Appendix A.1

Terms of Reference for the Community Liaison Committee (CLC)

Beaver Dam Mine Project - Revised Environmental Impact Statement Marinette, Nova Scotia

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

Moose River Consolidated (MRC) Project

June 2017

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 meetings. Guests are only to attend the meetings where approved by the CLC by a majority vote of hands in the prior CLC meeting 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 50% plus one of the CLC membership and 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

ATLANTIC GOLD

Appendix A.2

Summary of Stakeholder and Mi'kmaq Engagement as Completed for the Project as of January 2018

Summary of Stakeholder and Mi'kmaq Engagement as Completed for the Project as of January 31, 2018

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.

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
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

Organization	Date	Means	Key Issues
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
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)

Organization	Date	Means	Key Issues
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
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

Organization	Date	Means	Key Issues
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
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

Organization	Date	Means	Key Issues
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
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.

Organization	Date	Means	Key Issues
CLC meeting and guest	Saturday, June 24, 2017	Meeting	Provided update on Beaver Dam EIS submission and a presentation on cyanide by Cyanco.
Nova Scotia Salmon Association	26-Jul-17	Presentation	Presentation by NSSA (Edmund Halfyard and Lewis Hinks) regarding their Liming Projects on the West River Sheet Harbour.
CEAA led technical session with Sipekne'katik and Millbrook	Wednesday September 20, 2017	Presentation	reviewed EIS methodology, Valued Components and Effects Assessment Process, conclusions and residual effects with Millbrook, Sipekne'katik and CEAA . Question and answer dialogue regarding project description and potential environmental effects
CEAA led technical session with KMKNO	Wednesday September 27, 2017	Presentation	reviewed EIS methodology, Valued Components and Effects Assessment Process, conclusions and residual effects with KMKNO and CEAA. Question and answer dialogue regarding project description and potential environmental effects
Native Council of Nova Scotia	Tuesday, January 9, 2018	meeting	reviewed Project Description, EIS methodology, Valued Components and Effects Assessment Process, conclusions and residual effects with Native Council. Question and answer dialogue regarding project description and potential environmental effects
CLC meeting	Saturday, January 13, 2018	meeting	Update and discussion on CEAA EA status and Information requests.
Millbrook First Nation - Community members, staff and Council	Tuesday, January 23, 2018	Presentation	Formal presentation and poster board session to Millbrook community members to answer specific technical questions on the Beaver Dam project regarding cyanide management and handling, contingency and reclamation planning and mining processes.
Millbrook First Nation (Sheet Harbour IR)	Wednesday, January 24, 2018	Presentation	Poster board session/Open House to Millbrook community members to answer specific technical questions on the Beaver Dam project regarding cyanide management and handling, contingency and reclamation planning and mining processes.
Nova Scotia Salmon Federation	Monday, January 1, 2018	Meeting	Meeting to discuss and review the Beaver Dam Mine Project with Edmund Halfyard and Lewis Hinks.
CLC	Saturday, April 7, 2018	meeting	Discussed water source for drilling operations for Beaver Dam and road construction related issues
Prest Brothers	Friday, April 27, 2018	Phone call	Phone call to Mark Smith of Prest Brothers - left message
Prest Brothers	Monday, April 30, 2018	Phone call	Land owners discussions about Beaver Dam project.
Community Bulletin	Tuesday, May 15, 2018	newsletter	Newsletter to subscribers about Atlantic Gold projects, consultation opportunities and general information

Organization	Date	Means	Key Issues
Property Owner meeting - Deborah Marlbrough	Wednesday, May 16, 2018	meeting	Site visit to property owner near proposed haul road.
Property owners email	Wednesday, May 23, 2018	email	To Deborah Marlborough to provide Beaver Dam background information, haul road map, and link to Beaver Dam EIS.
Property Owner letter - Musquodoboit Lumber Ltd	Thursday, June 7, 2018	letter	letter to Musquodoboit Lumber Ltd, a property owners near the Beaver Dam Project (Haul) to provide information on the Project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin
Property Owners letter - MacDonald	Wednesday, June 20, 2018	letter	letter to Eve MacDonald informing her of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin
Property Owner Letter - Spiers	Wednesday, June 20, 2018	letter	letter to Ronald Spiers, a property owner near the Beaver Dam Project (haul road) informing him of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin.
Property Owner letter - MacLeod	Wednesday, June 20, 2018	letter	letter to Ashley Macleod, a property owner near the Beaver Dam Project (haul road) informing him of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin.
Property Owner letter - Blakeney	Wednesday, June 20, 2018	letter	letter to Ward Winston Blakeney, a property owner near the Beaver Dam Project (haul road) informing him of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin.
Property Owner letter - Hobb	Wednesday, June 20, 2018	letter	letter to Winston Hobb , a property owner near the Beaver Dam Project (haul road) informing him of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin.
Property Owner letter - Raymond	Wednesday, June 20, 2018	letter	letter to Carolyn and Raymond, property owners near the Beaver Dam Project (haul road) informing him of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin.
Property owner meeting	Tuesday, June 26, 2018	meeting	meeting with 2 property owners, Deborah Marlborough and Winston Hobb to discuss potential impacts on their properties and potential mitigation strategies.
CLC meeting and guests	Saturday, July 7, 2018	meeting	Discuss Beaver Dam project and current groundwater monitoring well program and received a presentation on MMER.
Property owner letter - Prest Borthers	Saturday, July 21, 2018	letter	letter to Prest Brothers, property owners near the Beaver Dam Project (haul road) informing him of the project, providing high level overview and providing sign up location for Atlantic Gold's Community Bulletin.
Property owner call - Prest Brothers	Wednesday, August 1, 2018	phone call	Discussion of property issues and to arrange a time to meet.
Community Bulletin	Saturday, August 4, 2018	newsletter	Grammatic revisions to the July 31, 2018 newsletter
Millbrook First Nations	Monday, August 13, 2018	email	Offer to meet regarding mitigation and monitoring measures
Property Owner meeting - Ronald Speirs	Wednesday, August 15, 2018	meeting	meeting to discuss property owner issues and review Project.
Property owner meetings - Prest Brothers	Thursday, August 16, 2018	meeting	meeting to discuss property owners issues and Review Project
Nova Scotia Salmon Federation	Saturday, September 22, 2018	email	Offer to meet on groundwater and surface modeling, work completed and results to address the Beaver Dam IRs responses

Organization	Date	Means	Key Issues
Northern Pulp	Sunday, September 9, 2018	meeting	Provide an overview of Project and review land requirements.
Sipekne'katik	Wednesday, September 12, 2018	meeting	Review of Project Description including adjusted waste rock pile location, review of mitigation measures and monitoring plans to address potential surface water and around water impacts from tails deposition into the TQ pit and from mine run off into the Killag River System; reviewed dust suppression options and road access management along Haul Road, participated in a question and answer period.
Millbrook First Nation	Thursday September 13, 2018	email	Follow up request for meeting to review mitigation and monitoring for the Beaver Dam Project.
Northern Pulp	Thursday, September 13, 2018	email	Summary of meeting on September 12, 2018
Sipekne'katik	Friday, September 21, 2018	email	Summary notes of September 12, 2018 meeting on Mitigation Session
Millbrook First Nation	Friday, September 21, 2018	letter sent by ema	Request for meeting to review land use information and current and land use. Also provides summary of January presentation sessions.
KMKNO	Tuesday, September 18, 2018	meeting	Reviewed project description including adjusted waste rock pile location; discussed mitigation measures and monitoring plans, discussed dust suppression options along the Haul Road, reviewed the idea of potential lichen monitoring as indicator species for forest health.
KMKNO	Friday, September 21, 2018	email	Summary notes of September 18th provided and confirmation that action items are supported by AGC.
KMKNO	Friday, September 21, 2018	email	Summary notes of September 18th and confirmation of meeting on November 19th to Review the Preliminary Environmental Effects Monitoring program.
Millbrook First Nation	Thursday, October 4, 2018	meeting	Meeting included representatives from VEAA and OAA. Discussed TEKS reporting, including scope and study area, and the specific IRs that relate to the information in the TEKS. Provided an overview of the Touquoy project. Also provided the timeline for resubmission of the revised EIS.
J. Millard to Millbrook First Nation	October 5th	email	Summary notes of October 4th meeting and a listing of IRs that related to Mi'kmaq
Northern Pulp	Tuesday, October 9, 2018	Email	Follow up with Northern Pulp on meeting in September
CLC meeting	Saturday, October 13, 2018	meeting	Update on Beaver Dam Project. Formal motion for Touquoy CLC terms of reference to include the Beaver Dam Project.
Community Bulletin	Monday, October 15, 2018	newsletter	Newsletter to subscribers about Atlantic Gold projects, consultation opportunities and general information

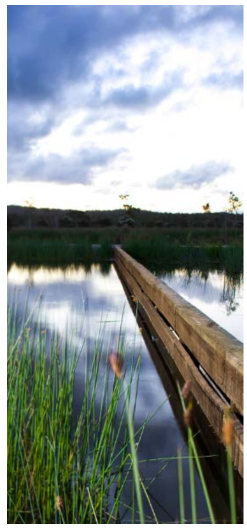
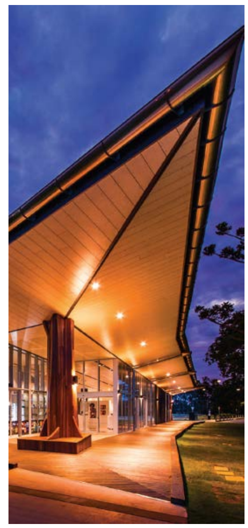
Organization	Date	Means	Key Issues
Sheet Harbour Chamber of Commerce	Friday, October 19, 2018	meeting	Provide a general update on Atlantic Gold projects, answer questions and offer a presentation to the membership of the Chamber in 2019.
J. Millard to Millbrook First Nation	Tuesday, October 23, 2018	email	Provided specific TEK information requested related to Beaver Dam CEAA Information requests in table format. Offered support to prepare a suitable confidentiality agreement.
Millbrook First Nation - G. Gloade	Wednesday, October 24, 2018	email	Questions regarding the methodology of the Archeological Study
G. Gloade to J. Millard	October 24. 2018	email	Acknowledgement of October 23rd email from J. Millard.
J. Millard to Millbrook First Nation	Monday, October 29, 2018	email	Request for update on provision of TEKS to AG.
Cultural Resource Management Group	Monday, October 29, 2018	email	Acknowledgement of October 24th email from G. Gloade . Indication of intention of work together once the Mi'kmaw Ecological Study and Traditional Land Use Study are ready for Review.
J. Millard to Millbrook First Nation	Wednesday, November 7, 2018	email	Request for TEKS. Request for a phone conversation to discuss possible ways AG can provide assistance.
Millbrook First Nations - S. Martin	Wednesday, November 7, 2018	email	TEK can not be released to AGC until it is released to community. Any release to AG will required an agreement on how the information would be used.
J. Millard to Millbrook First Nation	Thursday, November 8, 2018	email	Confirmation of intention to use TEK information to respond to IRs related to the. Offer to share Atlantic Gold regulatory documents.
J. Hartling to Millbrook First Nation	Tuesday, November 13, 2018	email	Explanation of why AGC is seeking the study information and acknowledgement of confidentialities of the data. Will provide a confidentiality agreement for Millbrook's consideration. AG is seeking to review the information by December 15, 2018
J. Hartling to Millbrook First Nation	Sunday, November 18, 2018	email	Follow up to email of November 13, 2018. Offer to have a phone conversation with Millbrook.
Millbrook First Nation, CEAA, NSE, OAA	Wednesday, January 31, 2018	meeting	Review of Millbrook Traditional Land and Resource Use Study (TLRU), review of Beaver Dam Project (technical update), discussion regarding thresholds for determination of significance, and recommendations reviewed from TLRU.

Appendix B.1

Noise Impact Study
Beaver Dam Mine Project

Beaver Dam Mine Project - Revised Environmental Impact Statement Marinette, Nova Scotia




Noise Impact Study
Beaver Dam Mine Project

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Table of Contents

Figure Index

Table Index

Appendix Index

1. Introduction

GHD was retained by Atlantic Gold Corporation (Atlantic Gold) to prepare a Noise Impact Study (Study) for the Beaver Dam Mine Project (the Project) in Halifax County, Nova Scotia. The Study has been prepared in support of the Environmental Assessment approval process.

The Beaver Dam Mine Project proposed by Atlantic Gold will operate as a satellite surface mine with an approximate ore extraction rate of 2 million tonnes per year (t/y). The Project is part of the Moose River Consolidated (MRC) Project. The MRC Project also includes the existing and fully permitted Touquoy Gold Project in nearby Moose River Gold Mines, Nova Scotia.

The proposed surface footprint of the Beaver Dam Mine Site is approximately 569 hectares, and is surrounded by lakes, rivers, and forested land in varying degrees of re-growth due to logging. The surface footprint of the Touquoy Mine Site will remain unchanged (roughly 300 hectares), and is currently surrounded by the Moose River and forested land in varying degrees of re-growth due to logging.

Processing of ore from the Beaver Dam gold deposit at the existing Touquoy plant will begin upon completion of mining ore from the Touquoy deposit. The Beaver Dam Mine Project is anticipated to begin construction in 2021, come into production in 2022, cease operations in 2026, and then be reclaimed. There will be no significant mining operations in the pit or waste rock areas of the Touquoy site while the Beaver Dam Mine Project is in production.

2. Methodology

The Project consists of three components:

- Mining and primary crushing of ore to be loaded onto trucks at the Beaver Dam mine site
- Transportation of ore from Beaver Dam along a 30.7 kilometer (km) haul road to existing facilities in Moose River
- Processing of ore and management of tailings at existing facilities developed as part of the Touquoy Gold Project

The locations of these Project components on a regional scale are displayed in Figure 1. The Study Area is defined by the area extending 2500 m from the existing and proposed operations. Based on GHD's extensive experience conducting noise impact assessments, facilities or industries with significant potential environmental noise profiles or equipment evaluate the off-site environmental noise impact up to 1500 m from the site because the noise impact beyond this distance is expected to be environmentally insignificant. The majority of the Study Area is rural, with an acoustical environment that is dominated by natural sounds having little or no road traffic.

The Study presented herein provides an evaluation of the potential noise impacts from the Project generated during normal operations on the sensitive receptors located nearest to the project operations, based on continuous 24-hour operations.

The Study was prepared consistent with the following guidelines from the Nova Scotia Environment and Labour (NSEL), which were supplemented by the following Ontario Ministry of Environment and Climate Change (MOECC) guidelines where necessary:

- "Guidelines for Environmental Noise Measurement and Assessment, May 2005", NSEL.
- "Pit and Quarry Guidelines, May 1999", NSEL.
- NPC-233, "Information to be Submitted for Approval of Stationary Sources of Sound, October 1995", MOECC.
- "Appendix A – Supporting Information for an Acoustic Assessment Report or Vibration Assessment Report Required by a Basic Comprehensive C of A" as specified in the MOE guideline entitled "Basic Comprehensive Certificates of Approval (Air) – User Guide, April 2004", MOECC.

2.1 Available Secondary Sources of Information: Collection and Review

Available secondary sources of information were collected and reviewed to determine the existing conditions within the Study Areas including:

- Review of current zoning plans, definitions and land use designations
- MOECC and NSEL technical guidelines and standards
- "Beaver Dam Mine Project – Environmental Impact Assessment" (dated June 12, 2017)

3. Existing Conditions

3.1 Review of Zoning

The Land Use By-Law and Municipal Planning Strategy (dated October 2014) for the Musquodoboit Valley and Dutch Settlement Plan Area identify the Beaver Dam Mine Site and Touquoy Mine Site as being located in an areas zoned for "Mixed Use", and are suitable for mining sites. The lands surrounding these sites are also zoned as "Mixed Use".

A zoning map of the Study Area is provided as Figure A.1 of Appendix A.

3.2 Baseline Noise Study Results

At various periods between January 2007 and September 2016, ambient noise levels were measured in the vicinity of the Beaver Dam Mine Site and the proposed haul roads to determine an approximate baseline where the expansion plans could cause new or incremental impacts to the natural environment.

The following table summarizes these measurements:

Monitoring Location	Dates	Time Period	Average L_{EQ} Value
Location #1 Waste Rock Pile (near current secondary logging road)	June 16 to 19, 2008	7:00 AM to 7:00 PM	63.0
		7:00 PM to 11:00 PM	57.5
		11:00 PM to 7:00 AM	58.0
Location #2 Northwest of Mine Site (near secondary logging road)	June 11 – 13, 2008	7:00 AM to 7:00 PM	47.4
		7:00 PM to 11:00 PM	35.9
		11:00 PM to 7:00 AM	31.0
Location #3 North of Mine Site (wilderness location on topographic high)	June 6 – 9, 2008	7:00 AM to 7:00 PM	35.5
		7:00 PM to 11:00 PM	32.4
		11:00 PM to 7:00 AM	31.3
AN#1 Northeast of Mine Site (beside primary logging road)	October 20 - 21, 2014	7:00 AM to 7:00 PM	41.2
		7:00 PM to 11:00 PM	30.9
		11:00 PM to 7:00 AM	30.0
AN#2 Northwest of Mine Site (near secondary logging road)	November 20 – 21, 2014	7:00 AM to 7:00 PM	33.2
		7:00 PM to 11:00 PM	34.6
		11:00 PM to 7:00 AM	27.4
AN#3 South of crusher location (along primary logging road)	November 20 – 21, 2014	7:00 AM to 7:00 PM	35.0
		7:00 PM to 11:00 PM	38.5
		11:00 PM to 7:00 AM	29.3
Beaver Dam Road (Haul Road) (near Highway 224)	September 8 – 9, 2016	7:00 AM to 7:00 PM	44.4
		7:00 PM to 11:00 PM	43.1
		11:00 PM to 7:00 AM	42.5
Mooseland Road (Haul Road) (south of proposed truck route)	September 20 – 21, 2016	7:00 AM to 7:00 PM	35.4
		7:00 PM to 11:00 PM	34.1
		11:00 PM to 7:00 AM	36.0
Location #1 (Touquoy) (north of proposed open pit)	January 9 – 12, 2007	7:00 AM to 7:00 PM	43.1
		7:00 PM to 11:00 PM	43.4
		11:00 PM to 7:00 AM	40.5

The baseline sampling program was completed between January 2007 and September 2016, at a total of nine locations, identified in Figure D.1 in Appendix D. The results from this sampling program are presented as equivalent continuous noise levels (L_{EQ}) averaged over a time period. It is a time-averaged sound level; a single-number value that expresses the time-varying sound level for the specified period as though it were a constant sound level with the same total sound energy as the time-varying level.

Sound level measurements for all sample locations, except for Location #1 at the Beaver Dam mine site, were within the NSE Pit and Quarry criteria for all time intervals. Sample Location #1 was approximately 10 feet from a hauling road that was in use during the monitoring period contributing to elevated noise level readings. Typical sound sources would include recreational vehicles, traffic on local roadways and contribution from existing forestry operations. The degree to which these sources would influence the existing noise levels would vary depending on the time of day and season. It should be noted that while these sound levels exceed the NSEL sound level limits, the sounds are produced by existing sources that are not associated with the Beaver Dam Mine Project.

The noise monitoring locations were chosen to be representative receptors and also to understand the ambient noise at the mine site, along the haul road, and at the Touquoy mine site. Location #1, 2 and 3 and AN #1, 2, and 3 were placed so to understand the noise levels directly around the mine site. The Beaver Dam Mines Road site was chosen as the closest receptor to a dwelling to the Mine site and the haul road. It is a surrogate for the Beaver Dam IR 17 location because the monitoring site would be more greatly affected by noise then the IR but would also record the same vehicle traffic from Highway 224 as would pass by the Beaver Dam IR. The IR is located approximately 3 km north of this monitoring location. The Mooseland Road monitoring location was chosen as a mid-point between the nearest dwelling on the Mooseland Road and the haul road. Location #1 at Touquoy was chosen to understand the noise levels directly around the Touquoy mine site and proposed open pit.

At the measurement locations around the mine site, based on the 2014 values (AN# 1,2,3) the average value is 33 dBA ±. The dominant noise sources noted are natural, including birds, the movement of leaves, and possibly the odd vehicle on a logging road. The measurement locations at Beaver Dam Mines Road and Mooseland Road would be mostly from natural sources. Mooseland Road measurements are comparable to the mine site. It is located on a little used gravel road. The Beaver Dam Mines Road is elevated and is near a paved highway with regular traffic. This road also passes through Beaver Dam IR and ambient sound will be the same as at the measured location.

Based on the measured ambient sound levels discussed above, the estimated lowest baseline ambient sound levels throughout the Study Area are as follows:

Time Period	Minimum Baseline Ambient Sound Level (L_{EQ})
7:00 AM to 7:00 PM	33 dBA
7:00 PM to 11:00 PM	31 dBA
11:00 PM to 7:00 AM	27 dBA

4. Noise Source Summary

This Study focused on the sound emissions from the noise sources identified and included in the "Beaver Dam Mine Project - Environmental Impact Statement" report, dated June 12, 2017. The Noise Source Summary is provided in Table 1 and the significant noise source locations are identified on Figure 2A (Beaver Dam Mine site) and Figure 2B (Touquoy Mine Site).

In order to predict the future worst-case noise impacts from the Project activities, representative octave band noise data was used, measured from processing equipment similar to what is noted to be required for the Project. This data was obtained from the Department of Environment Food and Rural Affairs (DEFRA) "Update of Noise Database for Prediction of Noise on Construction and Open Sites, 2005 and 2006". GHD also used the United States Department of Transportation, Federal Highway Administration (FHWA) document "FHWA Roadway Construction Noise Model User's Guide, 2006" as a supplemental document to obtain sound level data for equipment not listed by DEFRA.

The environmentally significant noise sources or activities occurring in each Study Area are as follows:

Site/Location	Noise Source Description	Cadna A ID(s)
Beaver Dam Mine Site	Truck - Haul Roads	L4 to L8
	Grader - Haul Roads	L9 to L13
	Drill	S57 to S63
	Jaw Crusher	S64
	Wheel Loader (x2)	S65, S66
	Light Tower - 8 m (x3)	S67 to S69
	Light Tower - 3 m (x3)	S70 to S72
	Tracked Dozer (x3)	S73 to S75
	Hydraulic Excavator (x4)	S76 to S79
	Crane	S80
	Fuel & Lubricant Truck (x2)	S81, S82
	Wheeled Backhoe Loader	S83
	Skid Steer	S84
	Forklift	S85
	Generator Set	S86
	Dewatering Pump (x2)	S87, S88
Inter-mine Haul Roads	Truck - Ore Transport Between Sites	L2
Touquoy Mine Site	Truck - Unloading Ore	S89
	Loader - Face Shovel	S6
	Loader - Transport of Material	S20
	Jaw Crusher	S42
	Heavy Duty Hopper	S43
	Cone Crusher	S44, S45
	Heavy Duty Belt Feeder Hopper	S46
	Twin Screen Plant	S47
	Tunnel Conveyor	S48
	CIL Tank - Electric Motor (x6)	S49 to S54

Locations of each noise source are indicated in Figures 2A and 2B. The reference sound level data for the proposed equipment are summarized in Table C1 of Appendix C.

5. Point-of-Reception Summary

A "point-of-reception" is any point on the premises of a person where sound origination from other than those premises is received. A point-of-reception may be located in areas where people normally live, work, or take part in recreation; this does not apply to the work force of a company.

The objective of this Study is to determine the predictable worst-case 1-hour equivalent sound level (1-hour L_{EQ}) at the worst-case points-of-reception. The worst-case points-of reception are defined as the sensitive receptors with the greatest potential exposure to the Facility noise sources due to proximity and direct line-of-sight exposure.

The worst-case sensitive points-of-reception (PORs) for this Study are:

- POR01 – Seasonal residence on Beaver Dam Mines Road (1.5 m AG)
- POR02 – Residence in Beaver Lake IR 17 (1.5 m AG)
- POR03 – Residence 2.5 km northwest of Mooseland, adjacent to Morgan River (1.5 m AG)
- POR04 – Residence on Mooseland Road, adjacent to Second Rocky Lake (1.5 m AG)
- POR05 – Receptor located on Scraggy Lake, approximately 185 m south of the southernmost polishing pond / dam berm of the Touquoy Site (1.5 m AG)

All POR locations within 5,000 m of the operations were considered; however, the noise impact at only the worst-case and most exposed PORs are presented herein. The locations of the worst-case PORs are identified in Figure 3.

5.1 Property Boundary Receptors

In order to assess noise levels at the property boundaries for the mine sites, four property boundary receptors were included in the model. These receptors were placed on the property boundaries of each of the sites, in order to calculate the minimum and maximum sound levels at the property boundaries.

The property boundary receptors (PBRs) are:

- PBR01 – Southwest Beaver Dam Mine property boundary (1.5 m AG)
- PBR02 – Northeast Beaver Dam Mine property boundary (1.5 m AG)
- PBR03 – North Touquoy Mine property boundary (1.5 m AG)
- PBR04 – Southeast Touquoy Mine property boundary (1.5 m AG)

Noise levels were considered at the entire property boundary of each of the mine sites, and the above receptor locations were selected to show the minimum and maximum noise levels. The locations of these PBRs are identified in Figures 4B and 4C.

6. Assessment Criteria

6.1 Point-of-Reception Noise Limits

The NSEL document "Guidelines for Environmental Noise Measurement and Assessment, May 2005" specifies the following sound level criteria:

Time Period	Exclusionary Sound Level Limit (L_{EQ})
7:00 AM to 7:00 PM	65 dBA
7:00 PM to 11:00 PM	60 dBA
11:00 PM to 7:00 AM	55 dBA

The guideline indicates that these limits are to be applied where people normally live, work, or take part in recreation (i.e., points-of-reception, or PORs). These limits do not apply to the workforce of a company. The limits are indicated to be in terms of equivalent sound levels; however, the duration over which the sound levels are to be averaged to obtain the L_{EQ} is not defined. The MOECC's NPC-300 guideline uses the 1-hour L_{EQ} as the assessment parameter for steady and quasi-steady noises, which has been used for the purposes of this Study.

As seen above, the baseline ambient sound levels at the Beaver Dam Mine Site are approximately in line with the exclusionary sound level limits in the NSEL guideline document. However, the baseline ambient sound levels at the off-site monitor locations were below these limits. Thus, the minimum nighttime L_{EQ} of 55 dBA has been used in this Study to evaluate noise levels at POR01 through POR05.

6.2 Property Line Noise Limits

The NSEL document "Pit and Quarry Guidelines, May 1999" specifies the following sound level limits at the property boundaries of pits and quarries:

Time Period	Exclusionary Sound Level Limit (L_{EQ})
7:00 AM to 7:00 PM	65 dBA
7:00 PM to 11:00 PM	60 dBA
11:00 PM to 7:00 AM, All Day Sunday and Statutory Holidays	55 dBA

Similar to the "Guidelines for Environmental Noise Measurement and Assessment, May 2005" mentioned above, the limits are indicated to be in terms of equivalent sound levels, but the duration over which the sound levels are to be averaged to obtain the L_{EQ} is not defined. The 1-hour L_{EQ} has been assumed as the appropriate sound level parameter to assess against these limits.

7. Impact Assessment

7.1 3-D Acoustical Model

Datakustik's Cadna A Acoustical Modelling Software (Cadna A) is the industry standard for environmental noise modelling in Canada. Cadna A version 2018 was used to model the potential impacts of the significant noise sources. Cadna A calculates sound level emissions based on the ISO 9613-2 standard "Acoustics – Attenuation of Sound During Propagation Outdoors", which accounts for attenuation effects due to geometric divergence, atmospheric attenuation, barriers/berms, ground absorption, and directivity. Topography for the site and surrounding environment was obtained from GHD's GIS department, and input in the 3-D acoustical model (5 m resolution for elevations).

Cadna A modelling assumptions used in this Study included:

- Noise Sources: All sources were modelled using full octave band data from the reference materials.
- Reflection Order: A maximum reflection order of 1.0 was used to evaluate indirect noise impact from reflecting surfaces.
- Ground Absorption: The model included a ground absorption factor of G = 1 for soft ground, and G = 0.5 was used for areas of gravel.
- Tonality: A +5 dB adjustment was applied for tonal sources, if applicable.
- Building Surfaces: Buildings are modelled as reflective surfaces.
- Noise sources whose dimensions are small in comparison to the distance to the PORs (generators, air intakes and exhausts) are modelled as point sources in Cadna A. Noise sources with a larger area such as bay doors are modelled as vertical area sources. Noise sources extending in only one direction with small dimensions in the other two directions such as conveyor lines or trucking routes are modelled as line sources. Each of these noise source types appears in the legend provided with Figure 3.3 and 3.4 identifying the source type.
- Temperature: 10°C.
- Relative humidity: 90%.
- Wind speed: Downwind condition, wind speed of 3 m/s.
- Maximum search radius: 20,000 m.
- Noise propagation model: Cadna A version 2018 (DataKustik).
- Standard: ISO 9613.
- Terrain parameters: Digital ground terrain for Study Area was incorporated. The pit was conservatively modelled with a depth of 10 m below grade.

It should be noted that the selected meteorological parameters (temperature and relative humidity) produce the worst case (most conservative) noise prediction results using Cadna A. Noise level predictions to account for varying temperature and relative humidity throughout the year were not conducted, but would produce slightly lower results.

7.2 Impacts at Residential Points-of-Reception

The calculated noise impacts at the each POR are presented below.

