20	20NQ28	Purple Finch	H	POSS	1	Jim A Elliott				
20	20NQ28	White-winged Crossbill	FY	CONF	1	Jim A Elliott				
20	20NQ28	Pine Siskin	FY	CONF	1	Jim A Elliott				

Close this window Print this window

Species list for square 20NQ29 (number of entries returned: 77)

Region	Square	Species	Breeding Evidence				Point Counts			
			Max BE	Categ	#Sq	Atlasser Name	#PC	%PC	Abun	#Sq
20	20NQ29	Canada Goose	FY	CONF	1	2 participants	1	5.26	0.0526	1
20	20NQ29	Wood Duck	H	POSS	1	Ken McKenna				
20	20NQ29	American Black Duck	H	POSS	1	2 participants				
20	20NQ29	Common Goldeneye	FY	CONF	1	Ken McKenna				
20	20NQ29	Common Merganser	H	POSS	1	Jim A Elliott				
20	20NQ29	Ruffed Grouse	D	PROB	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Spruce Grouse	FY	CONF	1	2 participants				
20	20NQ29	Common Loon	T	PROB	1	Ken McKenna	1	5.26	0.0526	1
20	20NQ29	Osprey	AE	CONF	1					
20	20NQ29	Northern Goshawk	H	POSS	1	Ken McKenna				
20	20NQ29	Red-tailed Hawk	T	PROB	1	Jim A Elliott				
20	20NQ29	Spotted Sandpiper	NE	CONF	1	Jim A Elliott				
20	20NQ29	Wilson's Snipe	D	PROB	1	Jim A Elliott				
20	20NQ29	American Woodcock	D	PROB	1	Jim A Elliott				
20	20NQ29	Great Horned Owl	H	POSS	1	Jim A Elliott				
20	20NQ29	Common Nighthawk	D	PROB	1	Jim A Elliott				
20	20NQ29	Chimney Swift	P	PROB	1	Jim A Elliott				
20	20NQ29	Belted Kingfisher	FY	CONF	1	Jim A Elliott				
20	20NQ29	Downy Woodpecker	H	POSS	1	Ken McKenna				
20	20NQ29	Hairy Woodpecker	FY	CONF	1	Ken McKenna	2	10.53	0.1053	1
20	20NQ29	Black-backed Woodpecker	H	POSS	1	Ken McKenna				
20	20NQ29	Northern Flicker	FY	CONF	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Pileated Woodpecker	S	POSS	1	Jim A Elliott				
20	20NQ29	American Kestrel	FY	CONF	1	Ken McKenna				
20	20NQ29	Olive-sided Flycatcher	S	POSS	1	Jim A Elliott				
20	20NQ29	Yellow-bellied Flycatcher	T	PROB	1	Jim A Elliott	6	31.58	0.3158	1
20	20NQ29	Alder Flycatcher	FY	CONF	1	Jim A Elliott	4	21.05	0.2632	1
20	20NQ29	Least Flycatcher	T	PROB	1	Jim A Elliott	1	5.26	0.1053	1
20	20NQ29	Blue-headed Vireo	FY	CONF	1	Ken McKenna	4	21.05	0.2105	1

20	20NQ29	Red-eyed Vireo	P	PROB	1	Jim A Elliott	4	21.05	0.2632	1
20	20NQ29	Gray Jay	FY	CONF	1	Jim A Elliott				
20	20NQ29	Blue Jay	H	POSS	1	Ken McKenna				
20	20NQ29	American Crow	P	PROB	1	Jim A Elliott	3	15.79	0.2105	1
20	20NQ29	Common Raven	S	POSS	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Tree Swallow	FY	CONF	1	Jim A Elliott				
20	20NQ29	Barn Swallow	H	POSS	1	Jim A Elliott				
20	20NQ29	Black-capped Chickadee	FY	CONF	1	3 participants				
20	20NQ29	Boreal Chickadee	FY	CONF	1	Ken McKenna	1	5.26	0.0526	1
20	20NQ29	Red-breasted Nuthatch	FY	CONF	1	Ken McKenna	1	5.26	0.0526	1
20	20NQ29	Winter Wren	FY	CONF	1	Ken McKenna				
20	20NQ29	Golden-crowned Kinglet	S	POSS	1	3 participants				
20	20NQ29	Ruby-crowned Kinglet	FY	CONF	1	Ken McKenna	10	52.63	0.5789	1
20	20NQ29	Swainson's Thrush	D	PROB	1	Ken McKenna	2	10.53	0.1053	1
20	20NQ29	Hermit Thrush	T	PROB	1	Jim A Elliott	4	21.05	0.2632	1
20	20NQ29	American Robin	CF	CONF	1	Jim A Elliott	1	5.26	0.1053	1
20	20NQ29	Gray Catbird	T	PROB	1	Jim A Elliott				
20	20NQ29	Cedar Waxwing	CF	CONF	1	Jim A Elliott				
20	20NQ29	Ovenbird	S	POSS	1	Jim A Elliott				
20	20NQ29	Northern Waterthrush	FY	CONF	1	Ken McKenna				
20	20NQ29	Black-and-white Warbler	FY	CONF	1	2 participants	2	10.53	0.1053	1
20	20NQ29	Tennessee Warbler	H	POSS	1	Ken McKenna				
20	20NQ29	Mourning Warbler	A	PROB	1	Ken McKenna				
20	20NQ29	Common Yellowthroat	FY	CONF	1	Ken McKenna	7	36.84	0.3684	1
20	20NQ29	American Redstart	T	PROB	1	Jim A Elliott	7	36.84	0.4211	1
20	20NQ29	Magnolia Warbler	T	PROB	1	Jim A Elliott	8	42.11	0.5263	1
20	20NQ29	Bay-breasted Warbler	D	PROB	1	Ken McKenna	2	10.53	0.1053	1
20	20NQ29	Blackburnian Warbler	H	POSS	1	Ken McKenna				
20	20NQ29	Yellow Warbler	T	PROB	1	Jim A Elliott	1	5.26	0.1053	1
20	20NQ29	Blackpoll Warbler	S	POSS	1	Jim A Elliott				
20	20NQ29	Black-throated Blue Warbler	S	POSS	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Palm Warbler	CF	CONF	1	Ken McKenna	1	5.26	0.0526	1

20	20NQ29	Yellow-rumped Warbler	CF	CONF	1	3 participants	1	5.26	0.0526	1
20	20NQ29	Black-throated Green Warbler	CF	CONF	1	Jim A Elliott	7	36.84	0.4211	1
20	20NQ29	Canada Warbler	CF	CONF	1	Ken McKenna				
20	20NQ29	Song Sparrow	T	PROB	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Lincoln's Sparrow	FY	CONF	1	Ken McKenna				
20	20NQ29	Swamp Sparrow	FY	CONF	1	2 participants				
20	20NQ29	White-throated Sparrow	CF	CONF	1	Ken McKenna	11	57.89	0.7368	1
20	20NQ29	Dark-eyed Junco	CF	CONF	1	2 participants	8	42.11	0.4737	1
20	20NQ29	Red-winged Blackbird	T	PROB	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Rusty Blackbird	FY	CONF	1	Jim A Elliott				
20	20NQ29	Common Grackle	CF	CONF	1	Ken McKenna	1	5.26	0.0526	1
20	20NQ29	Purple Finch	S	POSS	1	Jim A Elliott				
20	20NQ29	White-winged Crossbill	FY	CONF	1	Jim A Elliott				
20	20NQ29	Pine Siskin	S	POSS	1	Ken McKenna				
20	20NQ29	American Goldfinch	FY	CONF	1	Jim A Elliott	1	5.26	0.0526	1
20	20NQ29	Evening Grosbeak	P	PROB	1	Jim A Elliott				

Disclaimer: Data contained in these summaries are provisional data that have not necessarily been reviewed or edited, and may be subject to significant change. These data have been released for public interest only. If you wish to use the data in a publication, research or for any purpose, or would like information concerning the accuracy and appropriate uses of these data, read the data use policy and request form, or contact the Atlas, at telephone: 1-866-528-5275, e-mail: atlasmaritimes@gmail.com. **These data are current as of 29 Nov 2016 .**

Appendix M
Relative Abundance of Avian Species

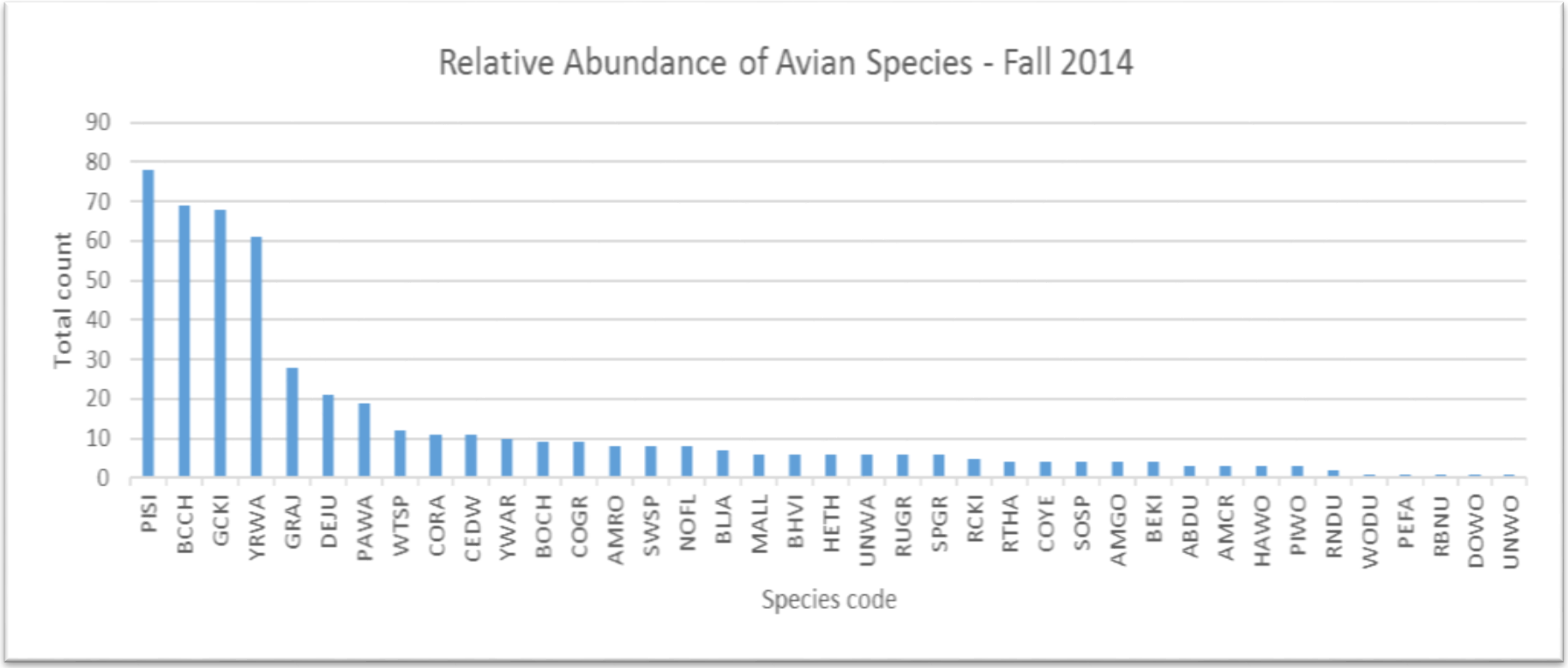

Figure 1: Relative abundance of avian species observed during dedicated fall migration surveys in 2014. This chart presents the four-letter (English Name) alpha codes in accordance with the 56th supplement to the AOU Check-list of North American Birds (Chesser et al., 2015). Unknown species codes are: UNWA (Unknown Warbler) and UNWO (Unknown Woodpecker).

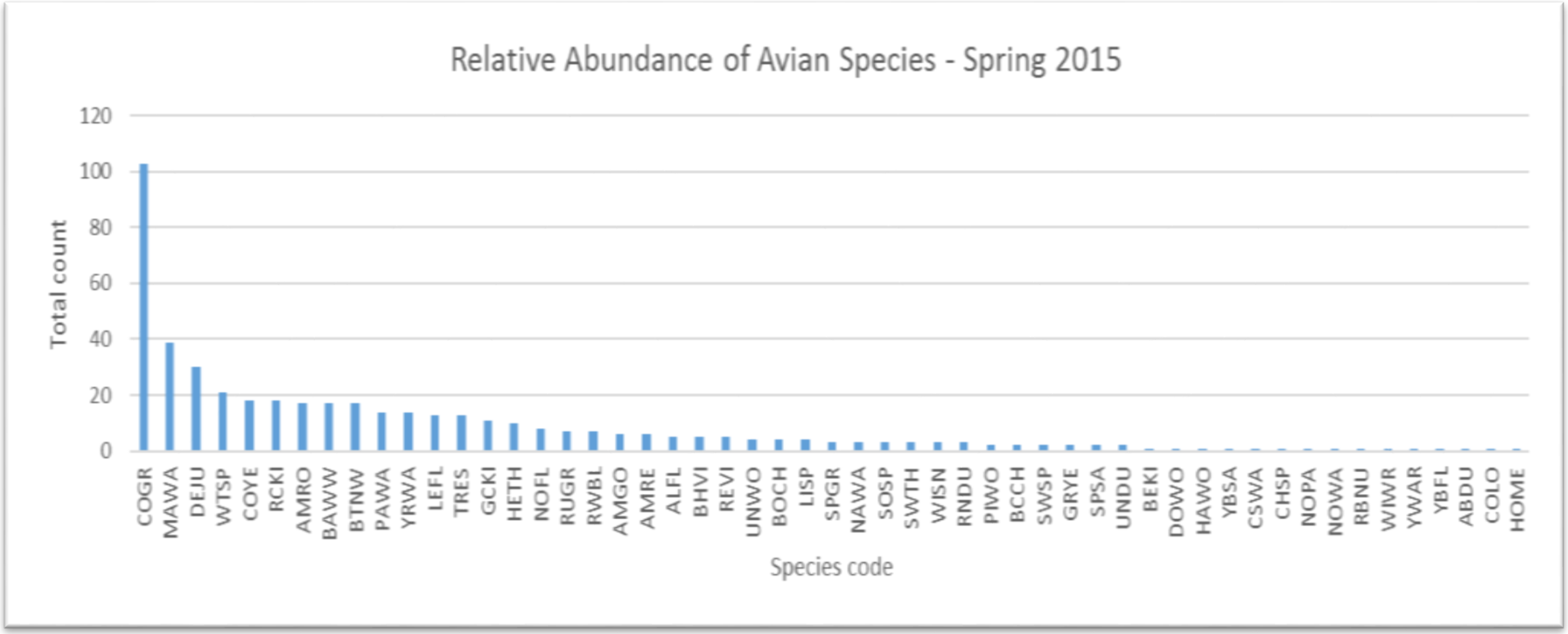

Figure 2: Relative abundance of avian species observed during spring migration surveys in 2015 within the mine footprint PA. This chart presents the four-letter (English Name) alpha codes in accordance with the 56th supplement to the AOU Check-list of North American Birds (Chesser et al., 2015). Unknown species code is: UNWO (Unknown Woodpecker).

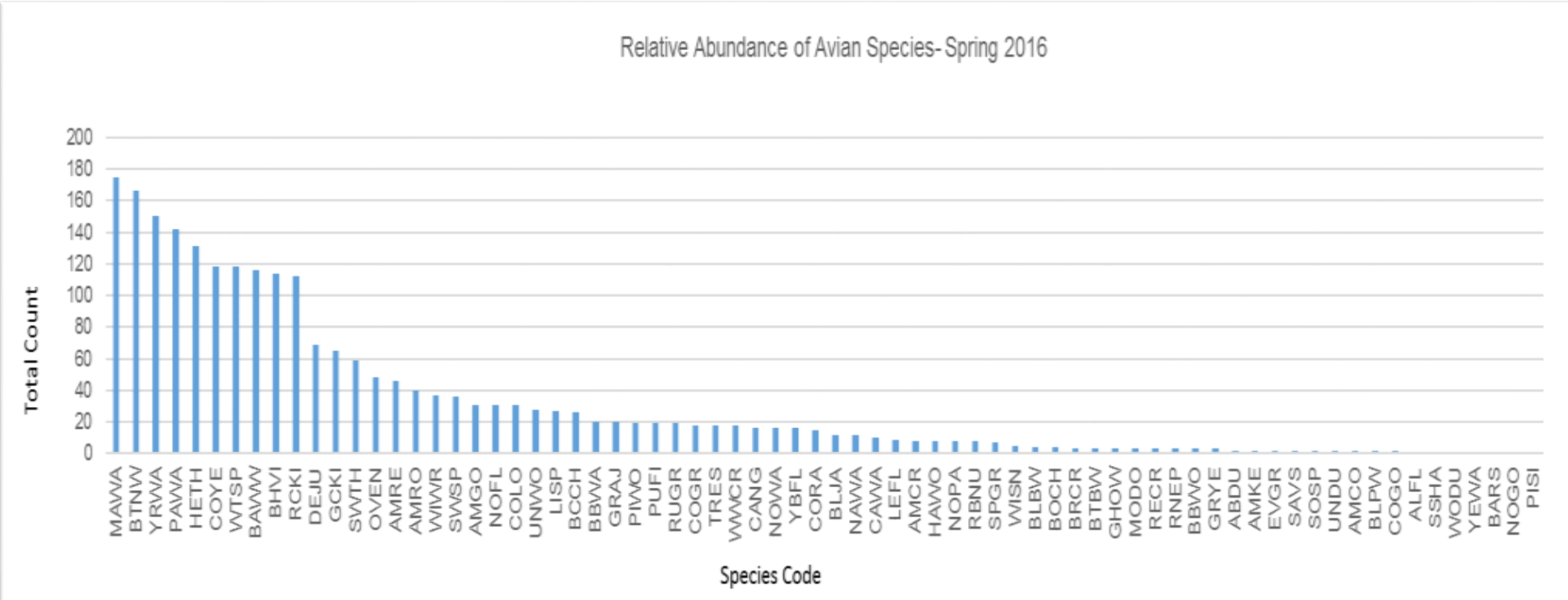

Figure 3: Relative abundance of avian species observed during spring migration surveys in 2016 within the haul road PA. This chart presents the four-letter (English Name) alpha codes in accordance with the 56th supplement to the AOU *Check-list of North American Birds* (Chesser et al., 2015). Unknown species codes are: UNDU (Unknown Duck) and UNWO (Unknown Woodpecker).

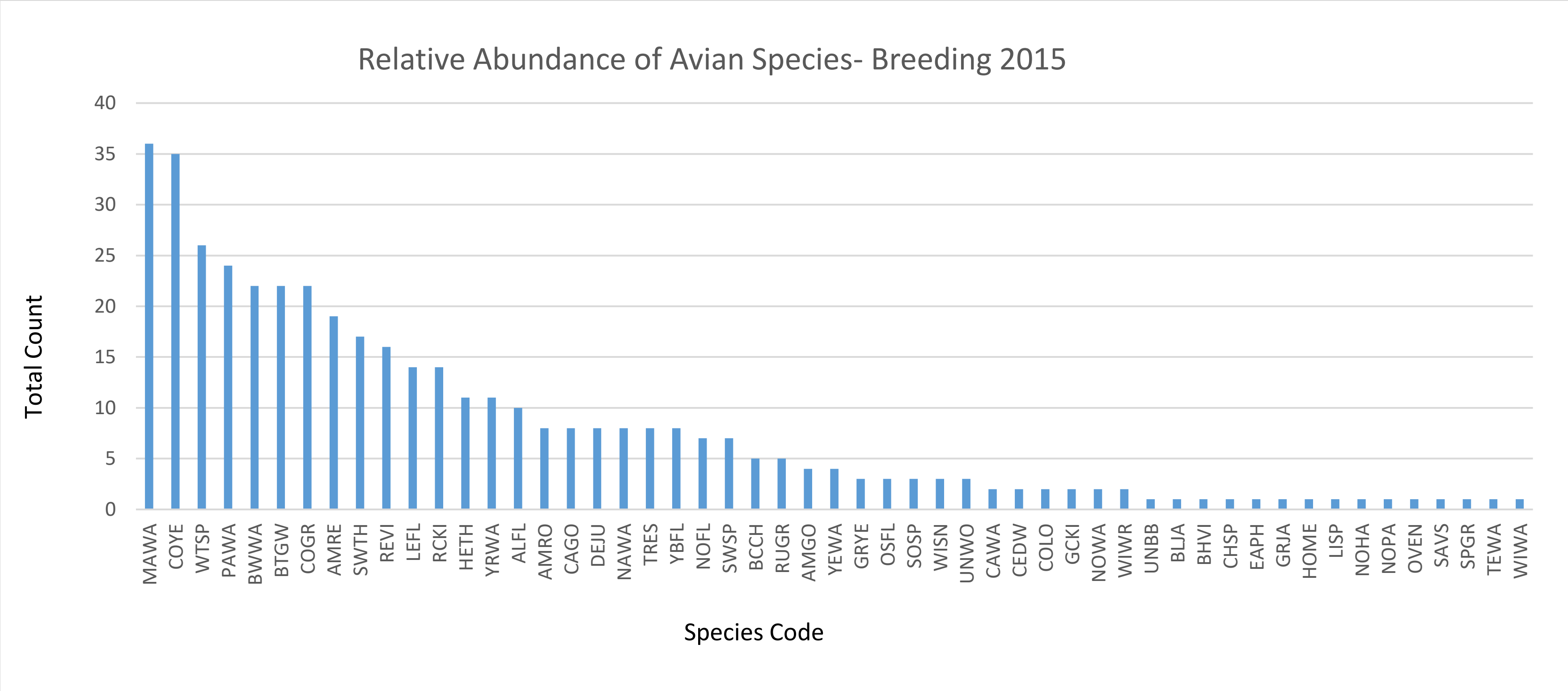

Figure 4: Relative abundance of avian species observed during breeding bird point count surveys in 2015. This chart presents the four-letter (English Name) alpha codes in accordance with the 56th supplement to the AOU *Check-list of North American Birds* (Chesser et al., 2015).

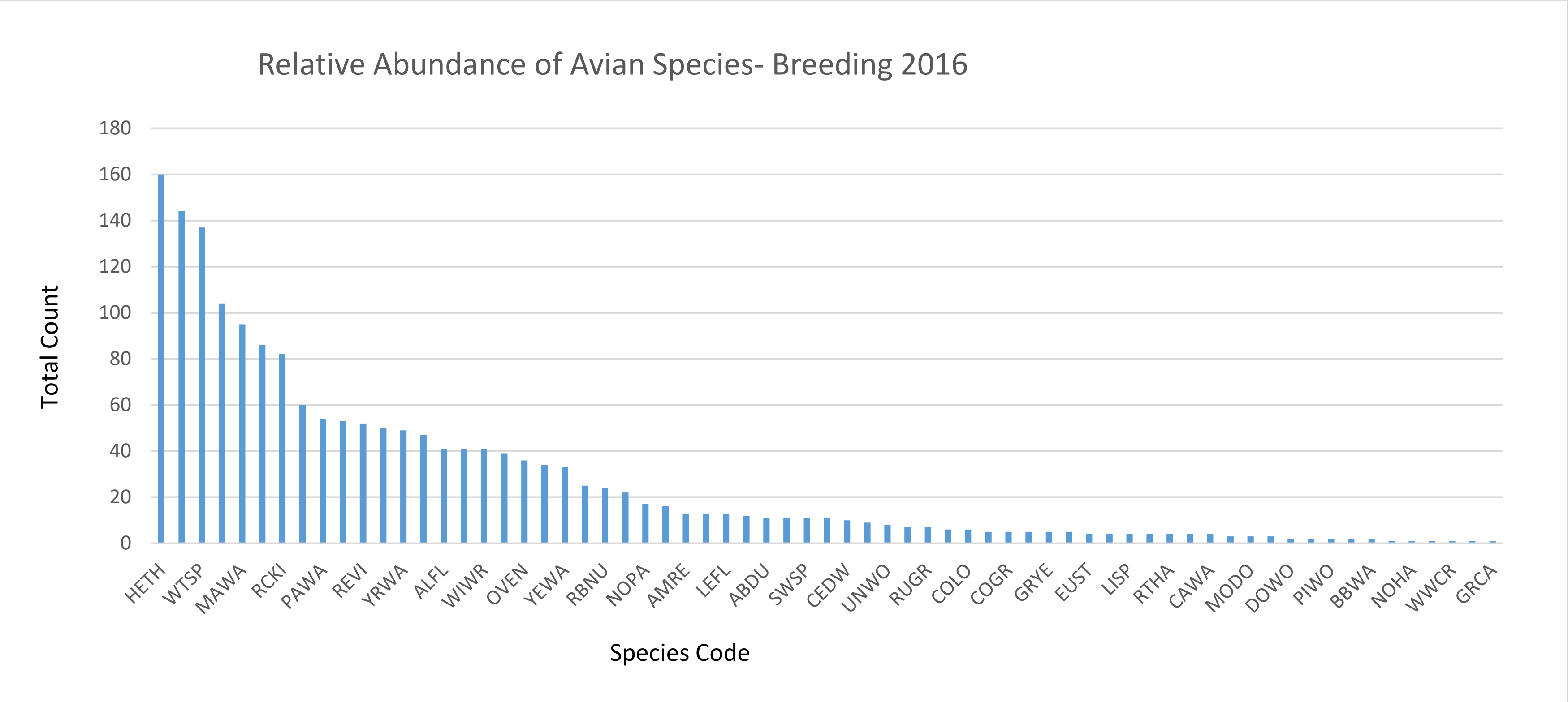

Figure 5: Relative abundance of avian species observed during breeding bird point count surveys in 2016. This chart presents the four-letter (English Name) alpha codes in accordance with the 56th supplement to the AOU Check-list of North American Birds (Chesser et al., 2015).