Receptor ID	Receptor Description	Predicted Total Sound Level (dBA)
POR01	Seasonal residence on Beaver Dam Mines Road (1.5 m AG)	49.9
POR02	Residence in Beaver Lake IR 17 (1.5 m AG)	32.2
POR03	Residence 2.5 km northwest of Mooseland, adjacent to Morgan River (1.5 m AG)	53.8
POR04	Residence on Mooseland Road, adjacent to Second Rocky Lake (1.5 m AG)	51.2
POR05	Receptor located on Scraggy Lake, approximately 185 m south of the southernmost polishing pond / dam berm of the Touquoy Site (1.5 m AG)	41.7

These predicted noise levels are within the nighttime exclusionary sound level limits specified in the NSEL document "Guidelines for Environmental Noise Measurement and Assessment, May 2005". The highest predicted noise levels occur at POR03, which is approximately 60 m from the ore haul route. Due to increased setback distances from the haul roads and mine sites, noise levels at all other receptors, including those not listed above, would be expected to be lower than those at POR03.

7.3 Property Line Assessment

The predicted noise levels at the property boundaries for each of the mine sites are presented below:

Receptor ID	Receptor Description	Predicted Total Sound Level Range (dBA)
PBR01, PBR02	Beaver Dam Mine Site Property Boundaries	51.5 to 65.6
PBR03, PBR04	Touquoy Mine Site Property Boundaries	39.2 to 53.9

The highest predicted noise levels at the property boundaries of the Beaver Dam Mine Site exceed the criteria in the NSEL document "Pit and Quarry Guidelines, May 1999" for all time periods. While the limits stated in these guidelines are clear and specific, they are not considered practical to meet for open pit mines with operations located close to the property lines. Mitigation of these noise excesses is not considered to be critical, as the predicted noise levels at the worst-case points of reception are within the applicable limits (see section 7.1 of this Study).

The predicted noise levels at the property boundaries of the Touquoy Mine Site are within the NSEL sound level limits for all time periods, and are acceptable.

The "Pit and Quarry Guidelines, May 1999" also state that sound levels shall be monitored at the property line of the site, or at other locations directed by the Minister or Administrator. GHD proposes that the PBR02 and PBR03 locations (shown in Figures 4B and 4C) be used for sound level monitoring, if acceptable to the Minister and/or Administrator.

7.4 Impact on Ambient Sound Levels

The mine operations are at times expected to increase the ambient sound levels for certain distances from the mine sites and ore haul road. Based on the baseline ambient sound level monitoring (see section 3.1 of this Study), ambient sound levels in the Study Area are as low as 33 dBA during the day, 31 dBA in the evening, and 27 dBA at night. Predicted noise levels from the proposed mine operations attenuate over large distances to these low ambient conditions. Figure 4A shows a contour plot, indicating the areas in which predicted noise levels from mine operations exceed these minimum baseline ambient sound levels.

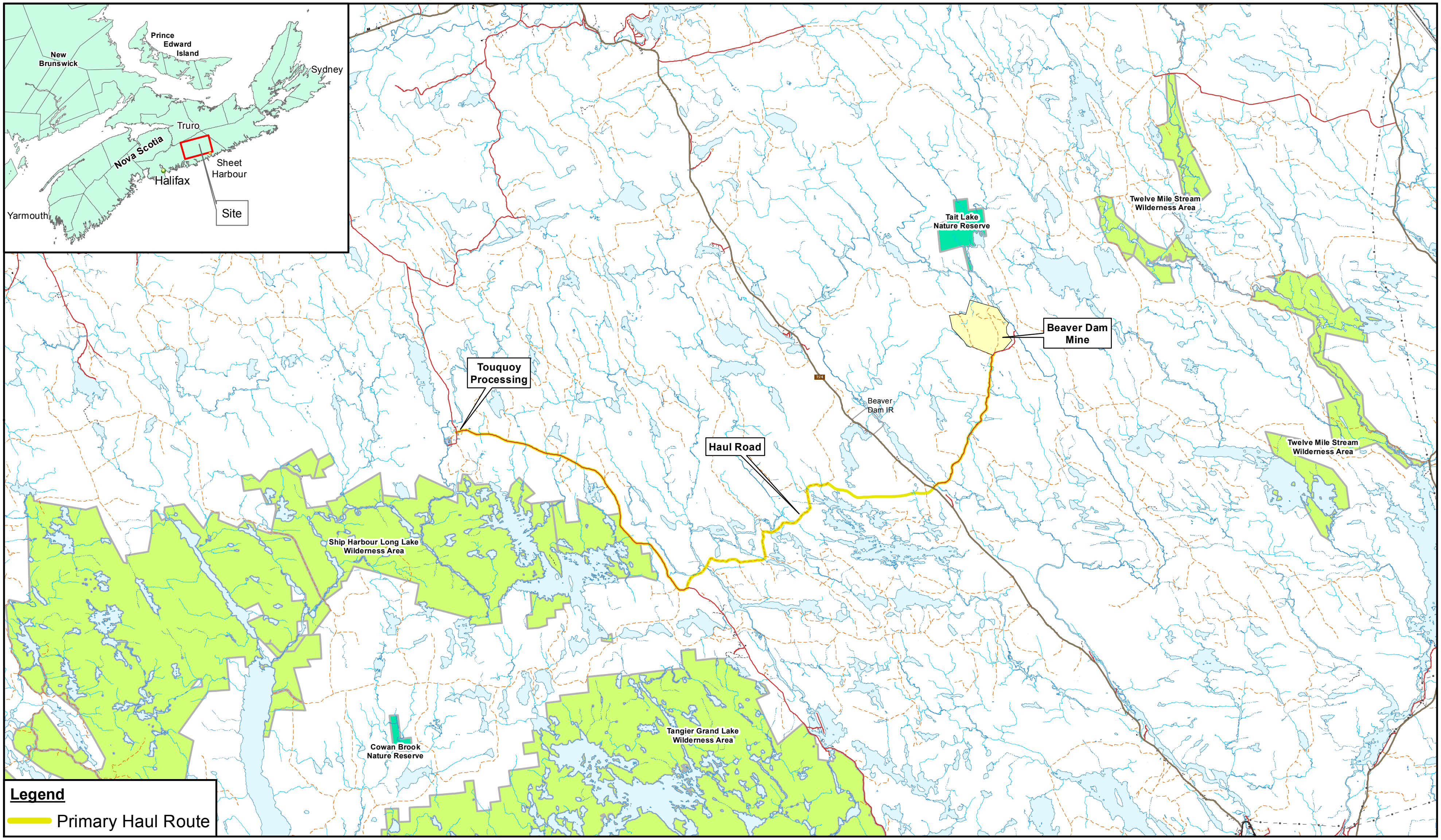
Specific effects on wildlife due to increased ambient sound levels have not been considered in this Study, however, it is expected that the results of this Study could be used to help determine what effects may result.

8. Conclusions

In general, mining operations often produce significant noise levels that have the potential to impact the surrounding environment. Thus, noise levels produced by equipment at the proposed Beaver Dam Mine Project have been assessed at various worst-case points of reception to determine the future impact on residents of the nearest communities. Predicted noise levels produced by operations at the Beaver Dam Mine Project are within the guideline limits specified by NSEL at all of the identified worst-case PORs. Based on these predictions, noise levels at all nearby residential receptors are expected to be within the NSEL noise level limits.

The NSEL's Pit and Quarry Guidelines also include noise level criteria for assessment at the property boundaries. There are no residential points of reception at the property boundaries of the sites, so sound levels at the property boundaries don't represent impacts on humans. There may be effects on wildlife, although assessment of these effects is outside the scope of this Study. The predicted noise levels from the Beaver Dam Mine Project exceed the NSEL limits at some locations on the property boundaries of the mine. Given the proximity of the mine operations to the property boundaries, it is not expected to be practical to mitigate these excesses. Predicted noise levels at the property boundaries of the Touquoy processing plant are within the guideline limits. GHD proposes that locations PBR02 and PBR03 (as shown in Figures 4B and 4C) be used for long-term sound level sampling to help monitor and control noise excesses.

Baseline ambient sound level monitoring was conducted at several locations in the Study Area between January 2007 and September 2016. Based on the data obtained from these sound level monitors, ambient sound levels in some parts of the Study Area are low, as expected for a characteristically rural environment. The proposed addition of the Beaver Dam Mine Project to the MRC Project is expected to increase ambient sound levels in the Study Area. Further assessment of the impact of the increased ambient sound levels (e.g., effects on wildlife) is outside the scope of this Study, although it is expected that the results of this Study could be used in estimating such effects.



Source: Service Nova Scotia

0 2,000 4,000 6,000

Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

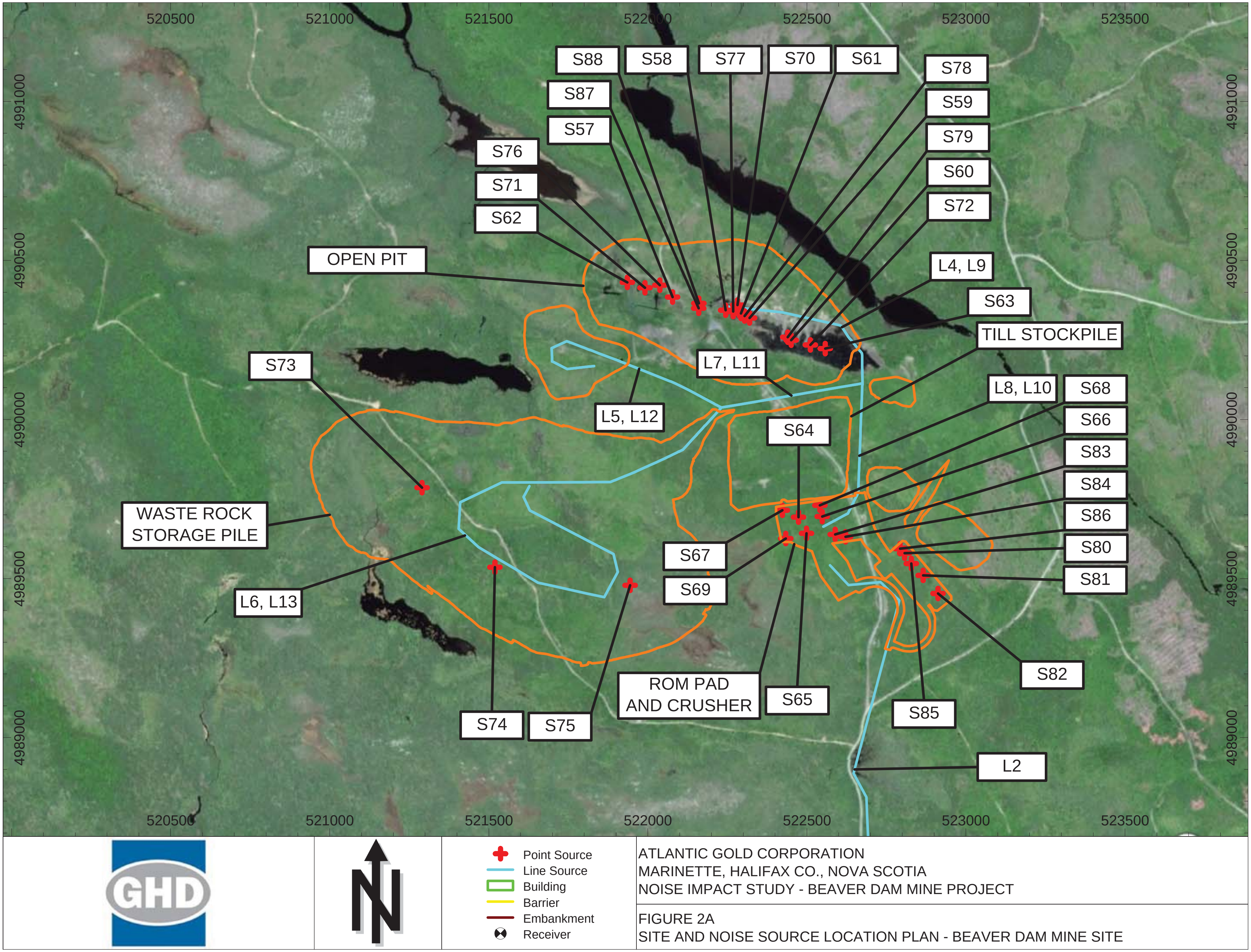
ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
ACOUSTIC ASSESSMENT REPORT – BEAVER DAM MINE

REGIONAL PLAN WITH
LOCATIONS OF PROJECT COMPONENTS

088664-20 (007)

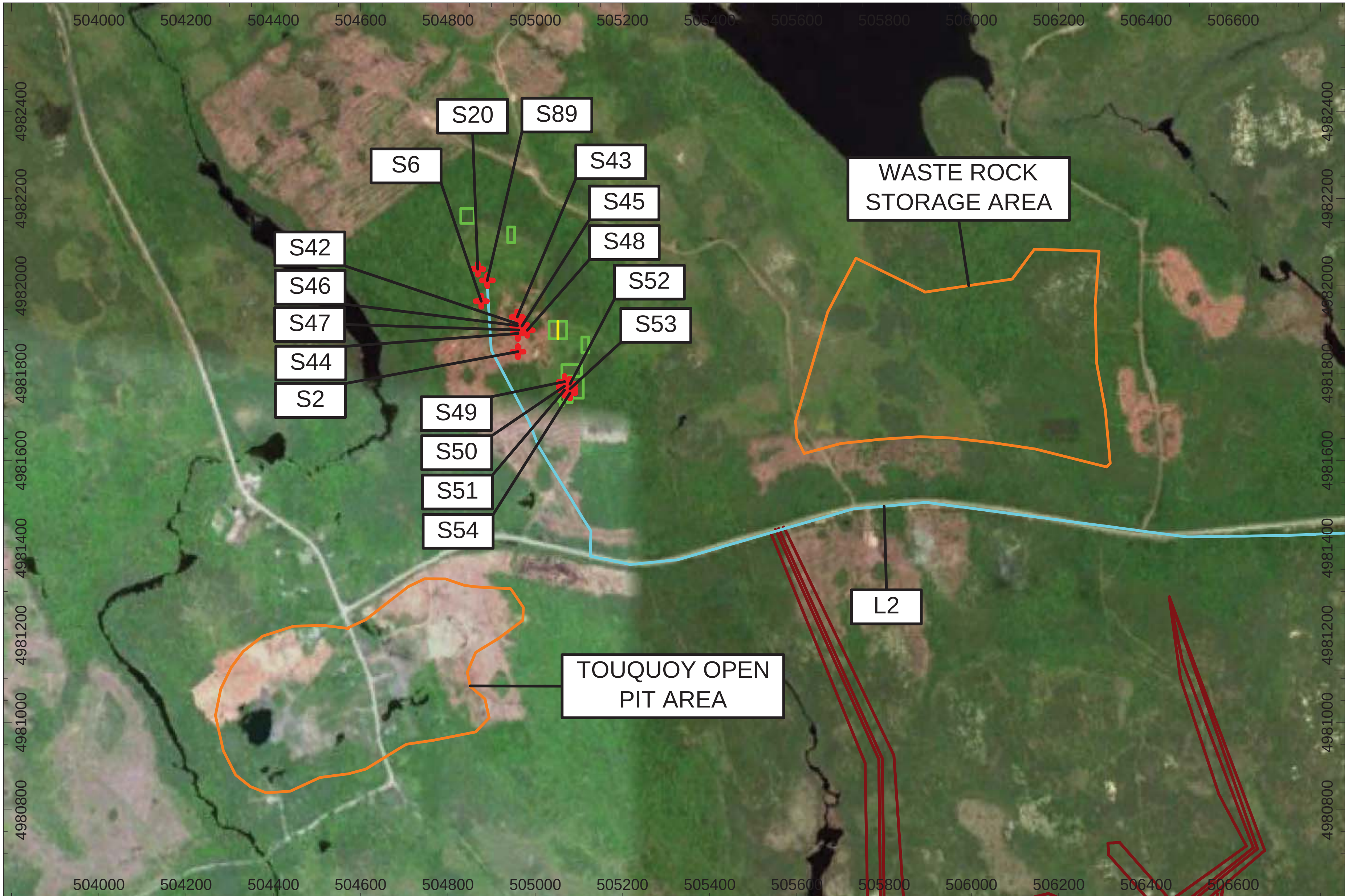
FIGURE 1

GIS File: I:\GIS_DATA\Projects\6-chars\08----\088---\088664 Atlantic BD\088664(007)\088664-20(007)_GIS-DA001.mxd



ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

FIGURE 2A
SITE AND NOISE SOURCE LOCATION PLAN - BEAVER DAM MINE SITE



GHD

N

Point Source
Line Source
Building
Barrier
Embankment
Receiver

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

FIGURE 2B
SITE AND NOISE SOURCE LOCATION PLAN - TOUQUOY PROCESSING FACILITY

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

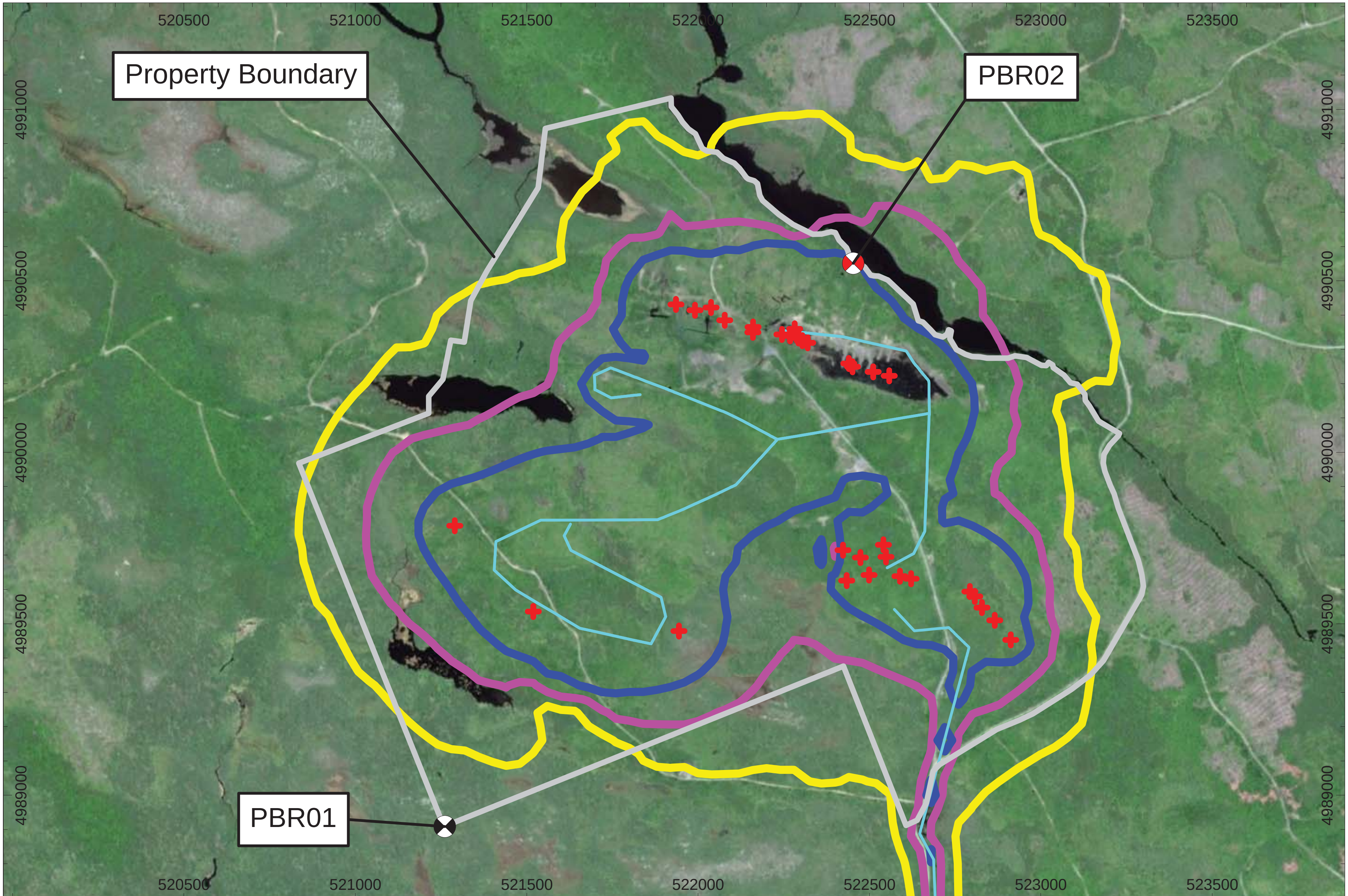
FIGURE 3
POINT-OF-RECEPTION LOCATION PLAN

GHD

27 dBA
31 dBA
33 dBA
55 dBA
60 dBA
65 dBA

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

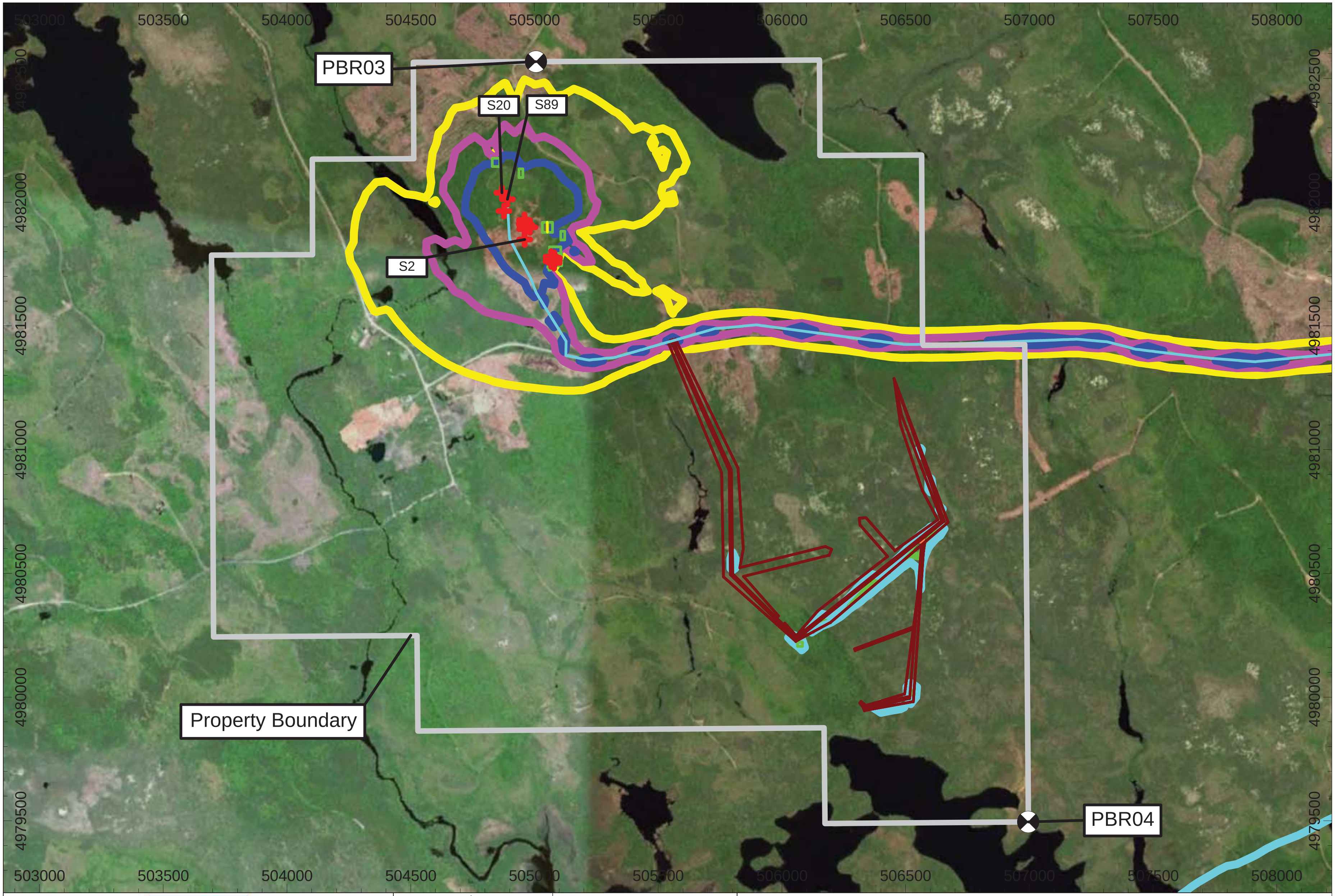
FIGURE 4A
NOISE CONTOUR PLOT (NIGHTTIME) - 1.5 M AG
ENTIRE STUDY AREA



Legend	
55 dBA	
60 dBA	
65 dBA	

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

FIGURE 4B
NOISE CONTOUR PLOT (NIGHTTIME) - 1.5 M AG
BEAVER DAM MINE SITE



55 dBA
60 dBA
65 dBA

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

FIGURE 4C
NOISE CONTOUR PLOT (NIGHTTIME) - 1.5 M AG
TOUQUOY MINE SITE

Table 1

Noise Source Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
Touquoy Mine Site						
S2	Truck - Hopper Discharge	115.5	S	O	U	Point
S6	Loader - Face Shovel	120.9	S	O	U	Point
S20	Loader - Transport of Material	116.0	S	O	U	Point
S42	Jaw Crusher	121.1	S	O	U	Point
S43	Heavy Duty Hopper	121.5	S	O	U	Point
S44	Cone Crusher	121.1	S	O	U	Point
S45	Cone Crusher	121.1	S	O	U	Point
S46	Heavy Duty Belt Feeder Hopper	100.2	S	O	U	Point
S47	Twin Screen Plant	112.1	S	O	U	Point
S48	Tunnel Conveyor	107.8	S	O	U	Point
S89	Truck - Unloading Ore	110.2	S	O	U	Point
Inter-Mine Haul Roads						
L2	Truck - Ore Transport Between Sites	125.6	S	O	U	Line
Beaver Dam Mine Site						
L4	Truck - Haul Roads	120.8	S	O	U	Line
L5	Truck - Haul Roads	120.8	S	O	U	Line
L6	Truck - Haul Roads	120.8	S	O	U	Line
L7	Truck - Haul Roads	120.8	S	O	U	Line
L8	Truck - Haul Roads	120.8	S	O	U	Line
L9	Grader - Haul Roads	119.6	S	O	U	Line
L10	Grader - Haul Roads	119.6	S	O	U	Line
L11	Grader - Haul Roads	119.6	S	O	U	Line
L12	Grader - Haul Roads	119.6	S	O	U	Line
L13	Grader - Haul Roads	119.6	S	O	U	Line
S57	Tracked Mobile Drill	117.8	S	O	U	Point
S58	Tracked Mobile Drill	117.8	S	O	U	Point
S59	Tracked Mobile Drill	117.8	S	O	U	Point
S60	Tracked Mobile Drill	117.8	S	O	U	Point
S61	Tracked Mobile Drill	117.8	S	O	U	Point
S62	Tracked Mobile Drill	117.8	S	O	U	Point
S63	Tracked Mobile Drill	117.8	S	O	U	Point
S64	Jaw Crusher	114.7	S	O	U	Point
S65	Wheel Loader	114.2	S	O	U	Point
S66	Wheel Loader	114.2	S	O	U	Point
S67	8m Light Tower	96.5	S	O	U	Point
S68	8m Light Tower	96.5	S	O	U	Point
S69	8m Light Tower	96.5	S	O	U	Point
S70	3m Light Tower	96.5	S	O	U	Point
S71	3m Light Tower	96.5	S	O	U	Point
S72	3m Light Tower	96.5	S	O	U	Point
S73	Tracked Dozer	115.1	S	O	U	Point
S74	Tracked Dozer	115.1	S	O	U	Point
S75	Tracked Dozer	115.1	S	O	U	Point

Table 1

Noise Source Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

Cadna A ID	Source Description	Sound Power Level[1] (dBA)	Source Characteristics[2]	Source Location[3]	Noise Control Measures[4]	Source Type
S76	Hydraulic Excavator	109.8	S	O	U	Point
S77	Hydraulic Excavator	109.8	S	O	U	Point
S78	Hydraulic Excavator	109.8	S	O	U	Point
S79	Hydraulic Excavator	109.8	S	O	U	Point
S80	Mobile_Crane	112.5	S	O	U	Point
S81	Fuel & Lube Truck	107.5	S	O	U	Point
S82	Fuel & Lube Truck	107.5	S	O	U	Point
S83	Wheeled Backhoe Loader	97.8	S	O	U	Point
S84	Skid Steer	109.1	S	O	U	Point
S85	Forklift	99.5	S	O	U	Point
S86	Generator	118.1	S	O	U	Point
S87	Dewatering Pump	110.4	S	O	U	Point
S88	Dewatering Pump	110.4	S	O	U	Point

Notes:

[1] Sound Power Level (PWL) in dBA and includes +5 dBA total penalty if applicable.
[2] Sound characteristics:
- S – Steady
- Q – Quasi-steady impulsive
- I – Impulsive
- B – Buzzing
- T – Tonal
- C – Cyclic

[3] Source location:
- O – Outside of building
- I – Inside of building

[4] Noise control measures:
- S – Silencer, acoustic louvre, muffler
- A – Acoustic lining, plenum
- B – Barrier, berm, screening
- L – Lagging
- E – Acoustic enclosure
- O – Other
- U – Uncontrolled
- AC – Administrative control

Table 2

Point of Reception Unattenuated Noise Impact
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

Cadna A ID	Source Description	Beaver Dam Mine Road Seasonal Residence POR01 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Lower Beaver Lake Residence POR02 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Mooseland Seasonal Residence POR03 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Steady State Noise Impact													
L2	Truck - Ore Transport Between Sites	125	50.0	50.0	50.0	2238	27.7	27.7	27.7	62	53.9	53.9	53.9
L4	Truck - Haul Roads	6278	20.0	20.0	20.0	6181	19.2	19.2	19.2	13820	11.8	11.8	11.8
L5	Truck - Haul Roads	6144	8.7	8.7	8.7	5725	9.6	9.6	9.6	13337	0.2	0.2	0.2
L6	Truck - Haul Roads	5532	26.6	26.6	26.6	5094	27.5	27.5	27.5	12721	17.5	17.5	17.5
L7	Truck - Haul Roads	6143	19.1	19.1	19.1	5864	19.3	19.3	19.3	13506	10.4	10.4	10.4
L8	Truck - Haul Roads	5830	12.7	12.7	12.7	5776	12.7	12.7	12.7	13422	3.6	3.6	3.6
L9	Grader - Haul Roads	6278	—	—	—	6181	—	—	—	13820	—	—	—
L10	Grader - Haul Roads	5830	—	—	—	5776	—	—	—	13422	—	—	—
L11	Grader - Haul Roads	6143	—	—	—	5864	—	—	—	13506	—	—	—
L12	Grader - Haul Roads	6144	0.4	0.4	0.4	5725	1.5	1.5	1.5	13337	—	—	—
L13	Grader - Haul Roads	5532	5.7	5.7	5.7	5094	7.0	7.0	7.0	12721	—	—	—
S2	Truck - Hopper Discharge	16901	—	—	—	14494	—	—	—	10118	2.8	2.8	2.8
S6	Loader - Face Shovel	16970	—	—	—	14551	0.2	0.2	0.2	10233	5.0	5.0	5.0
S20	Loader - Transport of Material	16970	—	—	—	14543	—	—	—	10263	4.9	4.9	4.9
S42	Jaw Crusher	16894	1.5	1.5	1.5	14481	3.5	3.5	3.5	10138	8.3	8.3	8.3
S43	Heavy Duty Hopper	16892	—	—	—	14478	—	—	—	10143	5.1	5.1	5.1
S44	Cone Crusher	16895	0.9	0.9	0.9	14484	3.3	3.3	3.3	10130	8.0	8.0	8.0
S45	Cone Crusher	16884	0.8	0.8	0.8	14472	3.3	3.3	3.3	10126	8.0	8.0	8.0
S46	Heavy Duty Belt Feeder Hopper	16894	—	—	—	14482	—	—	—	10137	—	—	—
S47	Twin Screen Plant	16893	—	—	—	14481	—	—	—	10131	0.2	0.2	0.2
S48	Tunnel Conveyor	16873	—	—	—	14462	—	—	—	10112	—	—	—
S57	Tracked Mobile Drill	6479	10.0	10.0	10.0	6083	8.5	8.5	8.5	13710	—	—	—
S58	Tracked Mobile Drill	6448	9.5	9.5	9.5	6131	8.2	8.2	8.2	13767	—	—	—
S59	Tracked Mobile Drill	6431	8.4	8.4	8.4	6149	7.0	7.0	7.0	13789	—	—	—
S60	Tracked Mobile Drill	6374	4.2	4.2	4.2	6160	4.9	4.9	4.9	13804	—	—	—
S61	Tracked Mobile Drill	6442	8.6	8.6	8.6	6147	7.6	7.6	7.6	13785	—	—	—
S62	Tracked Mobile Drill	6519	8.7	8.7	8.7	6055	8.9	8.9	8.9	13672	—	—	—
S63	Tracked Mobile Drill	6361	3.4	3.4	3.4	6198	2.0	2.0	2.0	13844	—	—	—
S64	Jaw Crusher	5825	12.7	12.7	12.7	5716	12.9	12.9	12.9	13363	0.9	0.9	0.9
S65	Wheel Loader	5778	12.7	12.7	12.7	5690	12.8	12.8	12.8	13337	0.7	0.7	0.7
S66	Wheel Loader	5837	12.6	12.6	12.6	5762	12.9	12.9	12.9	13409	0.8	0.8	0.8
S67	8m Light Tower	5840	—	—	—	5704	—	—	—	13351	—	—	—
S68	8m Light Tower	5871	—	—	—	5786	—	—	—	13433	—	—	—
S69	8m Light Tower	5753	—	—	—	5638	—	—	—	13285	—	—	—
S70	3m Light Tower	6468	—	—	—	6164	—	—	—	13801	—	—	—
S71	3m Light Tower	6504	—	—	—	6066	—	—	—	13688	—	—	—
S72	3m Light Tower	6366	—	—	—	6181	—	—	—	13826	—	—	—
S73	Tracked Dozer	5888	16.2	16.2	16.2	5189	17.8	17.8	17.8	12784	5.3	5.3	5.3
S74	Tracked Dozer	5625	16.7	16.7	16.7	5070	18.1	18.1	18.1	12694	5.4	5.4	5.4
S75	Tracked Dozer	5567	16.9	16.9	16.9	5238	17.6	17.6	17.6	12883	5.2	5.2	5.2
S76	Hydraulic Excavator	6514	5.7	5.7	5.7	6096	5.2	5.2	5.2	13720	—	—	—
S77	Hydraulic Excavator	6447	4.9	4.9	4.9	6140	4.5	4.5	4.5	13777	—	—	—
S78	Hydraulic Excavator	6435	4.8	4.8	4.8	6146	4.0	4.0	4.0	13785	—	—	—
S79	Hydraulic Excavator	6383	1.8	1.8	1.8	6162	2.1	2.1	2.1	13806	—	—	—
S80	Mobile_Crane	5765	10.9	10.9	10.9	5832	10.7	10.7	10.7	13471	1.6	1.6	1.6
S81	Fuel & Lube Truck	5708	3.8	3.8	3.8	5816	3.4	3.4	3.4	13452	—	—	—
S82	Fuel & Lube Truck	5662	3.8	3.8	3.8	5804	3.4	3.4	3.4	13436	—	—	—
S84	Skid Steer	5784	6.1	6.1	6.1	5756	6.1	6.1	6.1	13401	—	—	—
S86	Generator	5777	11.3	11.3	11.3	5834	11.0	11.0	11.0	13474	—	—	—
S87	Dewatering Pump	6448	3.0	3.0	3.0	6093	2.5	2.5	2.5	13726	—	—	—
S88	Dewatering Pump	6464	3.0	3.0	3.0	6107	3.2	3.2	3.2	13739	—	—	—
S89	Truck - Unloading Ore	16951	—	—	—	14527	—	—	—	10234	2.4	2.4	2.4
Total Facility Sound Level (1-hour Leq):			**50.0**	**50.0**	**50.0**		**32.3**	**32.3**	**32.3**		**53.9**	**53.9**	**53.9**

Cadna A ID	Source Description	Second Rocky Lake Residence POR04 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Scraggy Lake Recreational Receptor POR05 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Southwest Beaver Dam Property Boundary PBR01 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Steady State Noise Impact													
L2	Truck - Ore Transport Between Sites	102	51.2	51.2	51.2	1660	29.0	29.0	29.0	1399	29.5	29.5	29.5
L4	Truck - Haul Roads	15425	10.9	10.9	10.9	19222	8.5	8.5	8.5	1795	34.9	34.9	34.9
L5	Truck - Haul Roads	14829	—	—	—	18602	—	—	—	1343	26.7	26.7	26.7
L6	Truck - Haul Roads	14274	16.2	16.2	16.2	18076	13.6	13.6	13.6	698	49.8	49.8	49.8
L7	Truck - Haul Roads	15152	9.3	9.3	9.3	18966	6.8	6.8	6.8	1489	35.1	35.1	35.1
L8	Truck - Haul Roads	15223	2.3	2.3	2.3	19080	—	—	—	1536	28.2	28.2	28.2
L9	Grader - Haul Roads	15425	—	—	—	19222	—	—	—	1795	16.2	16.2	16.2
L10	Grader - Haul Roads	15223	—	—	—	19080	—	—	—	1536	18.4	18.4	18.4
L11	Grader - Haul Roads	15152	—	—	—	18966	—	—	—	1489	17.8	17.8	17.8
L12	Grader - Haul Roads	14829	—	—	—	18602	—	—	—	1343	22.8	22.8	22.8
L13	Grader - Haul Roads	14274	—	—	—	18076	—	—	—	698	33.8	33.8	33.8
S2	Truck - Hopper Discharge	5445	10.7	10.7	10.7	2454	22.6	22.6	22.6	17763	—	—	—
S6	Loader - Face Shovel	5552	14.8	14.8	14.8	2596	27.3	27.3	27.3	17795	—	—	—
S20	Loader - Transport of Material	5577	14.1	14.1	14.1	2663	23.7	23.7	23.7	17774	—	—	—
S42	Jaw Crusher	5460	17.6	17.6	17.6	2509	29.2	29.2	29.2	17739	0.9	0.9	0.9
S43	Heavy Duty Hopper	5463	19.8	19.8	19.8	2522	32.4	32.4	32.4	17733	—	—	—
S44	Cone Crusher	5454	17.4	17.4	17.4	2489	28.9	28.9	28.9	17747	0.8	0.8	0.8
S45	Cone Crusher	5448	17.4	17.4	17.4	2498	28.8	28.8	28.8	17732	0.8	0.8	0.8
S46	Heavy Duty Belt Feeder Hopper	5459	—	—	—	2505	7.0	7.0	7.0	17741	—	—	—
S47	Twin Screen Plant	5454	9.1	9.1	9.1	2495	20.2	20.2	20.2	17742	—	—	—
S48	Tunnel Conveyor	5434	—	—	—	2484	12.9	12.9	12.9	17724	—	—	—
S57	Tracked Mobile Drill	15249	—	—	—	19028	—	—	—	1687	30.9	30.9	30.9
S58	Tracked Mobile Drill	15352	—	—	—	19144	—	—	—	1740	30.3	30.3	30.3
S59	Tracked Mobile Drill	15396	—	—	—	19194	—	—	—	1764	29.2	29.2	29.2
S60	Tracked Mobile Drill	15455	—	—	—	19265	—	—	—	1792	27.1	27.1	27.1
S61	Tracked Mobile Drill	15383	—	—	—	19178	—	—	—	1759	29.8	29.8	29.8
S62	Tracked Mobile Drill	15169	—	—	—	18936	—	—	—	1665	31.4	31.4	31.4
S63	Tracked Mobile Drill	15524	—	—	—	19341	—	—	—	1847	22.8	22.8	22.8
S64	Jaw Crusher	15137	—	—	—	18988	—	—	—	1444	31.7	31.7	31.7
S65	Wheel Loader	15127	—	—	—	18983	—	—	—	1439	31.7	31.7	31.7
S66	Wheel Loader	15198	—	—	—	19053	—	—	—	1508	31.3	31.3	31.3
S67	8m Light Tower	15109	—	—	—	18956	—	—	—	1414	14.6	14.6	14.6
S68	8m Light Tower	15213	—	—	—	19065	—	—	—	1521	14.0	14.0	14.0
S69	8m Light Tower	15065	—	—	—	18919	—	—	—	1374	14.8	14.8	14.8
S70	3m Light Tower	15392	—	—	—	19184	—	—	—	1774	11.7	11.7	11.7
S71	3m Light Tower	15201	—	—	—	18973	—	—	—	1673	12.2	12.2	12.2
S72	3m Light Tower	15493	—	—	—	19307	—	—	—	1822	8.7	8.7	8.7
S73	Tracked Dozer	14261	3.7	3.7	3.7	18041	0.3	0.3	0.3	878	39.0	39.0	39.0
S74	Tracked Dozer	14282	3.7	3.7	3.7	18096	0.2	0.2	0.2	678	41.5	41.5	41.5
S75	Tracked Dozer	14584	3.4	3.4	3.4	18425	—	—	—	890	37.5	37.5	37.5
S76	Hydraulic Excavator	15242	—	—	—	19016	—	—	—	1701	23.6	23.6	23.6
S77	Hydraulic Excavator	15369	—	—	—	19162	—	—	—	1750	22.2	22.2	22.2
S78	Hydraulic Excavator	15388	—	—	—	19184	—	—	—	1759	22.0	22.0	22.0
S79	Hydraulic Excavator	15452	—	—	—	19261	—	—	—	1792	20.7	20.7	20.7
S80	Mobile_Crane	15341	0.3	0.3	0.3	19215	—	—	—	1685	26.2	26.2	26.2
S81	Fuel & Lube Truck	15348	—	—	—	19230	—	—	—	1713	21.6	21.6	21.6
S82	Fuel & Lube Truck	15355	—	—	—	19242	—	—	—	1739	21.4	21.4	21.4
S84	Skid Steer	15219	—	—	—	19082	—	—	—	1540	24.5	24.5	24.5
S86	Generator	15337	—	—	—	19210	—	—	—	1678	30.5	30.5	30.5
S87	Dewatering Pump	15290	—	—	—	19077	—	—	—	1699	19.2	19.2	19.2
S88	Dewatering Pump	15301	—	—	—	19086	—	—	—	1712	19.7	19.7	19.7
S89	Truck - Unloading Ore	5549	8.7	8.7	8.7	2629	17.3	17.3	17.3	17764	—	—	—
Total Facility Sound Level (1-hour Leq):			**51.3**	**51.3**	**51.3**		**37.8**	**37.8**	**37.8**		**51.7**	**51.7**	**51.7**

Cadna A ID	Source Description	Northeast Beaver Dam Property Boundary PBR02 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	North Touquoy Property Boundary PBR03 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am	Southeast Touquoy Property Boundary PBR04 Distance (m)	Partial Sound Levels¹ (dBA) Day 7am–7pm	Evening 7pm–11pm	Night 11pm–7am
Steady State Noise Impact													
L2	Truck - Ore Transport Between Sites	1023	29.4	29.4	29.4	632	32.7	32.7	32.7	1942	28.9	28.9	28.9
L4	Truck - Haul Roads	222	59.5	59.5	59.5	18996	8.6	8.6	8.6	18790	8.7	8.7	8.7
L5	Truck - Haul Roads	558	39.9	39.9	39.9	18349	—	—	—	18178	—	—	—
L6	Truck - Haul Roads	564	49.0	49.0	49.0	17883	13.7	13.7	13.7	17641	13.9	13.9	13.9
L7	Truck - Haul Roads	469	53.4	53.4	53.4	18775	6.9	6.9	6.9	18528	7.1	7.1	7.1
L8	Truck - Haul Roads	499	42.0	42.0	42.0	18967	—	—	—	18625	0.0	0.0	0.0
L9	Grader - Haul Roads	222	43.9	43.9	43.9	18996	—	—	—	18790	—	—	—
L10	Grader - Haul Roads	499	34.0	34.0	34.0	18967	—	—	—	18625	—	—	—
L11	Grader - Haul Roads	469	38.1	38.1	38.1	18776	—	—	—	18528	—	—	—
L12	Grader - Haul Roads	558	37.3	37.3	37.3	18349	—	—	—	18178	—	—	—
L13	Grader - Haul Roads	564	33.2	33.2	33.2	17883	—	—	—	17641	—	—	—
S2	Truck - Hopper Discharge	19537	—	—	—	720	38.7	38.7	38.7	3112	19.1	19.1	19.1
S6	Loader - Face Shovel	19561	—	—	—	617	46.0	46.0	46.0	3254	23.8	23.8	23.8
S20	Loader - Transport of Material	19536	—	—	—	547	40.7	40.7	40.7	3316	21.0	21.0	21.0
S42	Jaw Crusher	19510	0.3	0.3	0.3	656	45.8	45.8	45.8	3161	25.9	25.9	25.9
S43	Heavy Duty Hopper	19503	—	—	—	641	48.1	48.1	48.1	3173	29.1	29.1	29.1
S44	Cone Crusher	19518	0.1	0.1	0.1	678	45.4	45.4	45.4	3143	25.8	25.8	25.8
S45	Cone Crusher	19502	0.1	0.1	0.1	661	45.6	45.6	45.6	3150	25.7	25.7	25.7
S46	Heavy Duty Belt Feeder Hopper	19511	—	—	—	661	24.6	24.6	24.6	3158	3.7	3.7	3.7
S47	Twin Screen Plant	19513	—	—	—	670	36.3	36.3	36.3	3148	17.2	17.2	17.2
S48	Tunnel Conveyor	19496	—	—	—	670	32.2	32.2	32.2	3135	9.9	9.9	9.9
S57	Tracked Mobile Drill	410	52.9	52.9	52.9	18776	—	—	—	18602	—	—	—
S58	Tracked Mobile Drill	294	56.2	56.2	56.2	18911	—	—	—	18714	—	—	—
S59	Tracked Mobile Drill	267	57.1	57.1	57.1	18970	—	—	—	18762	—	—	—
S60	Tracked Mobile Drill	302	55.6	55.6	55.6	19061	—	—	—	18828	—	—	—
S61	Tracked Mobile Drill	270	57.0	57.0	57.0	18951	—	—	—	18747	—	—	—
S62	Tracked Mobile Drill	531	50.2	50.2	50.2	18666	—	—	—	18514	—	—	—
S63	Tracked Mobile Drill	344	50.2	50.2	50.2	19149	—	—	—	18902	—	—	—
S64	Jaw Crusher	859	38.0	38.0	38.0	18865	—	—	—	18536	—	—	—
S65	Wheel Loader	910	36.2	36.2	36.2	18869	—	—	—	18528	—	—	—
S66	Wheel Loader	862	37.6	37.6	37.6	18935	—	—	—	18599	—	—	—
S67	8m Light Tower	838	20.3	20.3	20.3	18826	—	—	—	18505	—	—	—
S68	8m Light Tower	826	20.7	20.7	20.7	18941	—	—	—	18612	—	—	—
S69	8m Light Tower	926	18.2	18.2	18.2	18803	—	—	—	18465	—	—	—
S70	3m Light Tower	256	36.1	36.1	36.1	18952	—	—	—	18754	—	—	—
S71	3m Light Tower	481	30.1	30.1	30.1	18710	—	—	—	18550	—	—	—
S72	3m Light Tower	322	29.8	29.8	29.8	19110	—	—	—	18869	—	—	—
S73	Tracked Dozer	1392	34.8	34.8	34.8	17813	0.4	0.4	0.4	17614	0.6	0.6	0.6
S74	Tracked Dozer	1379	34.9	34.9	34.9	17923	0.4	0.4	0.4	17657	0.6	0.6	0.6
S75	Tracked Dozer	1187	36.3	36.3	36.3	18294	0.1	0.1	0.1	17976	0.3	0.3	0.3
S76	Hydraulic Excavator	435	44.1	44.1	44.1	18755	—	—	—	18592	—	—	—
S77	Hydraulic Excavator	280	48.5	48.5	48.5	18931	—	—	—	18731	—	—	—
S78	Hydraulic Excavator	270	48.9	48.9	48.9	18958	—	—	—	18752	—	—	—
S79	Hydraulic Excavator	292	44.1	44.1	44.1	19055	—	—	—	18825	—	—	—
S80	Mobile_Crane	1034	33.0	33.0	33.0	19132	—	—	—	18754	—	—	—
S81	Fuel & Lube Truck	1120	27.6	27.6	27.6	19161	—	—	—	18765	—	—	—
S82	Fuel & Lube Truck	1190	26.9	26.9	26.9	19185	—	—	—	18775	—	—	—
S84	Skid Steer	936	30.6	30.6	30.6	18979	—	—	—	18625	—	—	—
S86	Generator	1016	38.1	38.1	38.1	19124	—	—	—	18749	—	—	—
S87	Dewatering Pump	355	46.1	46.1	46.1	18837	—	—	—	18649	—	—	—
S88	Dewatering Pump	346	46.4	46.4	46.4	18844	—	—	—	18658	—	—	—
S89	Truck - Unloading Ore	19528	—	—	—	568	35.9	35.9	35.9	3281	14.6	14.6	14.6
Total Facility Sound Level (1-hour Leq):			**65.8**	**65.8**	**65.8**		**53.9**	**53.9**	**53.9**		**35.2**	**35.2**	**35.2**

Note:

¹ Sound level at the receptor was calculated using Cadna A acoustical modelling software.

Table 3

Acoustic Assessment Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

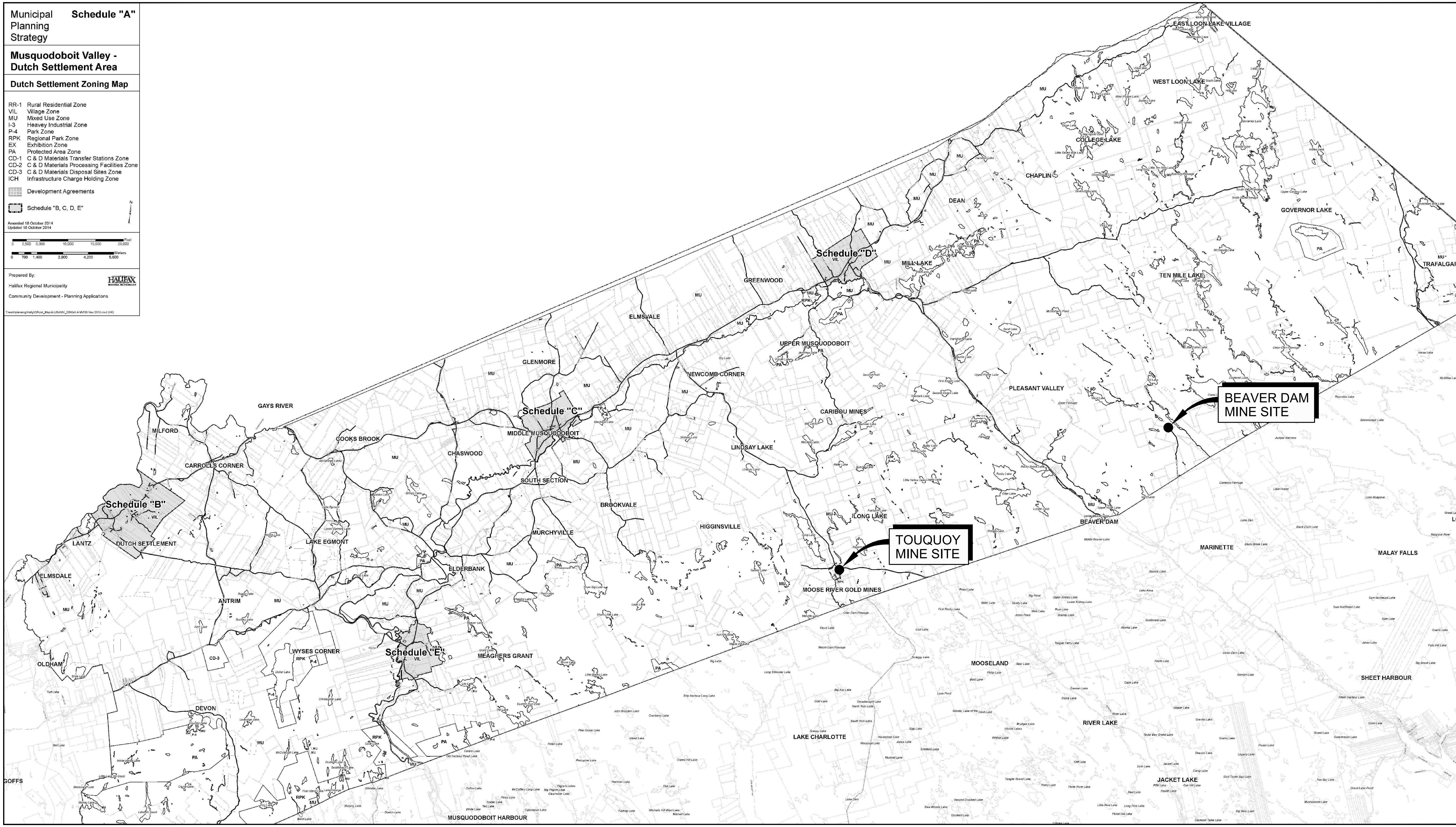
Point of Reception ID	Point of Reception Description	Time of Day	Steady State Sound Levels (L_{EQ}) (dBA)	Performance Limit[1] (L_{EQ}) (dBA)	Compliance with Performance Limit (Yes/No)	Verified by Acoustic Audit
Steady State Noise Impact						
POR01	Beaver Dam Mine Road Seasonal Residence	07:00–19:00	50.0	65	Yes	No
		19:00–23:00	50.0	60	Yes	No
		23:00–07:00	50.0	55	Yes	No
POR02	Lower Beaver Lake Residence	07:00–19:00	32.3	65	Yes	No
		19:00–23:00	32.3	60	Yes	No
		23:00–07:00	32.3	55	Yes	No
POR03	Mooseland Seasonal Residence	07:00–19:00	53.9	65	Yes	No
		19:00–23:00	53.9	60	Yes	No
		23:00–07:00	53.9	55	Yes	No
POR04	Second Rocky Lake Residence	07:00–19:00	51.3	65	Yes	No
		19:00–23:00	51.3	60	Yes	No
		23:00–07:00	51.3	55	Yes	No
POR05	Scraggy Lake Recreational Receptor	07:00–19:00	37.8	65	Yes	No
		19:00–23:00	37.8	60	Yes	No
		23:00–07:00	37.8	55	Yes	No
PBR01	Southwest Beaver Dam Property Boundary	07:00–19:00	51.7	65	Yes	No
		19:00–23:00	51.7	60	Yes	No
		23:00–07:00	51.7	55	Yes	No
PBR02	Northeast Beaver Dam Property Boundary	07:00–19:00	65.8	65	No	No
		19:00–23:00	65.8	60	No	No
		23:00–07:00	65.8	55	No	No
PBR03	North Touquoy Property Boundary	07:00–19:00	53.9	65	Yes	No
		19:00–23:00	53.9	60	Yes	No
		23:00–07:00	53.9	55	Yes	No
PBR04	Southeast Touquoy Property Boundary	07:00–19:00	35.2	65	Yes	No
		19:00–23:00	35.2	60	Yes	No
		23:00–07:00	35.2	55	Yes	No

Note:

[1] Minimum sound level limits as defined in NSEL documents "Guidelines for Environmental Noise Measurement and Assessment" (2005) and "Pit and Quarry Guidelines" (1999).

Appendices

Appendix A
Land Use Zoning Designation Plan



Source: Musquodoboit Valley - Dutch Settlement Area, Dutch Settlement Zoning Map, Schedule "A".

0 2000 4000 6000m

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE

88664-20
Nov 2, 2017

ZONING MAP WITH MINE SITE LOCATIONS

FIGURE A.1

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Appendix B
Summary of Insignificant Noise Sources

Table B.1

Insignificant Noise Source Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

CadnaA ID	Source Description	Comments
S5	Excavator	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S7	Drill	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S8, S9	Dozer (x2)	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S10	Grader	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S17	Excavator	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S18	Loader - Transport of Material	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S19	Crane	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S21	Generator Set	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S22 - S25	Light Tower (x4)	Equipment for the open pit and waste rock pile at the Touquoy Mine Site, which will not be in use once the Beaver Dam Mine Project is in production.
S49 - S54	CIL Tank - Electric Motor (x6)	Based on the model predictions, each of these sources contributes less than 20 dBA at the nearest receptors, which is insignificant. Noise source reference data included in Table C.1.
S83	Wheeled Backhoe Loader	Based on the model predictions, each of these sources contributes less than 20 dBA at the nearest receptors, which is insignificant. Noise source reference data included in Table C.1.
S85	Forklift	Based on the model predictions, each of these sources contributes less than 20 dBA at the nearest receptors, which is insignificant. Noise source reference data included in Table C.1.