Appendix N
Mi’kmaq Ecological Knowledge Study

Mi'kmaq Ecological Knowledge Study

Beaver Dam Gold Mine Expansion Project -
Beaver Dam Mines Road Marinette, NS

Prepared for Atlantic Gold Corporation
6479 Moose River Road,
RR2 Middle Musquodoboit, NS, B0N 1X0

Prepared by
Mainland Mi'kmaq Development Inc.
P.O. Box 1590
57 Martin Crescent, Truro, Nova Scotia, B2N 5V3
Tel: (902) 895-6385
Fax: (902) 893-1520

The Confederacy of Mainland Mi'kmaq

November, 2016

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TABLES & FIGURES

1.0 INTRODUCTION

1.1 Mainland Mi'kmaq Development Inc.

The Confederacy of Mainland Mi'kmaq (CMM) Environmental Services is a program operated by the Lands, Environment, and Natural Resources, that provides fee for service in environmental consulting; this division is currently known as Mainland Mi'kmaq Developments Incorporated (MMDI). The CMM provides advisory services to seven Mi'kmaq communities in the province of Nova Scotia: Paqtnkek Mi'kmaw Nation, Annapolis Valley First Nation, Bear River First Nation, Glooscap First Nation, Millbrook First Nation, Pictou Landing and Sipekne'katik First Nation.

The MMDI had been successful in the contract to complete a second Mi'kmaq Ecological Knowledge Study (MEKS) for the Beaver Dam Gold Mine Expansion Project, for The Atlantic Gold Corporation.

The CMM Lands, Environment & Natural Resources, MMDI contact information:

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Acting Director, Lands, Environment and Natural Resources
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1.2 Project Description

The Mainland Mi'kmaq Development Inc. has been selected to complete a second MEKS for the Beaver Dam Gold Mine Project Study of 2009. The project site is located in Halifax County, between Sheet Harbour and Upper Musquodoboit, off of Highway 224 near Cameron Flowage, near Beaver Lake IR #17.

The New Proponent, Atlantic Gold Corporation, has since replaced the Acadian Mining Corporation is the current proponent and an updated MEKS for 2016, includes the same study area as the original project area for the Expansion Project, with two additional road expansions near Beaver Lake (IR #17).

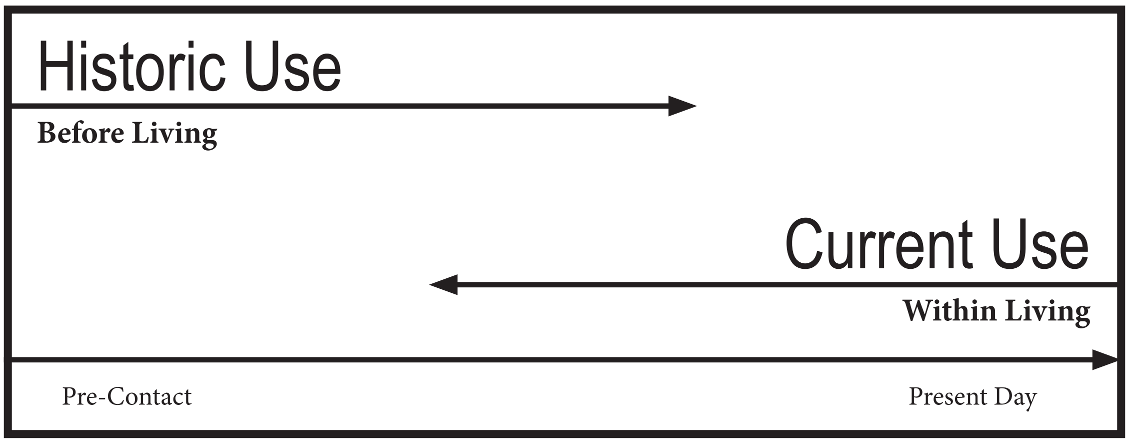
2.0 DEFINITION OF TERMS

Living Memory is the memory of living Mi'kmaw. The period of time included in living memory varies from knowledge holder to knowledge holder. Living memory often extends to the parent and grandparent of the knowledge holder and can be estimated at three to four generations.

Current Mi'kmaq Land and Resource Use occurred within living memory or is occurring at the present day (Figure 1)

Historic Mi'kmaq Land and Resource Use occurred before living memory (Figure 1)

Figure 1: Historic and Current Use Timeline



Mi'kmaw Ecological Knowledge (MEKS) is the collective body of knowledge which Mi'kmaq possess based on their intimate relationship with their natural surroundings, which involves exploitation, conservation and spiritual ideologies, and has been passed on from generation to generation, *"kisaku kinutemuatel mijuijij"*, elder to child.

Mi'kmaq Land and Resource Use Sites are locations where Mi'kmaq land and resource use activities have taken place or are taking place at present day. These sites may or may not display physical evidence of Mi'kmaq use.

Mi'kmaq/Mi'kmaw: *Mi'kmaq* means the Family and is an undeclined form. The variant form, *Mi'kmaw*, plays two grammatical roles: 1) it is the singular of Mi'kmaq and 2) it is an adjective in circumstances where it precedes a noun.

Mi'kma'ki is the Mi'kmaw homeland (Atlantic Provinces and Gaspé Peninsula)

Specific Land Claim arises when a First Nation alleges that the federal government has not honoured its treaties, agreements or legal responsibilities. According to federal policy, a valid specific claim exists when a First Nation can prove the government has an "outstanding lawful obligation". The Mi'kmaq are currently pursuing several specific land claims in Nova Scotia.

Comprehensive Claim is based on underlying Aboriginal Title to traditional territory that has not been dealt with by treaty or other means. Aboriginal Title to lands exists as a legal right derived from First Nations historical occupation and possession of their tribal lands. The process of negotiating the settlement of comprehensive claims, which is known as modern-day treaty making, clarifies access and ownership to land and resources. Currently, the Mi'kmaq has a comprehensive claim to all lands within the province of Nova Scotia including all inland and adjacent waters.

3.0 PURPOSE AND SCOPE OF THE MI'KMAQ ECOLOGICAL KNOWLEDGE STUDY

3.1 Purpose of the Mi'kmaq Ecological Knowledge Study

The purpose of the Mi'kmaq Ecological Knowledge Study is to support the integration of Mi'kmaq knowledge of use and occupation of Mi'kma'ki into development decisions via the environmental assessment process.

3.2 Scope of the Mi'kmaq Ecological Knowledge Study

The MEKS includes:

1) a study of historic and current Mi'kmaq land and resource use;
2) an evaluation of the potential impacts of the Project on Mi'kmaq use and occupation and constitutionally based rights;
3) an evaluation of the significance of the potential impacts of the Project on Mi'kmaq use and occupation; and
4) Recommendations to proponents and regulators that may include recommendations for mitigation measures, further study, or consultation with Mi'kmaq.

3.3 Not included in the scope of the Mi'kmaq Ecological Knowledge Study

3.3.1 Section 35 Consultation

This study is not consultation for justification of the infringement of constitutionally protected aboriginal and treaty rights. If the project involves possible infringements of Mi'kmaq constitutional rights, the MEKS recommends further action.

3.3.2 Archaeological Screening and Resource Impact Assessment

The study is not an Archaeological Screening or Archaeological Resource Impact Assessment. Results presented in the study can inform and be informed by archaeological screenings and assessments.

3.3.3 Notification of Mi'kmaw individuals or communities of the Project

The study is not intended to inform or notify Mi'kmaw individuals or communities of the Project, solicit the opinions or concerns of Mi'kmaw individuals or communities on the Project, or promote the Project to Mi'kmaw individuals or communities.

4.0 METHODOLOGY

4.1 Historic Mi'kmaq Land and Resource Use

Historic Mi'kmaq land and resource use occurred before living memory. The study of historic land and resource use paints a broad portrait of Mi'kmaq use and occupation of Mi'kma'ki in centuries past.

4.1.1 Study Area

This study encompasses the area surrounding Cameron Flowage located in Beaver Dam, Halifax County, Nova Scotia. The study area is adjacent to Beaver Lake I.R. #17 and is located about 30 kms north of Sheet Harbour I.R. #36, which are part of the Millbrook First Nation. A broader scope of research has been included to show Mi'kmaq use and occupation within Halifax County. Included within the study area, are the lands adjacent to the road expansion projects, Moose River Cross road and the Beaver Dam Mine road.

4.1.2 Methods

Research was completed from within The Confederacy of Mainland Mi'kmaq research department library as well as external sources from the Nova Scotia Public Archives, Nova Scotia Museum, Cape Breton University's Mi'kmaq Resource Centre and the Colchester library. Secondary sources include Crown Land index sheets, church records, cemetery record, maps and published papers and books on Nova Scotia History.

4.1.3 Limitations

Recorded documents are the primary source of information for the study of historic Mi'kmaq land and resource use. There are no recorded documents in the pre-contact period and recorded documents in the post-contact period are not comprehensive. Furthermore, existing documentation has largely been written by people of a different culture. This means that information may either not be completely accurate or may be incomplete.

4.2 Current Mi'kmaq Land and Resource Use

Current Mi'kmaq land and resource use occurred within living memory or is presently occurring. The MEKS includes a study of:

1) Current Mi'kmaq land and resource use sites
2) Species of Significance to Mi'kmaq
3) Mi'kmaw Communities

4.2.1 Study Areas

The study areas are described in Figure 2.

4.2.1.1 Current Mi'kmaq Land and Resource Use Sites

The study area for current Mi'kmaq land and resource use sites is the proposed area of development – five-kilometer radius surrounding proposed project site.

4.2.1.2 Species of Significance to Mi'kmaq

Study areas are marked on Figure 2.

4.2.1.3 Mi'kmaw Communities

The study area for Mi'kmaw communities is a 5 km radius surrounding the proposed development area.

4.2.2 Methods

4.2.2.1 Current Mi'kmaq Land and Resource Use Sites

Mi'kmaq knowledge on current land and resource sites will be gathered through a review of information collected through oral interviews with Mi'kmaw knowledge holders.

All individuals, whom will be interviewed, will sign consent forms. Knowledge will be gathered in accordance within the spirit of the *Mi'kmaq Ecological Knowledge Protocol*.

Knowledge collected is reported in a general format only. No names or specific locations are published. Collected knowledge will be digitized and compiled to allow for an analysis of potential impacts of the project on current Mi'kmaq land and resource use.

4.2.2.2 Species of Significance to Mi'kmaq

A system of stratified random sampling was employed to identify flora species present in the study areas of significance to Mi'kmaq. Plants were surveyed in the summer of 2016. Information collected is reported in a general format only. The names of the species are not recorded.

4.2.2.3 Mi'kmaw Communities

A review of outstanding specific land claims within the study area was undertaken by CMM. There are three specific land claims identified within the project area, however, the records of outstanding specific land claims are not currently fully researched.

4.2.3 Limitations

While every attempt was made to document all available Mi'kmaw knowledge, the knowledge gathering process may not have captured some available Mi'kmaw knowledge. It is also recognized that over generations of cultural and political suppression, much Mi'kmaq knowledge has been irretrievably lost.

5.0 RESULTS

Results of the study are divided into two categories:

1) Historic land and resource use, that is, use that occurred before living memory, and
2) Current land and resource use, or use that occurred within living memory or is occurring at the present day.

Land and resource use may be for hunting, burial/birth, ceremonial, gathering, or habitation purposes.

5.1 Historic Mi'kmaq Land and Resource Use

5.1.1 Pre-Contact Introduction

Mi'kmaq traditional use of the land in Nova Scotia involved semi-permanent and permanent settlements. Summer villages of the Mi'kmaq were usually located on the banks of streams or rivers. The most important factor in the choice of a site was the proximity of the site to a navigable body of water. Sites around the mouths of rivers with heavy spawning runs were highly favourable for use, as well as smaller rivers running back into a system of lakes.[1] It is therefore likely that the Mi'kmaq settled in the study area, which exhibits these types of natural features.

Beaver Dam lies within *Eskikewa'kik* or the "skin dressing territory". This particular district spans from Halifax County across to Guysborough County. Various authors and historians have differed in their description of how far this territory expands, but all have agreed that Beaver Dam lies within this district.

Eskikewa'kik lies within the Meguma Terrane in the Atlantic Uplands of Nova Scotia. The Meguma Zone occupies the southern mainland of Nova Scotia and extends seaward beneath younger sedimentary rocks.[2] It is a mix of fine sandstone, shale, quartz rich sand and mud. "The Mi'kmaq and their ancestors acquired an impressive knowledge of the geology of their land by using rocks and minerals to develop one of the first technologies – the working of stone."[3] Certain stones would have been used as grinding tools on other types of stone, bone, antlers and wood. Other hard stones such as quartz would have been used as hammers, choppers, knives and arrowheads. (Natalie Stoddard; pg. 2)

The area contains a variety of spruce, fir, birch, ash, maple pine and shrubs inland, which would have been used in making baskets and building shelter. "Small mammal diversity is moderately high in well drained mixed and hardwood forest habitats, especially along rivers and streams",[4] drawing lynx, moose, beaver, deer, marten and hare to the area, all harvested food by the Mi'kmaq.

There is no recorded archaeological activity recorded within the study area. A further investigation into areas that border Fifteen Mile Stream has been included later on in this report. Stephen Davis has commented on the lack of archaeological evidence with Maritime Coastal areas. "Unfortunately for the archaeologists, the shorelines of 10,000 to 5,000 years ago no longer exist. The demise was related to ongoing geological events."[5] The harsh winters, strong winds, and erosion have left little evidence of early use and occupation.

Although little historical information has been written about Mi'kmaq inhabiting these areas in large numbers, there is some documentation that suggests that they mainly inhabited Halifax and Port Mulgrave. Bernard Hoffman has noted that there were seven main sites within Eskikewa'kik; including sites at Ship Harbour, Spry Bay Harbour and Liscomb Harbour near the study area.

Mi'kmaq cultures hunted land and marine mammals and fish for sustenance and some trading until the late sixteenth century, when traditional activities began to change in

[1] Donald M. Julien, Historical Perspective of Micmac Indians Pre & Post Contact Period, p. 3.
[2] Davis, Derek S and Sue Browne. Natural History of Nova Scotia, Volume 1: Topics, page 20
[3] Davis, Derek S and Sue Browne. Natural History of Nova Scotia, Volume 1: Topics, page 322
[4] Davis, Derek S and Sue Browne. Natural History of Nova Scotia, Volume 1: Topics, page 57
[5] Davis, Stephen. The Micmac, page 12.
[6] Davis, Derek S and Sue Browne. Natural History of Nova Scotia, Volume 1: Topics, page 368

response to contact with the Europeans.[6] Settlements, although not permanent, were located near major waterways and harbours, providing accessibility to trade with the Europeans. The Mi'kmaq traveled inland through minor streams and rivers, either by canoe or on foot.

5.1.2 Post Contact

Nicholas Denys gives a brief description of the area "Bay de Toutes Isles" which would cover the area along the Eastern Shore know as the Bay of Islands running from Ship Harbour along the coast to Liscomb Harbour. "This bay has nearly four leagues of depth, and there are several rivers which discharge into it. These are small and are only, as it were, large brooks, [though] by them the Indians come and go."[7] He stated that there seems to be a large number of Indians living in that area in order to hunt the moose.

Mi'kmaq at Beaver Dam

The Mi'kmaq referred to this area as *Kopitewey Kwimuti*[8] literally meaning Beaver Harbour. In 1852, 100 acres had been set-aside for Simon Francis on the Sheet Harbour Road at the head of Beaver Lake. There is little written prior to the setting aside of this reserve under Samuel Fairbanks' Return of Land report in 1866.

The reference plan from Natural Resources Canada shows a parcel of ten acres adjacent to the Beaver Dam reserve as being allotted to Peter Paul in 1930. The original letters patent and grant was not located, but Peter Paul's name again comes up in lands held by himself and his brother adjacent to the Sheet Harbour Reserve.

In the *Old Man Told Us* by Ruth Holmes Whitehead, reference is made to John Cope killing 18 moose at Beaver Dam and selling them to the men at Fifteen Mile Stream Goldmine in 1918.

In 1973, John Covert conducted another survey at Beaver Lake and found that the reserve contained 122 acres instead of the initial one hundred acres granted to Simon. The reserve was formally set-aside to Millbrook Band in 1960.

Mi'kmaq at Sheet Harbour

Around the seventeen hundreds, the Mi'kmaq lived along the eastern coast, at Spry Bay Harbour, Ship Harbour and Sheet Harbour. In 1762, Jonathan Belcher issued a proclamation protecting the traditional hunting and fishing territories of the Indians. This area included all that portion of Canso and running westerly as far as Musquodoboit.

Following the American Revolution in 1776, an influx of loyalists induced on settling in Nova Scotia, were given gratuitous land grants and most of the land laid out for the Indians was encroached upon. In 1783 a license of occupation was issued to the Indians for 11,520 acres in order to protect their fishing and hunting rights. James E. Rutledge

[7] Ganong, William F. The Description and Natural History of Coasts of North America (Acadia) by Nicholas Denys p. 157
[8] Stevens, Arlene. Mi'kmaq Place Names, pg.
[9] Rutledge, James E. A History of Sheet Harbour, pg. 13

mentioned in his book *History of Sheet Harbour* that when a number of soldiers had moved to the area in 1784, "there was an encampment of Indians in the maple grove now the property of the heirs of Robert Rutledge at Watt Section"[9] . This in all likelihood was the section of land included within the license of occupation.

A large portion of the areas given under these licenses, were encroached upon by European settlers but Mi'kmaq occupation continued at Sheet Harbour prior to the establishment of the formal reserve in 1915. The white settlers, angered by Belcher's proclamation for protecting Mi'kmaq hunting territories, ignored his rule, and continued to settler there. The lands set aside for the Indians were eventually abandoned, but some continued to return there to hunt and fish.

In Frank Speck's work, *Beothuk and Micmacs*, he describes the hunting territories. "The Micmac, like the rest of the northern and eastern Algonkian, whose subsistence was gained by hunting and fishing, had their country subdivided into more or less well recognized districts in which certain individual proprietors or families enjoyed the inherited privileges of hunting. [10]

Contained within Speck's list of territories, predominantly Cope surnames continued to hunt and fish at Ship Harbour, Jeddore, Ten and Fifteen Mile Lake, Sheet Harbour and Liscomb. See part of Speck's list below. [11]

Shubenacadie and Sheet Harbour Bands		
27	Frank Paul	Stewiacke river valley
28	John Newell Cope	Musquodoboit river between Middle Musquodoboit and Musquodoboit.
29	Andrew Francis	North of Ship Harbour lake, Gould Lake
30	Joe Cope	North of Jeddore
31	Young Joe Cope (Son of No. 30)	Northeast of Jeddore
32	Andrew Paul	Grassy lake north of Killag river
33	(Territory supposed to have belonged to Pauls).	
34	Sandy Cope	Tangier lake and Scraggy lakes
35	Frank Cope	Hunting lake, Governor's lake, and Ten Mile lake
36	Peter Joe Cope	Fifteen Mile lake, Rocky lake
37	Michael Tom (Toney)	Moser River
38	Young Peter Joe Cope	Large district north of Sheet Harbour
39	Mathew Salome	Big Liscomb lake
40	Jim Paul	Hunting lake and Liscomb river
41	Abram Paul (son of No. 32)	Lake Mooin, back of Liscomb
46	Abram Gould	Neighbourhood of Sheet harbour, (He came originally from Cape Breton Island, where his family had territory and received a tract from the Cope family in Nova Scotia

[10] Speck, Frank G. Beothuks and Micmac, pg 86.
[11] Speck, Frank G. Beothuks and Micmac, pg. 103-105

Mi'kmaq at Ship Harbour

The Mi'kmaq referred to the area at Ship Harbour as *Tetmnipukwek*[12] meaning blunt harbour. In 1813, a petition came from Francis Coop for land at Ship Harbour for himself, his wife and seven children as outlined in document RG 20 A – Coop Francis. The petition stated that 200 acres of land be laid out for him, as he was sober and industrious, on the proviso that it could only be passed on to his children at the head of the Ship Harbour River.

In 1848, John Spry Morris laid out 500 acres of land in 100-acre lots, with a small lot measuring 47 acres being reserved for fishing. The five lots were laid off to Francis Paul, Joseph Paul, Lewis Paul, Lewis Newal and Lewis Brooks. Two additional lots were allotted to Francis Paul's sons, James Paul and Joseph Paul. A survey of the area in 1853 had referred to 700 acres of land but did not mention the 47 acres reserved for fishing.

After 1855 little correspondence is written about the Mi'kmaq living at Ship Harbour. There are a few bills for provisions and aid given to them in 1856 (MG 15 Volume 6 no. 14). Various requests for blankets had dropped from 1861 onward, as they believed that an outbreak of smallpox had serious effect on the numbers living at Musquodoboit, Sheet Harbour and Ship Harbour. Joseph Browner had requested that four dollars worth of blankets be sent to him for Indians living at Tangier, but no mention of Ship Harbour. (Journal of Assembly: 1863, No. 16, p.5.)

In 1893, J. Lewis & Sons inquired into the possibility of purchasing land at Ship Harbour Reserve in order to locate a factory and use the timber on the land. The Superintendent General then wrote to the Indian agent to inquire any Indians lived there, and would be willing to surrender the reserve. Joseph Cope's letter to the Superintendent General stated: "the said or supposed Reserve has been abandoned by the Indians thirty or forty years ago. Although a good number of us are there every summer for the [?] work purposes…"[13].

In 1919, the government wanted to centralize the Mi'kmaq on two main reserves at Shubenacadie and Indian Brook. They had made several attempts with the Halifax County Indians to either settle permanently on Ship Harbour, or to dispose of the land. The property was eventually surrendered along with Sambro and Ingram River, but the Mi'kmaq continued to use that area as shown in Frank Speck's *Beothuks and Micmac*. He pointed out that Andrew Francis was allotted hunting territory #29 in 1922, which covered land at the Great Ship Harbour: whether or not that fell into the lands originally set aside as an Indian Reserve is unknown.

5.1.3 Archaeology

Nova Scotia Museum records did not contain any archaeological sites within the study area. The adjoining areas have had some activity recorded in the Maritime Archaeological Resource Inventory. The information collected from that research has shown that Mi'kmaq presence occurred all around the study area.

[12] Stevens, Arlene. Mi'kmaq Place Names, pg. 35

[13] DIAND file 274/30-1, Volume 1.

5.2 Current Mi'kmaq Land and Resource Use

The study of current Mi'kmaq land and resource use is comprised of a study of current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities.

5.2.1 Current Mi'kmaq Land and Resource Use Sites

Current Mi'kmaq land and resource use activities are divided into five categories:

1) Kill/hunting
2) Burial/birth
3) Ceremonial
4) Gathering food/ medicinal
5) Occupation/habitation

Table 1 provides a description of activities undertaken at the sites.

Table 1: Description of Activities Undertaken in Current Mi'kmaq Land and Resource Use Site

TYPE OF SITE	DESCRIPTION OF ACTIVITIES IN STUDY AREA
HUNTING/KILL	Trout, Eel, Bear, Rabbit, Deer, Porcupine, Partridge, Coyote, Mink, Muskrat, Weasels, Racoon, Fox, Otter, Beaver
BURIAL/BIRTH	Potential Burial sites
CEREMONIAL	
GATHERING	Wild Fruit, Berries, H2O, Food Plant, Specialty wood, logs, feathers, quills
HABITATION	Anchored boat, Travel route, Overnight Site

Potential Burial Sites were recorded within the study area on the Western side of the Beaver Dam Mine road, but not within the project area.

5.2.2 Species of Significance to Mi'kmaq present in study area

Species of significance to Mi'kmaq in the study area are divided into three categories:

1) Medicinal
2) Food/Beverage
3) Craft/Art

The following table describes the number of plants of significance present in the study areas during the summer survey of 2016.

Table 2: Number of Species of Significance to Mi'kmaq Present in the Study Areas Summer 2016

TYPE OF USE	NUMBER OF SPECIES PRESENT SUMMER 2016
MEDICINAL	49
FOOD/BEVERAGE	27
CRAFT/ART	11

5.2.3 *Mi'kmaw Communities*

There are two Indian Reserves located near the study area: these reserves were set aside under the Indian Act for the use and benefit of the Indians under federal legislation.

Beaver Lake is located in Halifax County along Highway 224 and is a satellite community belonging to Millbrook First Nation. The reserve was established on March 2, 1867, is approximately 49.4 hectares in size. There are a small number of homes and hunting camps located on the property. The estimated population on reserve is 22, with a total of five homes and 4 small cottages/camps.

Sheet Harbour is located along Highway #7, approximately 112 kms from Halifax, and is comprised of 2 lots amounting to 32.7 hectares. The land was purchased from William Tupper in 1915, for the purpose of creating an Indian Reserve. The reserve was set aside under the administration of Millbrook First Nation in 1960. There are approximately 75 members living on reserve with nine homes, and two trailers, as well as a community hall and a convenience/gas bar.

The following is a list of Mi'kmaq place names:

Nukumkiaq – Moser River (Gravelly Stream)

Ktuaqati – Quoddy Head (Place of War Whoop)

Nutaqati – New Quoddy (Place of Seal Hunting)

Kopitewey kwimuti – Beaver Harbour (literal translation)

Nikanaputik – Beaver Point (Foresight)

Waijuik – Sheet Harbour River (Deceitfully flowing)

Kiso'quetek – Sheet Harbour Road (Going up in the Country)

Kuimutijk – Spry Bay Harbour

Amaqopskikek – Tangier River (Tumbling over rocks)

Kisna Kopilk – Moose River

Tetmnipukwek – Ship Harbour

Eski'kewa'kik – Skin Dressers Territory

Sikna'qiknek – Taylor's Head (A spread sail)

6.0 POTENTIAL PROJECT IMPACTS ON MI'KMAQ LAND AND RESOURCE USE

The following table presents potential project impacts on historic and current Mi'kmaq land and resource use.