Appendix C
Noise Source Data Summary

Table C.1

Noise Source Sound Level Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day (min)	Operating Time Evening (min)	Operating Time Night (min)	Reference/Comments
L2	Truck - Ore Transport Between Sites	PWL (dB)	31.0	122.0	121.0	114.0	114.0	112.0	110.0	101.0	92.0	125.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	95.8	104.9	105.4	110.8	112.0	111.2	102.0	90.9	**117.0**	No	0	108.0	60	60	60	DEFRA Table 1(c) #16.
L4	Truck - Haul Roads	PWL (dB)	31.0	130.0	126.0	118.0	117.0	115.0	114.0	108.0	104.0	132.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	103.8	109.9	109.4	113.8	115.0	115.2	109.0	102.9	**120.8**	No	0	124.8	60	60	60	DEFRA Table 1(c) #16.
L5	Truck - Haul Roads	PWL (dB)	31.0	130.0	126.0	118.0	117.0	115.0	114.0	108.0	104.0	132.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	103.8	109.9	109.4	113.8	115.0	115.2	109.0	102.9	**120.8**	No	0	147.5	60	60	60	DEFRA Table 1(c) #16.
L6	Truck - Haul Roads	PWL (dB)	31.0	130.0	126.0	118.0	117.0	115.0	114.0	108.0	104.0	132.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	103.8	109.9	109.4	113.8	115.0	115.2	109.0	102.9	**120.8**	No	0	165.6	60	60	60	DEFRA Table 1(c) #16.
L7	Truck - Haul Roads	PWL (dB)	31.0	130.0	126.0	118.0	117.0	115.0	114.0	108.0	104.0	132.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	103.8	109.9	109.4	113.8	115.0	115.2	109.0	102.9	**120.8**	No	0	160.1	60	60	60	DEFRA Table 1(c) #16.
L8	Truck - Haul Roads	PWL (dB)	31.0	130.0	126.0	118.0	117.0	115.0	114.0	108.0	104.0	132.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	103.8	109.9	109.4	113.8	115.0	115.2	109.0	102.9	**120.8**	No	0	160.1	60	60	60	DEFRA Table 1(c) #16.
L9	Grader - Haul Roads	PWL (dB)	31.0	119.0	118.0	114.0	110.0	115.0	109.0	115.0	96.0	124.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	92.8	101.9	105.4	106.8	115.0	110.2	116.0	94.9	**119.6**	No	0	124.8	60	60	60	DEFRA Table 1(c) #16.
L10	Grader - Haul Roads	PWL (dB)	31.0	119.0	118.0	114.0	110.0	115.0	109.0	115.0	96.0	124.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	92.8	101.9	105.4	106.8	115.0	110.2	116.0	94.9	**119.6**	No	0	160.1	60	60	60	DEFRA Table 1(c) #16.
L11	Grader - Haul Roads	PWL (dB)	31.0	119.0	118.0	114.0	110.0	115.0	109.0	115.0	96.0	124.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	92.8	101.9	105.4	106.8	115.0	110.2	116.0	94.9	**119.6**	No	0	160.1	60	60	60	DEFRA Table 1(c) #16.
L12	Grader - Haul Roads	PWL (dB)	31.0	119.0	118.0	114.0	110.0	115.0	109.0	115.0	96.0	124.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	92.8	101.9	105.4	106.8	115.0	110.2	116.0	94.9	**119.6**	No	0	147.5	60	60	60	DEFRA Table 1(c) #16.
L13	Grader - Haul Roads	PWL (dB)	31.0	119.0	118.0	114.0	110.0	115.0	109.0	115.0	96.0	124.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	92.8	101.9	105.4	106.8	115.0	110.2	116.0	94.9	**119.6**	No	0	165.6	60	60	60	DEFRA Table 1(c) #16.
S2	Truck - Hopper Discharge	PWL (dB)	31.0	119.0	113.0	108.0	110.0	111.0	110.0	104.0	98.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	92.8	96.9	99.4	106.8	111.0	111.2	105.0	96.9	**115.5**	No	0	143.0	60	60	60	GHD Reference Spectra
S6	Loader - Face Shovel	PWL (dB)	31.0	119.0	119.0	118.0	116.0	117.0	114.0	108.0	101.0	125.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	92.8	102.9	109.4	112.8	117.0	115.2	109.0	99.9	**120.9**	No	0	147.0	60	60	60	GHD Reference Spectra
S20	Loader - Transport of Material	PWL (dB)	31.0	114.0	120.0	123.0	111.0	102.0	100.0	95.0	89.0	125.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	103.9	114.4	107.8	102.0	101.2	96.0	87.9	**116.0**	No	0	147.0	60	60	60	GHD Reference Spectra
S42	Jaw Crusher	PWL (dB)	31.0	122.0	122.0	119.0	118.0	116.0	114.0	109.0	100.0	127.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	95.8	105.9	110.4	114.8	116.0	115.2	110.0	98.9	**121.1**	No	0	140.0	60	60	60	GHD Reference Spectra
S43	Heavy Duty Hopper	PWL (dB)	—	—	—	—	124.7	—	—	—	—	124.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	—	—	—	—	121.5	—	—	—	—	**121.5**	No	0	139.0	60	60	60	GHD Reference Spectra
S44	Cone Crusher	PWL (dB)	31.0	122.0	122.0	119.0	118.0	116.0	114.0	109.0	100.0	127.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	95.8	105.9	110.4	114.8	116.0	115.2	110.0	98.9	**121.1**	No	0	139.0	60	60	60	GHD Reference Spectra
S45	Cone Crusher	PWL (dB)	31.0	122.0	122.0	119.0	118.0	116.0	114.0	109.0	100.0	127.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	95.8	105.9	110.4	114.8	116.0	115.2	110.0	98.9	**121.1**	No	0	139.0	60	60	60	GHD Reference Spectra
S46	Heavy Duty Belt Feeder Hopper	PWL (dB)	31.0	102.0	99.0	93.0	94.0	97.0	93.0	89.0	82.0	105.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	75.8	82.9	84.4	90.8	97.0	94.2	90.0	80.9	**100.2**	No	0	139.0	60	60	60	GHD Reference Spectra

Table C.1

Noise Source Sound Level Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day (min)	Operating Time Evening (min)	Operating Time Night (min)	Reference/Comments
S47	Twin Screen Plant	PWL (dB)	31.0	115.0	113.0	110.0	110.0	105.0	105.0	102.0	95.0	119.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	88.8	96.9	101.4	106.8	105.0	106.2	103.0	93.9	**112.1**	No	0	139.0	60	60	60	GHD Reference Spectra
S48	Tunnel Conveyor	PWL (dB)	31.0	102.0	100.0	99.0	102.0	106.0	98.0	94.0	88.0	110.0							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	75.8	83.9	90.4	98.8	106.0	99.2	95.0	86.9	**107.8**	No	0	137.0	60	60	60	GHD Reference Spectra
S57	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	127.0	60	60	60	GHD Reference Spectra
S58	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	127.0	60	60	60	GHD Reference Spectra
S59	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	127.0	60	60	60	GHD Reference Spectra
S60	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	127.0	60	60	60	GHD Reference Spectra
S61	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	127.0	60	60	60	GHD Reference Spectra
S62	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	127.0	60	60	60	GHD Reference Spectra
S63	Tracked Mobile Drill	PWL (dB)	31.0	114.0	115.0	110.0	116.0	113.0	110.0	106.0	102.0	121.5							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	87.8	98.9	101.4	112.8	113.0	111.2	107.0	100.9	**117.8**	No	0	125.4	60	60	60	GHD Reference Spectra
S64	Jaw Crusher	PWL (dB)	109.9	118.0	117.0	114.4	113.5	108.6	105.6	100.3	93.8	122.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	70.5	91.8	100.9	105.8	110.3	108.6	106.8	101.3	92.7	**114.7**	No	0	169.3	60	60	60	GHD Reference Spectra
S65	Wheel Loader	PWL (dB)	31.0	119.0	115.0	112.0	115.0	107.0	101.0	99.0	92.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	92.8	98.9	103.4	111.8	107.0	102.2	100.0	90.9	**114.2**	No	0	163.3	60	60	60	GHD Reference Spectra
S66	Wheel Loader	PWL (dB)	31.0	119.0	115.0	112.0	115.0	107.0	101.0	99.0	92.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	92.8	98.9	103.4	111.8	107.0	102.2	100.0	90.9	**114.2**	No	0	164.7	60	60	60	GHD Reference Spectra
S67	8m Light Tower	PWL (dB)	31.0	109.0	102.0	97.0	93.0	90.0	86.0	87.0	80.0	110.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	82.8	85.9	88.4	89.8	90.0	87.2	88.0	78.9	**96.5**	No	0	169.5	60	60	60	GHD Reference Spectra
S68	8m Light Tower	PWL (dB)	31.0	109.0	102.0	97.0	93.0	90.0	86.0	87.0	80.0	110.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	82.8	85.9	88.4	89.8	90.0	87.2	88.0	78.9	**96.5**	No	0	170.7	60	60	60	GHD Reference Spectra
S69	8m Light Tower	PWL (dB)	31.0	109.0	102.0	97.0	93.0	90.0	86.0	87.0	80.0	110.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	82.8	85.9	88.4	89.8	90.0	87.2	88.0	78.9	**96.5**	No	0	165.7	60	60	60	GHD Reference Spectra
S70	3m Light Tower	PWL (dB)	31.0	109.0	102.0	97.0	93.0	90.0	86.0	87.0	80.0	110.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	82.8	85.9	88.4	89.8	90.0	87.2	88.0	78.9	**96.5**	No	0	126.0	60	60	60	GHD Reference Spectra
S71	3m Light Tower	PWL (dB)	31.0	109.0	102.0	97.0	93.0	90.0	86.0	87.0	80.0	110.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	82.8	85.9	88.4	89.8	90.0	87.2	88.0	78.9	**96.5**	No	0	126.0	60	60	60	GHD Reference Spectra
S72	3m Light Tower	PWL (dB)	31.0	109.0	102.0	97.0	93.0	90.0	86.0	87.0	80.0	110.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	82.8	85.9	88.4	89.8	90.0	87.2	88.0	78.9	**96.5**	No	0	125.4	60	60	60	GHD Reference Spectra
S73	Tracked Dozer	PWL (dB)	31.0	120.0	121.0	122.0	104.0	105.0	101.0	99.0	95.0	125.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	93.8	104.9	113.4	100.8	105.0	102.2	100.0	93.9	**115.1**	No	0	157.0	60	60	60	GHD Reference Spectra

Table C.1

Noise Source Sound Level Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

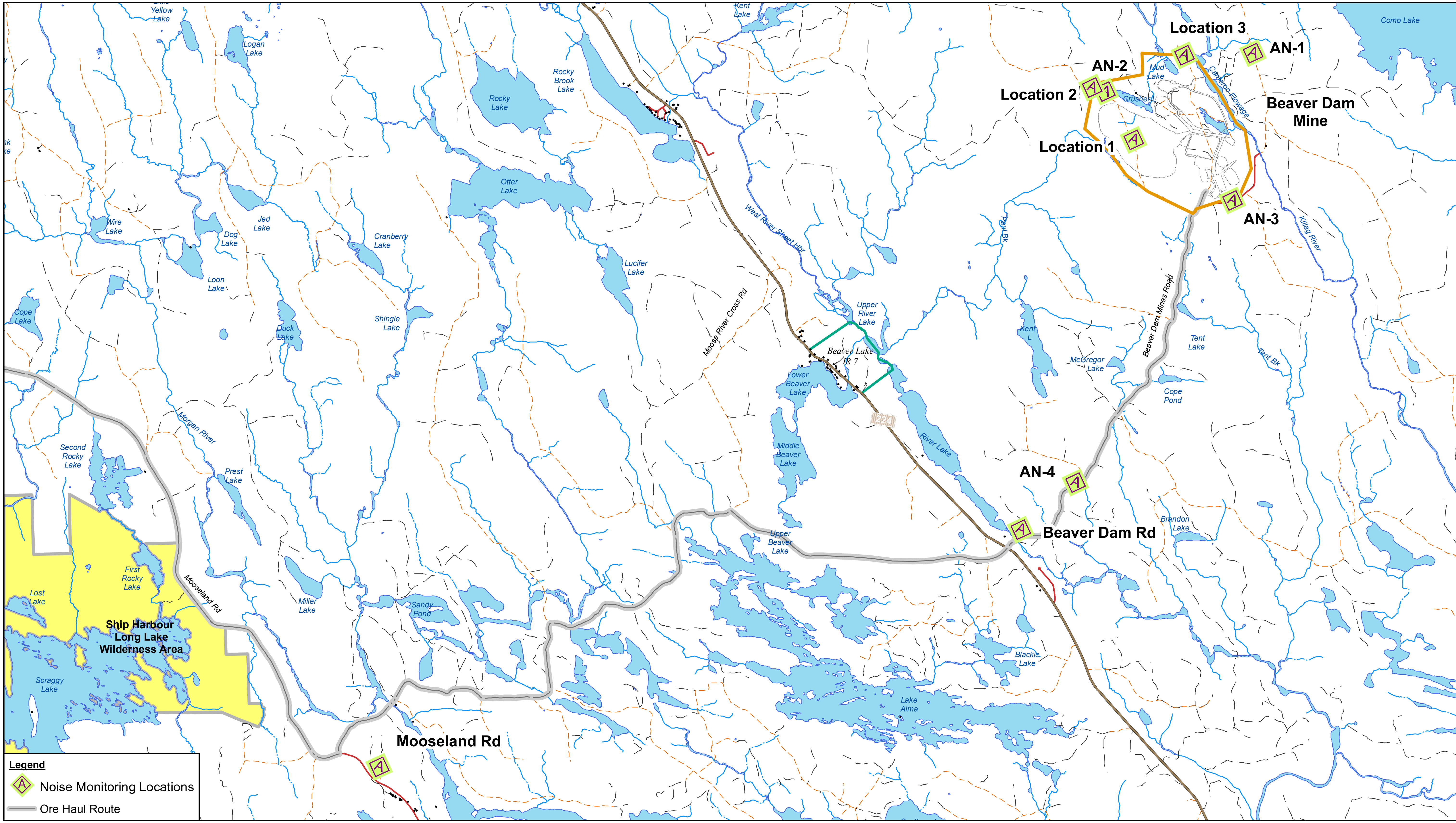
Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day (min)	Operating Time Evening (min)	Operating Time Night (min)	Reference/Comments
S74	Tracked Dozer	PWL (dB)	31.0	120.0	121.0	122.0	104.0	105.0	101.0	99.0	95.0	125.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	93.8	104.9	113.4	100.8	105.0	102.2	100.0	93.9	**115.1**	No	0	166.2	60	60	60	GHD Reference Spectra
S75	Tracked Dozer	PWL (dB)	31.0	120.0	121.0	122.0	104.0	105.0	101.0	99.0	95.0	125.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	93.8	104.9	113.4	100.8	105.0	102.2	100.0	93.9	**115.1**	No	0	169.0	60	60	60	GHD Reference Spectra
S76	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S77	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S78	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S79	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S80	Mobile_Crane	PWL (dB)	31.0	121.0	112.0	109.0	105.0	108.0	107.0	100.0	92.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	94.8	95.9	100.4	101.8	108.0	108.2	101.0	90.9	**112.5**	No	0	159.0	60	60	60	GHD Reference Spectra
S81	Fuel & Lube Truck	PWL (dB)	31.0	110.0	104.0	102.0	106.0	103.0	100.0	90.0	81.0	113.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	83.8	87.9	93.4	102.8	103.0	101.2	91.0	79.9	**107.5**	No	0	158.0	60	60	60	GHD Reference Spectra
S82	Fuel & Lube Truck	PWL (dB)	31.0	110.0	104.0	102.0	106.0	103.0	100.0	90.0	81.0	113.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	83.8	87.9	93.4	102.8	103.0	101.2	91.0	79.9	**107.5**	No	0	158.0	60	60	60	GHD Reference Spectra
S83	Wheeled Backhoe Loader	PWL (dB)	31.0	99.0	98.0	94.0	93.0	93.0	92.0	85.0	78.0	103.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	72.8	81.9	85.4	89.8	93.0	93.2	86.0	76.9	**97.8**	No	0	158.4	60	60	60	GHD Reference Spectra
S84	Skid Steer	PWL (dB)	—	103.0	115.0	106.0	107.0	103.0	101.0	97.0	87.0	116.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-39.4	76.8	98.9	97.4	103.8	103.0	102.2	98.0	85.9	**109.1**	No	0	157.0	60	60	60	GHD Reference Spectra
S85	Forklift	PWL (dB)	87.8	101.1	97.2	98.7	95.1	93.3	93.8	87.9	83.4	105.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.4	74.9	81.1	90.1	91.9	93.3	95.0	88.9	82.3	**99.5**	No	0	157.0	60	60	60	GHD Reference Spectra
S86	Generator	PWL (dB)	103.3	110.5	115.2	116.0	114.9	112.8	110.7	108.1	95.1	121.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.9	84.3	99.1	107.4	111.7	112.8	111.9	109.1	94.0	**118.1**	No	0	156.5	60	60	60	GHD Reference Spectra
S87	Dewatering Pump	PWL (dB)	31.0	112.0	113.0	98.0	103.0	102.0	105.0	104.0	97.0	116.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	85.8	96.9	89.4	99.8	102.0	106.2	105.0	95.9	**110.4**	No	0	124.0	60	60	60	GHD Reference Spectra
S88	Dewatering Pump	PWL (dB)	31.0	112.0	113.0	98.0	103.0	102.0	105.0	104.0	97.0	116.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	85.8	96.9	89.4	99.8	102.0	106.2	105.0	95.9	**110.4**	No	0	124.0	60	60	60	GHD Reference Spectra
S89	Truck - Unloading Ore	PWL (dB)	31.0	119.0	115.0	106.0	104.0	106.0	103.0	99.0	91.0	120.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	92.8	98.9	97.4	100.8	106.0	104.2	100.0	89.9	**110.2**	No	0	145.0	60	60	60	GHD Reference Spectra

Table C.1

Noise Source Sound Level Summary
Atlantic Gold Corporation
Beaver Dam Mine Project, Marinette, Halifax County, Nova Scotia

Cadna A ID	Noise Source Description		1/1 Octave Band Data 32	63	125	250	500	1000	2000	4000	8000	Unadjusted Total Sound Power Level (dBA)	Tonal Penalty Assessment	(dBA)	Height Absolute (m)	Operating Time Day (min)	Operating Time Evening (min)	Operating Time Night (min)	Reference/Comments
		PWL (dBA)	-8.4	93.8	104.9	113.4	100.8	105.0	102.2	100.0	93.9	**115.1**	No	0	166.2	60	60	60	GHD Reference Spectra
S75	Tracked Dozer	PWL (dB)	31.0	120.0	121.0	122.0	104.0	105.0	101.0	99.0	95.0	125.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	93.8	104.9	113.4	100.8	105.0	102.2	100.0	93.9	**115.1**	No	0	169.0	60	60	60	GHD Reference Spectra
S76	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S77	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S78	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S79	Hydraulic Excavator	PWL (dB)	31.0	116.0	109.0	108.0	108.0	104.0	102.0	96.0	94.0	118.1							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	89.8	92.9	99.4	104.8	104.0	103.2	97.0	92.9	**109.8**	No	0	125.0	60	60	60	GHD Reference Spectra
S80	Mobile_Crane	PWL (dB)	31.0	121.0	112.0	109.0	105.0	108.0	107.0	100.0	92.0	122.2							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	94.8	95.9	100.4	101.8	108.0	108.2	101.0	90.9	**112.5**	No	0	159.0	60	60	60	GHD Reference Spectra
S81	Fuel & Lube Truck	PWL (dB)	31.0	110.0	104.0	102.0	106.0	103.0	100.0	90.0	81.0	113.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	83.8	87.9	93.4	102.8	103.0	101.2	91.0	79.9	**107.5**	No	0	158.0	60	60	60	GHD Reference Spectra
S82	Fuel & Lube Truck	PWL (dB)	31.0	110.0	104.0	102.0	106.0	103.0	100.0	90.0	81.0	113.3							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	83.8	87.9	93.4	102.8	103.0	101.2	91.0	79.9	**107.5**	No	0	158.0	60	60	60	GHD Reference Spectra
S83	Wheeled Backhoe Loader	PWL (dB)	31.0	99.0	98.0	94.0	93.0	93.0	92.0	85.0	78.0	103.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	72.8	81.9	85.4	89.8	93.0	93.2	86.0	76.9	**97.8**	No	0	158.4	60	60	60	GHD Reference Spectra
S84	Skid Steer	PWL (dB)	—	103.0	115.0	106.0	107.0	103.0	101.0	97.0	87.0	116.7							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-39.4	76.8	98.9	97.4	103.8	103.0	102.2	98.0	85.9	**109.1**	No	0	157.0	60	60	60	GHD Reference Spectra
S85	Forklift	PWL (dB)	87.8	101.1	97.2	98.7	95.1	93.3	93.8	87.9	83.4	105.4							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	48.4	74.9	81.1	90.1	91.9	93.3	95.0	88.9	82.3	**99.5**	No	0	157.0	60	60	60	GHD Reference Spectra
S86	Generator	PWL (dB)	103.3	110.5	115.2	116.0	114.9	112.8	110.7	108.1	95.1	121.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	63.9	84.3	99.1	107.4	111.7	112.8	111.9	109.1	94.0	**118.1**	No	0	156.5	60	60	60	GHD Reference Spectra
S87	Dewatering Pump	PWL (dB)	31.0	112.0	113.0	98.0	103.0	102.0	105.0	104.0	97.0	116.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	85.8	96.9	89.4	99.8	102.0	106.2	105.0	95.9	**110.4**	No	0	124.0	60	60	60	GHD Reference Spectra
S88	Dewatering Pump	PWL (dB)	31.0	112.0	113.0	98.0	103.0	102.0	105.0	104.0	97.0	116.6							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	85.8	96.9	89.4	99.8	102.0	106.2	105.0	95.9	**110.4**	No	0	124.0	60	60	60	GHD Reference Spectra
S89	Truck - Unloading Ore	PWL (dB)	31.0	119.0	115.0	106.0	104.0	106.0	103.0	99.0	91.0	120.9							
		A-weighted correction	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1								
		PWL (dBA)	-8.4	92.8	98.9	97.4	100.8	106.0	104.2	100.0	89.9	**110.2**	No	0	149.7	60	60	60	GHD Reference Spectra

Appendix D
Baseline Noise Monitoring Locations Plan



Source: Service Nova Scotia (Water, Wetlands, Roads), NS Environment (Protected Areas), Atlantic Gold (Route)

0 500 1,000 1,500
Metres

Coordinate System:
NAD 1983 CSRS UTM Zone 20N

ATLANTIC GOLD CORPORATION
MARINETTE, HALIFAX CO., NOVA SCOTIA
NOISE IMPACT STUDY - BEAVER DAM MINE PROJECT

NOISE MONITORING LOCATIONS

088664 (007)
Nov 6, 2017

FIGURE D.1

GIS File: I:\GIS_DATA\Projects\6-chars\08----\088---\088664 Atlantic BD\088664(007)\088664(007)GIS-DA001.mxd www.ghd.com

ATLANTIC GOLD

Appendix C.1

Air Dispersion Modelling and Air Emission Estimate Technical Memorandum

Beaver Dam Mine Project - Revised Environmental Impact Statement Marinette, Nova Scotia

February 15, 2019 Reference No. 088664

Ms. Meghan Milloy
2 Bluewater Road, Suite 115
Bedford, Nova Scotia
B4B 1G7

Dear Ms. Milloy:

Re: Air Dispersion Modelling and Air Emission Estimate Technical Memorandum
Atlantic Gold Corporation, Beaver Dam Mine Project, Beaver Dam, Nova Scotia

1. Introduction

GHD Limited (GHD) performed air emission estimates and dispersion modelling for the Atlantic Gold Corporation Beaver Dam Mine Project, located near Beaver Dam, Nova Scotia (the Project). The Project is composed of the Beaver Dam Mine Site, the Touquoy Mie Site, and a connecting Haul Road.

This letter report summarizes the methodology used to estimate the air emissions and develop the dispersion models that was used to assess the impact of air compounds from the Project in response to comments from Nova Scotia Environment and Environment Canada. Air compounds evaluated included total suspended particulates (TSP), particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$), nitrogen oxides (NOx), sulfur dioxide (SO_2) and volatile organic compounds (VOC).

2. Air Emission Estimates

Emission rates from the Project-related sources were calculated using USEPA AP-42 (5th Edition) emission factors for the Beaver Dam Mine Site and Haul Road dust emissions, and MOBILE6.2 (M6.2) for Haul Road vehicle emissions. As the operational phase is anticipated to be of longer duration than the construction phase, and it is likely that the number of vehicles, extraction rates, and material processing rates will be higher during operations than during construction, it is expected that operations represent the worst case, and so air emission estimates were only completed for the operations phase.

2.1 Sources of Particulates

Haul road emissions calculations assume that the roads are unpaved, and a dust management plan (75 percent effective) will be being applied. As the roads are constructed using clean waste rock, no additional compounds were evaluated for air emissions from the roads. Emissions calculations for Haul Road dust are provided in Table 1, including all the assumptions and constants, based on the AP-42 methodology.

M6.2 can estimate the particulate matter emissions from diesel highway motor vehicles (exhaust particulate, tire wear particulate, and break wear particulate), however these represented less than 1% of the particulate emitted from the road surfaces and so were considered insignificant and therefore not modelled.

Particulate-generating processes related to the Beaver Dam Mine Site consist of transfer conveyors, primary crushing of rock, and truck loading at the working face, all activities that occur within the mining pit. Emissions calculations for activities within the mining pit are summarized in Table 2A. AP-42 standard calculations and assumptions were used to generate these values and are provided in the Table. No. 2A, mitigation has been assumed for emissions within the property boundaries at either mine site.

Particulate-generating processes related to the Touquoy Mine Site consist of transfer conveyors, material handling, loading and unloading operations at the ROMTRANS (Raw Material Storage Pile Transfer operations), and primary, secondary and tertiary ore crushing. These activities occur at grade. Emissions calculations for activities at the Touquoy Mine Site are summarized in Table 2B. AP-42 standard calculations and assumptions were used to generate these values and are provided in the Table. Crushing and material handling operations have been assumed to be “controlled” due to ore moisture content.

2.2 Sources of Gaseous Compounds

Tailpipe emissions from haul trucks along the Haul Road between the Beaver Dam Mine Site and the Touquoy Site include NOx, SO_2 and VOCs. These emissions were calculated using M6.2 (which provides emission factors in a “grams-per-vehicle-mile-travelled” format). The total emissions of tailpipe emissions based on distance travelled is provided in Table 3.

3. Background Air Quality Data

3.1 Regional Background

Appropriate background data was investigated for the Project to evaluate the existing conditions versus the conditions when the proposed operations commence. There are currently no permanent air monitoring stations within the vicinity of the Project.

Recent (2014 – 2016, the most recent three years for which all data are currently available) ambient air quality monitoring data were obtained from the National Pollutant Surveillance network (NAPS). The nearest representative stations which report substances of interest for this assessment are:

- Lake Major, Nova Scotia (station ID 030120) – $PM_{2.5}$, NO_2, SO_2.
- Port Hawkesbury, Nova Scotia (station ID 030201) – $PM_{2.5}$, NO_2, SO_2.
- Aylesford Mountain, Nova Scotia (station ID 030701) – $PM_{2.5}$, NO_2.
- Pictou, Nova Scotia (station ID 030901) – $PM_{2.5}$, NO_2.

PM_{10} is not measured in many areas in Canada. Of the locations which do measure PM_{10}, most are in British Columbia urban centres, with four in Manitoba cities, one in Regina, Saskatchewan, and four in the Northwest Territories. In terms of locations that are somewhat comparable to the Project (human habitation, regional activities that may generate airborne particulate, etc.), Norman Wells NW Regional Office (Station ID 129102) is suitably rural and at a distance from significant human activities and industry and therefore appears appropriate and has recent data available. As such, this station has been included to provide context for PM_{10}, and comparison for the other species of interest ($PM_{2.5}$, NO_2, and SO_2) in this assessment. There is a great deal of uncertainty in how representative these values might be for background, but they represent the best available data at this time. Of particulate note is that the 75th percentile 24-hour PM_{10} value was reported at 14.0 µg/m^3, but the 90th percentile value jumped to 31.0 चg/m^3 and the maximum value was 176.0 µg/m^3. This indicates that there are a few very high concentrations being measured which are strongly influencing the maximum and the 90th percentile. Use of the 90th percentile concentration for PM_{10} at this location as "background" for the Project is therefore likely to be very conservative, a finding supported by the limited PM_{10} monitoring completed historically in the area (see Section 3.2).

Total particulates are not measured routinely anywhere in Canada, and so cannot be represented by NAPS monitoring data.

The background air concentration is provided in Table 4, which shows the 25th, 50th, 75th, and 90th percentile values for 1-hour and 24-hour NO_2, 1-hour and 24-hour SO_2, and 24-hour PM_{10} and $PM_{2.5}$ for the 2014 through 2016 period (the most recent complete years for which data are available as of the time of writing). GHD has completed the air assessment using the 90th percentile measured concentration as "background". This is a conservative approach, but excludes extreme high values that are very rarely measured (the "maximum" values). The bolded values in Table 4 are those that were carried forward for use in the cumulative effects assessment. Annual values for $PM_{2.5}$ and PM_{10} are represented by the "Average" values for 24-hour.

Port Hawkesbury was identified as a station in reasonable proximity to the site, that is likely relatively comparable in terms of current human activity. Existing air quality at this location is likely similar to (or slightly worse – with higher concentrations) than existing conditions at the Project, and so for all species except PM_{10}, this location has been selected as "background". It should be noted that the Norman Well station generally had similar ambient air quality concentrations (up to the 90th percentile) as the other stations considered, however maximum concentrations measured at this location are much higher than other locations assessed.

The cumulative effect is therefore the modelled concentrations from the Project activities plus the identified background concentration (site + background = cumulative).

3.2 Project Monitoring

Preliminary baseline particulate monitoring was undertaken for TSP and PM_{10}. Air samples were collected at nine locations near the Beaver Dam Mine Site and along the proposed Haul Road, and at five additional locations on the Touquoy Site and the data provided to GHD for review.

A summary of these baseline measurements is presented in Table 5.

Total suspended particulate concentrations ranged from 1.7 to 41.7 µg/m^3, with the highest value obtained at Location #2 during monitoring in June 2008. This monitoring station was located in a recently clear-cut area, which may have contributed to higher particulate levels in comparison to the other locations. This area was resampled in 2014 (AN-2). The 2014 results for that area were 4.6 µg/m^3. All samples collected were below the Nova Scotia Air Quality Standards (NSAQS) for TSP. Due to a lack of other sources of data for ambient TSP, the background concentration for TSP is based on the maximum measured 24-hour TSP concentration (there are insufficient data to provide a meaningful 90th percentile value), and the average of all the TSP measurements. There is a great deal of uncertainty in how representative these values might be for background, but they represent the best available data at this time. Use of the maximum of the 24-hour concentrations measured is likely to be very conservative, over predicting background air quality in the cumulative effects assessment.

Results for PM_{10} concentrations ranged from 7.1 to 13.1 µg/m^3, with the highest value also obtained at Location #2 during monitoring in June 2008. The measured values presented suggest it is possible that the background data from Norman Wells may be higher than local background (which were more representative of the 75th percentile data from Norman Wells), but there is not sufficient data to be sure. There is no NSAQS for PM_{10} but the values measured were all less than 30% of the Ontario Interim guideline for PM_{10}.

4. Air Quality Criteria

Where Nova Scotia has air quality criteria, these have been used as the Assessment Criteria. If there were no Nova Scotia criteria for compounds of interest, then Canada-wide standards have been assumed to apply. PM_{10} is not regulated in either Nova Scotia or federally. Ontario has an Interim Ambient Air Quality Criteria (AAQC) for PM_{10}, but this value is not used to assess compliance for single facilities or operations, and is generally applied at the regional level. This Interim criteria has been provided for context for this assessment, but is not considered a guideline for the Project. Table 6 provides a summary of the compounds of concern for this assessment, the identified air quality criteria and averaging periods, and the data source. The assessment criteria selected for this assessment are provided in the final column of Table 6.

Volatile organic compounds are not regulated as a group in any of the jurisdictions identified and PM_{10} is not regulated at the facility level in any of the jurisdictions identified. Ontario has a provisional PM_{10} ambient guideline of 50 µg/m^3 for the 24-hour averaging period. VOC and PM_{10} concentrations are therefore provided for informational purposes only, and PM_{10} will be compared to this interim standard for context, but is not considered a regulated compound in Nova Scotia.

5. Air Dispersion Modelling

Dispersion modelling was performed using the United States Environmental Protection Agency (USEPA) multi-source dispersion model AERMOD, following a modified methodology as described in the Air Dispersion Modelling Guideline for Ontario (MECP, date) and in Ontario Regulation 419/05 (O. Reg. 419/05). There is currently no guidance on the use of air dispersion models in Nova Scotia, therefore the Ontario O. Reg. 419/05 requirements were used as a framework for this assessment. The air dispersion model and methodology used in this project are currently accepted in Ontario, and the AERMOD model is accepted in multiple provinces and territories, as well as in the United States. AERMOD is an advanced steady-state plume model that has the ability to incorporate building cavity downwash, actual source parameters, emission rates, terrain and historical meteorological information to predict ground level concentrations (GLCs) at specified locations and has been peer reviewed and compared both to other models and monitoring data (U.S. EPA, 2003).

5.1 Dispersion Modelling Executables

The following dispersion and pre-processor models were used in this assessment:

- AERMOD digital terrain pre-processor (AERMAP), version 11103.
- American Meteorological Society/Environmental Protection Agency Regulatory Improvement Committee (AERMIC) air dispersion model (AERMOD), version 16216r.
- Building Profile Input Program (BPIP), version 04274.
- AERMET meteorological preprocess (AERMET), version 16216.

5.2 Meteorological Data

Five years of unprocessed hourly meteorological data for the Facility was obtained from Environment Canada (EC, 2017a). The surface data is from the Upper Stewiacke Research Climate Station (WMO ID 71753) with missing data either interpolated for short periods (6 hours or less) or filled in using data from another nearby meteorological station (Derbert Airport; WMO ID 71317). Upper air data was retrieved from the NOAA radiosonde database for Yarmouth, NS (NOAA, 2018). The meteorological data covers the dates from January 1, 2012 to December 31, 2016. The data was processed using AERMET version 16216 with land use characteristics representative of the Project's surroundings. The hourly data included many factors which affect the dispersion of air compounds including wind speed, wind direction, temperature, ceiling height, and atmospheric stability.

Figure 1 shows the location of the Beaver Dam Mine Site.

5.3 Averaging Periods and Time Based Concentration Conversion

Air compounds were modelled with appropriate averaging periods based on their respective air quality criteria. The averaging periods of interest for each compound are provided in Table 6. Maximum predicted concentrations presented are exclusive of “meteorological anomalies”. Under Ontario dispersion modelling guidance, the highest 8 hours (for hourly results) or the highest 1 day (for 24-hour results) for each year modelled are considered to be attributable to meteorological anomalies, and so are not considered. Where “maximum concentrations” are reported, these are maximum concentrations after meteorological anomalies have been removed.

5.4 Digital Elevation Model Data

Digital elevation model (DEM) data was obtained from Natural Resources Canada through their geospatial data extraction tool (http://geogratis.gc.ca/site/eng/extraction). The DEM data was used to include the effects of terrain in the modelling.

DEM data was preprocessed with AERMAP version 11103 for use with AERMOD. Figure 2 shows a contour plot of the extracted terrain data for the modelling domain.

5.5 Source Input Parameters

Three different types of sources were modelled to represent the Project: the Haul Road between the Beaver Dam Mine Site and the Touquoy Mine Site; the Beaver Dam Mine Site, and the Touquoy Mine Site.

5.5.1 Haul Road

The approximately 30 km Haul Road connecting Beaver Dam to Touquoy was modelled as a line volume source representing both road and tailpipe emissions from truck traffic associated with the Beaver Dam Mine Site. The Haul Road is assumed to have a control efficiency of 75 percent of the re-suspended road dust. This will be achieved through the implementation of a fugitive dust best management plan including dust suppressant applications on the road surface.

The current project description provides several options for the Haul Road. The air emission estimates and dispersion modelling for this assessment considered what is thought to the worst case option. Based on this distance, the dust concentrations at the sensitive receptors would be expected to decrease significantly for all size fractions such that at that distance there will be negligible levels of TSP, PM_{10}, and $PM_{2.5}$ attributable to the Haul Road activity and future ambient concentrations will be dominated by background sources.

5.5.2 Beaver Dam Mine

The Beaver Dam mining, crushing, and transfer operations will primarily operate from within an open pit. Although vehicle traffic is also expected, it was assumed that most of these operations also occur within the pit. Therefore, the Beaver Dam emissions were modelled such that all emissions from mining operations were summed and attributed to an open pit source.

5.5.3 Touquoy Mine Site

The Touquoy Mine Site remained unchanged from previous assessments, consisting of the crushers and mining sources as volume sources. These sources were previously modelled in AERMOD for an Emissions Summary and Dispersion Modelling assessment (GHD, 2007). As the Project will use Touquoy for its refining capabilities, the crushing and mining sources remain unchanged from the previous assessment. Emission rates have been updated based on US EPA AP-42 calculations, but procession and throughput rates have not been modified.

5.6 Deposition

Deposition was modelled for TSP. Per default model set up, plume depletion was included. For consistency, plume depletion was permitted for all three size fractions (including PM_{10} and $PM_{2.5}$), in order to ensure that predicted concentrations were consistent with each other. Plume depletion calculates the settling of particles from emitted plumes as a result of their mass and aerodynamic properties, and can provide the predicted deposition (in grams per square metre, g/m^2) that may be used further to estimate health risks based on biological intake (i.e., ingestion). Deposition was not modelled for the air quality assessment, but results were provided to the Human Health Risk team for assessment. Data provided for the Health Risk Assessment (including concentrations and deposition) are shown in Appendix A.

5.7 Tiered Receptors

A series of tiered receptor grids, located at ground level, were used to identify the maximum point of impingement (POI) outside the Beaver Dam Mine Site and Touquoy Mine Site, and along the connecting Haul Road.

Around both facilities, the receptor grids were set up with the following grid spacing:

- 20 m spacing within 200 m of the edge of a bounding box that encompassed all onsite facility sources.
- 50 m spacing from 200 to 500 m.
- 100 m spacing from 500 to 1,000 m.
- 200 m spacing from 1,000 to 2,000 m.
- 500 m spacing from 2,000 to 5,000 m.

A property line ground level receptor grid with 10 m spacing was used to evaluate the maximum property boundary concentration. No receptors were placed inside either Mine's property line.

Along the Haul Road, receptors were placed with a 100 m spacing to a distance of 1000 m on either side of the road.

An overall general grid was also placed over a significantly larger area with a 1000 m receptor spacing to a distance of 15 km from any sources within the models.

Modelling was also completed to sensitive receptors within the vicinity of the proposed operations. The gridded and sensitive receptors for the modelling are provided on Figure 3. The sensitive receptors that were evaluated are as follows:

- Sensitive Receptor 1 - Musquodoboit Lumber Company.
- Sensitive Receptor 2 - Deepwood Estates.
- Sensitive Receptor 3 – 9 Beaver Da Mines Road.
- Sensitive Receptor 4 – 3373 Highway 224.

As the modelling results at sensitive receptor locations are more relevant for the Human Health Risk Assessment, predicted concentrations at the sensitive receptor locations are provided in Appendix A (Tables A-2 through A-5).

5.8 On-Site Building Data

There are several buildings at the Touquoy Mine Site, however point sources at this location were insignificant and not included in the dispersion modelling. There were no buildings identified for the Beaver Dam Mine Site. For these reasons, building downwash effects were not included in the modelling

6. Results

6.1 Haul Road Results and Cumulative Effects Assessment

Air dispersion modelling was completed for concentrations of TSP, PM_{10} and $PM_{2.5}$ in addition to nitrogen oxides (NOx), sulfur dioxide (SO_2), and volatile organic compounds (VOC). The maximum predicted concentrations of the species of interest for this Project are summarized in Table 7, for the Haul Road, and Tables 8 and 9 for the Beaver Dam and Touquoy Mine sites, respectively, minus meteorological anomalies (see Section 5.3).

Figure 4, 5, and 6 show the maximum predicted 24-hour TSP, PM_{10} and $PM_{2.5}$ concentrations because of Haul Road traffic. Figures 7, and 8 show the maximum predicted annual average TSP, and $PM_{2.5}$ concentrations because of Haul Road traffic. For all isopleth figures, red indicates that the predicted concentration exceeds the assessment guideline for that species and averaging period; yellow indicates that the predicted concentration would exceed the assessment guideline once background is added (the cumulative effect), and other colours show various concentrations below assessment guidelines. The highest predicted concentrations for all compounds occurred in close proximity to the road, in areas that are not continuously occupied. Maximum predicted concentrations presented occur at 30 m from the road, and decrease rapidly with distance. The TSP cumulative effects concentrations decline to values below assessment guidelines at all times within approximately 200 m of the road or less. The PM_{10} cumulative effects concentrations are more strongly affected by the assumed background concentrations (which are, themselves, 65% of the assessment criteria). Using this highly conservative assessment, it is estimated that PM_{10} cumulative effects concentrations would decline to values below the assessment guideline at all times within 800 m. If background PM_{10} were found to be half the current estimate, this distance would drop to approximately 350 m.

Maximum predicted concentrations of total particulate (TSP) and PM_{10} from Haul Road operations were both above the identified assessment criteria for the 24-hour averaging period in close proximity to the road, even without the inclusion of background ambient concentrations. Annual predicted concentrations of total particulates were also predicted to exceed the assessment criteria. There is significant uncertainty in the assumed background concentrations for the TSP and PM_{10} size fractions, due to lack of local data. The assessment herein is considered conservative, and should future monitoring indicate that background concentrations are lower than have been assumed, the area over which the cumulative effects assessment indicates predicted concentrations greater than the assessment values will decrease closer to the road.

It should be also noted that PM_{10} is not a regulated compound either in Nova Scotia or at the federal level.

Predicted 24-hour $PM_{2.5}$ concentrations meet the assessment criteria for the Haul Road alone, but with the addition of background, the annual $PM_{2.5}$ may exceed the assessment criteria (shown in yellow on the figure, extending approximately 80 m from the road). However, more than 50% of the contribution to the cumulative effects are from existing background.

Even with a 75% dust mitigation plan, it is unsurprising that concentrations of particulate may exceed guideline values in close proximity to the road as unpaved roads with high vehicle kilometers travelled are recognized by Environment Canada as being significant sources of airborne particulate (EC, 2017b).

Predicted concentrations of the gaseous species (NO_2, SO_2 and VOCs) were at least an order of magnitude below their respective assessment criteria. The cumulative effects assessment similarly showed these compounds to be well below relevant criteria. Based on the very low concentrations predicted, these species are negligible and have not been carried forward into the Residual Effects Assessment.

Maximum predicted concentrations of TSP, PM_{10}, and $PM_{2.5}$ and maximum predicted deposition are provided in Appendix A, in Table A-1.

Predicted concentrations and deposition values at the sensitive receptors are provided in Appendix A, Tables A-2, A-3, A-4 and A-5. As provided in each of the tables, the concentrations of TSP, and $PM_{2.5}$ are below the criteria at the sensitive receptors without the addition of the background air quality data. Maximum concentrations of PM_{10} exceeded the Ontario interim guideline less than 2% of the time at the Deepwood Estates receptor without the addition of the background air quality data (i.e., up to 7 days per year, the model predicts that Deepwood Estates may experience concentrations of PM_{10} above 50 µg/m^3 due to Haul Road operations alone, without including background).

With the addition of background concentrations, 24-hour concentrations of TSP and PM_{10} may exceed their respective criteria at Deepwood Estates (Table A-2) up to 0.3% of the time for TSP (1 day per year) and up to 57% of the time for PM_{10} (207 days per year). Due to the large uncertainty regarding the TSP and PM_{10} background concentrations, this frequency analysis is somewhat speculative (as it relies on 14 data points for TSP, and data from over 3000 km away for PM_{10}). At #9 Beaver Dam Mines Road 24-hour PM_{10} may also exceed the 24-hour assessment criteria at (Table A-4) when background concentrations are considered. A frequency analysis at this location suggests that Haul Road plus background sources together may result in 24-hour concentrations of PM_{10} greater than the Ontario Interim guideline of 50 µg/m^3 up to 13% of the time (or 47 days per year). As at Deepwood Estates, reliance on what could be elevated background concentrations for PM_{10} may result in over predicting these cumulative effects.

PM_{10} is not a regulated compound in Nova Scotia, or at the federal level in Canada, and the estimated background concentration of PM_{10}, 31 µg/m^3, represents 62% of the Interim guideline, so there is a great deal of uncertainty in the 24-hour PM_{10} assessment. The possible exceedance of 24-hour TSP and PM_{10} at Deepwood Estates should be a consideration for future monitoring programs, as well as ensuring that the Haul Road dust best management practices plan is implemented and monitored.

$PM_{2.5}$, which is regulated at the federal level, meets the CAAQS at all sensitive receptors.

6.2 Beaver Dam Results and Cumulative Effects Assessment

Modelling results for all particulate size fractions resulting from on-site operations at Beaver Dam Mine Site were predicted to meet the identified assessment criteria for all averaging periods, from operations alone and when added to background concentrations. The predicted concentrations of TSP and PM_{10} were similar for the 24-hour period as the plume depletion for TSP is significantly higher than depletion for PM_{10}.

6.3 Touquoy Results and Cumulative Effects Assessment

Modelling results for all particulate size fractions resulting from on-site operations at Touquoy Processing facility were predicted to meet the identified assessment criteria for all averaging periods, from operations alone and when added to background concentrations. The predicted concentrations of TSP and PM_{10} were similar for the 24-hour period as the plume depletion for TSP is significantly higher than depletion for PM_{10}.

7. Conclusions

Modelling of sources at the Beaver Dam Mine Site and the Touquoy Mine Site showed maximum predicted concentrations at their respective fencelines well below applicable air quality criteria, which are unlikely to cause adverse effects.

The Haul Road between the proposed Beaver Dam and the Touquoy Mine Sites is the source primarily responsible for the maximum predicted concentrations at both the gridded receptors and the sensitive receptors identified for this assessment. Emissions of particulates from the Haul Road are predicted to result in some exceedances of the assessment criteria for all particulate species in close proximity to the road. With the addition of regional background concentrations, the cumulative effects assessment demonstrates that these exceedances may extend up to 200 m on either side of the road for TSP, 800 m on either side of the road for PM_{10}, and less than 100 m on either side of the road for $PM_{2.5}$ (actual distances may be lower, due to the conservatism and uncertainty in the regional background concentrations for these compounds).

Emissions of gaseous species from the Haul Road are predicted to be at least an order of magnitude below any respective assessment criteria. As such, they are negligible and will not be carried forward to the Residual Effects Assessment.

Maximum predicted $PM_{2.5}$ concentrations did not exceed the CAAQs for either the 24-hour or annual averaging periods at any of the sensitive receptor locations, based on Project alone predictions, or Project plus background. PM_{10} was predicted to exceed the Ontario Interim 24-hour guideline at Deepwood Estates up to 2% of the time without background) and up to 57% of the time with background concentration included. PM_{10} was also predicted to exceed the Ontario Interim 24-hour guideline at 9 Beaver Dam Mines Road up to 13% of the time with background concentration included, but met the guideline without background. TSP was predicted to exceed the 24-hour Nova Scotia Air Quality Standard up to 0.3% of the time with background included at the Deepwood Estates receptor. There is a great deal of uncertainty in the presented background concentrations of both PM_{10} and TSP. A more extensive baseline monitoring program for these species may demonstrate that background concentrations have been over-estimated, significantly reducing the likelihood of predicted exceedances. This is a matter which should be taken into consideration and included in the proposed operations monitoring program.

Should you have any questions on the above, please do not hesitate to contact us.

Yours truly,

G <Original
signed
by>

L. Allison Barrett, M.Sc., C.Met.

MG/LAB/sw/2

Encl.

8. References

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Figures

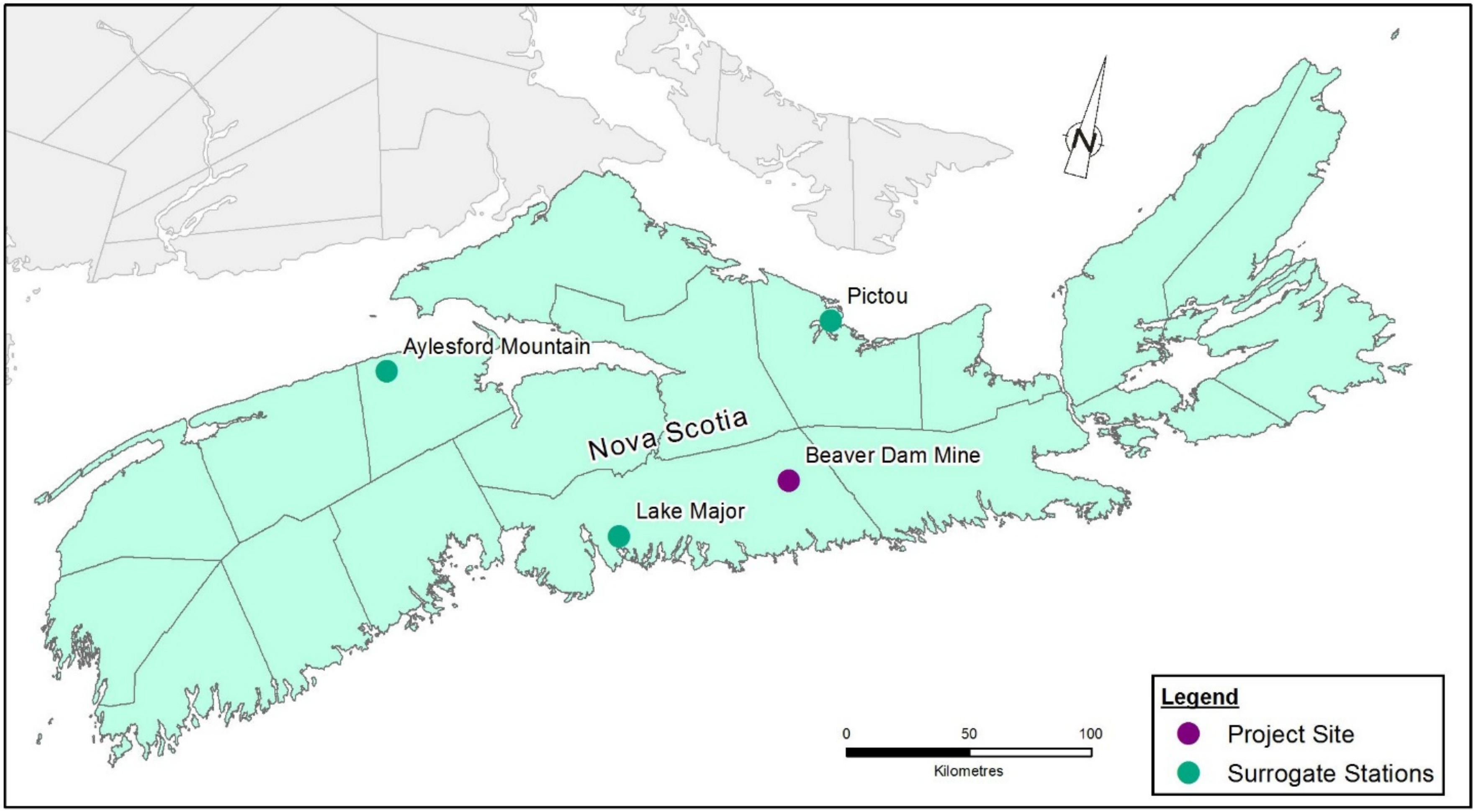
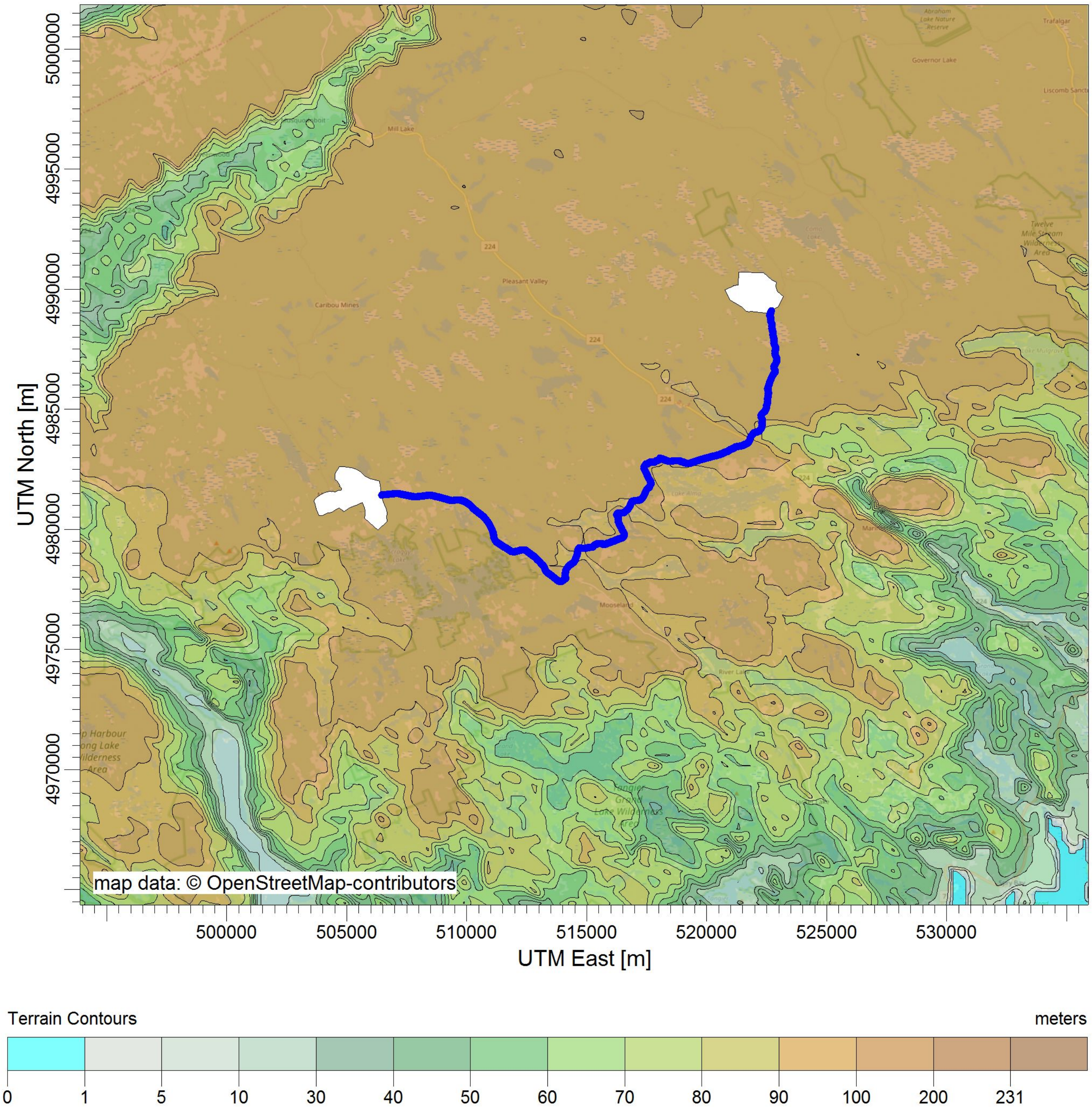


Figure 1 Beaver Dam Mine Project Site and Selected Baseline Air Quality Monitoring Stations

PROJECT TITLE:

Figure 2
Model Domain Terrain Contours



COMMENTS:

SOURCES:
4

COMPANY NAME:

RECEPTORS:
15089

MODELER:
GHD

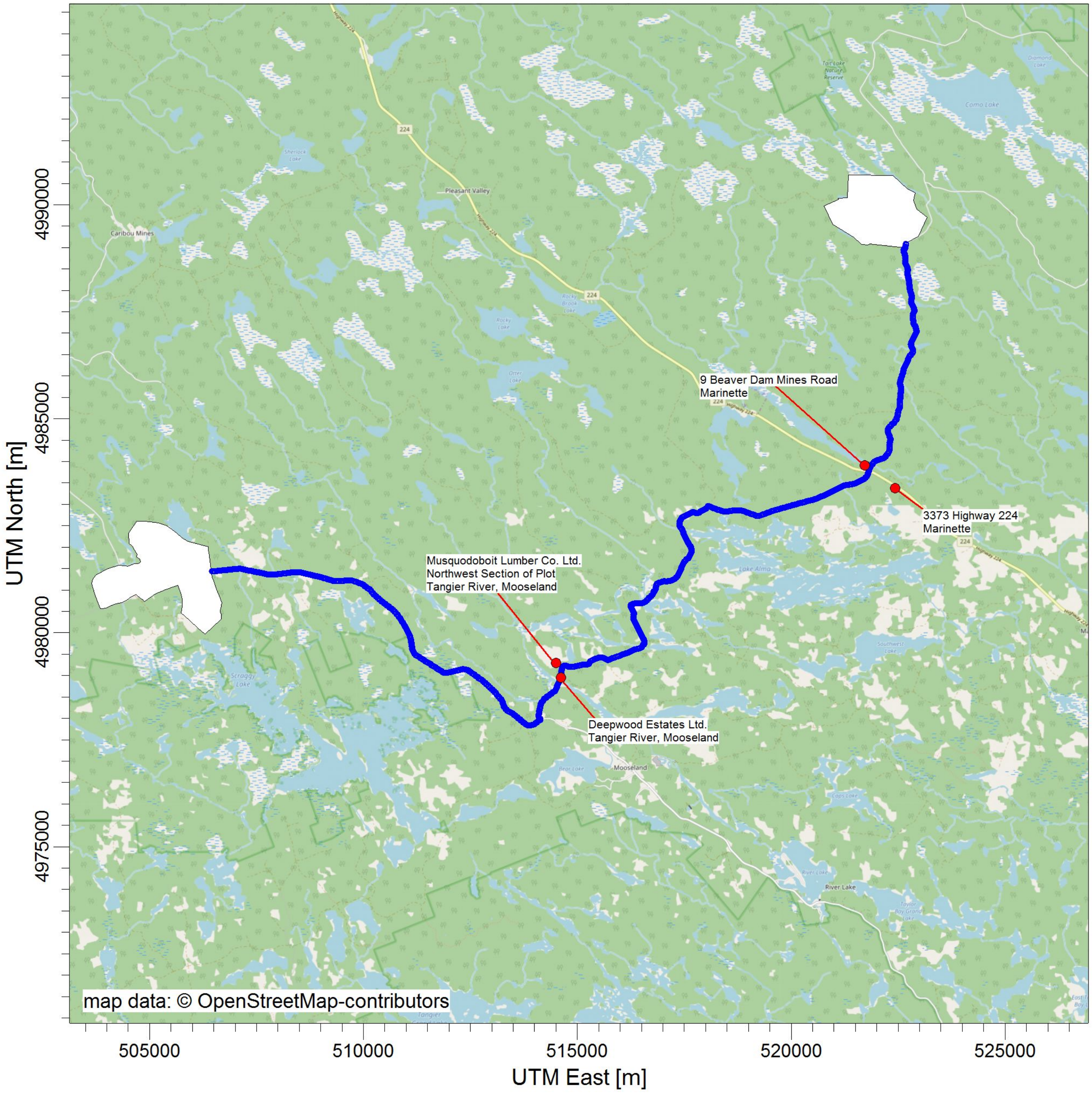
SCALE: 1:264,209
0 10 km

DATE:
2/11/2019

PROJECT NO.:
088664

PROJECT TITLE:

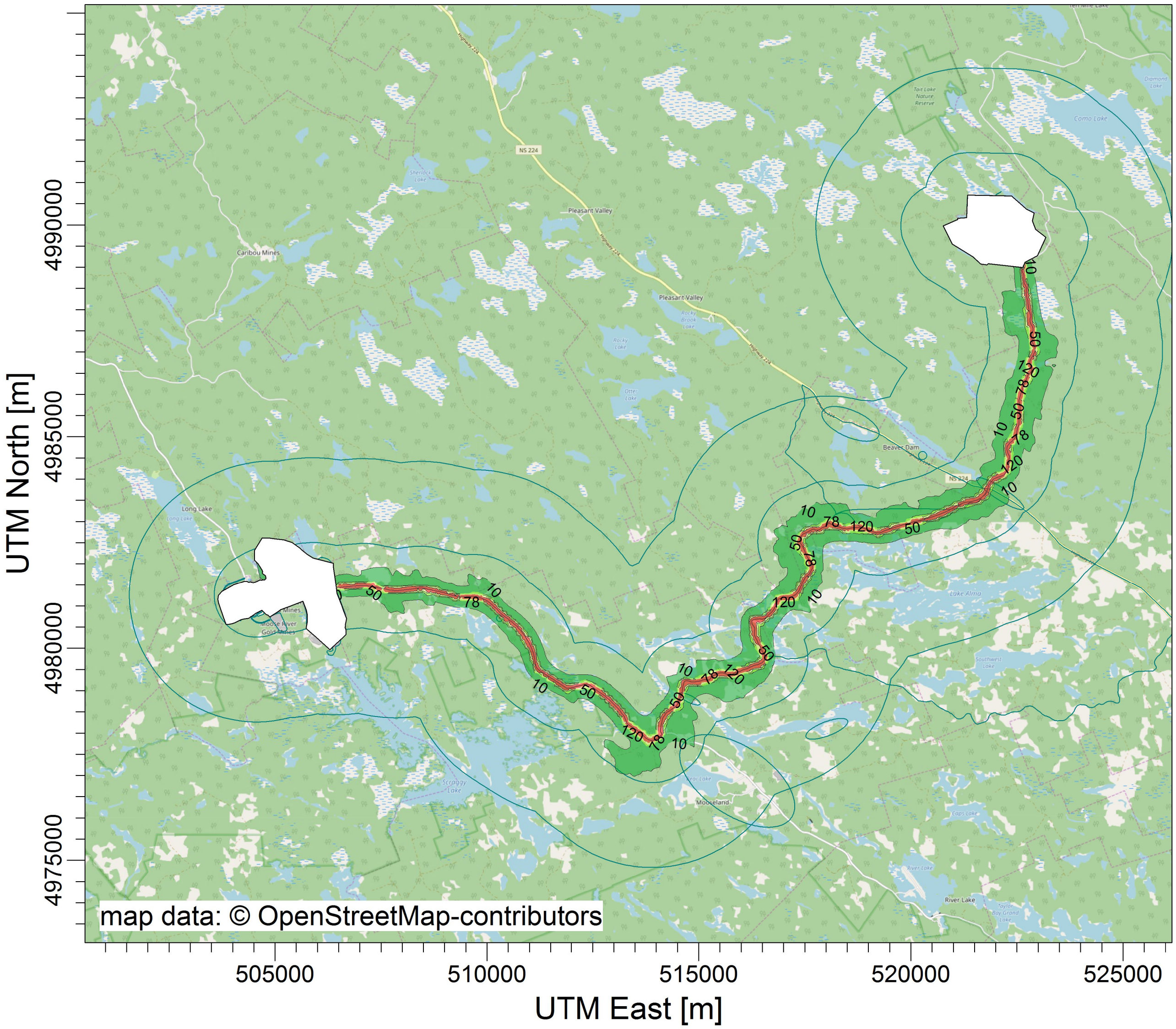
Figure 3
Modelled Sensitive Receptors



COMMENTS:	SOURCES: **4**	COMPANY NAME:	
	RECEPTORS: **15089**	MODELER: **GHD**	GHD
		SCALE: 1:149,800 0 5 km	
		DATE: **2/11/2019**	PROJECT NO.: **088664**