Table 3: Potential Project Impacts on Mi'kmaq Land and Resource Use

POTENTIAL IMPACTS ON MI'KMAQ LAND AND RESOURCE USE	
6.01	The historic review of Mi'kmaq use and occupation documents historic Mi'kmaq use and occupation in the study area, and potentially the project area. A potential impact of the project is the disturbance of archaeological resources and Burial sites.
6.02	Several species of significance to Mi'kmaq have been identified in the study area. Permanent loss of some species is an impact of the project.
6.03	Current Hunting, Gathering and Trapping activities have been identified in the study area. Permanent loss of habitat is a potential impact.

7.0 SIGNIFICANCE OF POTENTIAL PROJECT IMPACTS ON MI'KMAQ LAND AND RESOURCE USE

The concept of significance in the Mi'kmaq Ecological Knowledge Study is distinct from the concept of significance under the *Canadian Environmental Assessment Act* or the *Nova Scotia Environmental Assessment Regulations*. Significance to Mi'kmaq is evaluated only in accordance with the criteria listed below. The MEKS evaluation of the significance of the potential project impacts on Mi'kmaq should be used by regulators to inform their determination of the significance of the environmental effects of the Project.

7.1 Significance Criteria

The following criteria are used to analyze the significance of the potential project impacts on Mi'kmaq use:

1) Uniqueness of land or resource
2) Culture or spiritual meaning of land or resource
3) Nature of Mi'kmaq use of land or resource
4) Mi'kmaq constitutionally protected rights in relation to land or resource.

7.2 Evaluation of Significance

Table 4: Significance of Potential Project Impacts on Mi'kmaq Land and Resource Use

POTENTIAL IMPACT		EVALUATION OF SIGNIFICANCE	
6.01	The historic review of Mi'kmaq use and occupation documents Mi'kmaq use and occupation in the study area, and potentially the project area. A potential impact of the project is the disturbance of archaeological resources and burial site.	7.2.01	Mi'kmaq archaeological resources are extremely important to Mi'kmaq as a method of determining Mi'kmaq use and occupation of Mi'kma'ki and as an enduring record of the Mi'kmaq nation and culture across the centuries. Archaeological resources are irreplaceable. Any disturbance of Mi'kmaq archaeological resources is significant. The potential Burial sites are not located within the proposed project site, therefore, impact of the project is not likely significant.
6.02	Several species of significance to Mi'kmaq have been identified in the study areas. Permanent loss of some specimens is an impact of the Project.	7.2.02	The plant species of significance to Mi'kmaq identified within the study area exists within the surrounding area. The destruction of some specimens within the study areas does not pose a threat to Mi'kmaq use of the species. The impact of the permanent loss of some specimens of plant species of significance to Mi'kmaq is evaluated as not likely significant.
6.03	Hunting, gathering and trapping activities have been identified in the study area. Permanent loss of habitat is an impact of the project.	7.2.03	The potential habitat loss located in and around the wetlands and lakes of the projects can be evaluated as significant.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.01 In the event that Mi'kmaw archaeological deposits are encountered during construction or operation of the Project, all work should be halted and immediate contact should be made Laura Bennett, Special Places Coordinator, at the Nova Scotia Museum, Kwilmu'kw Maw-klusagn Negotiation Office (KMKNO) and the Sipekne'katik and Millbrook Community.

8.02 There are three identified potential claims within the project site according to The Confederacy of Mainland Mi'kmaq research department. The potential claims include loss of reserve lands, a department of highway road allowance, and a Nova Scotia Power easement. Locations of these potential claims are adjacent to the Beaver Lake IR #17 foot print. More research is needed on these potential claims.

8.03 The project includes two road expansion along the Beaver Dam Mine Road and the Moose River Cross road, which is located adjacent to Beaver Lake IR #17. Concerns of increased traffic, loss of wetland habitat and the potential loss of areas with the study area including Tent lake and Cope Pond, Rocky, Otter, Como, Grassy and Beaver lakes, Killag River and the West River and the West River Sheet Harbour, where the majority of hunting, gather and trapping activity has and continues to take place. Any rights-based issues relating to loss of access to traditional use would have to involve the Kwilmu'ku Maw-klusuaqn Negotiations Office, Sipekne'katik and Millbrook Communities.

9.0 REFERENCES, SOURCES, AND RECORDS CONSULTED

Bartlett, Richard H. **Indian Reserves in the Atlantic Provinces of Canada**. University of Saskatchewan Law Centre, 1986.

The Confederacy of Mainland Mi'kmaq: Research Department. History of Beaver Dam

The Confederacy of Mainland Mi'kmaq: Research Department. History of Sheet Harbour.

The Confederacy of Mainland Mi'kmaq: Research Department. History of Ship Harbour.

Davis, Derek S. and Sue Browne, eds. **The Natural History of Nova Scotia: Topics and Habitats, vol. 1.** Halifax: Nimbus/Nova Scotia Museum, 1996.

Davis, Derek S. and Sue Browne, eds. **The Natural History of Nova Scotia: Theme Regions, vol. 2.** Halifax: Nimbus/Nova Scotia Museum, 1996.

Davis, Stephen A. **The Micmac: Peoples of the Maritimes.** Tantallon: Four East Publications, 1991.

Dawson, J.W. **A Handbook of the Geography and Natural History of the Province of Nova Scotia for the use of schools, families and travelers.** Pictou: James MacPherson & Co., 1860.

Frame, Elizabeth. **A List of Micmac Place Names, Rivers, Etc., in Nova Scotia.** Cambridge: John Wilson & Son, 1892.

Ganong, William F. **The Description and Natural History of the Coasts of North America (Acadia) by Nicholas Denys.** Toronto: Champlain Society, 1908.

Gould, Gary P. and Alan J. Semple. **Our Land: The Maritimes.** Fredericton: Saint Annes Point Press, 1980.

Hoffman, Bernard Gilbert. **The Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries.** Anthropology Doctoral Thesis: University of California, 1955.

Julien, Dr. Donald M. O.N.S., DCL, DHL. **Historical Perspectives of Micmac Indians: Pre and Post Contact Period.** Millbrook: The Confederacy of Mainland Mi'kmaq, 1995.

Nietfield, Patricia Kathleen Linskey. **Determinants of Aboriginal Micmac Political Structure.** New Mexico: University of New Mexico- Dissertation, 1981.

Rand, Silas T. (Rev). **Micmac Place-Names in the Maritime Provinces and Gaspe Peninsula.** Ottawa: Surveyor General's Office, 1919.

Rutledge, James E. **Sheet Harbour: A Local History.** Halifax: William Macnab & Son, 1954.

Speck, Francis G. **Indian Notes and Monographs: Beothuk and Micmacs.** New York: Museum of the American Indian, 1922.

Stoddard, Natalie B. **Indian Tools of Nova Scotia.** Halifax: Nova Scotia Museum, 1967.

Upton, L.F.S. **Micmacs and Colonists: Indian White Relations in the Maritimes, 1713-1867.** University of British Columbia Press, Vancouver, 1979.

Whitehead, Ruth Holmes. **The Old Man Told Us: Excerpts from Micmac History, 1500-1950.** Halifax: Nimbus Publishing, 1991.

Wicken, William C. **Encounters with tall sails and tall tales: Mi'kmaq Society, 1500-1760.** Department of History: McGill University, Montreal, 1994.

Records Consulted

Indian Affairs Annual Reports 1864-1920
Indian Affairs Files – Re: Halifax County Claim/Surrender of 1919

RG1 Volume 430
RG1 Volume 431
RG1 Volume 432

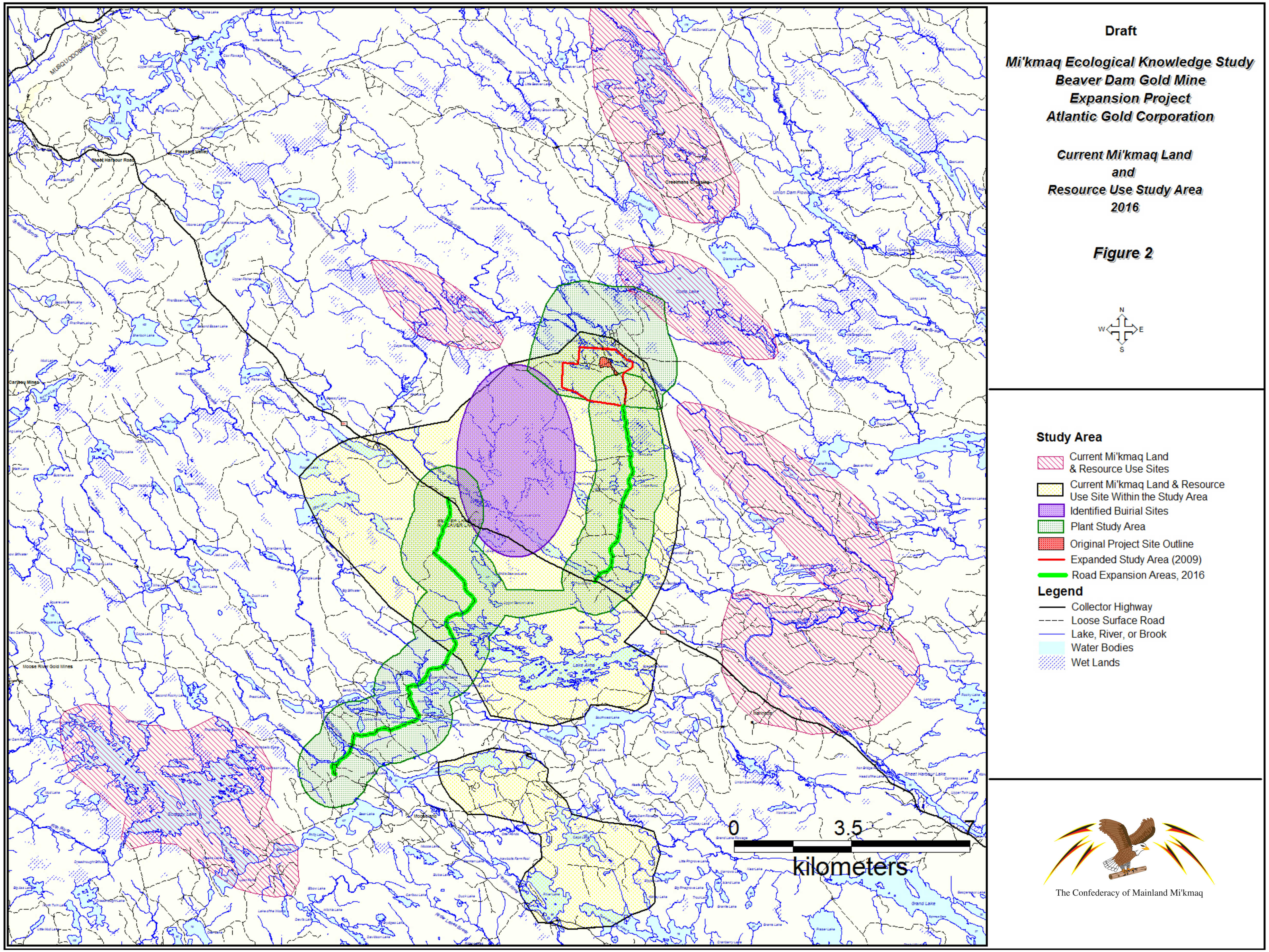
RG 10 Volume 459
RG 10 Volume 460
RG 10 Volume 461

MG 15 Volumes 3-6, and Volumes 17-19

Sources Consulted

Archivia Net
Archway
Canadian Archival Information Network
Cape Breton University (Mi'kmaq Resource Centre)
DocuShare - Union of Nova Scotia Indians Collection
Nova Scotia Archives and Records Management

Figure 2: Map of Current Mi'kmaq Land and Resource Use Study Area



Appendix O
Archaeological Reconnaissance Reports and Nova Scotia Communities, Culture & Heritage Communications

CONESTOGA-ROVERS & ASSOCIATES

BEAVER DAM GOLD PROJECT
ARCHAEOLOGICAL ASSESSMENT
HALIFAX REGIONAL MUNICIPALITY, NOVA SCOTIA

FINAL REPORT

Submitted to:
Conestoga-Rovers & Associates
and the
Special Places Program of the Nova Scotia Department of Communities, Culture and Heritage

Prepared by:
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Halifax, Nova Scotia
B3K 1T8

Consulting Archaeologist: Kathryn J. Stewart
Report Preparation: Kathryn J. Stewart & Kyle G. Cigolotti

Heritage Research Permit Number: A2014NS101

CRM Group Project Number: 2014-0015-01

MARCH 2015

The following report may contain sensitive archaeological site data. Consequently, the report must not be published or made public without the written consent of Nova Scotia's Coordinator of Special Places Program, Department of Communities, Culture and Heritage.

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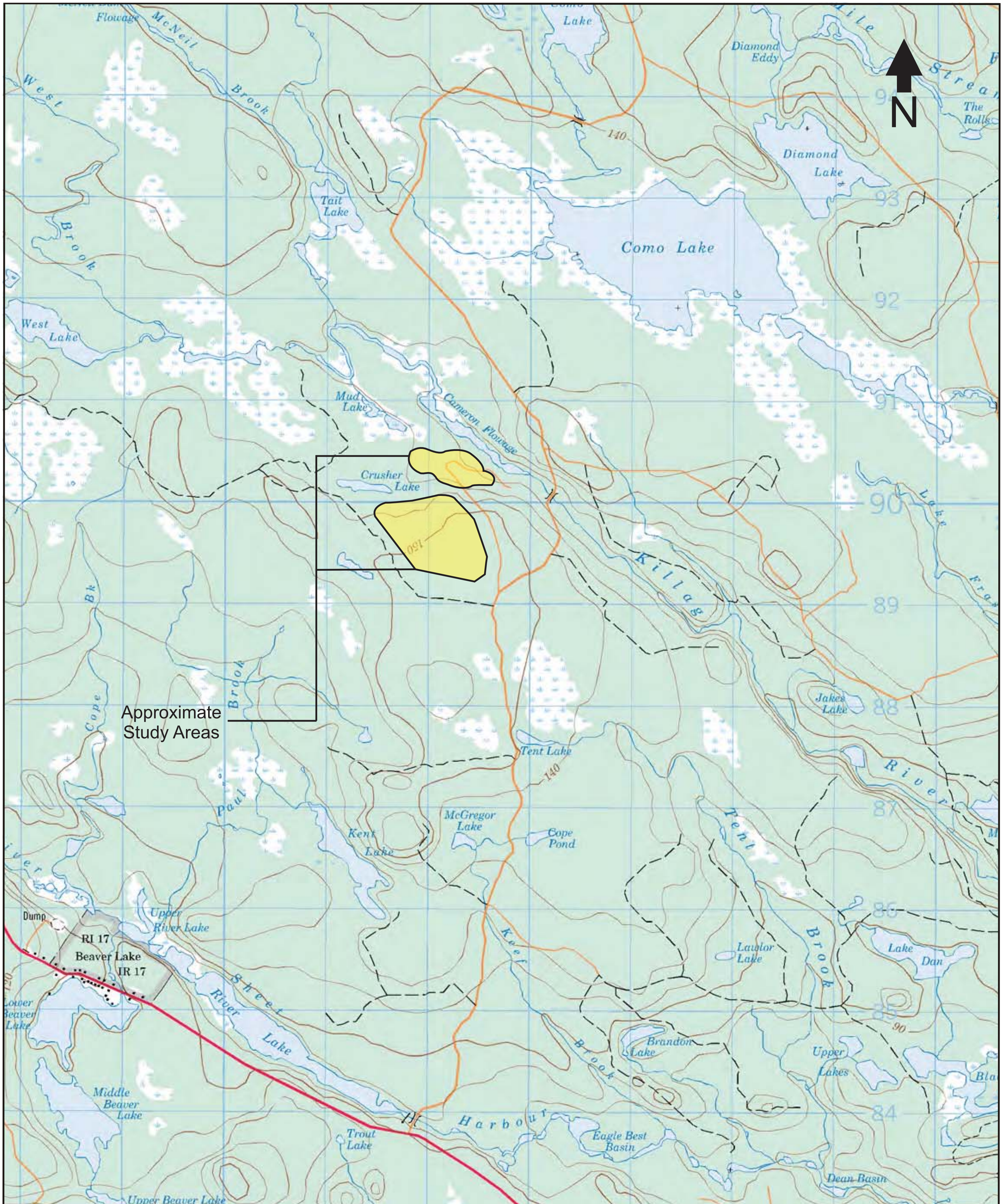
1.0 INTRODUCTION

Atlantic Gold Corporation (Atlantic Gold) is proposing to develop the Beaver Dam Gold Project located in the north-eastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figures 1 & 2***). The present assessment builds upon the research and reconnaissance of the Beaver Dam property on behalf of Acadian Mining (Acadian) undertaken by Cultural Resource Management (CRM) Group in 2008 (Beanlands 2008). Atlantic Gold is proposing to develop an open pit, as well as establish a waste rock storage pile (WRSP) and a crusher location.

In order to investigate the potential for encountering archaeological resources during any redevelopment of the facility, CRM Group was retained by Conestoga-Rovers & Associates (CRA) on behalf of Atlantic Gold to undertake archaeological screening and reconnaissance of the proposed mine expansion and conduct limited shovel testing where proposed development overlapped with previously identified archaeological features. However subsequent changes to the project study area removed from consideration the area of identified archaeological features that were to be shovel tested.

The fieldwork was undertaken by Staff Archaeologist, Kathryn J. Stewart with the assistance of W. Bruce Stewart, President and Senior Technical Advisor of CRM Group.

The archaeological investigation was conducted according to the terms of Heritage Research Permit A2014NS101 (Category 'C'), issued to K. Stewart through the Special Places Program (SPP). In addition to the elimination of the requirement for shovel testing, the proposed location of the crusher site was also modified so that it now falls within the overall area of the WRSP. This report describes the archaeological assessment of the proposed redevelopment area, presents the results of these efforts and offers cultural resource management recommendations.



Approximate Study Areas	Figure 1
BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2015 Scale 1:50 000

CRM Group
Cultural Resource Management Group Ltd.

CRM Group
Cultural Resource Management Group Ltd.

	Pit and Waste Rock Storage Pile	*Figure 2*
	BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2015

2.0 STUDY AREA

The Beaver Dam Gold Project property is located on the western side of Killag River in the northeastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figure 1***). The property comprises the historic Beaver Dam Gold District situated between Crusher Lake and Cameron Flowage (***Figure 2; Plate 1***). The study area, consisting of proposed pit and WRSP, covers an area of approximately 87 hectares. Access to the property can be gained by following Highway 224 approximately 17 kilometres northwest from Highway 7 to Beaver Dam Mines Road, then following Beaver Dam Mines Road north.

PLATE 1: Abandoned mining pit within the Beaver Dam Gold Project area; facing southeast. October 21, 2014.

3.0 METHODOLOGY

CRA retained CRM Group to undertake archaeological reconnaissance of the Beaver Dam study area. To address the potential of encountering significant archaeological resources within the study area, CRM Group developed a work plan consisting of the following components: review relevant site documentation to develop archaeological potential model (screening); archaeological reconnaissance of the area(s) to be impacted by development activities; and, prepare a report summarizing the results of the background research, and field survey, as well as recommend strategies for assessment and management of areas exhibiting high archaeological potential and/or features.

3.1 Background Research

The archival research component of the archaeological screening and reconnaissance was designed to explore the land use history of the study area, and provide information necessary to evaluate the area's archaeological potential. To achieve this goal, CRM Group utilized the resources of various institutions including documentation available through Nova Scotia Archives, the Department of Natural Resources (DNR) and Crown Land Information Management Centre.

The background study included a review of relevant historic documentation incorporating land grant records, legal survey and historic maps, as well as local and regional histories. Topographic maps and aerial photographs, both current and historic, were also used to evaluate the study area. This data facilitated the identification of environmental and topographic features which would have influenced human settlement and resource exploitation patterns. The historical and cultural information was integrated with the environmental and topographic data to identify potential areas of archaeological sensitivity. In preparation for the archaeological reconnaissance, the information obtained from this suite of research materials was reviewed to facilitate the interpretation of any archaeological features encountered within the study area.

3.2 Field Reconnaissance

The goals of the archaeological field reconnaissance were to conduct visual inspection of the study areas, document any areas of archaeological sensitivity or archaeological sites identified during the course of visual inspection, and design a strategy for testing areas of archaeological potential, as well as any archaeological resources identified within the study areas. Although the ground search did not involve sub-surface testing, the researchers were alert for topographic or vegetative anomalies that might indicate the presence of buried archaeological resources. The process and results of the field reconnaissance were documented in field notes and photographs.

A hand-held Global Positioning System (GPS) unit was used to record UTM coordinates (NAD 83) for all survey areas, as well as any identified diagnostic artifacts, formal tools, isolated finds and site locations.

4.0 RESULTS OF SCREENING AND RECONNAISSANCE

4.1 Background Study

The following discussion details the environmental and cultural setting of the study area. This background study provides a framework for the evaluation of archaeological potential and the initial interpretation of any resources encountered during the field component of the assessment.

4.1.1 Environmental Setting

A number of environmental factors such as water sources, physiographic features, soil types and vegetation have influenced settlement patterns and contribute to the archaeological potential of the area.

Water Sources

The Beaver Dam Development property is drained by way of the Killag River, a tributary of West River Sheet Harbour that flows south across the eastern portion of the study area. The Killag River has been dammed creating a reservoir along the eastern edge of the study area, known as Cameron Flowage. The dam is located at the southeastern end of Cameron Flowage. Several small lakes also fall in close proximity to the study area, including Crusher Lake and Mud Lake. Proximity to water, for both drinking and transportation, is a key factor in identifying Precontact and historic Native, as well as early Euro-Canadian, archaeological potential.

Topography

The study area is located within the greater terrestrial region known as the Atlantic Interior – Quartzsite Barrens (Guysborough) Unit (Davis & Browne 1996: 134). The bedrock-dominated topography can be generally described as undulating to rolling. Elevation within the study area ranges from approximately 109 metres to 171 metres above sea level. Low-lying areas are typically swampy. Elevated areas within the study area may have provided important vantage points for viewing the surrounding region and for sighting large game. The Beaver Dam Gold Project property is located within the Goldenville Group of the Meguma terrane of Nova Scotia, a sequence of Cambro-Ordovician-aged metasedimentary rocks and Devonian-aged granitoid intrusives. Gold deposits are present throughout much of the exposed stratigraphy of the Goldenville Group (Sangster & Smith 2007).

Soils

The Beaver Dam area is covered primarily by *Halifax* series (ST2, ST14) soils, although concentrations of *Bridgewater* (ST2 and ST8) and *Aspotogan* (ST4) series soils and peat are also found within the study area. *Halifax* soils are well drained but typically shallow, stony and porous. The parent material is olive to yellowish-brown sandy loam to gravelly sandy loam glacial till derived primarily from quartzite. In general, *Halifax* soils are too stony for agriculture (MacDougall *et. al.* 1963: 32-33). The well-drained *Bridgewater* soils are developed from a medium-textured, olive coloured glacial till that is derived principally from Precambrian slates. The *Bridgewater* soils in the Beaver Dam area are moderately stony and unsuitable for cultivation (MacDougall *et. al.* 1963: 28). *Aspotogan* soils are described as a dark grayish brown sandy loam overlaying and mottled with a dark reddish brown sandy loam. The soil has poor drainage and is considered too stony for cultivation. The parent material is an olive stony loam till derived from quartzite or granite (MacDougall *et. al.* 1963: 35)

Vegetation

The forest growth within this ecological region includes Balsam Fir, Red Spruce, White Spruce, Eastern Hemlock and Yellow Birch. Slow-moving streams are bordered by broad swampy areas populated with

Balsam Fir, Red Maple and Black Spruce. The nature of the soils found within the study area does not encourage heavy forest growth (Davis & Browne 1996: 56-57).

4.1.2 Native Land Use

The land within the study area was once part of the greater Mi'kmaq territory known as *Eskikewa'kik*, meaning 'skin dressers territory'. The rivers in the surrounding area would have been important transportation corridors and a resource base for the Mi'kmaq and their ancestors for millennia prior to the arrival of European settlers. The West River Sheet Harbour in particular, located approximately 700 metres south of the study area, would have been part of a transportation route facilitating travel inland from Sheet Harbour on the Atlantic Ocean.

A review of the Maritime Archaeological Resource Inventory, a provincial archaeological site database maintained by the SPP, determined that there are no registered archaeological sites within the study area. The lack of archaeological data for the area may reflect a lack of archaeological investigation, rather than an absence of archaeological sites. According to an environmental screening prepared by the SPP (Ogilvie 2008), the greater project area, which is dense with lakes and watercourses, is considered to exhibit moderate to high potential for encountering Precontact archaeological sites. It should be noted, however, that the project area as reviewed by the SPP encompassed a larger area than that subjected to archaeological screening and reconnaissance by CRM Group.

Based on available historic documentation, there is evidence to suggest a historic Mi'kmaq presence in the Beaver Dam area. The following account was related to Harry Piers by Jeremiah Bartlett Alexis (Jerry Lonecloud) in 1918 (Whitehead 1991: 310):

> *The death occurred at Stewarts, Upper Musquodoboit, on 31st, August, of an old and well-known Indian, John Cope, at the age of 71 years, he having been born at Beaver Dam, Halifax County, in April 1847, son of old Molly Cope who is said to have been 113 years of age when she passed away about 13 years ago . . . . John Cope had considerable fame as a hunter, at least judging by the number of moose he shot, and acted as a guide for various Halifax sportsmen some thirty years ago. He used to hunt back of Beaver Dam and Moose Head [?] with Captain C. Lestrange, who was formerly well-known here. One winter, probably about forty years ago, Cope by himself killed eighteen moose . . . . The meat of these he sold to Fifteen-Mile Stream gold camp, which was then in operation.*

Based on the environmental setting and Native land use, the Beaver Dam Development property is ascribed elevated potential for encountering Precontact and/or early historic Native archaeological resources.