PROJECT TITLE:

Figure 4
Maximum 24-hour Total Particulate Matter Concentrations



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

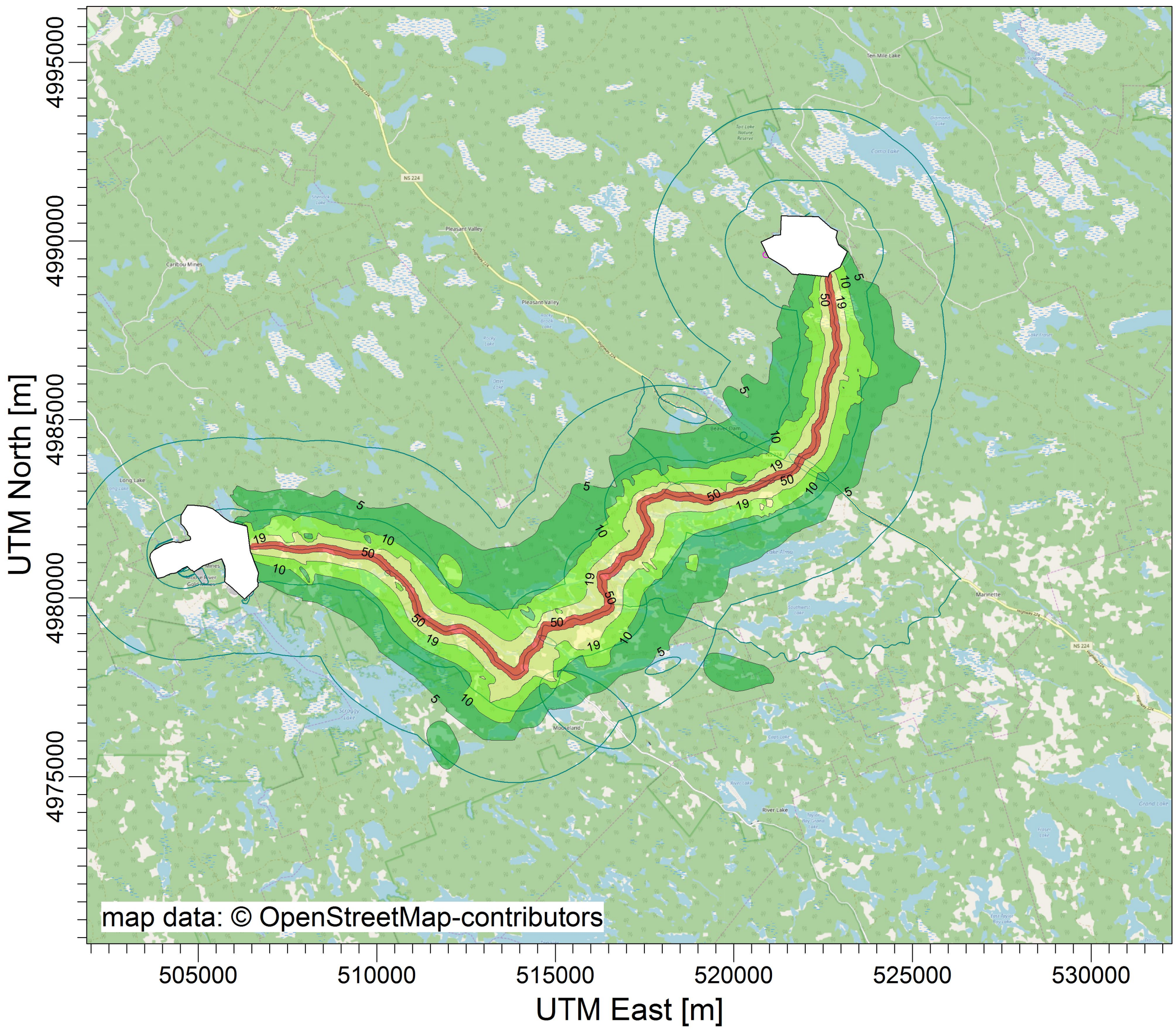
Max: 251 [ug/m^3] at (518696.25, 4982830.42)

10 50 78 120

COMMENTS:	SOURCES:	COMPANY NAME:	
Dust control measures along haul road (75% effective), assumed.	**4**	**Beaver Dam Mine Project**	
	RECEPTORS: **15089**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:163,373 0 5 km	
	MAX: **251 ug/m^3**	DATE: **2/13/2019**	PROJECT NO.: **088664**

PROJECT TITLE:

Figure 5
Maximum 24-hour PM10 Concentrations



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: HAULROAD — ug/m^3

Max: 146 [ug/m^3] at (514098.40, 4977983.03)

5 | 10 | 19 | 50

COMMENTS:

Dust control measures along haul road (75% effective), assumed.

SOURCES:

4

COMPANY NAME:

Beaver Dam Mine Project

RECEPTORS:

15089

MODELER:

GHD

OUTPUT TYPE:

Concentration

SCALE: 1:193,652

0 — 5 km

MAX:

146 ug/m^3

DATE:

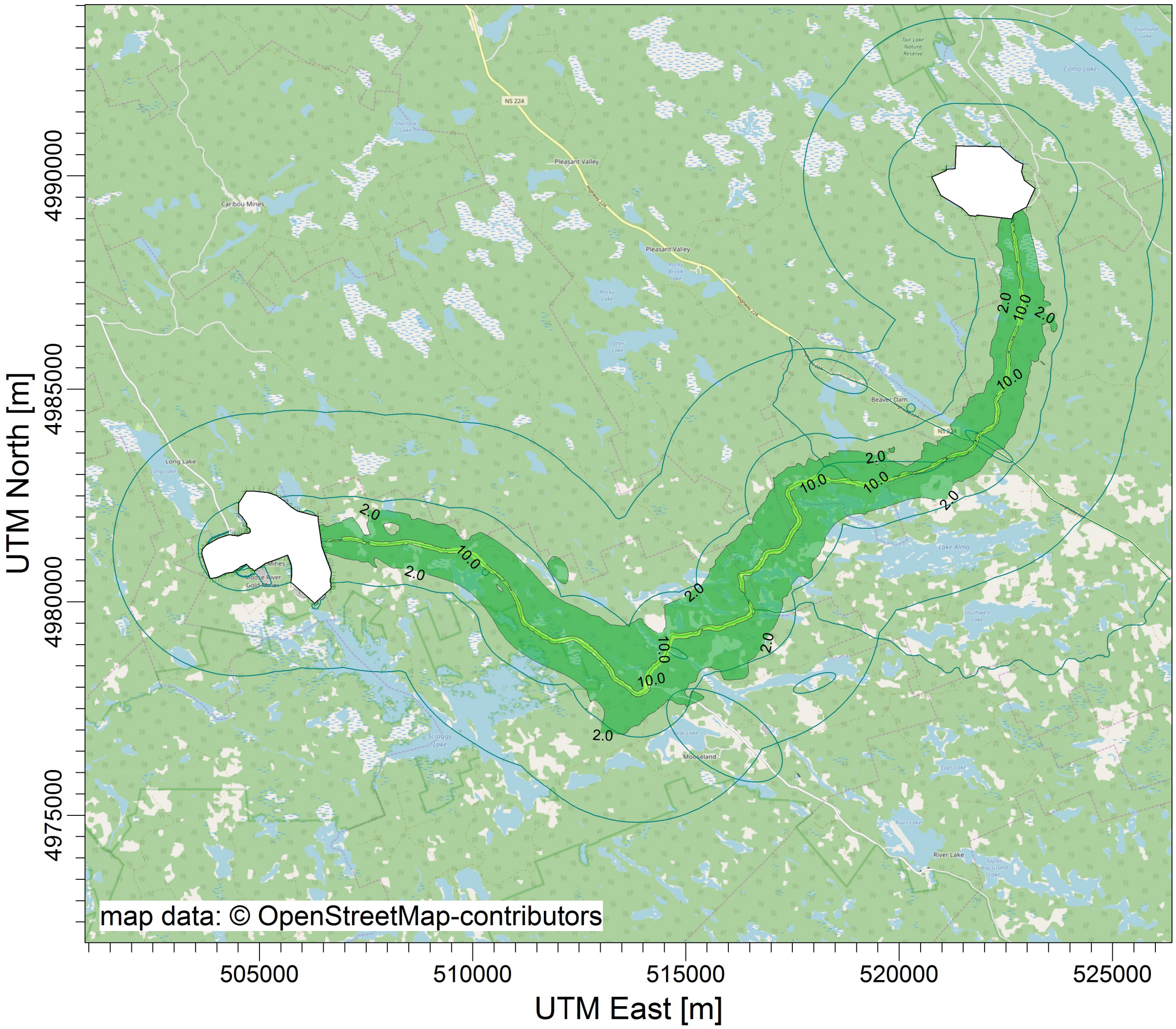
2/22/2019

PROJECT NO.:

088664

PROJECT TITLE:

Figure 6
Maximum 24-hour PM2.5 Concentrations



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: HAULROAD — ug/m^3

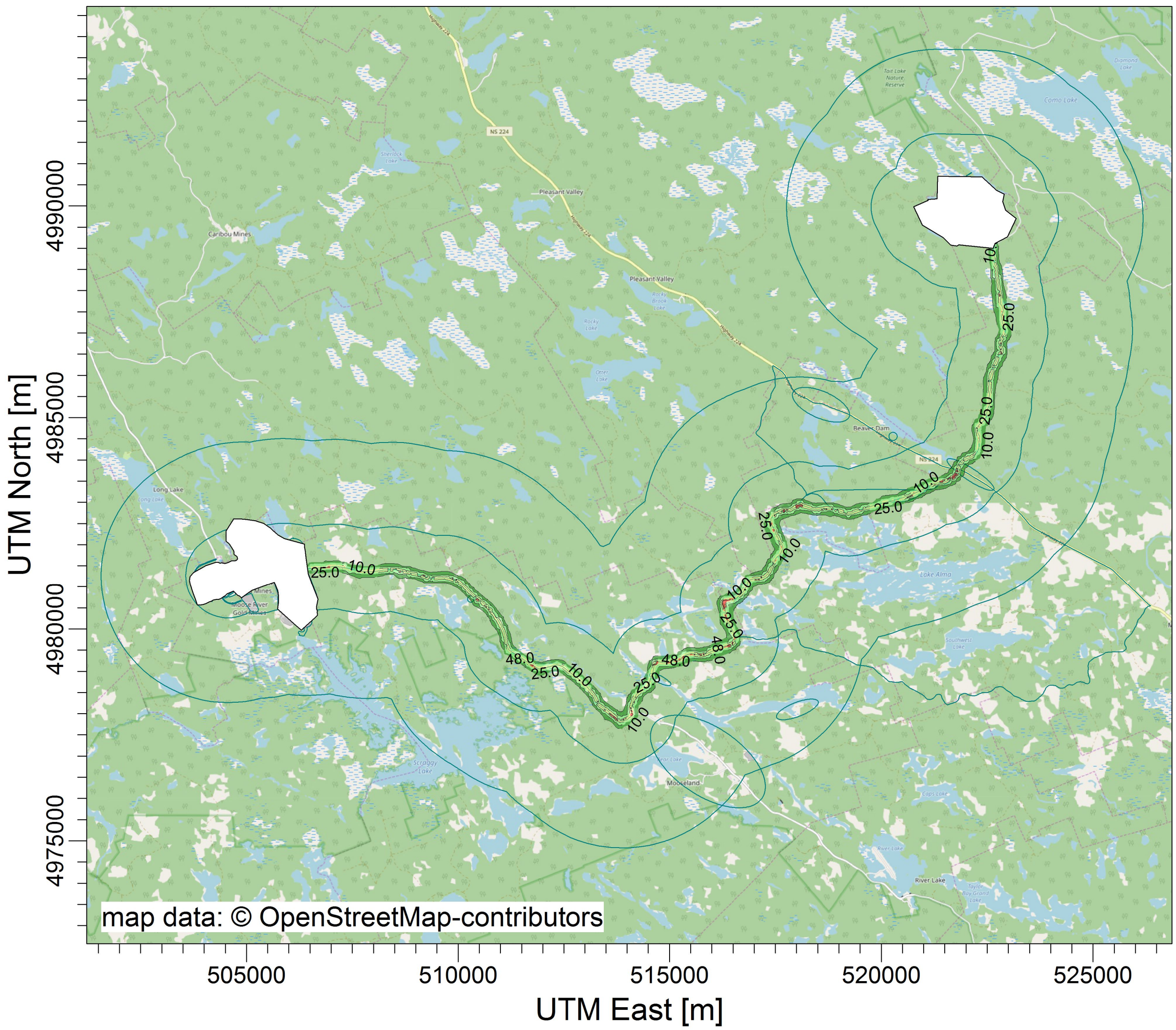
Max: 16.2 [ug/m^3] at (514098.40, 4977983.03)

2.0 | 10.0 | 18.0 | 27.0

COMMENTS:	SOURCES:	COMPANY NAME:	
Dust control measures along haul road (75% effective), assumed.	**4**	**Beaver Dam Mine Project**	
	RECEPTORS: **15089**	MODELER: **GHD**	GHD
	OUTPUT TYPE: **Concentration**	SCALE: 1:162,383 (0 — 5 km)	
	MAX: **16.2 ug/m^3**	DATE: **2/13/2019**	PROJECT NO.: **088664**

PROJECT TITLE:

Figure 7
Annual Average Total Particulate Matter Concentrations



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: ALL ug/m^3

Max: 84.4 [ug/m^3] at (516285.38, 4980640.90)

10.0 | 25.0 | 48.0 | 60.0

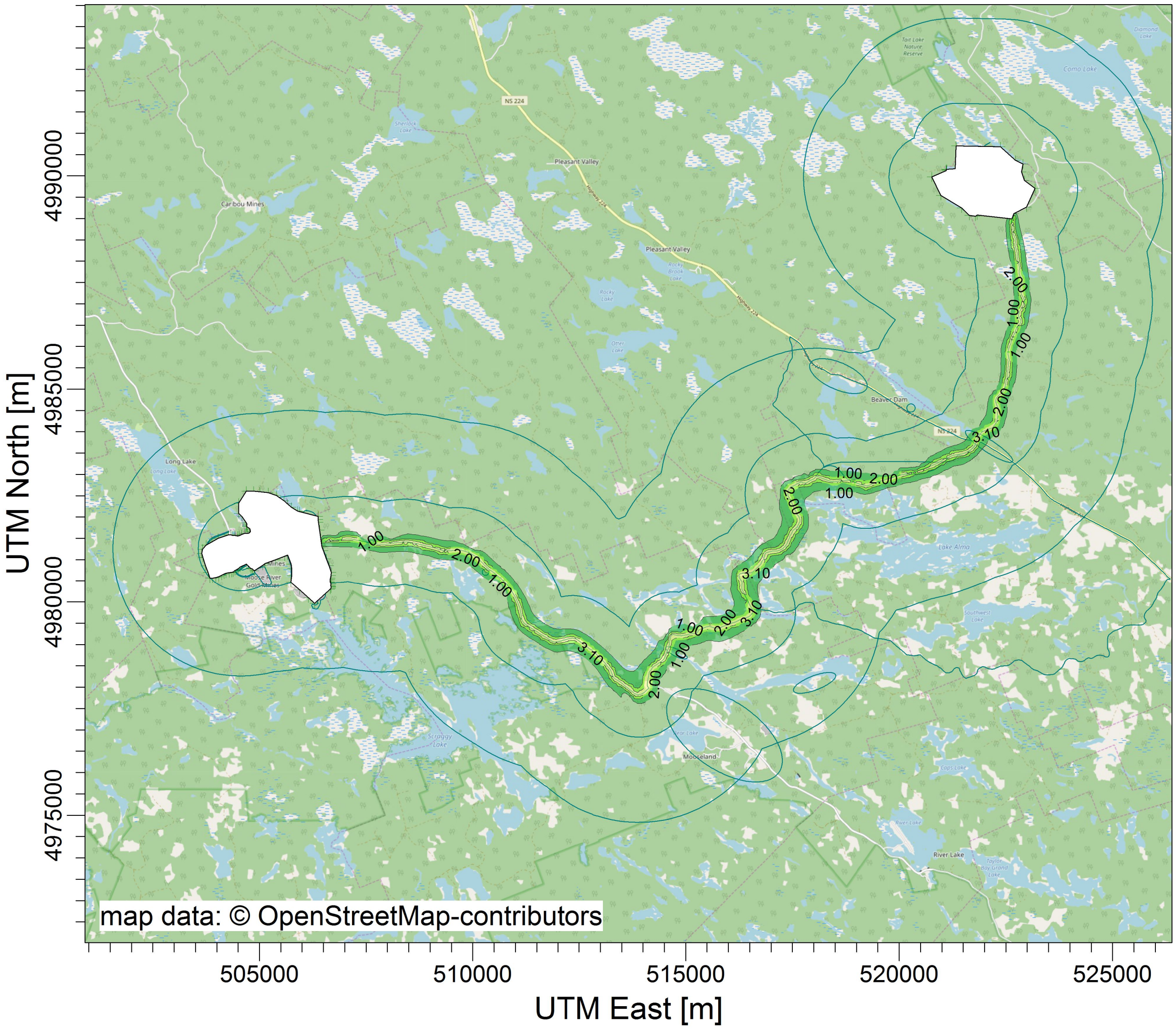
COMMENTS: Dust control measures along haul road (75% effective), assumed.	SOURCES: **4**	COMPANY NAME: **Beaver Dam Mine Project**	
	RECEPTORS: **15089**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:163,384 0 5 km	
	MAX: **84.4 ug/m^3**	DATE: **2/13/2019**	PROJECT NO.: **088664**

AERMOD View - Lakes Environmental Software

C:\temp\088664 Beaver Dam Mine\88664_BeaverDam_26Nov2018_ParticulateMatter_TSP_grid\TSP.isc

PROJECT TITLE:

Figure 8
Annual PM2.5 Concentrations



PLOT FILE OF ANNUAL VALUES AVERAGED ACROSS 5 YEARS FOR SOURCE GROUP: HAULROAD ug/m^3

Max: 5.07 [ug/m^3] at (514098.40, 4977983.03)

1.00 2.00 3.10 8.80

COMMENTS:	SOURCES:	COMPANY NAME:	
Dust control measures along haul road (75% effective), assumed.	**4**	**Beaver Dam Mine Project**	
	RECEPTORS: **15089**	MODELER: **GHD**	GHD
	OUTPUT TYPE: **Concentration**	SCALE: 1:162,383 0 5 km	
	MAX: **5.07 ug/m^3**	DATE: **2/13/2019**	PROJECT NO.: **088664**

Tables

Table 1

Estimated Particulate Emission Rates - Haul Route between Beaver Dam and Touquoy

Unpaved Road Calculation Variables

Empirical constant (k) - TSP	4.9	lb/VMT	Particulate size distribution	Diameter	Mass Fraction
Empirical constant (k) - PM10	1.5	lb/VMT		2.5	0.02
Empirical constant (k) - PM2.5	0.15	lb/VMT		10	0.23
Empirical constant (a) - TSP	0.7			TSP	0.75
Empirical constant (b) - TSP	0.45				
Empirical constant (a) - PM10/2.5	0.9				
Empirical constant (b) - PM10/2.5	0.45				
Surface material silt content (3)	6.4	%			
Number of Trucks	**92**				

Operation		Site Operations Variables			Emission Estimate Variables				Emission Factor (2) E	Dust Reduction From Control Measures (1)	Emission Rate (6)
		No. of Trips	Distance	Hours/day of Operation	Total Vehicle km Traveled per Day D	Vehicle Weight	Average Vehicle Weight W				
		(trips per day)	(km)	(hr)	(VKT/day)	(tonnes)	(tonnes)	(tons)	(g/VKT)	(%)	(g/s)
Road Dust											
Line Source 1 - From Beaver Dam to Touquoy Mine											
Trailer Full	Unpaved	92	30.700	24	2824.4	40				75	
Trailer Empty		92	30.700	24	2824.4	20	30	33.1			
TSP (equal to or less than 30 µm)									2620 (4)		4.28E+01
PM10									707 (4)		1.16E+01
PM2.5									71 (4)		1.16E+00

Notes:

(1) An estimated reduction was applied based on expected mitigation measures.
(2) As noted in USEPA AP-42 Chapter 13.2.1 - Paved Roads and 13.2.2 - Unpaved Roads, 'W' is the mean weight of all vehicles travelling the road. Only one emission factor (E) is to be calculated to represent the 'fleet' average of all vehicles travelling each road.
(3) Silt content used for all material types as a conservative estimate (USEPA AP-42 Unpaved Roads - Chapter 13.2.2).
(4) Converted to g/VKT using a conversion factor of 281.9 as specified in USEPA AP-42 Chapter 13.2.2 - Unpaved roads.
(5) Mean landfill surface silt loading (USEPA AP-42 Paved Roads Emissions Model - Chapter 13.2.1).
(6) Equations used to estimate dust emissions are found in USEPA AP-42 (Chapters 13.2.2 - Unpaved Road).
(7) Tailpipe emissions have not been included as they are insignificant, see the summary text for further details.

Table 2A

Estimated Particulate Emissions from Material Handling - Beaver Dam Mine Pit

Summary	**Emission Rate (g/s) Using AP-42**		
	TSP	**PM10**	**PM2.5**
Conveyors	2.87E-02	9.44E-03	2.67E-03
Crusher	2.46E-01	1.11E-01	2.05E-02
Truck Loading	6.57E-03	3.29E-03	1.64E-03
TOTAL	**2.82E-01**	**1.24E-01**	**2.48E-02**

Conveyors

Source ID	***Max. Production Rate (tonnes/hour)***	***Controlled or Uncontrolled?***	***Species***	***USEPA AP-42 Emission Factor (kg/Mg) (1) (2)***	***Emission Rate (g/s)***
Primary Stacker Conveyor	1,478	Controlled	TSP	7.00E-05	2.87E-02
			PM10	2.30E-05	9.44E-03
			PM2.5	6.50E-06	2.67E-03

Notes

(1) Emission factors are from USEPA AP-42, Section 11.19.2 Crusher Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for controlled conveyor transfer points.

(2) It has been assumed there is only one transfer point.

Crusher

Source ID	***Max. Production Rate (tonnes/hour)***	***Controlled or Uncontrolled?***	***Species***	***USEPA AP-42 Emission Factor (kg/Mg) (1)***	***Emission Rate (g/s)***
Crusher	1,478	Controlled	TSP	6.00E-04	2.46E-01
			PM10	2.70E-04	1.11E-01
			PM2.5	5.00E-05	2.05E-02

Notes:

(1) Emission factors for Tertiary Crushing have been used due to a lack of Primary Crushing emission factors. This is a conservative assumption.

Truck Loading

Source ID	***Max. Production Rate (tonnes/hour)***	***Controlled or Uncontrolled?***	***Species***	***USEPA AP-42 Emission Factor (kg/Mg)***	***TSP Emission Rate (g/s)***
Truck Loading at Working Face	1,478		TSP	1.60E-05 (1)	6.57E-03
			PM10	8.00E-06	3.29E-03
			PM2.5	4.00E-06 (2)	1.64E-03

Notes:

(1) Emission factors are from USEPA AP-42, Section 11.19.2 Crusher Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for truck unloading of fragmented stone. As the emission factors are given for PM-10 only, the total PM emission factors was assumed to be the PM-10 emission factor multiplied by 2.

(2) Emission factors are from USEPA AP-42, Section 11.19.2 Crusher Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for truck unloading of fragmented stone. As the emission factors are given for PM-10 only, the total PM emission factors was assumed to be the PM-10 emission factor divided by 2.

Table 2B

Estimated Particulate Emissions from Material Handling - Touqoy Processing Facility

Summary	**AP-42 Emission Rate (g/s)**		
	TSP	**PM10**	**PM2.5**
Crusher	9.38E-02	4.22E-02	7.81E-03
ROMTRANS	8.42E-02	3.17E-02	1.58E-02

Crushers

Source ID	***Max. Production Rate (tonnes/hour)***	***Controlled or Uncontrolled?***	***Species***	***USEPA AP-42 Emission Factor (kg/Mg) (1)***	***Emission Rate (g/s)***
Primary Crusher	187.5	Controlled	TSP	0.0006	3.13E-02
			PM10	0.00027	1.41E-02
			PM2.5	5.00E-05	2.60E-03
Secondary Crusher	187.5	Controlled	TSP	0.0006	3.13E-02
			PM10	0.00027	1.41E-02
			PM2.5	5.00E-05	2.60E-03
Tertiary Crusher	187.5	Controlled	TSP	0.0006	3.13E-02
			PM10	0.00027	1.41E-02
			PM2.5	5.00E-05	2.60E-03

Notes:

(1) Emission factors for Tertiary Crushing have been used due to a lack of Primary Crushing and Secondary Crushing emission factors. This is a conservative assumption.

ROMTRANS (Transfer operations around Raw Material Storage Pile)

Source ID	***Max. Production Rate (tonnes/hour)***	***Controlled or Uncontrolled?***	***Species***	***USEPA AP-42 Emission Factor (kg/Mg)***	***TSP Emission Rate (g/s)***
Handling, Transfering and Conveying	187.5	Controlled	TSP	1.50E-03	7.81E-02
			PM10	5.50E-04	2.86E-02
			PM2.5	2.75E-04 (1)	1.43E-02
Loading ROM Stockpiles	187.5	Controlled	TSP	1.60E-05 (2)	8.33E-04
			PM10	8.00E-06	4.17E-04
			PM2.5	4.00E-06 (3)	2.08E-04
Unloading from ROM Stockpiles	187.5	Controlled	TSP	1.00E-04 (4)	5.21E-03
			PM10	5.00E-05	2.60E-03
			PM2.5	2.50E-05 (5)	1.30E-03

Notes:

(1) Emission factors are from USEPA AP-42, Section 11.19.1 Crushed Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for Conveyor Transfer Point. As there is no PM-2.5 emission factor, emission factors were assumed to be the PM-10 emission factor divided by 2.
(2) Emission factors are from USEPA AP-42, Section 11.19.1 Crushed Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for Truck Unloading Fragmented Stone. As the emission factors are given for PM-10 only, the total PM emission factors were assumed to be the PM-10 emission factor times 2.
(3) Emission factors are from USEPA AP-42, Section 11.19.1 Crushed Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for Truck Unloading Fragmented Stone. As the emission factors are given for PM-10 only, the PM2.5 emission factors were assumed to be the PM-10 emission factor divided by 2.
(4) Emission factors are from USEPA AP-42, Section 11.19.1 Crushed Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for Truck Loading Conveyor, crushed stone. As the emission factors are given for PM-10 only, the TSP emission factors were assumed to be the PM-10 emission factor times 2.
(5) Emission factors are from USEPA AP-42, Section 11.19.1 Crushed Stone Processing and Pulverized Mineral Processing, Table 11.19.2-1 for Truck Loading Conveyor crushed stone. As the emission factors are given for PM-10 only, the PM2.5 emission factors were assumed to be the PM-10 emission factor divided by 2.

Table 3

Summary of NOx, SO2, and VOC Emissions from Haul Road

	Trips per Day (1-way)	Road Length (mi, 1-way)	Total Distance (mi/day)	Emission Rate (g/VMT)	Emission Rate (g/s)
NOx	184	19.2	3530.5	15.7	0.6415
SO_2				0.0151	0.0006
VOC				0.655	0.0268

Notes:

Emission Rate determined from USEPA Mobile 6.1
Beaver Damn to Touquoy is 30.7 km or approximately 19.2 mi
VMT - Vehicle Miles traveled

Table 4

Background Ambient Air Monitoring Results (NAPS) 2014 - 2016

	Concentration ($\mu g/m^3$)					
24-hour PM_{10}	**25th %ile**	**50th %ile**	**75th %ile**	**90th %ile**	**Average**	**Maximum**
Lake Major (030120)	—	—	—	—	—	—
Port Hawkesbury (030201)	—	—	—	—	—	—
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	3.0	6.0	14.0	**31.0**	14.1	176.0
24-hour $PM_{2.5}$						
Lake Major (030120)	3.0	5.0	6.0	8.0	5.4	24
Port Hawkesbury (030201)	4.0	5.0	7.0	**9.0**	5.7	31
Aylesford Mountain (030701)	4.0	5.0	7.0	8.0	5.7	23
Pictou (030901)	4.0	5.0	8.0	12.0	6.7	37
Norman Wells, NWT (129102)	1.0	2.0	3.0	5.0	3.5	85
1-hour NO_2						
Lake Major (030120)	0.0	1.9	3.8	5.6	2.8	47.0
Port Hawkesbury (030201)	0.0	1.9	3.8	**9.4**	3.4	79.0
Aylesford Mountain (030701)	0.0	0.0	0.0	1.9	0.6	13.2
Pictou (030901)	0.0	1.9	1.9	5.6	2.2	39.5
Norman Wells, NWT (129102)	0.0	0.0	1.9	7.5	3.6	73.4
24-hour NO_2						
Lake Major (030120)	1.9	1.9	3.8	5.6	2.7	11.3
Port Hawkesbury (030201)	0.0	1.9	5.6	**7.5**	3.3	28.2
Aylesford Mountain (030701)	0.0	0.0	0.0	1.9	0.5	5.6
Pictou (030901)	0.0	1.9	3.8	3.8	2.2	13.2
Norman Wells, NWT (129102)	0.0	1.9	3.8	9.4	3.5	30.1
1-hour SO_2						
Lake Major (030120)	0.0	0.0	0.0	2.6	0.4	62.8
Port Hawkesbury (030201)	0.0	0.0	2.6	**2.6**	1.9	222.5
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	0.0	0.0	2.6	2.6	0.7	5.2
24-hour SO_2						
Lake Major (030120)	0.0	0.0	0.0	2.6	0.3	7.9
Port Hawkesbury (030201)	0.0	0.0	2.6	**5.2**	1.9	31.4
Aylesford Mountain (030701)	—	—	—	—	—	—
Pictou (030901)	—	—	—	—	—	—
Norman Wells, NWT (129102)	0.0	0.0	0.0	2.6	0.5	2.6

Note:
Values in **BOLD** are the identified concentrations used to define "background" for this assessment.

Table 5

Beaver Dam Air Quality Sampling

Location	Program Date	24-hour TSP ($\mu g/m^3$)	24-hour PM_{10} ($\mu g/m^3$)
Location #1	June 5-6, 2008	19.4	9.1
Location #2	June 5-6, 2008	**41.7**	13.1
Location #3	June 5-6, 2008	12.9	7.1
AN#1	October 20-21, 2014	6.9	-
AN#2	October 20-21, 2014	4.6	-
AN#3	October 20-21, 2014	1.7	-
AN#4	October 20-21, 2014	3.9	-
Beaver Dam Road	September 7-8, 2016	9.7	-
Mooseland Road	September 7-8, 2016	5.8	-
Location # 1 (Touquoy)	3-Jan-07	11.6	-
Location # 2 (Touquoy)	3-Jan-07	10.5	-
Location # 3 (Touquoy)	4-Jan-07	14	-
Location # 4 (Touquoy)	4-Jan-07	16.1	-
Location # 5 (Touquoy)	4-Jan-07	14.4	-
Average		**12.4**	Ins.

Note:
Three measurements (for PM_{10}) are insufficient to provide a useful maximum or average background concentration
Values in **BOLD** are the identified concentrations used to define "background" for this assessment.

Table 6

Ambient Air Quality Criteria

Substance	Averaging Period	Nova Scotia (A) (µg/m^3)	Ontario (B) (µg/m^3)	CAAQS (C) (µg/m^3)	Selected for this Assessment (µg/m^3)
TSP	24-hour	120	120	—	120
	Annual (1)	70	—	—	70
PM_{10}	24-hour (2)	—	50	—	50
$PM_{2.5}$	24-hour (3) 24-hour (2020) (3)	— —	— —	28 27	27
	Annual (4) Annual (2020) (4)	— —	— —	10 8.8	8.8
NO_2	1-hour 1-hour (2020) (5) 1-hour (2025) (5)	400 — —	400 — —	— 112.9 79.0	400
	24-hour	—	200	—	200
	Annual Annual (2020) Annual (2025)	100 — —	— — —	— 32.0 22.6	100
SO_2	1-hour 1-hour (2020) (6) 1-hour (2023) 1-hour (2025) (6)	900 — — —	690 — 100 —	— 183.2 — 170.1	900
	24-hour 24-hour (2023)	300 —	275 —	— —	300
	Annual Annual (2020) Annual (2023) Annual (2025)	60 — — —	— — 10 —	— 13.1 — 10.5	60
VOC	—	—	—	—	—

Notes:
(A) https://novascotia.ca/just/regulations/regs/envairqt.htm Accessed February, 2019.
(B) MECP (Ontario), 2018
(C) https://www.ccme.ca/en/resources/air Accessed February, 2019.
(1) Geometric mean.
(2) Interim standard, never implemented.
(3) The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations.
(4) The 3-year average of the annual average concentrations.
(5) Three-year average of the annual 98th percentile of the NO2 daily-maximum 1-hour average concentrations
(6) The 3-year average of the annual 99th percentile of the SO2 daily-maximum 1-hour average concentrations.

Table 7

Maximum Predicted Concentrations due to Haul Road Emissions

Contaminant	Maximum Predicted Concentration ($\mu g/m^3$)	Averaging Period	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria (%)	Background Concentration ($\mu g/m^3$)	Modelled Concentration and Background Concentration ($\mu g/m^3$)	Percentage of Limit (%)
Total Suspended Particulate	**251.1**	24 hour	120	**209%**	41.7	**292.8**	**244%**
	84.4	Annual	70	**121%**	12.4	**96.7**	**138%**
PM_{10}	**146.3**	24 hour	50	**293%**	31.0	**177.3**	**355%**
$PM_{2.5}$	16.2	24 hour	27	60%	9.0	25.2	93%
	5.1	Annual	8.8	58%	5.7	10.8	**123%**
NO_2	16.1	1-hour	400	4%	9.4	25.5	6%
	6.2	24-hour	200	3%	7.5	13.8	7%
	2.3	Annual	100	2%	3.3	5.6	6%
SO_2	0.02	1-hour	900	<1%	2.6	2.6	<1%
	0.006	24-hour	300	<1%	5.2	5.2	2%
	0.002	Annual	60	<1%	1.9	1.9	3%
VOC	0.7	1-hour	—	—	—	—	—
	0.3	24-hour	—	—	—	—	—
	0.1	Annual	—	—	—	—	—

Notes
Results assume 75% mitigation of the resuspended particulate from haul roads
Maximum $PM_{2.5}$ 24-hour average is shown even though Assessment Criteria is based on 98th percentile.
Maximum $PM_{2.5}$ annual average is the average of the highest 3 consecutive years, as predicted by AERMOD.
Maximum predicted concentrations are shown for NO_2, SO_2 and VOC (even though Assessment Criteria may be based on 98th or 99th percentiles).
Values in **BOLD** exceed the identified assessment criteria.
PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Table 8

Maximum Predicted Concentrations due to Beaver Dam Site Operations

Contaminant	Maximum Predicted Concentration ($\mu g/m^3$)	Averaging Period	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria (%)	Background Concentration ($\mu g/m^3$)	Modelled Concentration and Background Concentration ($\mu g/m^3$)	Percentage of Limit (%)
Total Suspended Particulate	3.8	24 hour	120	3%	41.7	45.5	38%
	0.8	Annual	70	1%	12.4	13.2	19%
PM_{10}	3.7	24 hour	50	7%	31.0	34.7	69%
$PM_{2.5}$	1.4	24 hour	27	5%	9.0	10.4	39%
	0.3	Annual	8.8	3%	5.7	6.0	68%

Notes

PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Table 9

Maximum Predicted Concentrations due to Touquoy Site Operations

Contaminant	Maximum Predicted Concentration ($\mu g/m^3$)	Averaging Period	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria (%)	Background Concentration ($\mu g/m^3$)	Modelled Concentration and Background Concentration ($\mu g/m^3$)	Percentage of Limit (%)
Total Suspended Particulate	3.1	24 hour	120	3%	41.7	44.8	37%
	1.1	Annual	70	2%	12.4	13.4	19%
PM_{10}	3.1	24 hour	50	6%	31.0	34.1	68%
$PM_{2.5}$	1.3	24 hour	27	5%	9.0	10.3	38%
	0.4	Annual	8.8	5%	5.7	6.1	70%

Notes

PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Appendix A

Table A-1

Maximum Predicted Concentrations and Deposition for the Overall Project

Contaminant	Maximum Predicted Concentration ($\mu g/m^3$)	Averaging Period	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria (%)	Background Concentration ($\mu g/m^3$)	Modelled Concentration and Background Concentration ($\mu g/m^3$)	Percentage of Limit (%)
Total Suspended Particulate	**251.1**	24 hour	120	**209%**	41.7	**292.8**	**244%**
	84.4	Annual	70	**121%**	12.4	**96.7**	**138%**
PM_{10}	**146.3**	24 hour	50	**293%**	31.0	177.3	**355%**
$PM_{2.5}$	16.2	24 hour	27	60%	9.0	25.2	93%
	5.2	Annual	8.8	60%	5.7	**10.9**	**124%**
NO_2	16.1	1-hour	400	4%	9.4	25.5	6%
	6.2	24-hour	200	3%	7.5	13.8	7%
	2.3	Annual	100	2%	3.3	5.6	6%
SO_2	0.02	1-hour	900	<1%	2.6	2.6	<1%
	0.006	24-hour	300	<1%	5.2	5.2	2%
	0.002	Annual	60	<1%	1.9	1.9	3%
VOC	0.7	1-hour	—	—	—	—	—
	0.3	24-hour	—	—	—	—	—
	0.1	Annual	—	—	—	—	—
Deposition ($g/m^2/yr$)	193.0	Annual	—	—	—	—	—

Notes
Results assume 75% mitigation of the resuspended particulate from haul roads
Values in **BOLD** exceed the identified assessment criteria.

Appendix Table A-2

Maximum Predicted Concentrations For Sensitive Receptor 1: Musquodoboit Lumber Company

Contaminant	Maximum Predicted Concentration (µg/m³)	Averaging Period	Assessment Criteria (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Modelled Concentration and Background Concentration (µg/m³)	Percentage of Limit (%)
Total Suspended Particulate	15.0	24 hour	120	13%	41.7	56.7	47%
	3.5	Annual	70	5%	12.4	15.9	23%
PM_{10}	13.0	24 hour	50	26%	31.0	44.0	88%
$PM_{2.5}$	2.1	24 hour	27	8%	9.0	11.1	41%
	0.5	Annual	8.8	6%	5.7	6.2	71%
Deposition ($g/m^2/yr$)	13.2	Annual	—	—	—	—	—

Notes
Results assume 75% mitigation of the resuspended particulate from haul roads
PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Appendix Table A-3

Maximum Predicted Concentrations For Sensitive Receptor 2: Deepwood Estates

Contaminant	Maximum Predicted Concentration ($\mu g/m^3$)	Averaging Period	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria (%)	Background Concentration ($\mu g/m^3$)	Modelled Concentration and Background Concentration ($\mu g/m^3$)	Percentage of Limit (%)
Total Suspended Particulate	92.0	24 hour	120	77%	41.7	**133.7**	**111%**
	31.5	Annual	70	45%	12.4	43.8	63%
PM_{10}	**82.1**	24 hour	50	**164%**	31.0	**113.1**	**226%**
$PM_{2.5}$	9.7	24 hour	27	36%	9.0	18.7	69%
	2.7	Annual	8.8	30%	5.7	8.4	95%
Deposition ($g/m^2/yr$)	72.5	Annual	—	—	—	—	—

Notes
Results assume 75% mitigation of the resuspended particulate from haul roads
Values in **BOLD** exceed the identified assessment criteria.
PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Appendix Table A-4

Maximum Predicted Concentrations For Sensitive Receptor 3: 9 Beaver Dam Mines Road

Contaminant	Maximum Predicted Concentration (µg/m³)	Averaging Period	Assessment Criteria (µg/m³)	Percentage of Assessment Criteria (%)	Background Concentration (µg/m³)	Modelled Concentration and Background Concentration (µg/m³)	Percentage of Limit (%)
Total Suspended Particulate	25.6	24 hour	120	21%	41.7	67.3	56%
	9.6	Annual	70	14%	12.4	22.0	31%
PM_{10}	41.1	24 hour	50	82%	31.0	72.1	**144%**
$PM_{2.5}$	5.3	24 hour	27	20%	9.0	14.3	53%
	1.3	Annual	8.8	15%	5.7	7.0	80%
Deposition ($g/m^2/yr$)	23.2	Annual	—	—	—	—	—

Notes
Results assume 75% mitigation of the resuspended particulate from haul roads
Values in **BOLD** exceed the identified assessment criteria.
PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Appendix Table A-5

Maximum Predicted Concentrations For Sensitive Receptor 4: 3373 Highway 224

Contaminant	Maximum Predicted Concentration ($\mu g/m^3$)	Averaging Period	Assessment Criteria ($\mu g/m^3$)	Percentage of Assessment Criteria (%)	Background Concentration ($\mu g/m^3$)	Modelled Concentration and Background Concentration ($\mu g/m^3$)	Percentage of Limit (%)
Total Suspended Particulate	5.5	24 hour	120	5%	62.0	67.5	56%
	1.3	Annual	70	2%	28.2	29.4	42%
PM_{10}	7.9	24 hour	50	16%	31.0	38.9	78%
$PM_{2.5}$	1.3	24 hour	27	5%	9.0	10.3	38%
	0.3	Annual	8.8	4%	5.7	6.0	69%
Deposition ($g/m^2/yr$)	23.5	Annual	—	—	—	—	—

Notes
Results assume 75% mitigation of the resuspended particulate from haul roads
PM_{10} is not a regulated compound in Nova Scotia, Ontario's interim Ambient Air Quality Criteria is provided for context.

Appendix C.2

Evaluation of Exposure Potential Related to Dust Deposition from Haul Road Traffic onto Soils, Berries, and Vegetation

SCIENCE INTEGRITY KNOWLEDGE

EVALUATION OF EXPOSURE POTENTIAL RELATED TO DUST DEPOSITION FROM HAUL ROAD TRAFFIC ONTO SOILS BERRIES AND VEGETATION

Atlantic Mining NS Beaver Dam Mine Project

Technical Supporting Document

FINAL REPORT

January 15 2019

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EVALUATION OF EXPOSURE POTENTIAL RELATED TO DUST DEPOSITION FROM HAUL ROAD TRAFFIC ONTO SOILS, BERRIES AND VEGETATION

Table of Contents

Page

List of Tables

List of Figures

List of Appendices

EVALUATION OF EXPOSURE POTENTIAL RELATED TO DUST DEPOSITION FROM HAUL ROAD TRAFFIC ONTO SOILS, BERRIES AND VEGETATION

1 INTRODUCTION

The Beaver Dam Mine Site will involve the construction, operation, and decommissioning of a surface gold mine at Marinette, Nova Scotia, if this project is approved. The proposed mine will be a surface mine and is proposed to include mine Haul Roads and associated mine infrastructure for crushing and haul-out (*e.g.* on-site power generation and local supply systems, fuel storage, temporary offices) (GHD, 2015). The proposed plan is to develop the mine, and crush the ore at the site, with subsequent trucking of the crushed ore to the approved Touquoy Mine Site for processing. The total development area of the Beaver Dam Mine Project is approximately 167 hectares (ha), which includes the ore extraction area (surface mine) (30 ha), materials storage (waste rock, overburden) (98 ha), ore stockpiles (10 ha), and the operational facilities (15 ha) (GHD, 2015).

The main elements of the Beaver Dam Mine Project are as follows (GHD, 2015):

- A surface mine from which 46.9 Mt of ore and waste rock will be excavated;
- A proposed ore extraction rate of 2 million t/y.

Due to the hauling of crushed ore from Beaver Dam Mine Site to Touquoy Mine Site, upgrades to existing road infrastructure, such as widening, improving the road base (since approximately 14.9 km of the proposed Haul Road is logging roads), ditching, bridges spanning watercourses, and other potential improvements will have to occur. The transportation route for the hauling spans 30.7 km.

With respect to project stages, the following is the anticipated operations and closure timings:

- Site preparation and construction (year 1)
- Operation (years 2-5)
  - Pre-production (8 months)
  - Full production (3.3 years)
- Decommissioning and reclamation (years 6 to 8 and beyond)

An Environmental Assessment commenced in 2015, and an Environmental Impact Statement (EIS) for the Beaver Dam Mine Site was submitted for review to both the Canadian Environmental Assessment Agency (CEAA) and Nova Scotia Environment (NSE) in 2017. In response to the EIS, Information Requests (IRs) were issued by government.

This report is focused on an IR related to dust deposition, and potential implications for harvesting and consumption of vegetation for traditional purposes by Indigenous peoples in the area of the Beaver Dam Project was as follows:

"Evaluate the potential for dust deposition and subsequent consumption of vegetation (including consumption of metals in dusts) if plants are being harvested and consumed for traditional

purposes by Indigenous peoples in areas where fugitive dust emissions may be a concern (e.g. near haul roads)"

Therefore, the purpose of this report is to provide an assessment of potential human health impacts related to contaminants released via ore dust deposition (largely through fugitive dusting events along the Haul Road), in order to address the IR outlined above. This report assesses the potential for deposited dust, released via transportation of crushed ore, to change the chemistry of soils in the area, and whether that dust has the potential to accumulate in or on vegetation that may be consumed by humans, as well as human consumption of vegetation.

The assessment approach used in this report follows a standard screening level risk assessment approach, wherein future soil, berry and vegetation leaf concentrations are predicted based on predictions related to dust deposition over the operational period of the proposed facility. Dust deposition estimates are provided by GHD (2018) in response to other IRs. The predicted future soil concentrations are developed using standardized approaches, and are compared to both ecological and human health soil quality guidelines, as well as maximum baseline soil data, to identify any concerns and to provide perspective on potential increment change, as a result of operations. The predicted future vegetation concentrations are also derived using standardized equations, and are compared to maximum baseline concentrations. Possible consumption rates for vegetation are identified from the First Nations Food, Nutrition & Environment Study (FNFNES), results from the Atlantic region (Chan et al, 2017). Possible exposure and risks associated with consumption are evaluated using standardized methods (Health Canada, 2012).

This report focuses on dust deposition in areas outside the active operations of the Project (referred to as Potential Development Areas, or PDA), since these areas are most likely to be used for foraging activities by humans.

Since the vast majority of dusts generated from the Project are expected to be related to the transportation along Haul Roads, the chemical composition of the dust considered in this report is specifically associated with source of metals in road construction, which is proposed to be waste rock related to mining activities at the Beaver Dam Mine Site. Other sources for Haul Road construction may be used (such as rock from local quarry pits), but it was assumed that the geochemistry of waste rock would represent a reasonable base case characterization of metals dust levels, relative to other quarry sources. No other chemical analytes associated with Project emissions are considered in this report.

This report provides a brief overview of existing baseline monitoring programs related to the Haul Road (for the purposes of characterizing the geochemistry of baseline soils, berries and vegetation) (Section 2.0); characterization of dust geochemistry, and selection of Chemicals of Potential Concern (COPCs) (Section 3.0); predicted future dust deposition as a result of the proposed mine and Haul Road (Section 4.0); methods for predicting future soil, berry and vegetation concentrations, as well as human exposures are provided in Section 5.0; an assessment of metals in dusts on soils and vegetation based on dust deposition along the Haul Road (Section 6.0); an assessment of human exposure potential to trace metals in dusts related to local vegetation consumption (Section 7.0), and Conclusions and Uncertainties (Section 8.0). References cited are provided in Section 9.0.

2 BASELINE ENVIRONMENTAL MONITORING DATA (SOILS, BERRIES AND VEGETATION)

Baseline metals sampling in soil and vegetation were originally conducted in August of 2018 along the Haul Road by McCallum Environmental. At soil sampling stations, berries and vegetation (leaves) were also collected. Leaves and berries were sent to the laboratory without any rinsing or washing. Figure 1 identifies the sampling stations, and Table 2-1 provides details on the samples collected.

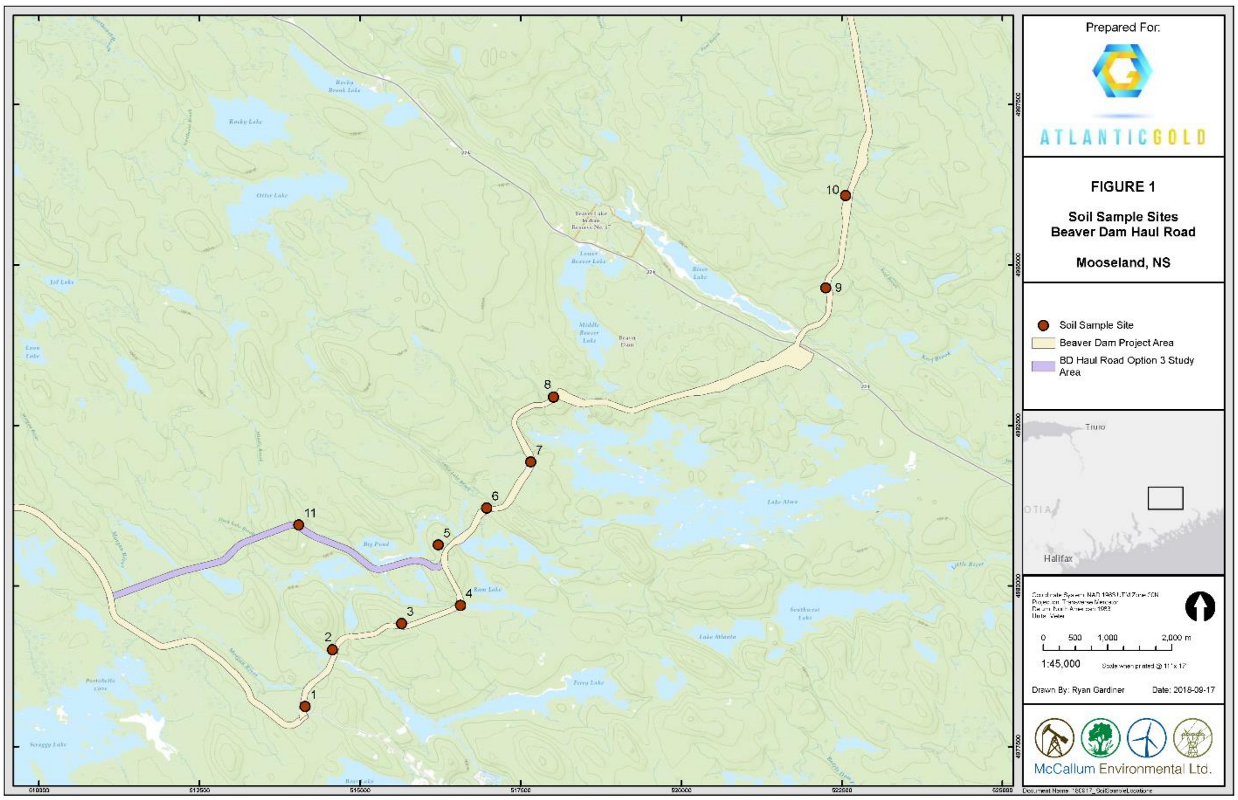


Figure 2-1 Soil, Berry and Vegetation Sampling Stations for Baseline Data Collection

Table 2-1 Sampling Locations, Distance from Haul Road, Berry and Vegetation Type, Sample Numbers and Depth

Site ID	*Distance from Road (m)*	*Berry Type*	*# of Berries Collected*	*Vegetation Type*	*Soil Sample Depth Range (cm)*
1	40	Blueberry	20	Blueberry Leaves	10 - 40
2	50	Raspberry	14	Raspberry Leaves	5 - 30
3	25	Blueberry	20	Blueberry Leaves	1 - 20
4	30	Cranberry	20	Sweet Gale Leaves	1 - 20
5	40	Raspberry	15	Raspberry Leaves	3 - 25
6	20	Blackberry	16	Blackberry Leaves	5 - 35
7	20	Bunch Berry	31	Bunch Berry Leaves	5 - 20
8	20	Black Huckle Berry	8	Black Huckle Berry Leaves	20 - 35
9	20	Raspberry	13	Raspberry Leaves	3 - 20
10	25	Blackberry	20	Blackberry Leaves	3 - 25
11	30	Blackberry	11	Blackberry Leaves	10 - 30

Note: all samples were collected on August 31, 2018, with the exception of Sample 11, which was collected on September 5, 2018.
Species names are as follows: Blackberry: *Rubus alleghaniensis*; Black Huckle Berry: *Gaylussacia baccata*; Blueberry: *Vaccinium myrtilloides*; Bunch Berry: *Cornus Canadensis*; Cranberry *Vaccinium macrocarpon*: Raspberry: *Rubus idaeus*; Sweet Gale:*Myrica gale*

The baseline soil, berry and vegetation samples were analyzed by RPC Laboratories in Fredericton, NB for available metals (see Appendix A for laboratory data sheets). Analytical results from these samples are provided in Tables 2-2 (soil), 2-3 (berry) and 2-4 (vegetation).

Table 2-2 Baseline Soil Metal Concentrations in mg/kg (dry weight)

Total Metals by ICPMS	*# Detected (of 11)*	*Min*	*Max*	*Average*	*90th Percentile*
Aluminum	11	2060	27400	9402	22400
Antimony	0	<0.1	<0.1	NC	NC
Arsenic	7	<1	14	4	10
Barium	11	6	49	21.8	35
Beryllium	5	<0.1	0.5	0.145	0.4
Bismuth	1	<1	1	0.545	0.5
Boron	6	<1	3	1.41	3
Cadmium	11	0.01	0.16	0.0673	0.11
Calcium	11	90	830	306	610
Chromium	11	2	26	10.2	21
Cobalt	11	0.3	20	4.36	10.2
Copper	10	<1	11	4.23	10
Iron	11	1340	44700	15571	32400
Lead	11	2.9	16.6	9.3	16.4
Lithium	11	1.2	53.9	11.6	29.6

Magnesium	11	210	4500	1532	2850
Manganese	11	27	3450	543	801
Mercury	11	0.01	0.16	0.0627	0.1
Molybdenum	4	<0.1	0.8	0.223	0.5
Nickel	10	<1	18	6.32	14
Potassium	11	120	1020	435	870
Rubidium	11	1.5	26.3	7.96	15
Selenium	3	<1	2	0.909	2
Silver	2	<0.1	0.3	0.0773	0.1
Sodium	2	<50	60	30.5	50
Strontium	11	2	10	6	9
Tellurium	0	<0.1	<0.1	NC	NC
Thallium	1	<0.1	0.2	0.0636	0.05
Tin	0	<1	<1	NC	NC
Uranium	11	0.2	1.2	0.509	0.9
Vanadium	11	3	40	18.6	35
Zinc	11	2	57	17.2	36
Carbon - Organic	11	0.83	9.58	4.07	7.11

Notes:
n = 11
Averages and 90th percentiles were calculated assuming chemicals which were not detected were present at ½ of the detection limit
< sign indicates chemical was not detected, value provided is the reportable detection limit
NC – indicates not calculated. Chemical was not detected in any samples.

Table 2-3 Baseline Berry Metal Concentrations in mg/kg (wet weight)

Total Metals by ICPMS	*# Detected (of 11)*	*Min*	*Max*	*Average*	*90th Percentile*
Aluminum	11	0.2	3.3	1.52	3.1
Antimony	0	<0.005	<0.005	NC	NC
Arsenic	0	<0.02	<0.02	NC	NC
Barium	11	0.52	2.93	1.50	2.55
Beryllium	0	<0.005	<0.005	NC	NC
Bismuth	0	<0.05	<0.05	NC	NC
Boron	11	0.64	3.24	1.85	3.05
Cadmium	9	<0.0005	0.0271	0.0124	0.0268
Calcium	11	136	648	281	424
Chromium	10	<0.02	0.11	0.0509	0.08
Cobalt	7	<0.002	0.052	0.0111	0.024
Copper	11	0.25	1.72	0.82	1.16
Iron	11	1	8	4.18	6
Lead	6	<0.002	0.013	0.00282	0.003

Lithium	7	<0.002	0.012	0.00318	0.006
Magnesium	11	70.8	412	220	350
Manganese	11	1.76	112	54.8	97.3
Mercury	0	<0.01	<0.01	NC	NC
Molybdenum	11	0.009	0.052	0.0287	0.046
Nickel	11	0.04	0.82	0.302	0.56
Potassium	11	752	2310	1533	2230
Rubidium	11	2.64	20.1	8.66	13.7
Selenium	0	<0.05	<0.05	NC	NC
Silver	0	<0.005	<0.005	NC	NC
Sodium	11	5	27	15.5	22
Strontium	11	0.87	8.68	2.33	3.72
Tellurium	0	<0.002	<0.002	NC	NC
Thallium	0	<0.002	<0.002	NC	NC
Tin	11	0.017	3.63	0.952	2.15
Uranium	0	<0.002	<0.002	NC	NC
Vanadium	0	<0.02	<0.02	NC	NC
Zinc	11	0.68	5.51	2.19	4.16
% Moisture	--	81.3	91.9	85.1	88.8

Notes:
n = 11
Averages and 90th percentiles were calculated assuming chemicals which were not detected were present at ½ of the detection limit
< sign indicates chemical was not detected, value provided is the reportable detection limit
NC – indicates not calculated. Chemical was not detected in any samples.