4.1.3 Property History

The Beaver Dam Development property has a long history of industrial use. Gold was discovered in the Beaver Dam district in 1868. By 1871, two belts of veins had been opened and a 15-stamp mill erected (Malcolm 1976: 57). However, the property remained largely inactive until 1886, when extensive prospecting and development work began. A 4-stamp mill run by water power was constructed at this time. In 1891, the Beaver Dam Mining Company acquired the site. This new company expanded operations on the property with the construction of a 10-stamp mill. Four years later, the property was leased to G.M. Christie and William Tupper, who employed fifteen men at the Beaver Dam Mine. In 1896, the mine was acquired by J. H. Austin, who erected a 10-stamp mill. Work at the Beaver Dam Mine site continued intermittently until the late 80s, changing mining rights at least a dozen times (Jacques Whitford 1986). More recently, a number of other companies, including Seabright Resources Inc., have conducted extensive exploration on the property.

Euro-Canadian settlement of the Beaver Dam area began in the second half of the nineteenth century and centered on mining activities. A cursory examination of historic mapping revealed that the study area occupies portions of at least eight historic lots. These properties were granted to, or otherwise obtained by, George H. Starr, David Allison, James F. Avery, J. Moll, R. Moseley, D. W. Archibald and the Pittsburgh Mining Co. (Crown Land Grant Sheet 89). An examination of the A. F. Church map of Halifax County failed to identify any structures depicted within the study area as of 1865. The 1899 Faribault map indicates the presence of approximately seven features within the study area (***Figures 3***). Four of those features, however, are depicted as overlying a quartz vein located near the centre of the Pit study area. This area was subsequently mined and the abandoned pit is now partially flooded (***Plate 1***). The other three features are depicted in the vicinity of another quartz vein running along the northern shore of Crusher Lake.

In 1928, Faribault did a geological survey of the Beaver Dam mine site, at this time indicating 10 structures associated with the mine (***Figure 4***). This includes 2 cookhouses, an engine house, the Austen mill, an office, an old mill 5 stamps and sluice, Gordon Zwicker & Levi Dimock's cabin, an old mill 8 stamps, the Bellemore cabin and an unnamed structure. According to a compilation of Faribault's memoirs (Malcolm 1976: 57), Zwicker and Dimock's cabin would date to between 1896 and 1904. He identifies the 5-stamp mill as being constructed in 1904 by W. H. Redding. The Austen mill may correspond with the 10-stamp mill erected by J. H. Austin when he became the owner of the mine in 1896 (Malcolm 1976: 57).

According to artist Joseph Purcell, the cabin portrayed in the painting below was built during the late 1920s by a miner named Johnnie Crouse who apparently lived and worked just north of Crusher Lake (***Plate 2***).

Aerial photographs from 1982 and 1992 show that the mine underwent a significant amount of development in this time period. This development likely destroyed any remains of features in this area, such as one of the cookhouses, the Austen mill, the Bellemore cabin and the unnamed structure.

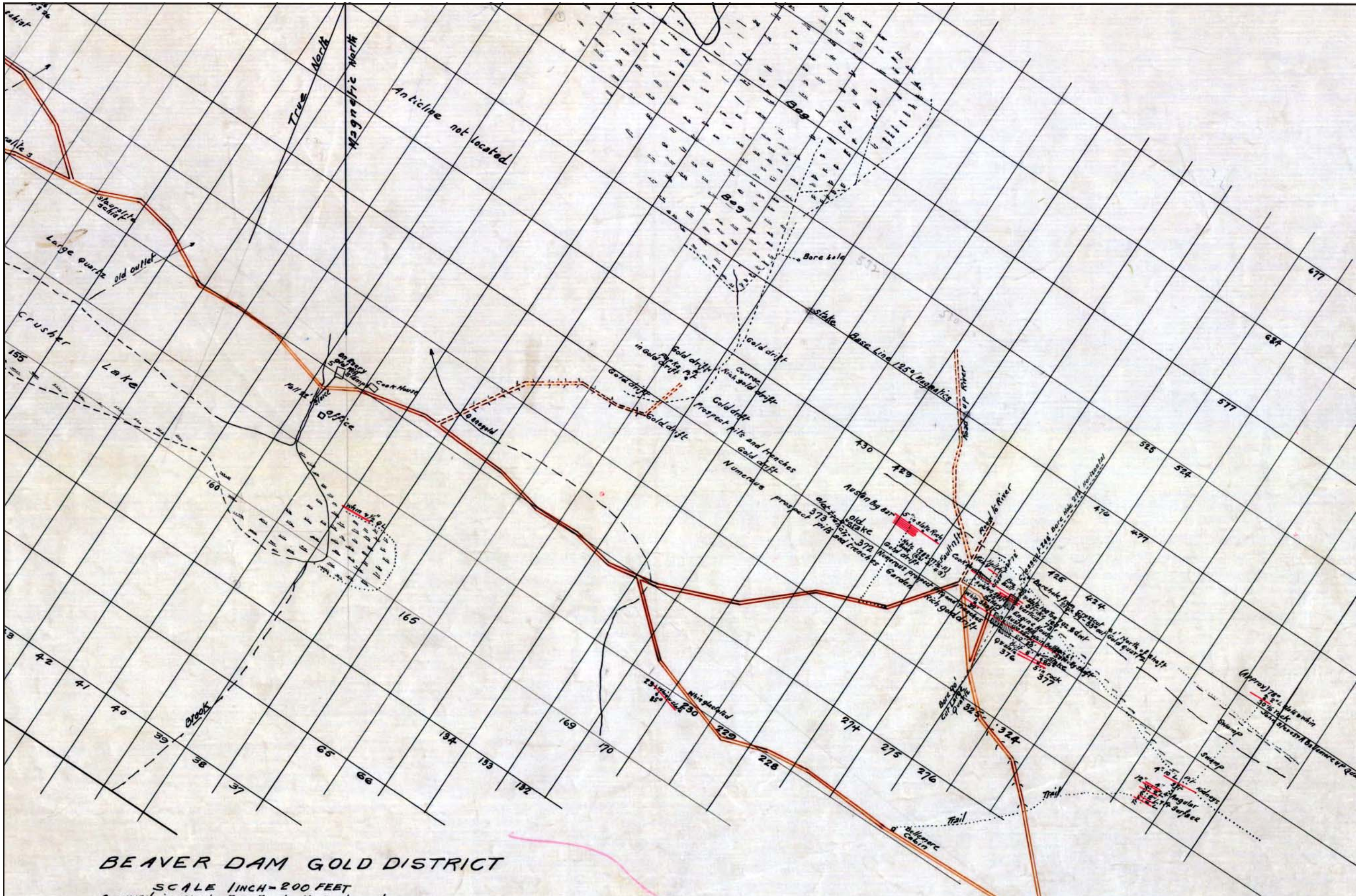
The DNR Abandoned Mine Opening (AMO) Database was used to identify where open mine shafts were located. The data was used both as a safety measure as well as for identifying areas more likely to contain archaeological features. According to the database, 20 AMOs are associated with Beaver Dam.

Based on the historical setting within the study area, the Beaver Dam Development property is ascribed elevated potential for encountering historic Euro-Canadian archaeological resources.

4.1.4 Archaeological Potential

Based on the various components of the background study, including environmental setting, Native land use and property history, the Beaver Dam Development property is considered to exhibit high potential for encountering Precontact and historic Native archaeological resources and high potential for encountering historic Euro-Canadian archaeological resources.

	Faribault, 1899	*Figure 3*
CRM Group Cultural Resource Management Group Ltd.	BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2015



Faribault, 1928	Figure 4
BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2015

CRM Group
Cultural Resource Management Group Ltd.

PLATE 2: “Crouse's Cabin, Beaver Dam Mine” by Joseph Purcell.

4.2 Field Reconnaissance

Fieldwork, consisting of a visual inspection of the study area, was conducted by CRM Group archaeologists on October 21 and November 8, 2014. The primary goals of the visit were to assess the archaeological potential of the proposed development area and to investigate various topographical and cultural features, which had been identified as areas of elevated potential during the background research.

The majority of the reconnaissance was focused within the Pit and WRSP study areas, but CRM Group was also asked to further investigate the area to the north of Crusher Lake. Each area will be discussed separately.

Pit

The Pit study area is located to the southwest of the Cameron Flowage. Background research indicated that four mine structures had been located within the study area. These include a cookhouse, the Austen Mill, the Engine house and an unnamed structure. According to the DNR AMO Database, 18 of the 20 open mine shafts associated with Beaver Dam are within the Pit study area (***Plates 3 & 4***).

Reconnaissance demonstrated that the area was heavily disturbed by exploration and mining activities. Large spoil piles and borrow pits dominated the landscape and much of the vegetation consists of young trees and brush (***Plate 5***). A pond, measuring approximately 90 metres (north/south) by 550 metres (east/west) covers areas that had been mined in the past (***Plate 1***). At least since the damming of the Cameron Flowage, the area of the pond has been low and marshy. The pond was developed as settling pond for the mine development activities in the mid-80s. No remains of the four features could be found.

Waste Rock Storage Pile

The WRSP study area is located to the south of the Pit. Background research did not identify any features within the area. The area has been heavily cut in recent years as can be seen with the vast sections of new growth and patchwork of skidder trails (***Plate 6***). According to the base mapping provided by CRA, a portion of the WRSP study area is marshy, particularly along the southern part. Low, wet areas were noted elsewhere as well. No features were noted or areas of high archaeological potential.

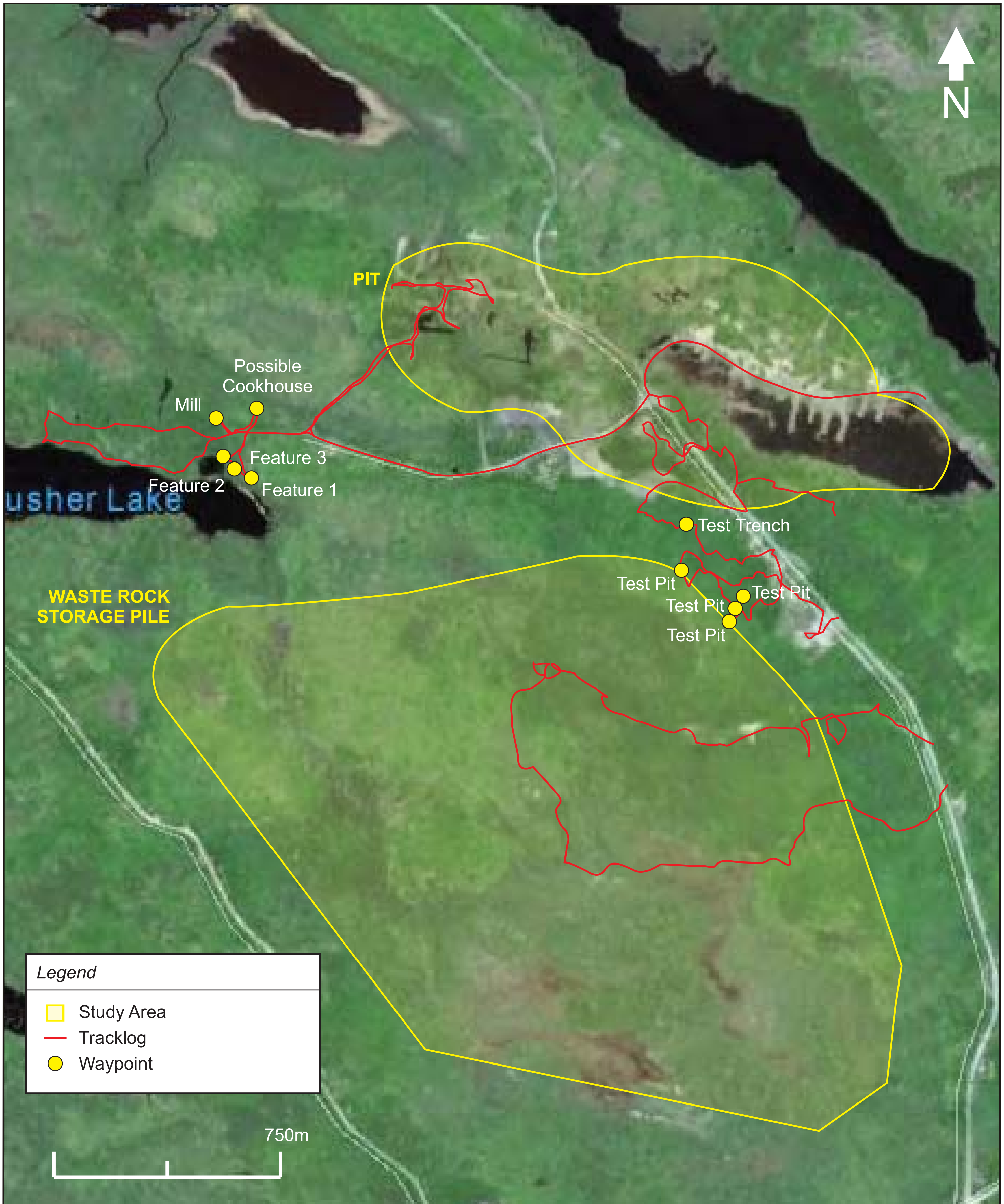
It was originally suspected that the Bellemore Cabin marked on Faribault's 1928 map would be within WRSP area. Upon further review, it seems it would have been between the WRSP and Pit study areas. A return to the Beaver Dam Development was made on November 8 in an attempt to identify any remains of the cabin in case of later changes to the boundaries of the study areas. This further assessment determined that extensive exploration/mining and woods clearing activities had occurred within this section, likely in conjunction with the same activities relating to the pit and had destroyed any architectural remains (see ***Figure 5*** for test pits and trenches; ***Plate 7***).

While conducting reconnaissance on the northern side of Crusher Lake, Historic and Modern features were noted. Features 1 and 2, documented in the 2008 screening and reconnaissance report, were revisited.

Historic Features

Feature 1 (Corresponds with Site 1 from 2008)

Reconnaissance in 2008: Feature 1, located approximately 40 metres north of Crusher Lake, includes the remains of a wooden structure measuring approximately 6.5 metres east-west by 6 metres north-south (UTM: 20T 521571E, 4990205N). Visual examination of the collapsed feature revealed the remains of a log cabin with interlocking saddle-notch corners. The cabin had a cellar, however, visibility was obscured



CRM Group
Cultural Resource Management Group Ltd.

Pit and Waste Rock Storage Pile Tracklog	*Figure 5*
BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2015

Plate 3: AMO included in DNR Database; facing southeast. October 21, 2014.

Plate 4: Either an abandoned mine shaft or borrow pit; facing north. October 21, 2014.

Plate 5: **Example of disturbance in the Pit study area; facing north. October 21, 2014.**

Plate 6: **Following a skidder trail in WRSP study area; facing northwest. October 21, 2014.**

Plate 7: Borrow pit; facing north. November 8, 2014.

due to the structural collapse. Careful inspection of the remains revealed the presence of wire nails and linoleum flooring. The presence of these materials suggests the feature was occupied during the twentieth century.

A cursory review of historic property documentation revealed that the parcel of land encompassing Feature 1 was originally obtained by the Pittsburgh Mining Co. (Crown Land Grant Sheet 89). The Faribault map indicates the presence of three unidentified features situated in the vicinity of Feature 1 at the turn of the century. Based on the observed artifacts, however, it is possible that Feature 1 represents the remains of a twentieth-century structure, much like the Crouse cabin.

Reconnaissance in 2014: The wooden structure has now completely collapsed and most of the remaining wood is obscured by moss (***Plate 8***). More recent modern refuse is also present. Based the background research, this structure could correspond with the office depicted on Faribault's 1928 map. The location was recorded on current GPS technology at UTM 20T 521579E, 4990205N

Feature 2 (Corresponds with Site 2 from 2008)

Reconnaissance in 2008: Feature 2, located approximately 20 metres southeast of Feature 1, includes the potential remains of a partially in-filled cellar hole (UTM: 20T 521584E, 4990190N). The feature measures approximately 5 metres east-west by 4 metres north-south and is littered with twentieth-century refuse. Careful examination of the feature revealed no visible structural remains.

A cursory review of historic property documentation revealed that the parcel of land encompassing Feature 2 was originally obtained by the Pittsburgh Mining Co. (Crown Land Grant Sheet 89). The Faribault map indicates the presence of three unidentified features situated in the vicinity of Feature 2 at the turn of the century. Based on the Faribault map, it is assumed that Feature 2 represents the remains of one of these nineteenth-century features.

Reconnaissance in 2014: There was no change noted with Feature 2 except for the possible accumulation of more refuse within the depression (***Plate 9***). The location was recorded on current GPS technology at UTM 20T 521586E, 4990192N.

Old Mill - Five Stamps (Feature 4)
Faribault's 1928 map indicated the presence of a mill on the north side of the mine road that runs on the north side of Crusher Lake. During reconnaissance the remains of the mill were noted, now just a rough outline composed of several large foundation stones (***Plate 10***). It measured approximately 10 metres north/south and 4 metres east/west. The remains are situated 14 metres east of a small unnamed stream flowing from Crusher Lake. Although there are no remains of the sluice depicted on the Faribault map, at the north end of the depression, a number of large stones and timber were observed, which could have formed the tail race (***Plate 11***). According to Faribault, this mill was built in 1904. The mill feature was recorded at UTM 20T 521571E, 4990253N.

Possible Cookhouse (Feature 5)
Faribault's 1928 map (***Figure 4***) of the Beaver Dam mine depicts a cookhouse on the north side of the mine road that runs along the north side of Crusher Lake. During reconnaissance, no structural remains were encountered to suggest the presence of the cookhouse, but a slight depression was noted and a heavy iron pot was discovered *in situ* in conjunction with the depression (***Plate 12***). It may indicate the site of the former cookhouse. The possible cookhouse feature was recorded at UTM 20T 521612E, 4990254E.

Plate 8: **Feature 1; facing northwest. October 21, 2014.**

Plate 9: Feature 2 with accumulation of refuse; facing southeast. October 21, 2014.

Plate 10: Standing in approximate centre of mill foundation; facing north. October 21, 2014.

Plate 11: **Possible tailrace along the north side of mill foundation; facing southwest. October 21, 2014.**

Plate 12: **Possible cookhouse location; facing northwest. October 21, 2014.**

Modern Features

Feature 3
Feature 3 was present but not recorded in 2008. During previous reconnaissance, a single cabin and outhouse had been noted which was likely used as a hunting cabin. On returning to the site in 2014, the original cabin had been updated with new siding and a shed had been erected nearby (***Plate 13***). The additional accumulation of garbage within the depression of Feature 2 may have come from these cabins. The centre point of the cabins was recorded at UTM 20T 521602E, 4990184N.

Plate 13: **Modern hunting cabin and shed; facing northwest. October 21, 2014.**

5.0 CONCLUSIONS AND RECOMMENDATIONS

The 2014 archaeological screening and reconnaissance of the Beaver Dam Gold Project site consisted of a visual inspection of the ground surface and did not involve sub-surface testing. The archaeological background research conducted by CRM Group archaeologists identified numerous historic features within the Pit study area, which through reconnaissance were determined to have been destroyed by mining activities undertaken in the 1980s. No archaeological features were identified within the WRSP study area, either during the background or the field reconnaissance.

Based on these results, CRM Group offers the following management recommendations for the study areas:

1. It is recommended that the current orientation of the Pit and WRSP study areas be cleared of any requirement for further archaeological investigation.

2. It is recommended that if any development is to occur within 100 metres of Crusher Lake, intensified reconnaissance should be conducted to identify any additional features.

3. It is recommended that if any development is to occur specifically around the historic features identified during the 2008 and/or 2014 reconnaissance, intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.

4. It is recommended that any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources.

5. In the event that archaeological deposits or human remains are encountered during any ground disturbance associated with the Beaver Dam Development, all work in the associated area(s) should be halted and immediate contact made with the Special Places Program (Sean Weseloh-McKeane: 902-424-6475).

6.0 REFERENCES CITED

Church, Ambrose F.
1865 *Topographical Township Map of Halifax County, Nova Scotia*. Halifax: A.F. Church & Co.

Davis, Derek & Sue Browne, eds.
1996 *The Natural History of Nova Scotia*. Vol. 2. *Theme Regions*. Halifax: Nimbus, Nova Scotia Museum.

Department of Land and Forests.
1946 *Crown Land Grant Index Sheet 89 – Halifax County*. Nova Scotia Department of Natural Resources.

Faribault, E. R.
1899 *Province of Nova Scotia, Colchester & Halifax Counties, Upper Musquodoboit Sheet, No 49*. Geological Survey of Canada.

MacDougall, J.I. et. al.
1963 *Soil Survey of Halifax County, Nova Scotia*. Report No. 13. Nova Scotia Soil Survey. Truro: Minister of Supply and Services.

Malcolm, W.
1976 *Gold Fields of Nova Scotia*. Geological Survey of Canada, Memoir 156.

Ogilvie, Robert.
2008 Environmental Screening 07-12-20d – Beaverdam Site. Report on file with the SPP-HD, Halifax.

Sangster, Alan & Paul Smith.
2007 Metallogenic Summary of the Meguma Gold Deposits, Nova Scotia in *Mineral Deposits of Canada.* Geological Association of Canada, Special Publication No. 5.

White, C.E. & S.M. Barr
2012 *Revised Stratigraphy and Tectonic Evolution of the Meguma Terrane*, Nova Scotia Department of Natural Resources, Halifax.

Whitehead, Ruth Holmes.
1991 *The Old Man Told Us: Excerpts from MicMac History 1500-1950*. Halifax: Nimbus.

NOVA SCOTIA

Communities, Culture & Heritage

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Tel: (902) 424-6475
Fax: (902) 424-0710

June 3, 2015

Kathryn Stewart
CRM Group Ltd.
6040 Almon St.
Halifax, NS B3K 1T8

Dear Ms. Stewart:

RE: Heritage Research Permit Report
A2014NS101 – Beaver Dam Redevelopment

We have received and reviewed your report on work conducted under the terms of Heritage Research Permit A2014NS101 for an archaeological resource impact assessment of the Beaver Dam Redevelopment Project.

The report details the archaeological assessment of the proposed waste rock storage pile and pit areas within the Beaver Dam Gold Project property near the Killag River, Halifax County, by CRM Group Ltd. in the fall of 2014. Based on the background and environmental research the project area was determined to exhibit high potential for archaeological resources. The field reconnaissance focused on the pit and WRSP areas as well as an area north of Crusher Lake. Several features identified during the background research required field inspection. Reconnaissance determined the features within the Pit study area to have been destroyed by mining activities. No archaeological features were identified within the WRSP study area.

Based on the above, the reporter recommends that the current layout of the Pit and WRSP study areas be cleared of any requirement for further archaeological investigation. It is recommended that if any development is to occur within 100 meters of Crusher Lake, intensified reconnaissance should be undertaken. It is recommended that if any development is to occur around the historic features identified during the 2008 and/or 2014 reconnaissance, intensified historical research and shovel testing should be conducted in advance of disturbance. It is recommended that any further changes in the mine layout and associated facilities be evaluated as to potential impacts to archaeological resources. Finally, in the event that archaeological deposits or human remains are encountered during any ground disturbance activities, all work in the associated areas should stop and contact made with the Coordinator of Special Places.

CCH staff finds the report and recommendations acceptable as submitted. Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,

<Original signed by>

Sean Weseloh McKeane
Coordinator, Special Places

GHD

BEAVER DAM GOLD PROJECT
ADDITIONAL ARCHAEOLOGICAL RECONNAISSANCE 2015
HALIFAX REGIONAL MUNICIPALITY, NOVA SCOTIA

FINAL REPORT

Submitted to:
GHD
and the
Special Places Program of the Nova Scotia Department of Communities, Culture and Heritage

Prepared by:
Cultural Resource Management Group Limited
6040 Almon Street
Halifax, Nova Scotia
B3K 1T8

Consulting Archaeologist: Kathryn J. Stewart
Report Preparation: Kathryn J. Stewart & Kyle G. Cigolotti

Heritage Research Permit Number: A2015NS043

CRM Group Project Number: 2014-0015-02

MARCH 2016

CRM Group
Cultural Resource Management Group Ltd

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BEAVER DAM GOLD PROJECT
ADDITIONAL ARCHAEOLOGICAL RECONNAISSANCE 2015
HALIFAX REGIONAL MUNICIPALITY
NOVA SCOTIA

1.0 INTRODUCTION

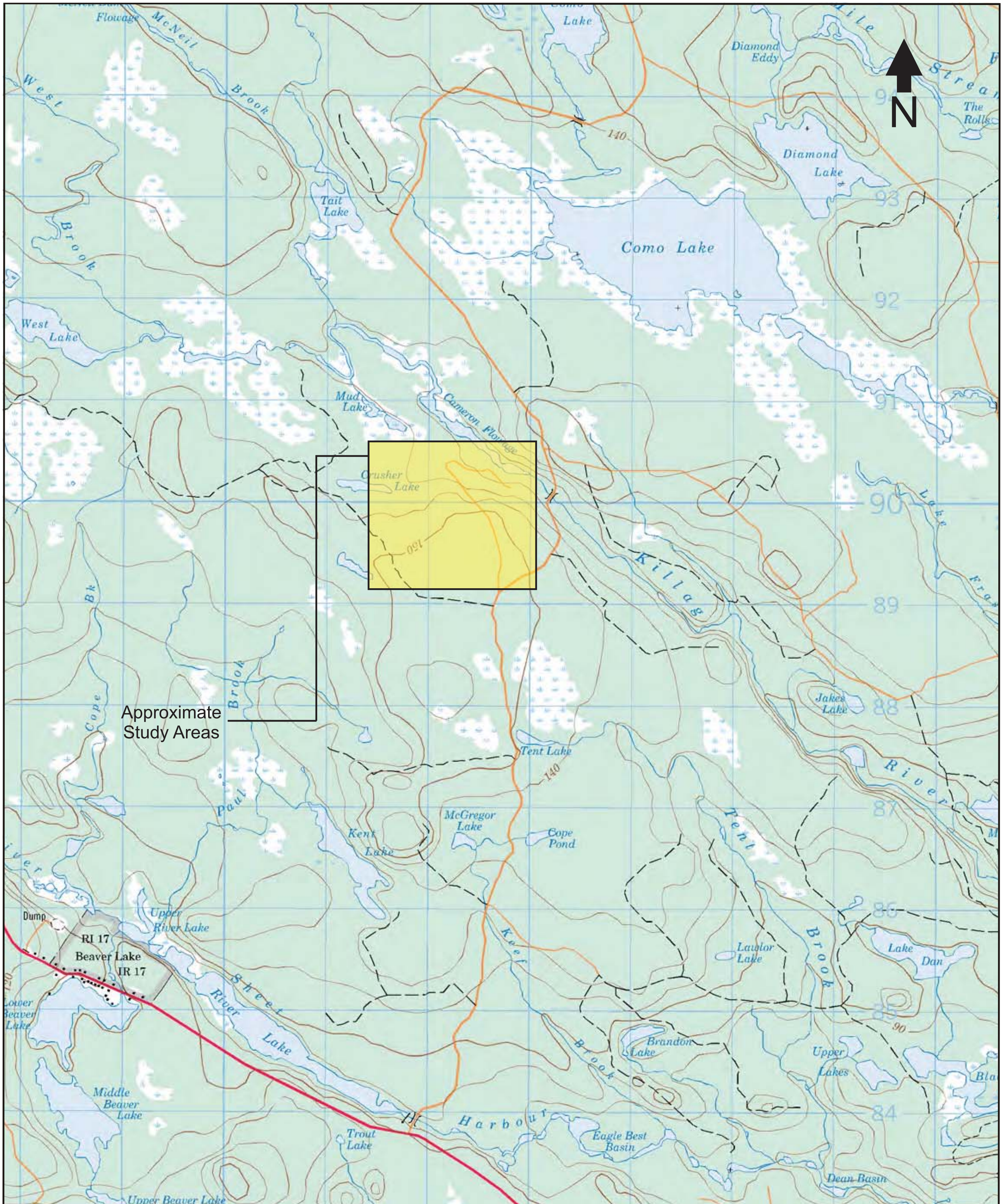
Atlantic Gold Corporation (Atlantic Gold) is proposing to redevelop the Beaver Dam Gold Project located in the north-eastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figures 1 & 2***).

In the fall of 2014, Cultural Resource Management (CRM) Group was retained by GHD (then Conestoga-Rovers & Associates) on behalf of Atlantic Gold to undertake archaeological screening and reconnaissance of the proposed mine expansion. The archaeological investigation was conducted under to the terms of Heritage Research Permit A2014NS107 (Category ‘C’), issued to Kathryn J. Stewart through the Special Places Program (Special Places).

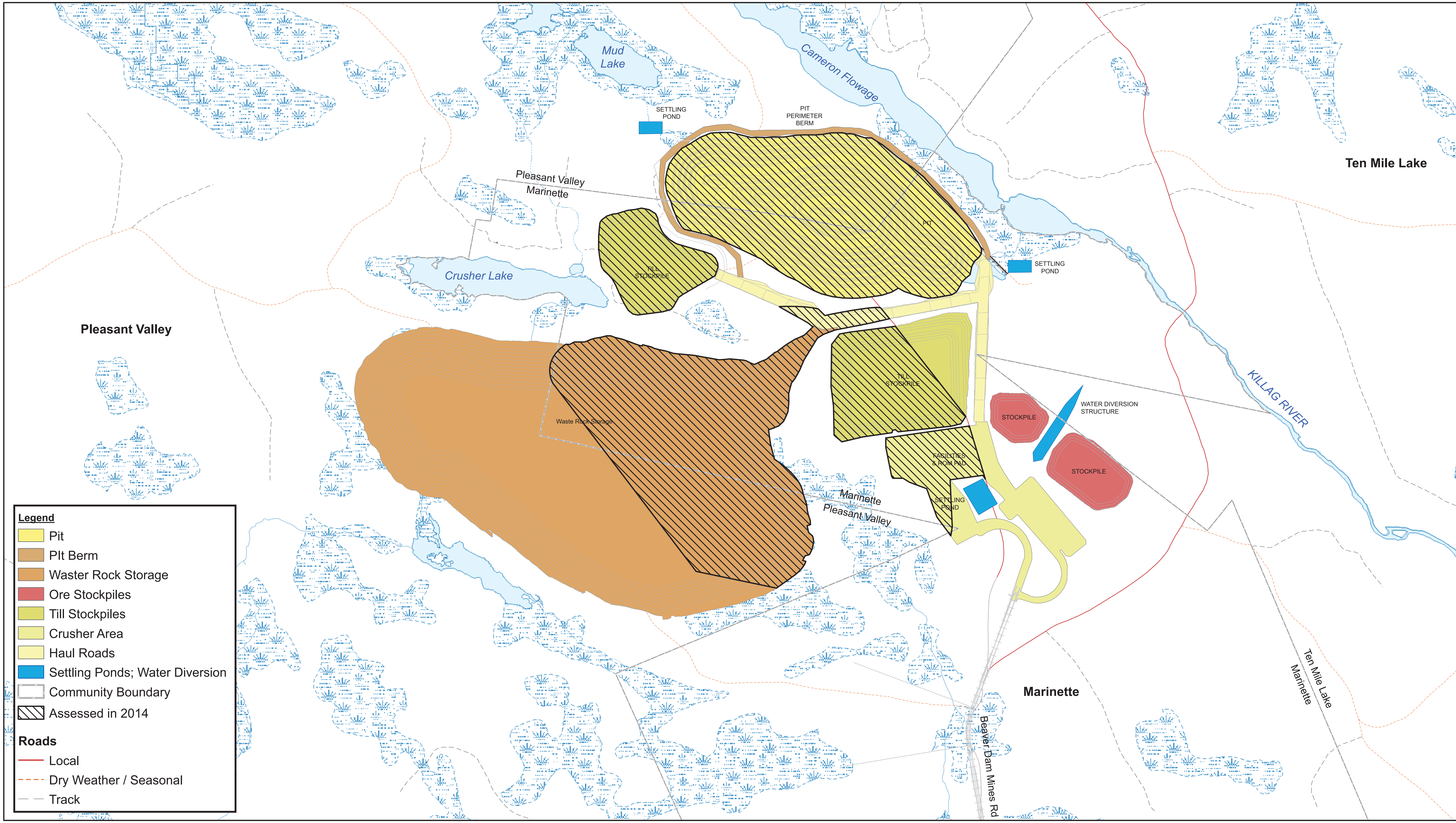
Subsequent changes to the layout of the proposed facility led to additional archaeological reconnaissance being undertaken in the summer of 2015. Previously investigated mine features, such as the waste rock storage (WRS) and the crusher site had been shifted to a different configuration. New work areas (two till piles, two ore piles, two settling ponds and a Run-of-Mine (ROM)/crusher/service pad site) were added to the project. The archaeological investigation was conducted according to the terms of Heritage Research Permit A2015NS043 (Category ‘C’), issued to Stewart. The fieldwork was undertaken by Stewart with the assistance of Staff Archaeologist Kiersten Green.

The primary focus of the study was to assess the potential for encountering archaeological resources during redevelopment of the mine site. The assessment builds upon the research and reconnaissance of the Beaver Dam property undertaken on behalf of Acadian Mining (Acadian) by CRM Group in 2008 (Beanlands 2008).

It should be noted that the final design of the Beaver Dam Gold Mine has yet to be determined. This report describes the archaeological reconnaissance of the current orientation of features at the mine site, presents the results of these efforts and offers cultural resource management recommendations.



CRM Group — Cultural Resource Management Group Ltd.	*Approximate Study Areas*	*Figure 1*
	BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2016 Scale 1:50 000



Source: Atlantic Gold, Service Nova Scotia, NS Natural Resources, NS Environment

CRM Group

Detailed Study Areas	Figure 2
BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2016
	Scale 1:10 000

0 100 200 300
Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

GENERAL MINE ARRANGEMENT

2.0 STUDY AREA

The Beaver Dam Gold Project property is located on the western side of Killag River in the northeastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figure 1***). The property comprises the historic Beaver Dam Gold District situated between Crusher Lake and Cameron Flowage (***Figure 2; Plate 1***). The study area, consisting of proposed pit, WRS, two till piles, two ore pills, two settling ponds and a ROM/crusher/service pad site, covers an area of approximately 87 hectares. Access to the property can be gained by following Highway 224 approximately 17 kilometres northwest from Highway 7 to Beaver Dam Mines Road, then following Beaver Dam Mines Road north.

PLATE 1: The Settling Pond within the Pit study area; facing west. June 19, 2015.

3.0 METHODOLOGY

GHD retained CRM Group to undertake additional archaeological reconnaissance of the Beaver Dam study area. To address the potential of encountering significant archaeological resources within the study area, CRM Group developed a work plan consisting of the following components: archaeological reconnaissance of the areas to be impacted by development activities; and, prepare a report summarizing the results of the field survey, as well as recommend strategies for assessment and management of areas exhibiting high archaeological potential and/or features.

3.1 Background Research

The archival research had already been completed during the initial screening and reconnaissance, so no additional background research was conducted. This component of the archaeological screening and reconnaissance was designed to explore the land use history of the study area, and provide information necessary to evaluate the area's archaeological potential. To achieve this goal, CRM Group utilized the resources of various institutions including documentation available through Nova Scotia Archives, the Department of Natural Resources (DNR) and Crown Land Information Management Centre.

The background study included a review of relevant historic documentation incorporating land grant records, legal survey and historic maps, as well as local and regional histories. Topographic maps and aerial photographs, both current and historic, were also used to evaluate the study area. This data facilitated the identification of environmental and topographic features, which would have influenced human settlement and resource exploitation patterns. The historical and cultural information was integrated with the environmental and topographic data to identify potential areas of archaeological sensitivity. In preparation for the archaeological reconnaissance, the information obtained from this suite of research materials was reviewed to facilitate the interpretation of any archaeological features encountered within the study area.

3.2 Field Reconnaissance

The goals of the archaeological field reconnaissance were to conduct visual inspection of the study areas, document any areas of archaeological sensitivity or archaeological sites identified during the course of visual inspection, and design a strategy for testing areas of archaeological potential, as well as any archaeological resources identified within the study areas. Although the ground search did not involve sub-surface testing, the researchers were alert for topographic or vegetative anomalies that might indicate the presence of buried archaeological resources. The process and results of the field reconnaissance were documented in field notes and photographs.

A hand-held Global Positioning System (GPS) unit was used to record UTM coordinates (NAD 83) for all survey areas, as well as any identified diagnostic artifacts, formal tools, isolated finds and site locations.

4.0 RESULTS OF SCREENING AND RECONNAISSANCE

4.1 Background Study

The following discussion details the environmental and cultural setting of the study area. This background study provides a framework for the evaluation of archaeological potential and the initial interpretation of any resources encountered during the field component of the assessment.

4.1.1 Environmental Setting

A number of environmental factors such as water sources, physiographic features, soil types and vegetation have influenced settlement patterns and contribute to the archaeological potential of the area.

Water Sources

The Beaver Dam Development property is drained by way of the Killag River, a tributary of West River Sheet Harbour that flows south across the eastern portion of the study area. The Killag River has been dammed creating a reservoir along the eastern edge of the study area, known as Cameron Flowage. The dam is located at the southeastern end of Cameron Flowage. Several small lakes also fall in close proximity to the study area, including Crusher Lake and Mud Lake. Proximity to water, for both drinking and transportation, is a key factor in identifying Precontact and historic Native, as well as early Euro-Canadian, archaeological potential.

Topography

The study area is located within the greater terrestrial region known as the Atlantic Interior – Quartzsite Barrens (Guysborough) Unit (Davis & Browne 1996: 134). The bedrock-dominated topography can be generally described as undulating to rolling. Elevation within the study area ranges from approximately 109 metres to 171 metres above sea level. Low-lying areas are typically swampy. Elevated areas within the study area may have provided important vantage points for viewing the surrounding region and for sighting large game. The Beaver Dam Gold Project property is located within the Goldenville Group of the Meguma terrane of Nova Scotia, a sequence of Cambro-Ordovician-aged metasedimentary rocks and Devonian-aged granitoid intrusives. Gold deposits are present throughout much of the exposed stratigraphy of the Goldenville Group (Sangster & Smith 2007).

Soils

The Beaver Dam area is covered primarily by *Halifax* series (ST2, ST14) soils, although concentrations of *Bridgewater* (ST2 and ST8) and *Aspotogan* (ST4) series soils and peat are also found within the study area. *Halifax* soils are well drained but typically shallow, stony and porous. The parent material is olive to yellowish-brown sandy loam to gravelly sandy loam glacial till derived primarily from quartzite. In general, *Halifax* soils are too stony for agriculture (MacDougall *et. al.* 1963: 32-33). The well-drained *Bridgewater* soils are developed from a medium-textured, olive coloured glacial till that is derived principally from Precambrian slates. The *Bridgewater* soils in the Beaver Dam area are moderately stony and unsuitable for cultivation (MacDougall *et. al.* 1963: 28). *Aspotogan* soils are described as a dark grayish brown sandy loam overlaying and mottled with a dark reddish brown sandy loam. The soil has poor drainage and is considered too stony for cultivation. The parent material is an olive stony loam till derived from quartzite or granite (MacDougall *et. al.* 1963: 35)

Vegetation

The forest growth within this ecological region includes Balsam Fir, Red Spruce, White Spruce, Eastern Hemlock and Yellow Birch. Slow-moving streams are bordered by broad swampy areas populated with

Balsam Fir, Red Maple and Black Spruce. The nature of the soils found within the study area does not encourage heavy forest growth (Davis & Browne 1996: 56-57).

4.1.2 Native Land Use

The land within the study area was once part of the greater Mi'kmaq territory known as *Eskikewa'kik*, meaning 'skin dressers territory'. The rivers in the surrounding area would have been important transportation corridors and a resource base for the Mi'kmaq and their ancestors for millennia prior to the arrival of European settlers. The West River Sheet Harbour in particular, located approximately 700 metres south of the study area, would have been part of a transportation route facilitating travel inland from Sheet Harbour on the Atlantic Ocean.

A review of the Maritime Archaeological Resource Inventory, a provincial archaeological site database maintained by the SPP, determined that there are no registered archaeological sites within the study area. The lack of archaeological data for the area may reflect a lack of archaeological investigation, rather than an absence of archaeological sites. According to an environmental screening prepared by the SPP (Ogilvie 2008), the greater project area, which is dense with lakes and watercourses, is considered to exhibit moderate to high potential for encountering Precontact archaeological sites. It should be noted, however, that the project area as reviewed by the SPP encompassed a larger area than that subjected to archaeological screening and reconnaissance by CRM Group.

Based on available historic documentation, there is evidence to suggest a historic Mi'kmaq presence in the Beaver Dam area. The following account was related to Harry Piers by Jeremiah Bartlett Alexis (Jerry Lonecloud) in 1918 (Whitehead 1991: 310):

> *The death occurred at Stewarts, Upper Musquodoboit, on 31st, August, of an old and well-known Indian, John Cope, at the age of 71 years, he having been born at Beaver Dam, Halifax County, in April 1847, son of old Molly Cope who is said to have been 113 years of age when she passed away about 13 years ago . . . . John Cope had considerable fame as a hunter, at least judging by the number of moose he shot, and acted as a guide for various Halifax sportsmen some thirty years ago. He used to hunt back of Beaver Dam and Moose Head [?] with Captain C. Lestrange, who was formerly well-known here. One winter, probably about forty years ago, Cope by himself killed eighteen moose . . . . The meat of these he sold to Fifteen-Mile Stream gold camp, which was then in operation.*

Based on the environmental setting and Native land use, the Beaver Dam Development property is ascribed elevated potential for encountering Precontact and/or early historic Native archaeological resources.

4.1.3 Property History

The Beaver Dam Development property has a long history of industrial use. Gold was discovered in the Beaver Dam district in 1868. By 1871, two belts of veins had been opened and a 15-stamp mill erected (Malcolm 1976: 57). However, the property remained largely inactive until 1886, when extensive prospecting and development work began. A 4-stamp mill run by water power was constructed at this time. In 1891, the Beaver Dam Mining Company acquired the site. This new company expanded operations on the property with the construction of a 10-stamp mill. Four years later, the property was leased to G.M. Christie and William Tupper, who employed fifteen men at the Beaver Dam Mine. In 1896, the mine was acquired by J. H. Austin, who erected a 10-stamp mill. Work at the Beaver Dam Mine site continued intermittently until the late 80s, changing mining rights at least a dozen times (Jacques Whitford 1986). More recently, a number of other companies, including Seabright Resources Inc., have conducted extensive exploration on the property.

Euro-Canadian settlement of the Beaver Dam area began in the second half of the nineteenth century and centered on mining activities. A cursory examination of historic mapping revealed that the study area occupies portions of at least eight historic lots. These properties were granted to, or otherwise obtained by, George H. Starr, David Allison, James F. Avery, J. Moll, R. Moseley, D. W. Archibald and the Pittsburgh Mining Co. (Crown Land Grant Sheet 89). An examination of the A. F. Church map of Halifax County failed to identify any structures depicted within the study area as of 1865. The 1899 Faribault map indicates the presence of approximately seven features within the study area (***Figures 3***). Four of those features, however, are depicted as overlying a quartz vein located near the centre of the Pit study area. This area was subsequently mined and the abandoned pit is now partially flooded (***Plate 1***). The other three features are depicted in the vicinity of another quartz vein running along the northern shore of Crusher Lake.

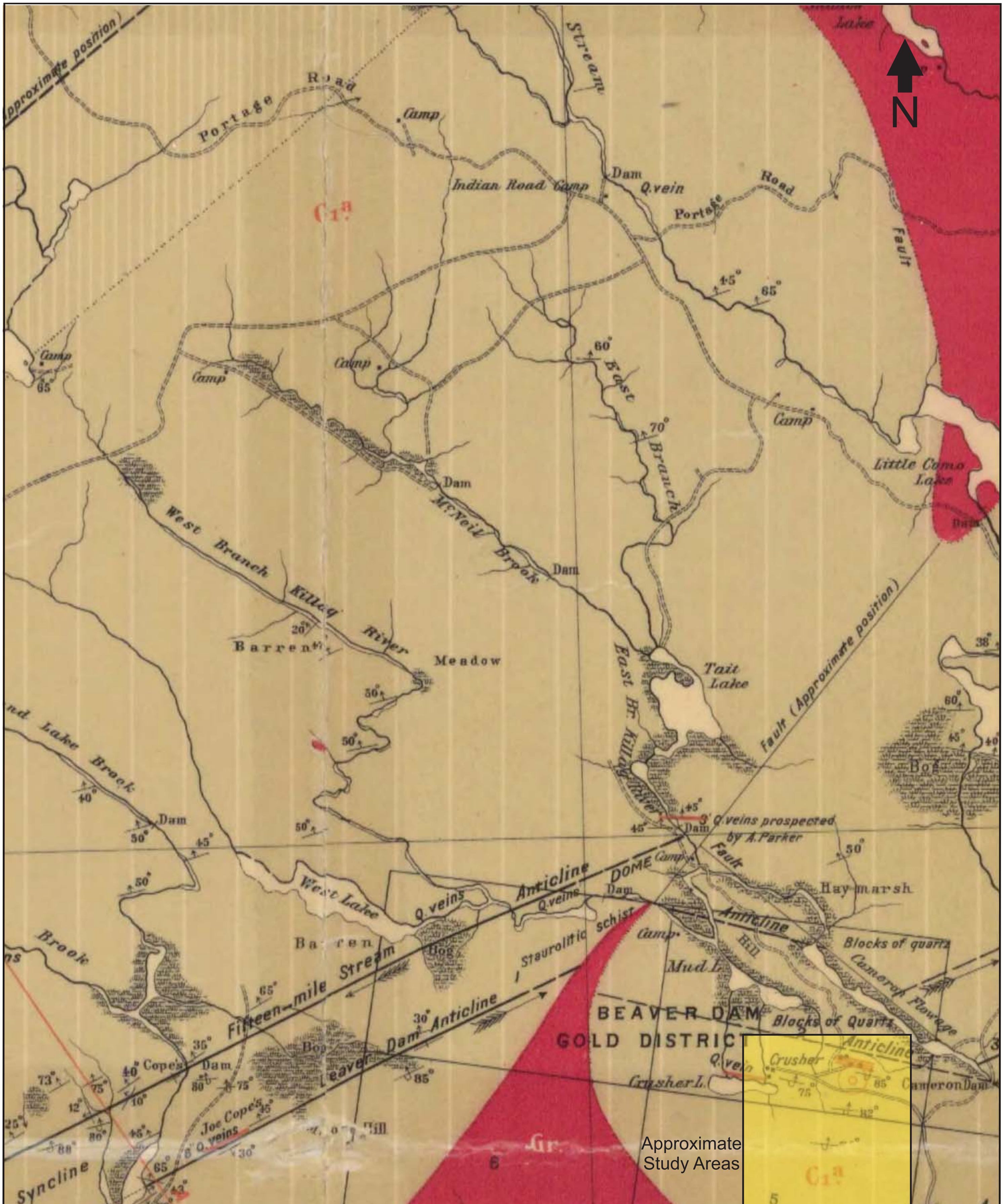
In 1928, Faribault did a geological survey of the Beaver Dam mine site, at this time indicating 10 structures associated with the mine (***Figure 4***). This includes 2 cookhouses, an engine house, the Austen mill, an office, an old mill 5 stamps and sluice, Gordon Zwicker & Levi Dimock's cabin, an old mill 8 stamps, the Bellemore cabin and an unnamed structure. According to a compilation of Faribault's memoirs (Malcolm 1976: 57), Zwicker and Dimock's cabin would date to between 1896 and 1904. He identifies the 5-stamp mill as being constructed in 1904 by W. H. Redding. The Austen mill may correspond with the 10-stamp mill erected by J. H. Austin when he became the owner of the mine in 1896 (Malcolm 1976: 57).

According to artist Joseph Purcell, the cabin portrayed in the painting below was built during the late 1920s by a miner named Johnnie Crouse who apparently lived and worked just north of Crusher Lake (***Plate 2***).

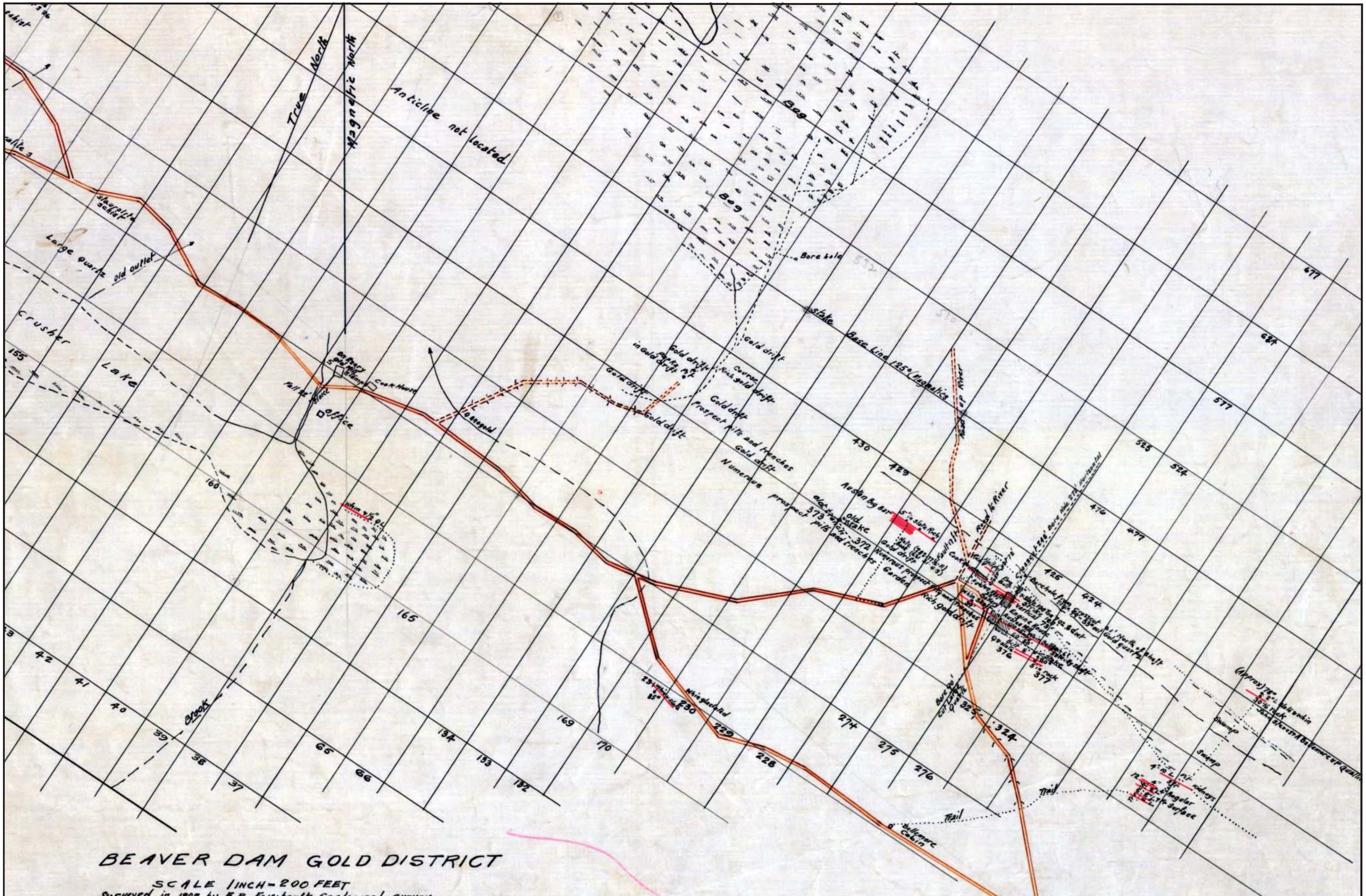
Aerial photographs from 1982 and 1992 show that the mine underwent a significant amount of development in this time period. This development likely destroyed any remains of features in this area, such as one of the cookhouses, the Austen mill, the Bellemore cabin and the unnamed structure.

The DNR Abandoned Mine Opening (AMO) Database was used to identify where open mine shafts were located. The data was used both as a safety measure as well as for identifying areas more likely to contain archaeological features. According to the database, 20 AMOs are associated with Beaver Dam (Stewart and Cigolotti 2015).

Based on the historical setting within the study area, the Beaver Dam Development property is ascribed elevated potential for encountering historic Euro-Canadian archaeological resources.



	Faribault, 1899	*Figure 3*
CRM Group Cultural Resource Management Group Ltd.	BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2016



CRM Group	*Faribault, 1928*	*Figure 4*
	BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2016

PLATE 2: "Crouse's Cabin, Beaver Dam Mine" by Joseph Purcell.

4.2 Field Reconnaissance

CRM Group archaeologists conducted fieldwork, consisting of a visual inspection of the study area, on June 19, 2015. The primary goals of the revisit were to assess the archaeological potential within the expanded development area and to investigate various topographical and cultural features that had been identified as areas of elevated potential during the background research.

The reconnaissance was focused within the pit, the WRS, the till piles, the ore piles, the settling ponds and the ROM/crusher/service pad site study areas (***Figure 5***). Each of these areas will be discussed separately.

Pit

The pit study area is located southwest of the Cameron Flowage. The layout of the pit remained the same as when the reconnaissance was conducted in the fall of 2014, so a return visit was not required. Reconnaissance in the fall had demonstrated that the area was heavily disturbed by exploration and mining activities.

Waste Rock Storage

The WRS study area is located to the southwest of the pit. Background research did not identify any features within the new layout of the proposed WRS. The area has been heavily cut in recent years as can be seen in the vast sections of new growth (***Plate 3***). According to the base mapping provided by GHD, parts of the WRS study area are marshy, particularly along the southeast and western portions. A large pit was noted along the mine road, just outside of the study area, likely attributable to recent mining/exploration activities (***Plate 4***). No features or areas of high archaeological potential were noted within the WRS study area.

Till Piles

Till Pile 1, although a new mine feature added this year, had already been addressed by the field reconnaissance conducted in the fall of 2014. It is suspected that the Bellemore Cabin marked on Faribault's 1928 map had been located within the Till Pile 1 footprint or immediately adjacent to it. Reconnaissance determined that extensive exploration/mining and tree clearing activities had occurred within this section, likely in conjunction with the same activities relating to the pit, and had destroyed any architectural remains that might have been found in that area.

Till Pile 2 is located to the southwest of the pit and north of the WRS. While it overlaps with the historic mine road, the only feature that appears within or immediately adjacent to the study area is the possible location of the cookhouse (Feature 5) identified during reconnaissance in 2014. The location was revisited and was confirmed to be on the western edge of the Till Pile 2 study area (***Plate 5***). No other areas of high archaeological potential were noted.

Ore Piles

The two ore piles are located to the southeast of the pit and immediately east of Till Pile 1. Portions of these two study areas had been heavily harvested and much of the two areas was wet, marshy and undulating (***Plate 6***). No areas of archaeological potential were noted within either of the ore piles.

Settling Ponds

The two proposed settling pond locations were investigated during the course of the reconnaissance. The first was located at the southeastern end of the existing settling pond, where there is an outflow to Cameron Flowage. This section was heavily disturbed by extensive exploration and mining activities related to the mine development activities in the mid-80s (***Plate 7***). In addition to the disturbance, much of the area was undulating, low and marshy, with the small outflow winding its way to the Cameron Flowage (***Plate 8 & 9***).

The second proposed settling pond location is situated to the northwest of the pit area and encompasses a small stream that flows out of Mud Lake (***Plate 10***). This location was also undulating, low and marshy (***Plate 11***). No areas of archaeological potential were noted within either of these study areas.

ROM/Crusher/Service Pad

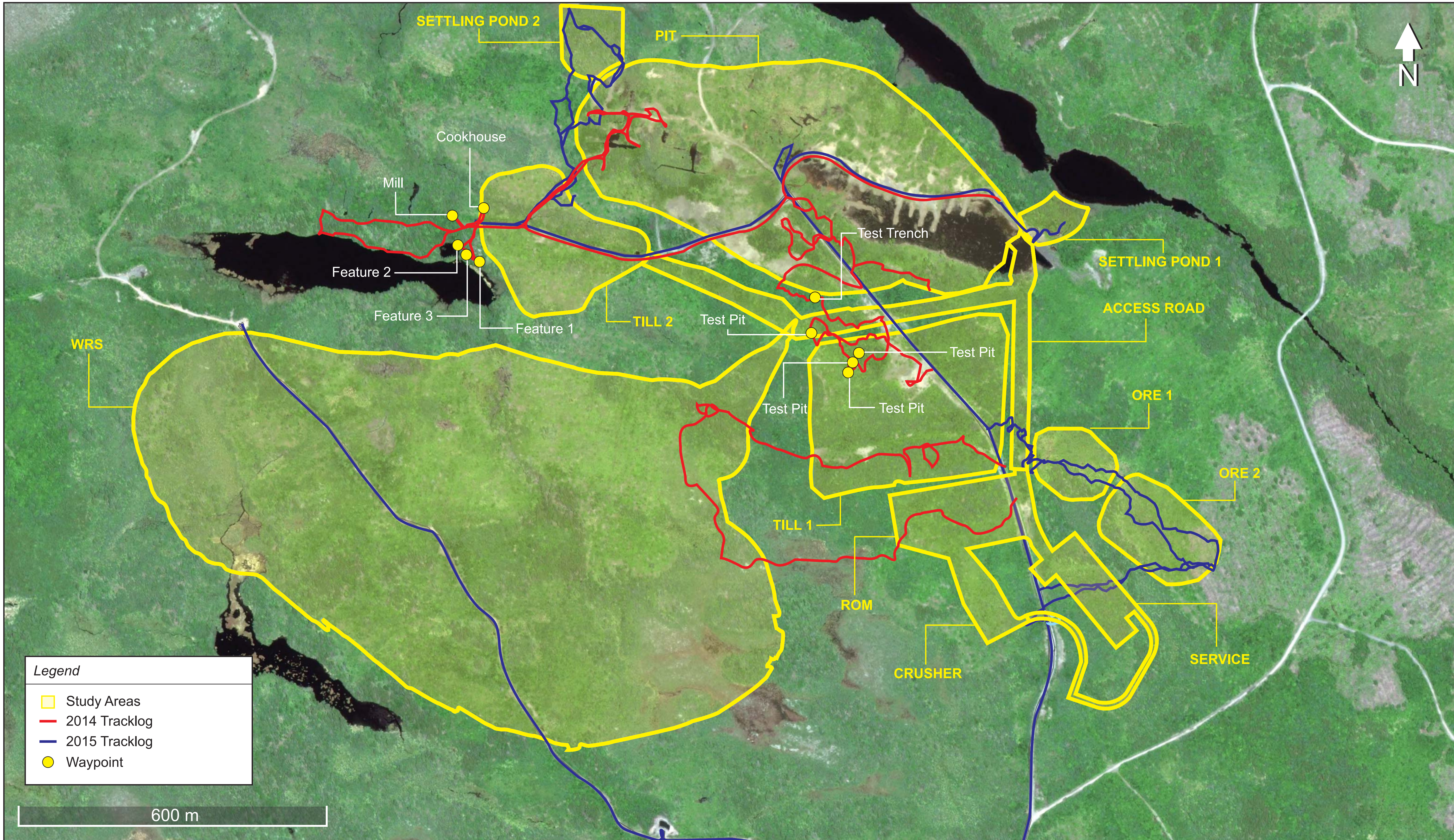
The west side of the ROM/crusher/service pad study area was covered in the reconnaissance conducted in the fall of 2014 as part of for the old layout for the WRS. Reconnaissance undertaken this spring focused on the east side of the study area (***Plate 12***). The area was similar to that of the nearby ore piles, with undulating ground that was often low and marshy. Particular attention was paid to the area where the service road connecting the crusher and service pad crossed over the Beaver Dam Mine Road. No areas of archaeological potential were noted.

Access Road

The layout of the proposed access road was covered both by reconnaissance conducted in the fall of 2014 and the spring of 2015. Areas of the access road close to the pit were heavily disturbed by exploration/mining activities. Undulating and marshy, no areas of archaeological potential were noted.

After the reconnaissance had been completed, another settling pond was added, as well as a water diversion structure. Although these were not in the initial plans when the reconnaissance was conducted, their orientation fell within areas that had been assessed in the spring of 2015.

Plate 3: WRS study area; facing northeast. June 19, 2015.



CRM Group	*Pit and Waste Rock Storage Pile Tracklog*	*Figure 5*
	BEAVER DAM GOLD PROJECT ARCHAEOLOGICAL ASSESSMENT HALIFAX REGIONAL MUNICIPALITY	March 2016

Plate 4: **Recent exploration/mining activities; facing northeast. June 19, 2015.**

Plate 5: **Possible location of the cookhouse (Feature 5) within the footprint of Till Pile 2; facing east. June 19, 2015.**

Plate 6: **Ore Pile 2 study area; facing east. June 19, 2015.**

Plate 7: **Investigating the outlet of the Settling Pond; facing southeast. June 19, 2015.**

Plate 8: Small winding stream; facing north. June 19, 2015.

Plate 9: Low and marshy area around Cameron Flowage; facing northeast. June 19, 2015.

Plate 10: Mud Lake; facing northwest. June 19, 2015.

Plate 11: Marshy area by Mud Lake; facing west. June 19, 2015.

Plate 12: Access Road study area; facing east. June 19, 2015.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The additional archaeological reconnaissance of the Beaver Dam Gold Project site undertaken in the spring of 2015 consisted of a visual inspection of the ground surface and did not involve sub-surface testing. The archaeological background research conducted by CRM Group archaeologists for the screening and reconnaissance conducted in 2008 and 2014 identified numerous historic features within the pit study area. Reconnaissance determined that the features had been destroyed by mining activities undertaken in the 1980s. One historic feature (Feature 5) was identified within the Till Pile 2 study area. No archaeological features or areas of archaeological potential were identified within any of the other study areas, either during the background or field reconnaissance.

Based on these results, CRM Group offers the following management recommendations for the study areas:

1. It is recommended that the current orientation of the Pit, the WRS, Till Pile 1, the Ore piles, the Settling Ponds and the ROM/crusher/service pad study areas as identified in this report (***Figure 5***) be cleared of any requirement for further archaeological investigation.

2. It is recommended that either a program of shovel testing be conducted around the possible cookhouse (Feature 5) or a buffer of 20 metres be put in place around the feature to protect it from any mining activities. No further archaeological work is required for the rest of the Till Pile 2 study area.

3. It is recommended that if any development is to occur specifically around the historic features identified during the 2008 and/or 2014 reconnaissance, intensified historical research and archaeological shovel testing should be conducted in advance of disturbance.

4. It is recommended that any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources.

5. In the event that archaeological deposits or human remains are encountered during any ground disturbance associated with the Beaver Dam Development, all work in the associated area(s) should be halted and immediate contact made with the Special Places Program (Sean Weseloh-McKeane: 902-424-6475).

6.0 REFERENCES CITED

Beanlands, Sara
2009 *Beaver Dam Development Archaeological Screening & Reconnaissance, Halifax Regional Municipality, Nova Scotia*. Manuscript. Report for Heritage Research Permit A2008NS21. On file with the Nova Scotia Museum.

Church, Ambrose F.
1865 *Topographical Township Map of Halifax County, Nova Scotia*. Halifax: A.F. Church & Co.

Davis, Derek & Sue Browne, eds.
1996 *The Natural History of Nova Scotia*. Vol. 2. *Theme Regions*. Halifax: Nimbus, Nova Scotia Museum.

Department of Land and Forests.
1946 *Crown Land Grant Index Sheet 89 – Halifax County*. Nova Scotia Department of Natural Resources.

Faribault, E. R.
1899 *Province of Nova Scotia, Colchester & Halifax Counties, Upper Musquodoboit Sheet, No 49*. Geological Survey of Canada.

MacDougall, J.I. et. al.
1963 *Soil Survey of Halifax County, Nova Scotia*. Report No. 13. Nova Scotia Soil Survey. Truro: Minister of Supply and Services.

Malcolm, W.
1976 *Gold Fields of Nova Scotia*. Geological Survey of Canada, Memoir 156.

Ogilvie, Robert.
2008 Environmental Screening 07-12-20d – Beaverdam Site. Report on file with the SPP-HD, Halifax.

Sangster, Alan & Paul Smith.
2007 Metallogenic Summary of the Meguma Gold Deposits, Nova Scotia in *Mineral Deposits of Canada*. Geological Association of Canada, Special Publication No. 5.

White, C.E. & S.M. Barr
2012 *Revised Stratigraphy and Tectonic Evolution of the Meguma Terrane*, Nova Scotia Department of Natural Resources, Halifax.

Whitehead, Ruth Holmes.
1991 *The Old Man Told Us: Excerpts from MicMac History 1500-1950*. Halifax: Nimbus.

NOVA SCOTIA
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Fax: (902) 424-0560

April 20, 2016

Kathryn Stewart
Cultural Resource Management Group
6040 Almon Street, Halifax, NS
B3K 1T8

Dear Ms. Stewart:

RE: Heritage Research Permit Report
A2015NS043 – Beaver Dam Gold Project

We have received and reviewed your report on work conducted under the terms of Heritage Research Permit A2015NS043 for the archaeological resource impact assessment of the Beaver Dam Gold Project expansion in HRM County.

The report details the additional archaeological reconnaissance of the proposed Beaver Dam Gold Project expansion area northwest of Sheet Harbour, HRM, by CRM Group Ltd. in the summer of 2015. The assessment included a review of previously compiled background and historical research, including indigenous land use, as well as previous archaeological assessments of the study area, and field reconnaissance of the new project layout. The goal of the assessment was to assess the potential for encountering archaeological resources during redevelopment of the mine site. One historic feature (Feature 5) was identified within Till Pile 2. No archaeological features or areas of archaeological potential were identified within any of the other study areas, either during the background review or field reconnaissance.

Based on the above, it is recommended that the current orientation of the Pit, the WRS, Till Pile 1, the Ore piles, the Settling Ponds and the ROM/crusher/service pad areas as defined in the report be cleared of any requirements for further archaeological investigation. It is recommended that either a program of shovel testing around the possible cookhouse (Feature 5) or a buffer of 20 meters be put in place around the feature for protection. No other archaeological work is required for the rest of Till Pile 2. It is recommended that if any development is to occur around the historic features identified in 2008 and/or 2014, reconnaissance, intensified historical research and shovel testing should be conducted in advance of disturbance. It is recommended that any further changes in the layout of the mine and associated facilities be evaluated as to potential impacts to archaeological resources. Finally, in the event that archaeological deposits or human remains are encountered during any ground disturbance associated with the Beaver Dam Gold Project, all work in the associated areas should stop and the Coordinator of Special Places contacted.

CCH Staff agrees with the recommendations and finds the report acceptable as submitted. Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,
<Original signed by>

Sean Weseloh McKeane
Coordinator, Special Places

GHD LIMTED

BEAVER DAM GOLD PROJECT
HAUL ROAD ARCHAEOLOGICAL RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY, NOVA SCOTIA

FINAL REPORT

Submitted to:
GHD Limited
and the
Special Places Program of the Nova Scotia Department of Communities, Culture and Heritage

Prepared by:
Cultural Resource Management Group Limited
6040 Almon Street
Halifax, Nova Scotia
B3K 1T8

Consulting Archaeologist: Kiersten Green
Report Preparation: Kathryn J. Stewart & Kyle G. Cigolotti

Heritage Research Permit Number: A2015NS101

CRM Group Project Number: 2014-0015-02

MARCH 2016

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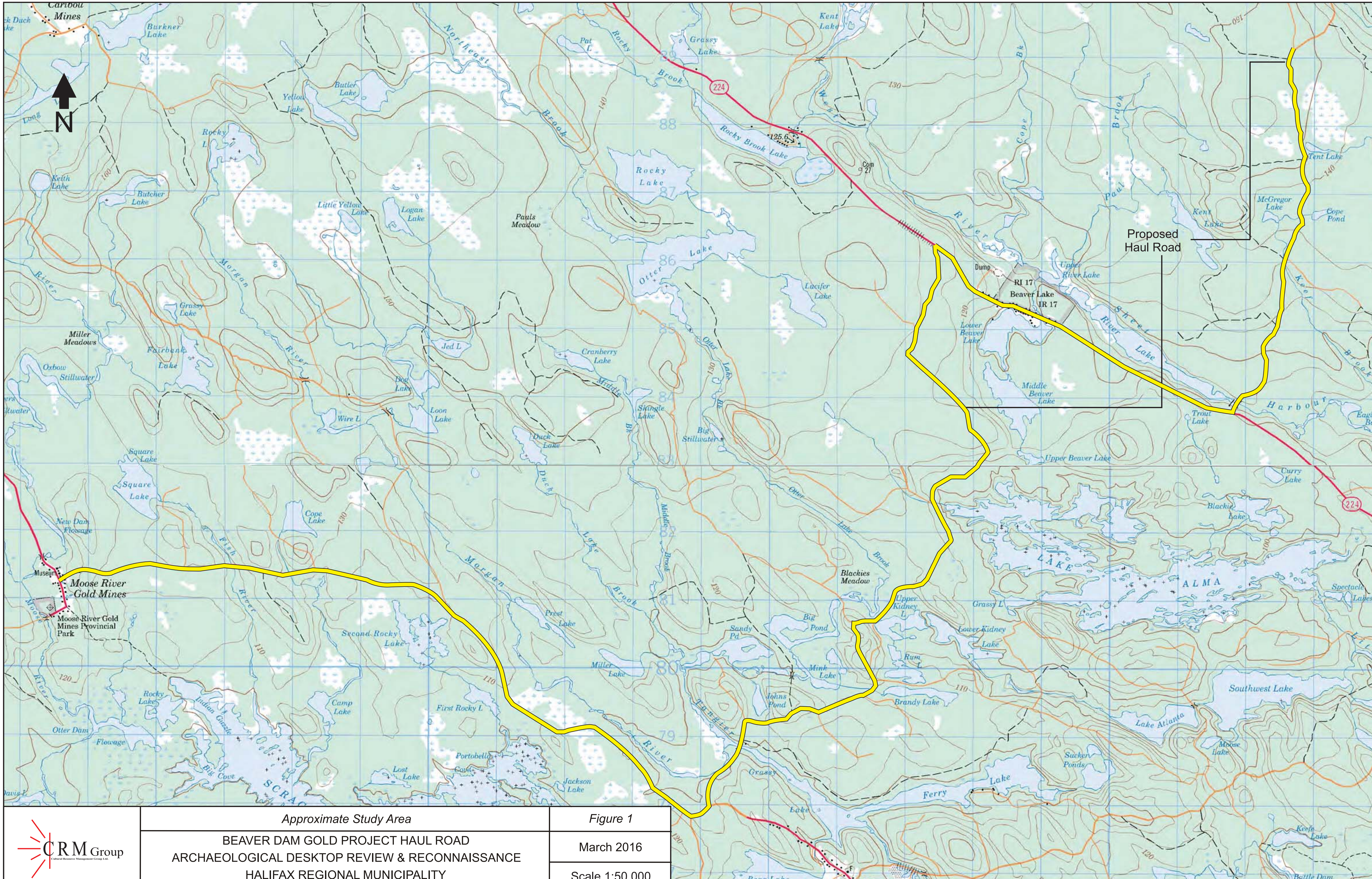
HAUL ROAD ARCHAEOLOGICAL RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY
NOVA SCOTIA

1.0 INTRODUCTION

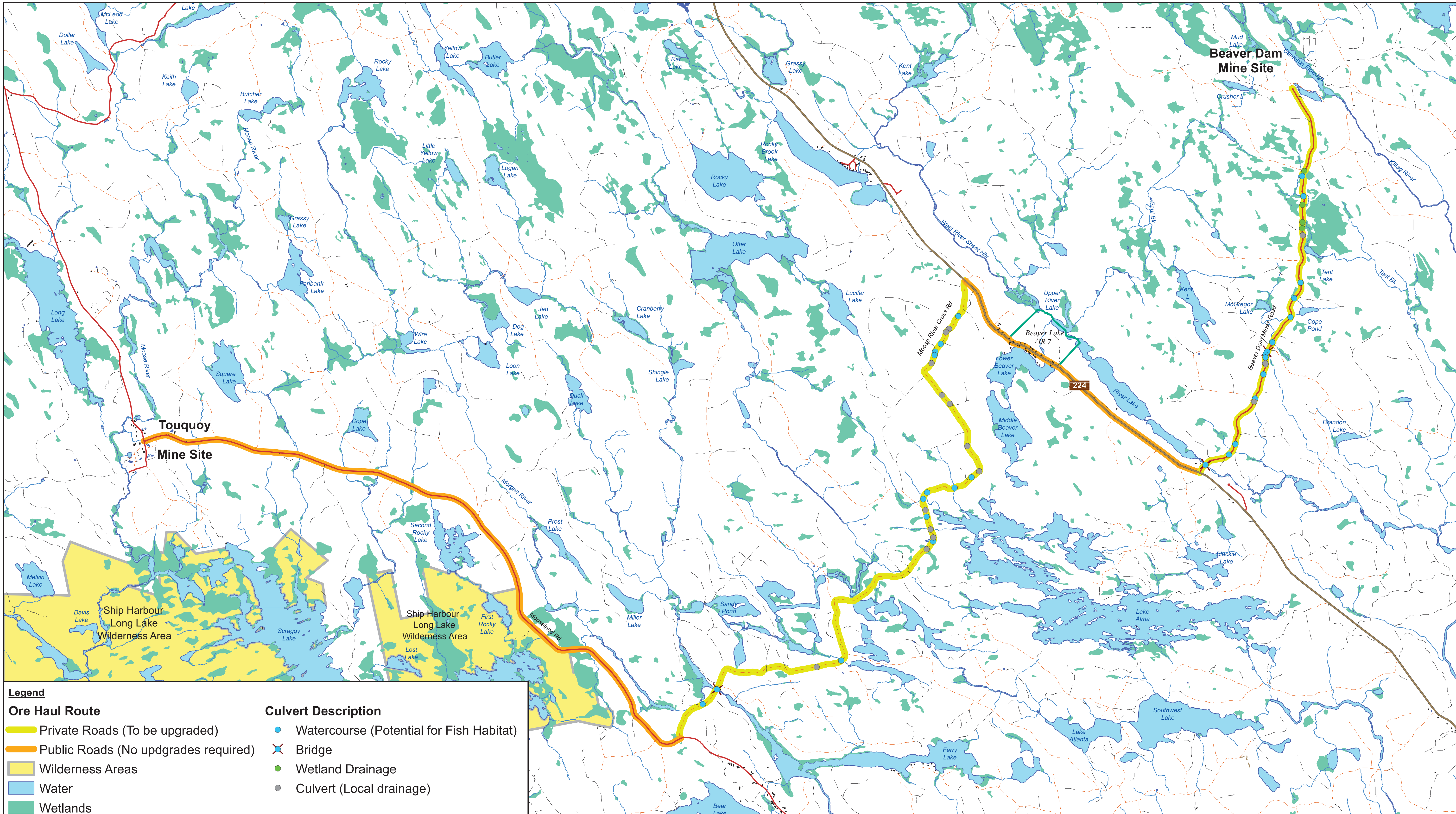
Atlantic Gold Corporation (Atlantic Gold) is proposing to redevelop the Beaver Dam Gold Project located in the northeastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figures 1 & 2***). In the fall of 2014 CRM Group was retained by GHD Limited (formerly Conestoga-Rovers & Associates) on behalf of Atlantic Gold to undertake archaeological screening and reconnaissance of the proposed mine expansion. The archaeological investigation was conducted under to the terms of Heritage Research Permit A2014NS107 (Category 'C'), issued to Staff Archaeologist Kathryn J. Stewart through the Special Places Program (Special Places).

Subsequent changes to the layout of the proposed facility led to additional archaeological reconnaissance in the summer of 2015. Previously investigated mine features such as the waste rock storage (WRS) and the crusher site had shifted to different locations within the overall development site. New work areas were added to the project, in the form of two till piles, two ore piles, two settling ponds and a Run-of-Mine (ROM)/crusher/service pad site. The archaeological investigation was conducted according to the terms of Heritage Research Permit A2015NS043 (Category 'C'), issued to K. J. Stewart. No additional features were identified during this reconnaissance.

In the fall of 2015, CRM Group was retained to conduct archaeological screening and reconnaissance of the proposed haul road connecting the Beaver Dam Mine and the Touquoy Mine sites. The work was conducted under the terms of Heritage Research Permit A2015NS101 by Staff Archaeologists Kiersten Green and K. J. Stewart. The primary focus of the study was to assess the potential for encountering archaeological resources during upgrading of the haul road. The assessment builds upon the research and reconnaissance of the Beaver Dam property undertaken on behalf of Acadian Mining (Acadian) by CRM Group in 2008 (Beanlands 2008). This report describes the archaeological reconnaissance of the proposed haul road, presents the results of these efforts and offers cultural resource management recommendations.



	Approximate Study Area	Figure 1
CRM Group	BEAVER DAM GOLD PROJECT HAUL ROAD ARCHAEOLOGICAL DESKTOP REVIEW & RECONNAISSANCE HALIFAX REGIONAL MUNICIPALITY	March 2016
		Scale 1:50 000



Source: Service Nova Scotia, NS Environment, GHD (Field)

CRM Group

Detailed Study Area	Figure 2
BEAVER DAM GOLD PROJECT HAUL ROAD ARCHAEOLOGICAL RECONNAISSANCE HALIFAX REGIONAL MUNICIPALITY	March 2016

GHD

ATLNATIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HAUL ROAD CONFIGURATION

0 250 500 750 1,000
Meters

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

N

2.0 STUDY AREA

The Beaver Dam Gold Project mine site is located on the western side of Killag River in the northeastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figure 1***). Access to the property can be gained by following Highway 224 approximately 17 kilometres northwest from Highway 7 to Beaver Dam Mines Road, then following Beaver Dam Mines Road north. The haul road overlaps with Beaver Dam Mine Road, which is the access road to the mine, then follows Highway 224 for 5.1 kilometres to the northwest (***Figure 2***). Turning left onto Moose River Cross Road, the haul road meanders for 12.1 kilometres along gravel roads heading southwest toward Mooseland Road. Upon reaching Mooseland Road, it turns northwest again, reaching the Touquoy Mine site after 11.2 kilometres.

Only portions of the proposed haul road require upgrades to allow for truck travel, so the focus of the reconnaissance was on Beaver Dam Mines Road and Moose River Cross Road. It is projected the upgrade will expand these sections of haul road to 20 metres wide.

PLATE 1: Small water crossing in the haul road study area; facing southwest. November 13, 2015.

3.0 METHODOLOGY

GHD retained CRM Group to undertake archaeological reconnaissance of the proposed haul road connecting the Beaver Dam Mine and Touquoy Mine sites. To address the potential of encountering significant archaeological resources within the proposed haul route, CRM Group developed a work plan consisting of the following components: archaeological reconnaissance of the area to be impacted by development activities; and, preparation of a report summarizing the results of the field survey, as well as recommending strategies for assessment and management of areas exhibiting high archaeological potential and/or features.

3.1 Background Research

The archival research had already been completed during the initial screening and reconnaissance of the Beaver Dam Mine site, so no additional background research was conducted. This component of the archaeological screening and reconnaissance was designed to explore the land use history of the study area, and provide information necessary to evaluate the area's archaeological potential. To achieve this goal, CRM Group utilized the resources of various institutions including documentation available through Nova Scotia Archives, the Department of Natural Resources (DNR) and Crown Land Information Management Centre.

The background study included a review of relevant historic documentation incorporating land grant records, legal survey and historic maps, as well as local and regional histories. This data facilitated the identification of environmental and topographic features, which would have influenced human settlement and resource exploitation patterns. The historical and cultural information was integrated with the environmental and topographic data to identify potential areas of archaeological sensitivity. In preparation for the archaeological reconnaissance, the information obtained from this suite of research materials was reviewed to facilitate the interpretation of any archaeological features encountered within the study area.

3.2 Field Reconnaissance

The goals of the archaeological field reconnaissance were to conduct visual inspection of the study area, document any areas of archaeological sensitivity or archaeological sites identified during the course of visual inspection, and design a strategy for testing areas of archaeological potential, as well as any archaeological resources identified within the study area. Although the ground search did not involve sub-surface testing, the researchers were alert for topographic or vegetative anomalies that might indicate the presence of buried archaeological resources. The process and results of the field reconnaissance were documented in field notes and photographs.

A hand-held Global Positioning System (GPS) unit was used to record UTM coordinates (NAD 83) for all survey areas, as well as any identified diagnostic artifacts, formal tools, isolated finds and site locations.

4.0 RESULTS OF SCREENING AND RECONNAISSANCE

4.1 Background Study

The following discussion details the environmental and cultural setting of the study area. This background study provides a framework for the evaluation of archaeological potential and the initial interpretation of any resources encountered during the field component of the assessment.

4.1.1 Environmental Setting

A number of environmental factors such as water sources, physiographic features, soil types and vegetation have influenced settlement patterns and contribute to the archaeological potential of the area.

Water Sources

The Beaver Dam Gold Project property is drained by way of the Killag River, a tributary of West River Sheet Harbour that flows south across the eastern portion of the study area. The Killag River has been dammed creating a reservoir along the eastern edge of the study area, known as Cameron Flowage. The haul road runs adjacent or crosses a number of watercourses and lakes, including River Lake, West River Sheet Harbour, Lake Alma and Ferry Lake. Proximity to water, for both drinking and transportation, is a key factor in identifying Precontact and historic Native, as well as early Euro-Canadian, archaeological potential.

Topography

Part of the study area is located within the greater terrestrial region known as the Quartzite Barrens Unit – Guysborough (Davis & Browne 1996: 56). This region is characterized by rocks belonging to the Meguma supergroup, which in this region is greywacke dating to between the Cambrian and Ordovician periods (White & Barr 2010; Davis & Browne 1996: 44). The topography of the bedrock-dominated barrens could be described as "ridge-swamp-swale". The area is almost completely covered by a quartzite till that ranges in thickness from 1 to 10 metres (Davis & Browne 1996: 56). In addition, a portion of the haul road is with the region known as Eastern Shore Drumlins Unit - Tangier River. This region is underlain by greywacke and slate interfolded into a series of wide bands that are oriented east-west (Davis & Browne 1996: 74). The general topography of the Beaver Dam region varies from level to rolling, and elevation within the study area ranges from approximately 92 metres to approximately 165 metres above sea level (Hilchey et al. 1964; 134).

Soils

The Beaver Dam area is covered primarily by *Halifax Series* (ST2, ST14) soils, although concentrations of *Bridgewater* (ST2 and ST8), *Aspotogan* (ST4), *Danesville* (ST3) and *Gibraltar* (ST2) S*eries* soils and peat are also found within the study area (Keys 2007: 8). *Halifax Series* soils are well drained but typically shallow, stony and porous. The parent material is olive to yellowish-brown sandy loam to gravelly sandy loam glacial till derived primarily from quartzite. In general, *Halifax Series* soils are too stony for agriculture (MacDougall *et. al.* 1963: 32-33). The well-drained *Bridgewater* S*eries* soils are developed from a medium-textured, olive coloured glacial till that is derived principally from Precambrian slates. The *Bridgewater* S*eries* soils in the Beaver Dam area are moderately stony and unsuitable for cultivation (MacDougall *et. al.* 1963: 28). *Aspotogan* S*eries* soils are described as a dark grayish brown sandy loam overlaying and mottled with a dark reddish brown sandy loam. The soil has poor drainage and is considered too stony for cultivation. The parent material is an olive stony loam till derived from quartzite or granite (MacDougall *et. al.* 1963: 35). *Danesville* S*eries* is a glacial till comprised of a grayish-brown gravelly sandy loam. This composition, principally derived from quartzite, is imperfectly drained (MacDougall *et. al.* 1963: 33-34). The parent material of *Gibraltar* S*eries* soils has a sandy loam texture derived from granite. It is a shallow soil, with poor moisture-holding capabilities and is extremely stony (MacDougall *et. al.* 1963: 34).

Vegetation
The forest growth within this ecological region includes Balsam Fir, Red Spruce, White Spruce, Eastern Hemlock and Yellow Birch. Slow-moving streams are bordered by broad swampy areas populated with Red Maple and Black Spruce. The nature of the soils found within the study area does not encourage heavy forest growth (Davis & Browne 1996: 56-57).

4.1.2 Native Land Use

The land within the study area was once part of the greater Mi'kmaq territory known as *Eskikewa'kik*, meaning 'skin dressers territory'. The rivers in the surrounding area would have been important transportation corridors and a resource base for the Mi'kmaq and their ancestors for millennia prior to the arrival of European settlers. The West River Sheet Harbour in particular, which the haul road crosses at a previously established bridge, would have been part of a transportation route facilitating travel inland from Sheet Harbour on the Atlantic Ocean.

A review of the Maritime Archaeological Resource Inventory, a provincial archaeological site database maintained by the SPP, determined that there are no registered archaeological sites within or close to the study area. The lack of archaeological data for the area may reflect a lack of archaeological investigation, rather than an absence of archaeological sites. According to an environmental screening prepared by the SPP (Ogilvie 2008), the greater project area, which is dense with lakes and watercourses, is considered to exhibit moderate to high potential for encountering Precontact archaeological sites. It should be noted, however, that the project area as reviewed by the SPP encompassed a larger area than that subjected to archaeological screening and reconnaissance by CRM Group.

Based on available historic documentation, there is evidence to suggest a historic Mi'kmaq presence in the Beaver Dam area. The following account was related to Harry Piers by Jeremiah Bartlett Alexis (Jerry Lonecloud) in 1918 (Whitehead 1991: 310):

> *The death occurred at Stewarts, Upper Musquodoboit, on 31st, August, of an old and well-known Indian, John Cope, at the age of 71 years, he having been born at Beaver Dam, Halifax County, in April 1847, son of old Molly Cope who is said to have been 113 years of age when she passed away about 13 years ago . . . . John Cope had considerable fame as a hunter, at least judging by the number of moose he shot, and acted as a guide for various Halifax sportsmen some thirty years ago. He used to hunt back of Beaver Dam and Moose Head [?] with Captain C. Lestrange, who was formerly well-known here. One winter, probably about forty years ago, Cope by himself killed eighteen moose . . . . The meat of these he sold to Fifteen-Mile Stream gold camp, which was then in operation.*

Based on the environmental setting and Native land use, the Beaver Dam Gold Project haul road is ascribed elevated potential for encountering Precontact and/or early historic Native archaeological resources.

4.1.3 Property History

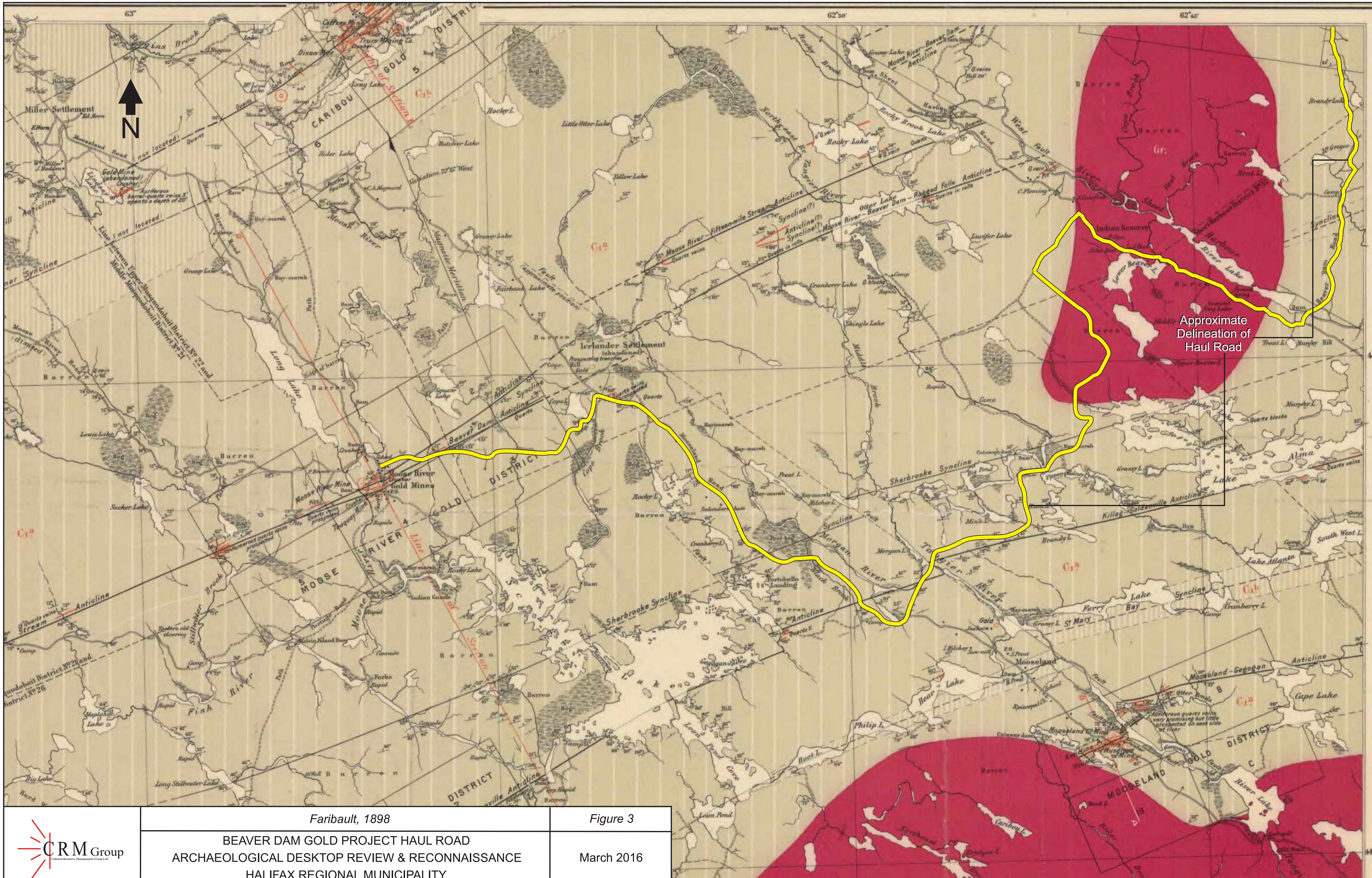
The Beaver Dam Development property has a long history of industrial use. Gold was discovered in the Beaver Dam district in 1868. By 1871, two belts of veins had been opened and a 15-stamp mill erected (Malcolm 1976: 57). However, the property remained largely inactive until 1886, when extensive prospecting and development work began. A 4-stamp mill run by water power was constructed at this time.

In 1891, the Beaver Dam Mining Company acquired the site. This new company expanded operations on the property with the construction of a 10-stamp mill. Four years later, the property was leased to G.M. Christie and William Tupper, who employed fifteen men at the Beaver Dam Mine. In 1896, the mine was acquired by J. H. Austin, who erected a 10-stamp mill. Work at the Beaver Dam Mine site continued intermittently until the late 80s, changing mining rights at least a dozen times (Jacques Whitford 1986). More recently, a number of other companies, including Seabright Resources Inc., have conducted extensive exploration on the property.

Euro-Canadian settlement of the Beaver Dam area began in the second half of the nineteenth century and centered on mining activities. A cursory examination of historic mapping revealed that the study area including the haul road occupies portions of at least two dozen historic lots (Crown Land Grant Sheet 89). An examination of the A. F. Church map of Halifax County failed to identify any structures depicted within the study area as of 1865. The 1898 Faribault map indicates the presence of approximately seven features within the mine study area but no features along or adjacent to the haul road (***Figures 3***). Four of those features in the mine study area, however, are depicted as overlying a quartz vein located near the centre of the Pit study area. This area was subsequently mined and the abandoned pit is now partially flooded. The other three features are depicted in the vicinity of another quartz vein running along the northern shore of Crusher Lake.

The DNR Abandoned Mine Opening (AMO) Database was used to identify where open mine shafts were located. The data was used both as a safety measure and for identifying areas more likely to contain archaeological features. According to the database, 20 AMOs are associated with Beaver Dam Mine site, and no AMOs are associated with the haul road (Stewart and Cigolotti 2015).

Based on the historical setting within the study area, the Beaver Dam Mine Project haul road is ascribed low potential for encountering historic Euro-Canadian archaeological resources.



Faribault, 1898

Figure 3

BEAVER DAM GOLD PROJECT HAUL ROAD
ARCHAEOLOGICAL DESKTOP REVIEW & RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY

March 2016

CRM Group

4.2 Field Reconnaissance

CRM Group archaeologists conducted fieldwork, consisting of a visual inspection of the study area, on November 13, 2015 under sunny and warm conditions. The primary goals of the reconnaissance were to assess the archaeological potential of the proposed haul road area and to investigate various topographical and cultural features, which had been identified as areas of elevated potential during the background research.

The water crossings exhibited the highest potential in the background research and were the focus of the reconnaissance.

The survey began by driving to the mine development site and then returning to Highway 224. All water crossings were investigated along the Beaver Dam Mines Road (***Plates 2 & 3***). The only crossing of significant size was West River Sheet Harbour, flowing out of River Lake alongside the highway. Areas immediately adjacent to the bridge were heavily disturbed as a result of bridge construction - bulldozing and importing gravel to build up the road. Outside the disturbance, the land is mostly low, wet and rocky (***Plates 4, 5 & 6***). In other areas the land dropped sharply down to the water over a bald rock face. The crossing exhibits low archaeological potential.

The other section of haul road that requires upgrading is Moose River Cross Road. Survey of this section resulted in the identification of one water crossing of significant size: Morgan River. The area around the river exhibits low potential as it is low and wet, with large boulders scattered throughout. As with the bridge over the West River Sheet Harbour, some disturbance was identified immediately adjacent to the bridge. The area had been built up for the construction of the bridge (***Plates 7 & 8***).

During the reconnaissance for the Beaver Dam Mine haul road, no areas were ascribed high archaeological potential.

Plate 2: A flooded area along the proposed haul road; facing southeast. November 13, 2015.

Plate 3: Water crossing along the proposed haul road; facing south. November 13, 2015.

Plate 4: West River Sheet Harbour crossing; facing northeast. November 13, 2015.

Plate 5: **West River Sheet Harbour crossing; facing southeast. November 13, 2015.**

Plate 6: **West River Sheet Harbour crossing, exhibiting some disturbance; facing north. November 13, 2015.**

Plate 7: Morgan River crossing; facing east. November 13, 2015.

Plate 8: Morgan River crossing; facing west. November 13, 2015.

5.0 CONCLUSIONS AND RECOMMENDATIONS

In the fall of 2015, CRM Group was retained by GHD to conduct archaeological screening and reconnaissance of the proposed haul road connecting the Beaver Dam Mine and the Touquoy Mine sites. Archaeological reconnaissance was conducted on November 13, 2015 under sunny and warm conditions. Visual inspection of the study area did not identify any areas exhibiting high archaeological potential.

Based on these results, CRM Group offers the following management recommendations for the study area:

1. It is recommended that the alignment of the haul road, as specified in this report, be cleared of any requirement for further archaeological investigation.

2. In the event that archaeological deposits or human remains are encountered during any ground disturbance associated with the Beaver Dam Gold Project haul road, all work in the associated area(s) should be halted and immediate contact made with the Special Places Program (Sean Weseloh-McKeane: 902-424-6475).

6.0 REFERENCES CITED

Beanlands, Sara
2009 *Beaver Dam Development Archaeological Screening & Reconnaissance, Halifax Regional Municipality, Nova Scotia*. Report for Heritage Research Permit A2008NS21. Manuscript on file with the Nova Scotia Museum.

Church, Ambrose F.
1865 *Topographical Township Map of Halifax County, Nova Scotia*. Halifax: A.F. Church & Co.

Davis, Derek & Sue Browne, eds.
1996 *The Natural History of Nova Scotia*. Vol. 2. *Theme Regions*. Halifax: Nimbus, Nova Scotia Museum.

Department of Land and Forests.
1946 *Crown Land Grant Index Sheet 89 – Halifax County*. Nova Scotia Department of Natural Resources.

Faribault, E. R.
1899 *Province of Nova Scotia, Colchester & Halifax Counties, Upper Musquodoboit Sheet, No 49*. Geological Survey of Canada.

MacDougall, J.I. et. al.
1963 *Soil Survey of Halifax County, Nova Scotia*. Report No. 13. Nova Scotia Soil Survey. Truro: Minister of Supply and Services.

Malcolm, W.
1976 *Gold Fields of Nova Scotia*. Geological Survey of Canada, Memoir 156.

Ogilvie, Robert.
2008 Environmental Screening 07-12-20d – Beaverdam Site. Report on file with the SPP-HD, Halifax.

Sangster, Alan & Paul Smith.
2007 Metallogenic Summary of the Meguma Gold Deposits, Nova Scotia in *Mineral Deposits of Canada*. Geological Association of Canada, Special Publication No. 5.

Stewart, Kathryn & Kyle G. Cigolotti
2015 *Beaver Dam Gold Project Archaeological Assessment, Halifax Regional Municipality, Nova Scotia*. Report for Heritage Research Permit A2015NS107. Manuscript on file with the Nova Scotia Museum.

White, C.E. & S.M. Barr
2012 *Revised Stratigraphy and Tectonic Evolution of the Meguma Terrane*, Nova Scotia Department of Natural Resources, Halifax.

Whitehead, Ruth Holmes.
1991 *The Old Man Told Us: Excerpts from MicMac History 1500-1950*. Halifax: Nimbus.

NOVA SCOTIA

**Communities,
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June 10, 2016

Kathryn Stewart
Cultural Resource Management Group
6040 Almon Street, Halifax, NS
B3K 1T8

Dear Ms. Stewart:

**RE: Heritage Research Permit Report
A2015NS101 – Beaver Dam Gold Haul Road Project**

We have received and reviewed your report on work conducted under the terms of Heritage Research Permit A2015NS101 for the archaeological resource impact assessment of the Beaver Dam Gold Project expansion in HRM County.

The report details the archaeological screening and reconnaissance of the proposed Beaver Dam Gold Project haul road area near Sheet Harbour, HRM by CRM Group Ltd. in November 2015. The screening and reconnaissance project included a review of past archaeological work for the area, a review of compiled background and historical research, and detailed field inspection of two sections of road planned for upgrading. No areas of elevated archaeological potential or areas with archaeological resources were identified.

Based on the above, the reporter recommends that the alignment of the haul road, as specified in the report, be cleared of any requirement for further archaeological investigation. In the event that archaeological deposits or human remains are encountered during any ground disturbance associated with the Beaver Dam Gold Project haul road, all work in the associated areas should stop and contact made with the Coordinator of Special Places.

CCH Staff agrees with the recommendations and finds the report acceptable as submitted. Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,
<Original signed by>

Sean Weseloh McKeane
Coordinator, Special Places

GHD

BEAVER DAM GOLD PROJECT
HAUL ROAD OPTION 2
ARCHAEOLOGICAL RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY, NOVA SCOTIA

FINAL REPORT

Submitted to:
GHD
and the
Special Places Program of the
Nova Scotia Department of
Communities, Culture and Heritage

Prepared by:
Cultural Resource Management Group Limited
6040 Almon Street
Halifax, Nova Scotia
B3K 1T8

Consulting Archaeologist: Kathryn J. Stewart
Report Preparation: Kathryn J. Stewart & Kyle G. Cigolotti

Heritage Research Permit Number: A2016NS044

CRM Group Project Number: 2014-0015-02

MARCH 2017

CRM Group
Cultural Resource Management Group Ltd

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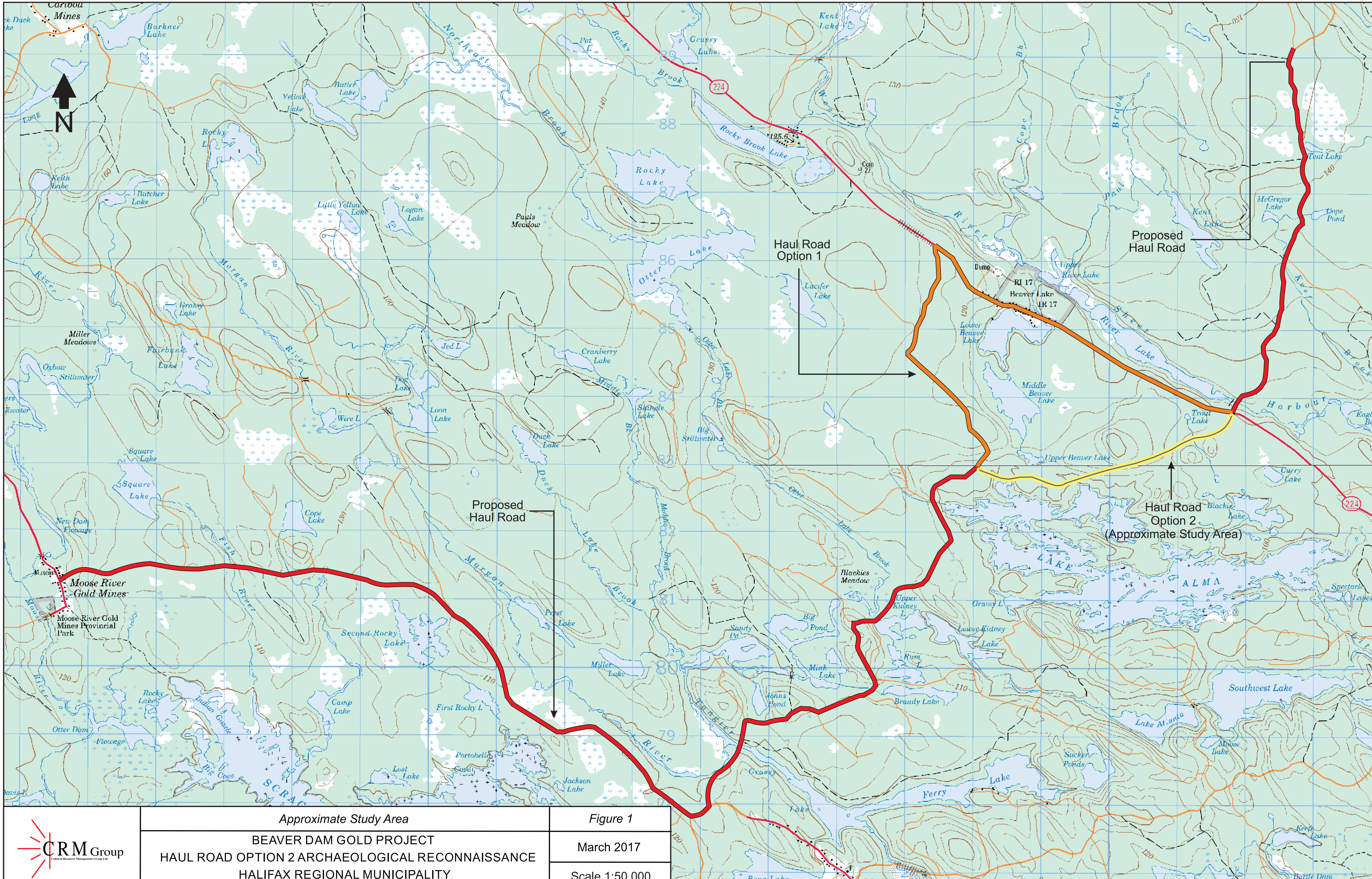
1.0 INTRODUCTION

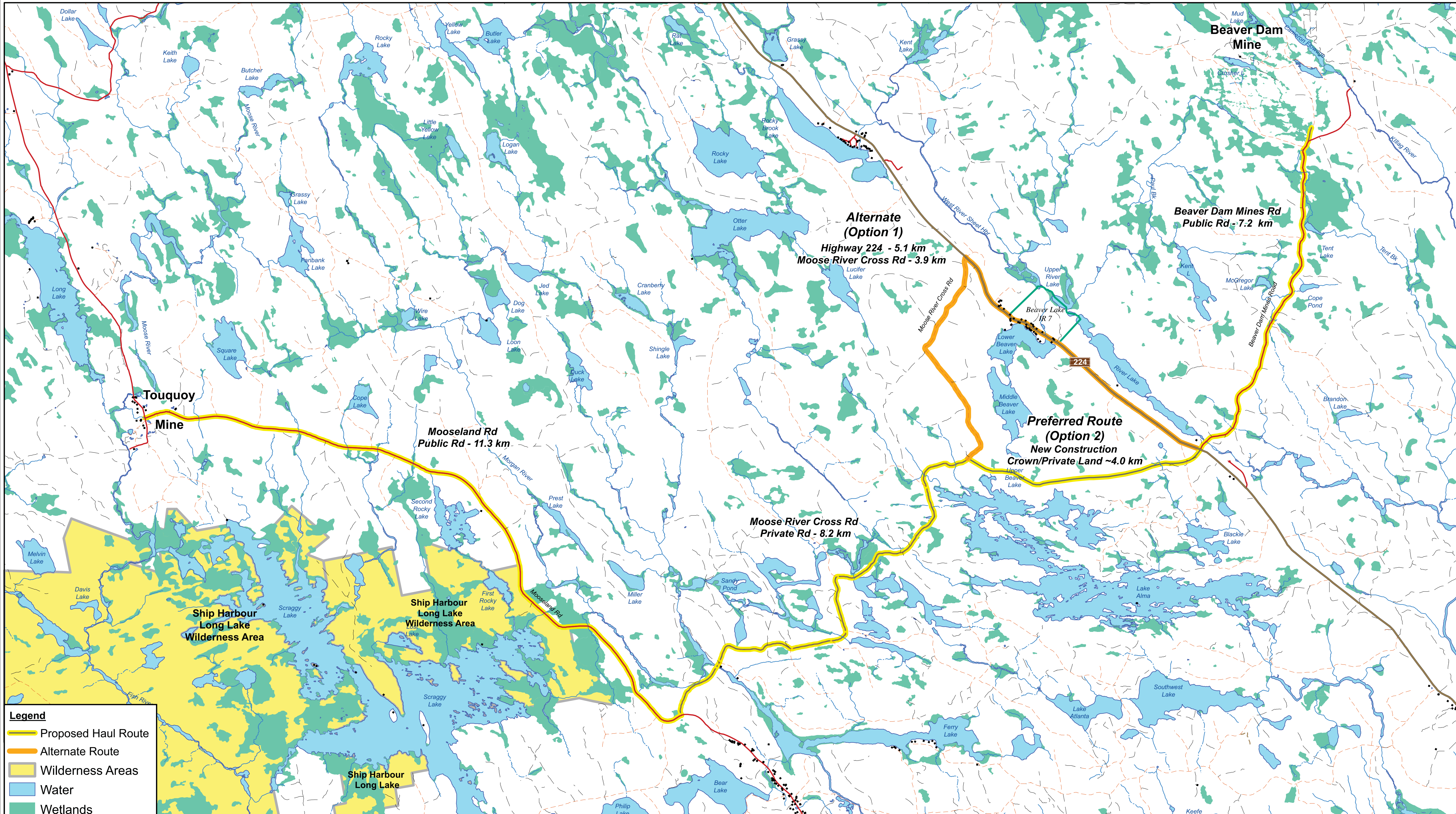
Atlantic Gold Corporation (Atlantic Gold) is proposing to redevelop the Beaver Dam Gold Project located in the northeastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figures 1, 2 & 3***). In the fall of 2014, CRM Group was retained by GHD (formerly Conestoga-Rovers & Associates) on behalf of Atlantic Gold to undertake archaeological screening and reconnaissance of the proposed mine expansion. The archaeological investigation was conducted under to the terms of Heritage Research Permit A2014NS107 (Category 'C'), issued to Staff Archaeologist Kathryn J. Stewart through the Special Places Program (Special Places).

Subsequent changes to the layout of the proposed facility led to additional archaeological reconnaissance in the summer of 2015. Previously investigated mine features had shifted to different locations and new work areas were added to the project. The archaeological investigation was conducted according to the terms of Heritage Research Permit A2015NS043 (Category 'C'), issued to K. J. Stewart. No additional features were identified during this reconnaissance.

In the fall of 2015, CRM Group was retained to conduct archaeological screening and reconnaissance of the proposed haul road connecting the Beaver Dam Mine and the Touquoy Mine sites. The work was conducted under the terms of Heritage Research Permit A2015NS101 by Archaeologist Kiersten Green with the assistance of K. J. Stewart. The primary focus of the study was to assess the potential for encountering archaeological resources during upgrading of the haul road. No archaeological resources were identified during this reconnaissance. In the spring of 2016, a second option was proposed for the section of the haul road located to the west of Highway 224. The reconnaissance work was conducted under the terms of Heritage Research Permit A2016NS044 by K. J. Stewart with the assistance of Archaeologist Kyle G. Cigolotti. This report describes the archaeological reconnaissance of the second option for the proposed haul road, presents the results of these efforts and offers cultural resource management recommendations.



CRM Group	*Approximate Study Area*	*Figure 1*
	BEAVER DAM GOLD PROJECT HAUL ROAD OPTION 2 ARCHAEOLOGICAL RECONNAISSANCE HALIFAX REGIONAL MUNICIPALITY	March 2017 Scale 1:50 000



Source: Service Nova Scotia (Water, Wetlands, Roads), NS Environment (Protected Areas), Atlantic Gold (Route)

CRM Group

Haul Road with Option 2

Figure 2

BEAVER DAM GOLD PROJECT
HAUL ROAD OPTION 2 ARCHAEOLOGICAL RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY

March 2017

0 600 1,200 1,800
Meters

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

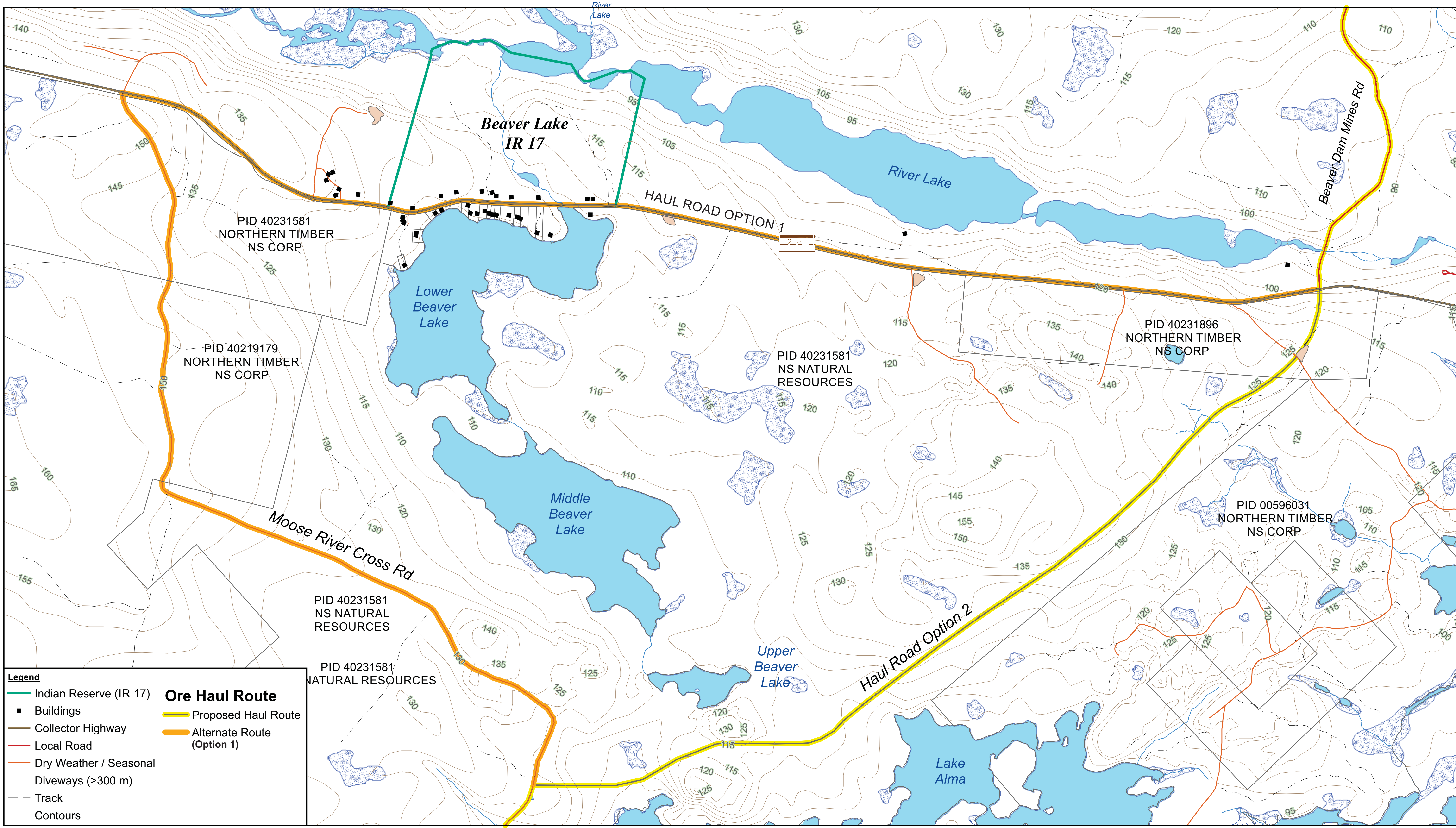
N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
BEAVER DAM MINE - HAUL ROAD OPTION 2

HAUL ROAD CONFIGURATION

088664
Jun 7, 2016



Source: Insert source text here.

Haul Road Option 2 Detail	Figure 3
BEAVER DAM GOLD PROJECT HAUL ROAD OPTION 2 ARCHAEOLOGICAL RECONNAISSANCE HALIFAX REGIONAL MUNICIPALITY	March 2017

CRM Group

0 150 300 450
Meters
Coordinate System:
NAD 1983 CSRS UTM Zone 20N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE - HAUL ROAD OPTION 2

088664
Jun 7, 2016

HAUL ROAD OPTION 2 - DETAIL

2.0 STUDY AREA

The Beaver Dam Gold Project mine site is located on the western side of Killag River in the northeastern corner of Halifax Regional Municipality, approximately 21 kilometres northwest of Sheet Harbour (***Figure 1***). Access to the property can be gained by following Highway 224 approximately 17 kilometres northwest from Highway 7 to Beaver Dam Mines Road, then following Beaver Dam Mines Road north. Option 2 for the haul road overlaps with Beaver Dam Mine Road, which is the access road to the mine, then crosses Highway 224 to follow a new alignment for 4 kilometres before connecting with Moose River Cross Road (so called for this project), the haul road meanders for 8.4 kilometres along gravel roads heading southwest toward Mooseland Road. Upon reaching Mooseland Road, it turns northwest again, reaching the Touquoy Mine site after 11.2 kilometres.

As the other sections of the haul road have already been subject to archaeological reconnaissance, only Option 2 of the haul road was addressed under this permit.

PLATE 1: The beginning of the Haul Road Option 2 alignment off Highway 224. The orange flagging tape denotes the alignment. Facing west. June 23, 2016.

3.0 METHODOLOGY

GHD retained CRM Group to undertake archaeological reconnaissance of the proposed haul road connecting the Beaver Dam Mine and Touquoy Mine sites. To address the potential of encountering significant archaeological resources within the proposed haul route, CRM Group developed a work plan consisting of the following components: background research; archaeological reconnaissance of the area to be impacted by development activities; and, preparation of a report summarizing the results of the field survey, as well as recommending strategies for assessment and management of areas exhibiting high archaeological potential and/or features.

3.1 Background Research

This component of the archaeological screening and reconnaissance was designed to explore the land use history of the study area, and provide information necessary to evaluate the area's archaeological potential. To achieve this goal, CRM Group utilized the resources of various institutions including documentation available through Nova Scotia Archives, the Department of Natural Resources (DNR) and Crown Land Information Management Centre.

The background study included a review of relevant historic documentation incorporating land grant records, legal survey and historic maps, as well as local and regional histories. This data facilitated the identification of environmental and topographic features, which would have influenced human settlement and resource exploitation patterns. The historical and cultural information was integrated with the environmental and topographic data to identify potential areas of archaeological sensitivity. In preparation for the archaeological reconnaissance, the information obtained from this suite of research materials was reviewed to facilitate the interpretation of any archaeological features encountered within the study area.

3.2 Field Reconnaissance

The goals of the archaeological field reconnaissance were to conduct visual inspection of the study area, document any areas of archaeological sensitivity or archaeological sites identified during the course of visual inspection, and design a strategy for testing areas of archaeological potential, as well as any archaeological resources identified within the study area. Although the ground search did not involve sub-surface testing, the researchers were alert for topographic or vegetative anomalies that might indicate the presence of buried archaeological resources. The process and results of the field reconnaissance were documented in field notes and photographs.

A hand-held Global Positioning System (GPS) unit was used to record UTM coordinates (NAD 83) for all survey areas, as well as any identified diagnostic artifacts, formal tools, isolated finds and site locations.

4.0 RESULTS OF SCREENING AND RECONNAISSANCE

4.1 Background Study

The following discussion details the environmental and cultural setting of the study area. This background study provides a framework for the evaluation of archaeological potential and the initial interpretation of any resources encountered during the field component of the assessment.

4.1.1 Environmental Setting

A number of environmental factors such as water sources, physiographic features, soil types and vegetation have influenced settlement patterns and contribute to the archaeological potential of the area.

Water Sources

The Beaver Dam Gold Project property is drained by way of the Killag River, a tributary of West River Sheet Harbour that flows south across the eastern portion of the study area. The Killag River has been dammed creating a reservoir along the eastern edge of the study area, known as Cameron Flowage. The second option for the haul road runs between Lake Alma and Upper Beaver Lake. It also crosses an unnamed stream feeding into Blackie Lake. Proximity to water, for both drinking and transportation, is a key factor in identifying Precontact and historic Native, as well as early Euro-Canadian, archaeological potential.

Topography

The study area is located within the greater terrestrial region known as the Quartzite Barrens Unit – Guysborough (Davis & Browne 1996: 56). This region is characterized by rocks belonging to the Meguma supergroup, which in this region is greywacke dating to between the Cambrian and Ordovician periods (White & Barr 2010; Davis & Browne 1996: 44). The topography of the bedrock-dominated barrens could be described as "ridge-swamp-swale". The area is almost completely covered by a quartzite till that ranges in thickness from 1 to 10 metres (Davis & Browne 1996: 56). The general topography of the Beaver Dam region is described as rolling, and elevation within the study area ranges from approximately 95 metres to 145 metres above sea level (Hilchey et al. 1964; 134).

Soils

The Beaver Dam area is covered by *Gibraltar* (ST2) and *Halifax Series* soils (ST2, ST14) (Keys 2007: 8). The parent material of *Gibraltar* S*eries* soils has a sandy loam texture derived from granite. It is a shallow soil, with poor moisture-holding capabilities and is extremely stony (MacDougall *et. al.* 1963: 34). *Halifax Series* soils are well drained but typically shallow, stony and porous. The parent material is olive to yellowish-brown sandy loam to gravelly sandy loam glacial till derived primarily from quartzite. In general, *Halifax Series* soils are too stony for agriculture (MacDougall *et. al.* 1963: 32-33).

Vegetation

The forest growth within this ecological region includes Balsam Fir, Red Spruce, White Spruce, Eastern Hemlock and Yellow Birch. Slow-moving streams are bordered by broad swampy areas populated with Red Maple and Black Spruce. The nature of the soils found within the study area does not encourage heavy forest growth (Davis & Browne 1996: 56-57).

4.1.2 Native Land Use

The land within the study area was once part of the greater Mi'kmaq territory known as *Eskikewa'kik*, meaning 'skin dressers territory'. The rivers in the surrounding area would have been important transportation corridors and a resource base for the Mi'kmaq and their ancestors for millennia prior to the arrival of European settlers. The West River Sheet Harbour in particular, which the previously assessed section of the haul road crosses at an established bridge, would have been part of a transportation route facilitating travel inland from Sheet Harbour on the Atlantic Ocean.

A review of the Maritime Archaeological Resource Inventory, a provincial archaeological site database maintained by the SPP, determined that there are no registered archaeological sites within or close to the study area. The lack of archaeological data for the area may reflect a lack of archaeological investigation, rather than an absence of archaeological sites. According to an environmental screening prepared by the SPP (Ogilvie 2008), the greater project area, which is dense with lakes and watercourses, is considered to exhibit moderate to high potential for encountering Precontact archaeological sites. It should be noted, however, that the project area as reviewed by the SPP encompassed a larger area than that subjected to archaeological screening and reconnaissance by CRM Group.

Based on available historic documentation, there is evidence to suggest a historic Mi'kmaq presence in the Beaver Dam area. The following account was related to Harry Piers by Jeremiah Bartlett Alexis (Jerry Lonecloud) in 1918 (Whitehead 1991: 310):

> *The death occurred at Stewarts, Upper Musquodoboit, on 31st, August, of an old and well-known Indian, John Cope, at the age of 71 years, he having been born at Beaver Dam, Halifax County, in April 1847, son of old Molly Cope who is said to have been 113 years of age when she passed away about 13 years ago . . . . John Cope had considerable fame as a hunter, at least judging by the number of moose he shot, and acted as a guide for various Halifax sportsmen some thirty years ago. He used to hunt back of Beaver Dam and Moose Head [?] with Captain C. Lestrange, who was formerly well-known here. One winter, probably about forty years ago, Cope by himself killed eighteen moose . . . . The meat of these he sold to Fifteen-Mile Stream gold camp, which was then in operation.*

Based on the environmental setting and Native land use, the Beaver Dam Gold Project Haul Road Option 2 is ascribed elevated potential for encountering Precontact and/or early historic Native archaeological resources.

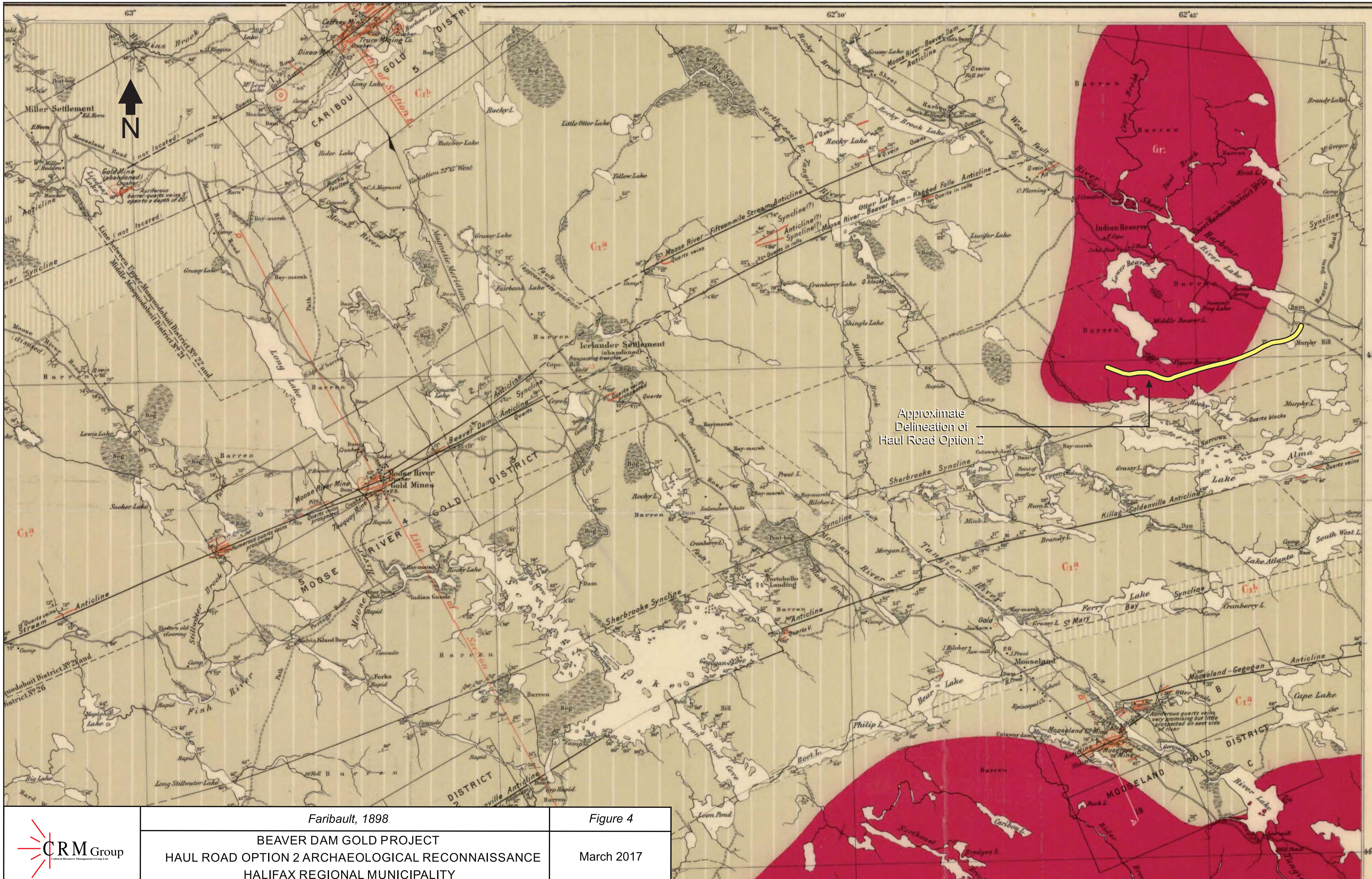
4.1.3 Property History

The Beaver Dam Development property has a long history of industrial use. Gold was discovered in the Beaver Dam district in 1868. By 1871, two belts of veins had been opened and a 15-stamp mill erected (Malcolm 1976: 57). However, the property remained largely inactive until 1886, when extensive prospecting and development work began. A 4-stamp mill run by water power was constructed at this time. In 1891, the Beaver Dam Mining Company acquired the site. This new company expanded operations on the property with the construction of a 10-stamp mill. Four years later, the property was leased to G.M. Christie and William Tupper, who employed fifteen men at the Beaver Dam Mine. In 1896, the mine was acquired by J. H. Austin, who erected a 10-stamp mill. Work at the Beaver Dam Mine site continued intermittently until the late 80s, changing mining rights at least a dozen times (Jacques Whitford 1986). More recently, a number of other companies, including Seabright Resources Inc., have conducted extensive exploration on the property.

Euro-Canadian settlement of the Beaver Dam area began in the second half of the nineteenth century and centered on mining activities. A cursory examination of historic mapping revealed that the study area, including the haul road, occupies portions of at least two dozen historic lots (Crown Land Grant Sheet 89). An examination of the 1865 A. F. Church map of Halifax County identifies three structures around Blackie Lake, though they do not appear to be within the study area. The 1898 Faribault map indicates the presence of approximately seven features within the mine study area but no features along or adjacent to the haul road (***Figures 3***). Four of those features in the mine study area, however, are depicted as overlying a quartz vein located near the centre of the Pit study area. This area was subsequently mined and the abandoned pit is now partially flooded. The other three features are depicted in the vicinity of another quartz vein running along the northern shore of Crusher Lake.

The DNR Abandoned Mine Opening (AMO) Database was used to identify where open mine shafts were located. The data was used both as a safety measure and for identifying areas more likely to contain archaeological features. According to the database, 20 AMOs are associated with Beaver Dam Mine site, and no AMOs are associated with the haul road (Stewart and Cigolotti 2015).

Based on the historical setting within the study area, the Beaver Dam Mine Project Haul Road Option 2 is ascribed low potential for encountering historic Euro-Canadian archaeological resources.



Faribault, 1898

Figure 4

CRM Group

BEAVER DAM GOLD PROJECT
HAUL ROAD OPTION 2 ARCHAEOLOGICAL RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY

March 2017