Table 2-4 Baseline Vegetation (Leaves) Metal Concentrations in mg/kg (wet weight)

Total Metals by ICPMS	*# Detected (of 11)*	*Min*	*Max*	*Average*	*90th Percentile*
Aluminum	11	7.6	208.0	46.2	70.6
Antimony	0	<0.005	<0.005	NC	NC
Arsenic	1	<0.02	0.04	0.013	0.010
Barium	11	8.5	46.5	24.3	37.4
Beryllium	0	<0.005	<0.005	NC	NC
Bismuth	0	<0.05	<0.05	NC	NC
Boron	11	8.4	25.1	13.3	19.0
Cadmium	11	0.0009	0.0765	0.0274	0.0593
Calcium	11	1150	8910	3196	4120
Chromium	11	0.03	0.14	0.059	0.08
Cobalt	11	0.005	0.069	0.0249	0.053
Copper	11	0.62	3.39	1.66	2.35
Iron	11	17	43	25.3	34.0
Lead	11	0.009	0.327	0.048	0.045
Lithium	11	0.006	0.149	0.027	0.036
Magnesium	11	570	2610	1217	1840
Manganese	11	30.5	1440	751	1430
Mercury	0	<0.01	<0.01	NC	NC
Molybdenum	11	0.01	0.119	0.0481	0.0870
Nickel	11	0.14	0.94	0.57	0.88
Potassium	11	980	3270	2232	3250
Rubidium	11	3.28	25.8	9.0	14.6
Selenium	1	<0.05	0.11	0.0327	0.0250
Silver	0	<0.005	<0.005	NC	NC
Sodium	11	6.0	365.0	44.4	23.0
Strontium	11	8.0	68.1	24.1	30.6
Tellurium	0	<0.002	<0.002	NC	NC
Thallium	4	<0.002	0.0220	0.0034	0.0040
Tin	11	0.006	0.062	0.023	0.055
Uranium	0	<0.002	<0.002	NC	NC
Vanadium	3	<0.02	0.05	0.02	0.04
Zinc	11	2.5	13.3	6.6	11.0
% Moisture	--	55.8	78.2	68.1	77.3

Notes:
n = 11
Averages and 90th percentiles were calculated assuming chemicals which were not detected were present at ½ of the detection limit

< sign indicates chemical was not detected, value provided is the reportable detection limit
NC – indicates not calculated. Chemical was not detected in any samples.

To characterize baseline soil, berry and vegetation concentrations, the 90th percentile value from Tables 2-2, 2-3 and 2-4 were used in the assessment, respectively. Where chemical concentrations were not detected in any soil samples, ½ of the detection limit was used in the assessment. Where chemical concentrations were not detected in any berry or leafy vegetation samples, baseline concentrations were predicted using literature-based bio concentration factors from the US EPA OSW (2005) and Baes et al. (1984).

3 GEOCHEMISTRY OF DUST AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

3.1 Geochemistry Characterization of Future Dust

The source material for Haul Road construction could include either local quarry materials, or waste rock from the Beaver Dam Mine Site. Geochemistry data from waste rock at Beaver Dam Mine Site was used to characterize metals concentrations on dust.

Lorax (2017) conducted geochemistry analysis on 30 samples of waste rock. To characterize metals concentrations on dust, an average concentration (geometric mean) was calculated for each element, and this value was converted from a mg/kg (ppm) concentration to percent. Non-detected elements were assumed to be present at one-half of the detection limit for these calculations. Appendix B provides the raw geochemistry data, statistical analysis, and final percent concentrations calculated to represent elemental levels on dust.

3.2 Selection of Chemicals of Potential Concern (COPCs)

The selection of COPCs for the evaluation considers both the potential chemistry of the dust (based on waste rock chemistry), as well as the baseline chemistry of selected media, such as soil, berries, and leaves. Waste rock were analyzed for a suite of thirty-five (35) metals (see Appendix B); whereas, soil, berries, and leaves were analyzed for a suite of thirty-two (32) metals (see Section 2.0; Appendix A).

To identify COPCs for the assessment, both datasets were examined. Select metals were excluded as COPC in the assessment due to the following reasons:

- Several elements are essential nutrients, and hence are regulated by the body and unlikely to be associated with adverse health effects (*i.e.*, calcium, iron, magnesium, phosphorus, potassium, and sodium) (US EPA, 2014);
- Other elements were not detected in any of the waste rock samples or were only detected in one (1) of thirty (30) waste rock samples (*i.e.*, bismuth, thallium, thorium, tungsten, and uranium). These circumstances were considered to not represent situations meriting further investigation, since the element is not present in measurable concentrations within the source material of the dust. The exception to this was cadmium, which was detected in one sample in the waste rock analysis. Cadmium was included as a COPC, due to the potential for bioaccumulation of this element;

- Some elements are considered to be of low toxicity relative to human health (*i.e.*, sulfur and titanium); and therefore were not considered further, titanium (in the form of titanium dioxide) is approved as a food additive by JECFA, SCF, and EFSA and reportedly there are no safety concerns associated with the use of this compound at concentrations ranging up to 3% (US EPA, 2005);
- Some elements were analyzed in environmental media but were not analyzed in waste rock samples (*i.e.*, lithium, rubidium, selenium, tellurium, and tin). These elements were excluded due to the lack of data to predict future media concentrations from the deposition of dust. Although there is some uncertainty with this exclusion, these elements are unlikely to be dominant in the dust, and, were either not detected or detected at low levels in environmental media; and,
- Several elements were analyzed in the waste rock samples, but have no environmental baseline data in either soils or berries. These elements include gallium, lanthanum, and scandium. The percent of these elements on dust is extremely low (gallium: 0.000983%; lanthanum: 0.002533%; scandium: 0.00054%; see Appendix B), and hence, these elements were not considered to represent COPC as the incremental future concentrations would be very low.

The remaining elements carried forward to predict possible incremental changes to soil and vegetation were identified as COPCs and were carried forward in the assessment (see Table 3-1). The percent composition of these elements within the waste rock is also presented in Table 3-1.

Table 3-1 Chemicals Considered in the Screening Level Risk Assessment

Chemicals of Potential Concern	*Percent Composition in Waste Rock*
Aluminum	2.14E+00
Antimony	1.05E-04
Arsenic	3.34E-03
Barium	7.82E-03
Beryllium	3.84E-05
Boron	5.24E-04
Cadmium	2.56E-05
Chromium	4.09E-03
Cobalt	1.52E-03
Copper	2.62E-03
Lead	6.88E-04
Manganese	5.44E-02
Mercury	2.50E-07
Molybdenum	6.74E-05
Nickel	3.12E-03
Silver	1.26E-05
Strontium	1.15E-03
Vanadium	4.49E-03
Zinc	7.54E-03

4 AIR DISPERSION PREDICTIONS OF FUTURE DUSTFALL AND SELECTION OF DUST DEPOSITION RATES FOR FUTURE PREDICTIONS

4.1 Air Dispersion Analysis Outcomes for Dust Deposition

The Project has the potential to generate dusts related to the surface mining operation at the Mine Site, as well as the operations related to crushed ore transport via truck (on the Haul Road). The vast majority of these dusts are expected to be generated from the mining, transportation, crushing, and stockpiling of ore. GHD (2018) has conducted an air dispersion analysis of various emissions from the operations of the Project.

Dust isopleths were provided by GHD (2018) for annual dust deposition outside the PDA of the various project areas (Touquoy Mine Site, Beaver Dam Mine Site and Haul Road). Figure 4-1 illustrates the annualized dust deposition rates for the various areas along the Haul Road, and Figure 4-2 provides deposition rates at key receptor locations where residents live or work (along the Haul Road).

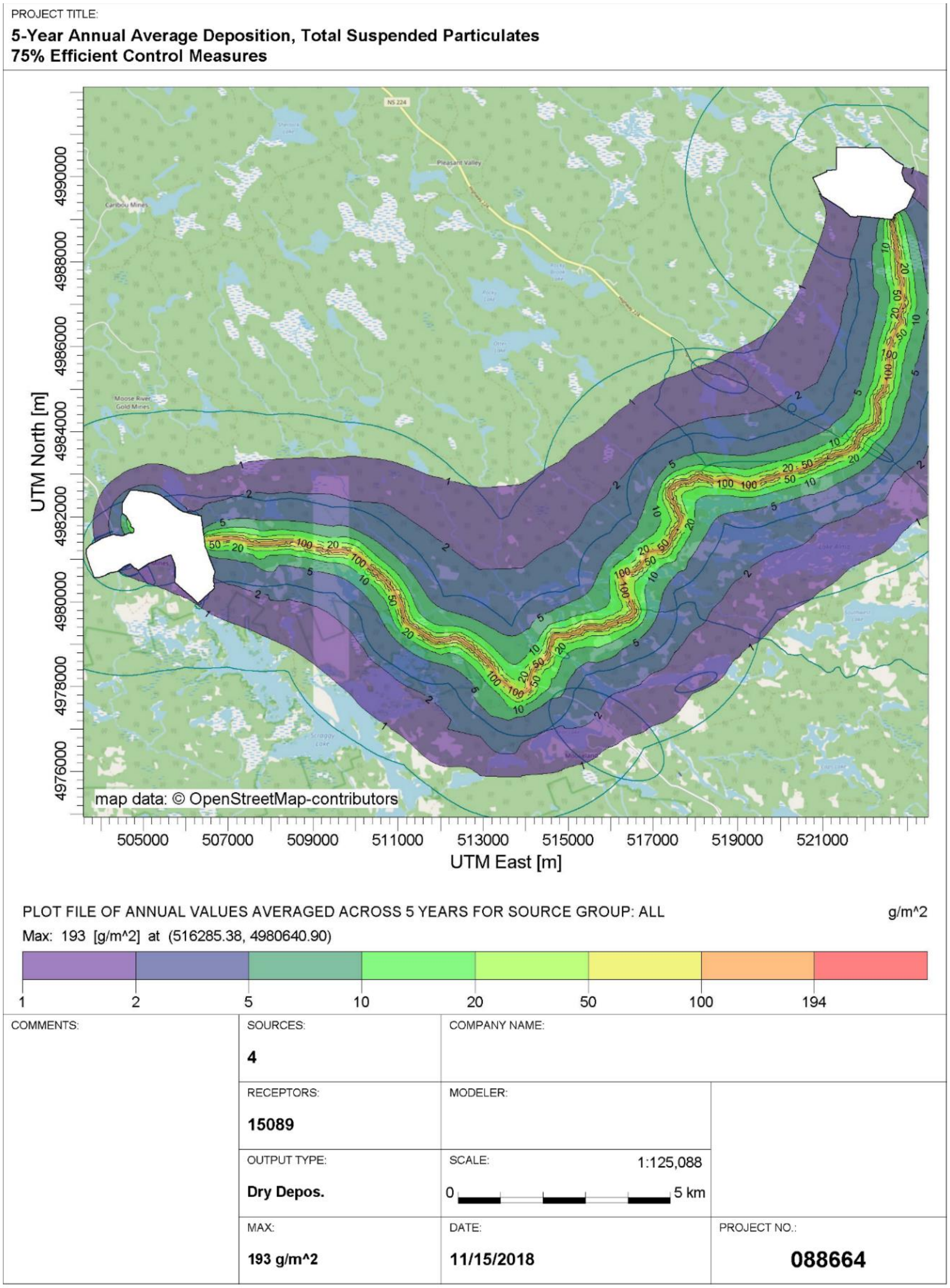
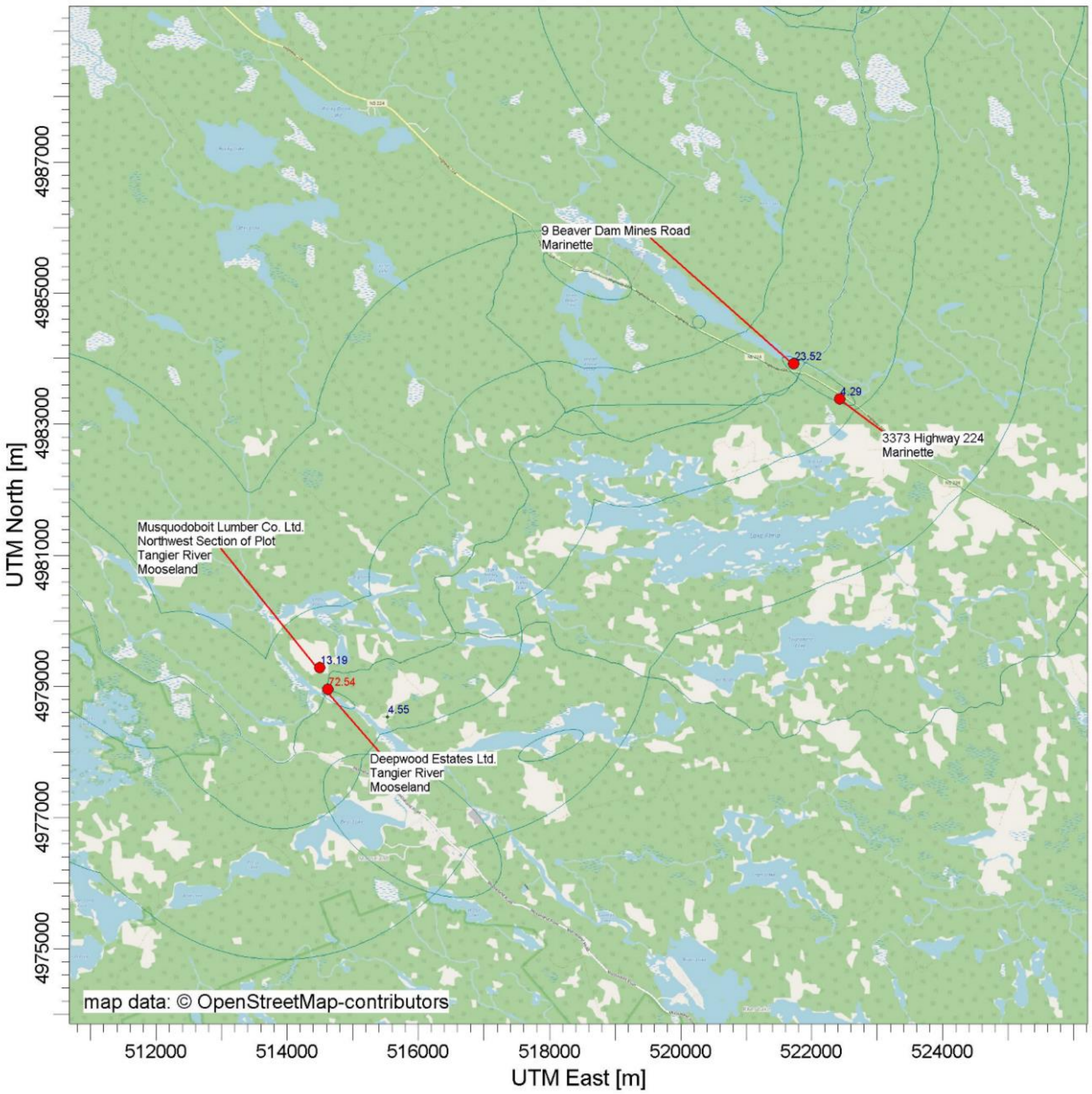


Figure 4-1 Predicted 5 Year Annual Average Dustfall at Beaver Dam Mine Site, Touquoy Mine Site and Haul Road between the Mine sites (Maximum Point of Impingement value of 193 g/m^2/year) (GHD, 2018)

PROJECT TITLE:

5-Year Annual Average Deposition at Sensitive Receptors, Total Suspended Particulates
75% Efficient Control Measures



COMMENTS:	SOURCES: **4**	COMPANY NAME:	
	RECEPTORS: **41**	MODELER:	
	OUTPUT TYPE: **Dry Depos.**	SCALE: 1:97,669 (0 – 3 km)	
	MAX: **72.5 g/m^2**	DATE: **11/15/2018**	PROJECT NO.: **088664**

Figure 4-2 Predicted 5 Year Annual Average Deposition at Sensitive Receptor Locations Along the Haul Road (GHD, 2018)

4.2 Selection of Dust Deposition Rates for Future Predictions

Based on the dust deposition predictions provided by GHD (2018), dusts are expected to settle in areas inside and outside of the PDA for each of the 3 operational areas of the Project; Touquoy Mine Site, Beaver Dam Mine Site and the connecting Haul Road. Dusts released from operational activities will be transported by air and will deposit on local soils and vegetation. The metals present in the dust will add to naturally occurring metals in soils and have the potential of being taken up into vegetation through root uptake. In addition, dusts will also deposit directly on vegetation. Some foliar uptake may occur but this is likely limited. Direct ingestion of dusts on vegetation is possible for both humans and wildlife. Based on this, humans have a potential to be exposed to dusts via consumption of food sources within areas near the mine and Haul Road. Since the areas inside the PDA have restricted access in terms of foraging (due to safety reasons), upper bound estimates of dust deposition were selected for areas either at the PDA boundary, or close to the PDA boundary, for assessment purposes.

In order to predict possible future soil concentrations in areas near the Mine Site and transportation areas, dust deposition rates had to be identified for modelling purposes. As discussed in Section 4.1, GHD modelled dust deposition for the operational period. Since dustfall is expected to be greatest during operations (particularly along the Haul Road), the dust deposition rate at the maximum point of impingement (MPOI) for areas outside the PDA was selected to evaluate the potential impact of deposition over the operational period. The PDA along the Haul Road was considered to have a 30 m boundary from the mid line of the Haul Road; therefore areas beyond 30 m were considered to be outside the PDA. With this in mind, the maximum annual average dust deposition rate over a 5 year period for areas between 30 m to 70 m distance from the Haul Road was also selected to evaluate the potential impact of deposition over the operational period. This second dust deposition rate represents deposition over a wider area wherein foraging for berries and traditional vegetation could occur, and hence, is a more realistic exposure scenario since it is unlikely that someone would forage the entire year at a single location, such as the MPOI.

Therefore, for the assessment of potential impacts, two scenarios were considered, as follows, based on modelling conducted by GHD (2018):

- For the Haul Road, a dustfall rate of 193.5 g/m^2/year was selected. This rate occurs at the MPOI along the Haul Road, and hence represents a highly conservative exposure scenario.
- A dustfall rate of 75.5 g/m^2/year was also selected, which represents the maximum annual average dust deposition rate for areas between 30 m to 70 m along the Haul Road.

Table 4-1 provides the selected dust deposition rates, as well as predicted rates of deposition at several additional receptor locations which were not modelled in the assessment, as they had lower levels of deposition.

Table 4-1 Deposition Rates at Various Receptor Locations

Location	Statistic	Deposition Rate (g/m^2/year)
All sources	Maximum	193.5
Beaver Dam	Maximum	0.529
Haul Road	Maximum	193.5
Moose River (sensitive receptors)	Maximum	0.0122
Haul Road (30 - 70 m)	Maximum annual average over 5 years	75.5
9 Beaver Dam Mines Road, Marinette	Maximum annual average over 5 years	23.52
3373 Highway 224, Marinette	Maximum annual average over 5 years	4.29
Musquodoboit Lumber Co. Ltd., Tangier River, Mooseland	Maximum annual average over 5 years	13.19
Deepwood Estates Ltd., Tangier River, Mooseland	Maximum annual average over 5 years	72.54

Note: shaded deposition rates were selected for modelling

5 POTENTIAL FUTURE SOIL, BERRY, AND LEAFY VEGETATION CONCENTRATIONS, METHODOLOGY AND OUTCOMES

5.1 Approach to Predicting Future Soil Concentrations

The approach taken to estimate future incremental soil concentrations of metals utilized the following:

- Geochemistry "fingerprint" ratios for road dust (see Appendix B,);
- Deposition rates for areas outside the PDA based on modelled estimates (see Table 4-1; Note that only the MPOI scenario and average scenario for areas 30 – 70 m from the Haul Road were modelled);
- Standardized equations from US EPA OSW (2005) used to predict changes to soils from atmospheric depositional sources. These equations are used in the vast majority of Environmental Impact Assessments to predict future impacts to soils, and associated media (such as vegetation) related to dust deposition.

The predicted increments resulting from these dust deposition rates for areas outside the PDA were subsequently added to the 90th percentile of the measured baseline soil concentrations (see Table 2-2), to calculate the potential future soil concentration.

Incremental increase in soil metal concentrations were calculated using the equations below, as suggested by the US EPA OSW (2005):

$$D_S = \left(\frac{D}{Zs \times BD}\right)$$

Where,

D_S = Annual deposition to soil over exposure duration (mg COPC/kg soil-year)
D = Yearly deposition rate of contaminant (mg/m^2-year)
Z_s = Soil mixing zone depth (assumed two depths, a shallow depth of 5 cm to represent the public health layer of soils, as per Health Canada, and a 20 cm mixing zone for root uptake, as per US EPA, 2005)
BD = Soil bulk density (Default 1.5 g/cm^3; US EPA, 2005)

Soil concentrations were calculated on a mass per mass basis (mg/kg) based on the following equation, as suggested by the US EPA (2005):

$$C_s = \frac{D_s \times [1 - \exp(-kt \times tD)]}{kt}$$

Where,

Cs = average soil concentration over deposition duration (mg/kg soil)
Ds = deposition to soil (mg COPC/kg-soil/year)
kt = chemical soil loss constant due to all processes (degradation or loss due to erosion) (yrs-1)

tD = time period over which deposition occurs (yrs)

It was conservatively assumed that no metal losses from soil (e.g., degradation, erosion, runoff), would occur once deposited, and therefore the equation for the average soil concentration over exposure duration was reduced to the following equation:

$$C_s = D_s \times tD$$

The following periods of deposition were assumed for the project:

- Project Pre-production: 8 months
- Project Operations: 3.3 years
- Total operational period assumed in model: 4 years

The calculated incremental metal soil concentrations were then added to the 90th percentile[1] of the measured baseline soil metals concentrations data (see Table 2-2), for each metal of interest.

Table 5-1 and 5-2 present the baseline, project increment alone, and the accumulated Project incremental and final total (baseline + increment) soil metals concentrations following the 4 year operational period for areas outside the PDA (*i.e.*, MPOI along the Haul Road, and areas between 30 to 70 m from the Haul Road, respectively).

Table 5-1 Baseline and Predicted Future Soil Concentrations (based on the MPOI annual deposition rate)

Metal/COPC	***Baseline Surface Soil Concentration (90th %ile) (mg/kg)***	***Incremental Contribution of Dust Deposition Outside of PDA (193.5 g/m2/year) over 4 years of operations***			
		5 cm Soil Depth		***20 cm Soil Depth***	
		Project	***Project + Baseline***	***Project***	***Project + Baseline***
Aluminum	22400	221	22600	55.1	22500
Antimony	0.05[a]	0.0108	0.0608	0.00270	0.0527
Arsenic	10	0.345	10.3	0.0863	10.1
Barium	35	0.807	35.8	0.202	35.2
Beryllium	0.4	0.00396	0.404	0.000990	0.401
Boron	3	0.0540	3.05	0.0135	3.01
Cadmium	0.11	0.00264	0.113	0.000660	0.111
Chromium	21	0.422	21.4	0.106	21.1
Cobalt	10.2	0.157	10.4	0.0393	10.2

[1] A number of regulatory agencies prefer or endorse the use of the 90th percentile for soil background or baseline concentration statistics. This would be a conservative (biased high) estimate of baseline soil concentrations in the area.

Copper	10	0.271	10.3	0.0677	10.1
Lead	16.4	0.0710	16.5	0.0178	16.4
Manganese	801	5.61	807	1.40	802
Mercury	0.1	0.0000258	0.100	0.00000645	0.100
Molybdenum	0.5	0.00695	0.507	0.00174	0.502
Nickel	14	0.322	14.3	0.0806	14.1
Silver	0.1	0.0013	0.101	0.000325	0.100
Strontium	9	0.118	9.12	0.0296	9.03
Vanadium	35	0.463	35.5	0.116	35.1
Zinc	36	0.779	36.8	0.195	36.2

Notes:
[a] Half of the detection limit presented as chemical was not detected in any samples

Table 5-2 Baseline and Predicted Future Soil Concentrations (based on the maximum annual average deposition rate for areas 30 – 70 m from the Haul Road)

Metal/COPC	*Baseline Surface Soil Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (75.5 g/m2/year) over 4 years of operations*			
		5 cm Soil Depth		*20 cm Soil Depth*	
		Project	*Project + Baseline*	*Project*	*Project + Baseline*
Aluminum	22400	86.0	22500	21.5	22400
Antimony	0.05[a]	0.00422	0.0542	0.00105	0.0511
Arsenic	10	0.135	10.1	0.0337	10.0
Barium	35	0.315	35.3	0.0787	35.1
Beryllium	0.4	0.00155	0.402	0.000386	0.400
Boron	3	0.0211	3.02	0.00527	3.01
Cadmium	0.11	0.00103	0.111	0.000258	0.110
Chromium	21	0.165	21.2	0.0412	21.0
Cobalt	10.2	0.0614	10.3	0.0153	10.2
Copper	10	0.106	10.1	0.0264	10.0
Lead	16.4	0.0277	16.4	0.00693	16.4
Manganese	801	2.19	803	0.547	802
Mercury	0.1	0.0000101	0.100	0.00000252	0.100
Molybdenum	0.5	0.00271	0.503	0.000678	0.501
Nickel	14	0.126	14.1	0.0314	14.0
Silver	0.1	0.0005	0.101	0.000127	0.100
Strontium	9	0.0462	9.05	0.0115	9.01
Vanadium	35	0.181	35.2	0.0452	35.0
Zinc	36	0.304	36.3	0.0759	36.1

Notes:
[a] Half of the detection limit presented as chemical was not detected in any results

5.2 Approach to Predicting Future Berry and Leafy Vegetation Concentrations

The approach to predicting future berry and leafy vegetation concentrations was based on the following:

- Measured baseline concentrations were used for the project (2018) and the concentrations are presented in Tables 2-3 and 2-4 for berries and leafy vegetation, respectively;
- Deposition rates for areas outside the PDA based on modelled estimates (see Section 4.2); and
- Standardized equations from US EPA OSW (2005) used to predict changes to berries and leafy vegetation from atmospheric depositional sources. These equations are used in the vast majority of Environmental Impact Assessments to predict future impacts to vegetation related to dust deposition.

The predicted increments resulting from these dust deposition rates for areas outside the PDA were subsequently added to the 90th percentile of the measured baseline berry (see Table 2-3) and leaves (see Table 2-4) concentrations, to calculate the potential future concentration.

The measured baseline vegetation concentration was correlated with the measured baseline soil concentration with a site-specific bio-concentration factor (BCF) where applicable; therefore, if soil concentrations increased then berry and leafy vegetation concentrations increased accordingly. BCF values were calculated based on the following equation:

$$BCF = \frac{C_L}{C_S}$$

Where,

BCF	=	Site-specific berry or leaf bio-concentration factor (kg-soil / kg-plant)
C_L	=	90th percentile concentration in berry or leaf (mg-COPC / kg-plant)
C_S	=	90th percentile concentration in soil (mg-COPC / kg-soil)

Site-specific BCFs could not be calculated where chemical concentrations were not detected in any of the baseline berry or leafy vegetation samples. Therefore, in these cases, literature-based BCFs from the US EPA OSW (2005) and Baes *et al*. (1984) were used instead in the assessment.

In addition to uptake of metals via soil, the future concentrations also included uptake via atmospheric deposition. The following equation was used to predict plant concentrations based on deposition (US EPA OSW 2005):

$$Pd = \frac{D \times Rp \times [1.0 - \exp(-kp \times Tp)]}{Yp \times kp}$$

Where,

Pd = plant concentration as a result of direct deposition (mg/kg DW)
D = deposition (mg/m²/yr)
Rp = intercept fraction of edible portions of plant (unitless)
kp = plant surface loss coefficient (yr-1)
Tp = length of plant exposure to deposition (yr)
Yp = yield or productivity (kg DW/m²)

The US EPA OSW (2005) recommends values for the intercept fraction of edible portions of plants (Rp) (unitless) based on two aboveground produce classes, exposed fruits and exposed vegetables. The Rp value of 0.053 for exposed fruits and the Rp value of 0.982 for exposed vegetables were assumed for the prediction of berry concentrations and leafy vegetable concentrations, respectively. The kp value is a measure of the amount of chemical lost as a result of removal by wind and water and growth dilution. The length of plant exposure was assumed to be 0.164 years or 60 days (US EPA OSW 2005). The US EPA OSW (2005) recommends a default kp value of 18 yr^{-1}, which corresponds to a 14-day half-life. Finally, the US EPA OSW (2005) recommends using a Yp value of 0.25 kg DW/m² for exposed fruits and 5.66 kg DW/m² for exposed vegetables. These values were assumed for the prediction of berry concentrations and leafy vegetable concentrations, respectively.

Predicted berry and leaf concentrations are provided in Tables 5-3 and 5-4, and include both root uptake and deposition. Note that baseline berry and leaf data were converted from wet weight (as presented in Table 2-3 and 2-4) to dry weight for calculations in the assessment, based on the average moisture content of the samples using the following equation:

$$C_{DW} = \frac{C_{WW}}{(1 - MC)}$$

Where,

C_{DW} = Concentration in berry or leaf in dry weight (mg/kg DW)
C_{WW} = Concentration in berry or leaf in wet weight (mg/kg WW)
MC = Moisture content in berry or leaf (% / 100%)

Table 5-3 Baseline and Predicted Future Berry Concentrations (mg/kg WW)

Metal/COPC	***Baseline Berry Concentration (90th %ile)***	***Incremental Contribution of Dust Deposition Outside of PDA (193.5 g/m2/year) over 4 years of operations***		***Incremental Contribution of Dust Deposition Outside of PDA (75.5 g/m2/year) over 4 years of operations***	
		Project	***Project + Baseline***	***Project***	***Project + Baseline***
Aluminum	3.1	6.9	10	2.7	5.8
Antimony	0.000239 [a]	0.000351	0.000590	0.000137	0.000376
Arsenic	0.00579 [a]	0.00663	0.0124	0.00259	0.00838
Barium	2.55	0.0399	2.59	0.0156	2.57

Beryllium	0.000155 [a]	0.000124	0.000279	0.0000485	0.000203
Boron	3.05	0.0154	3.06	0.00601	3.05
Cadmium	0.0268	0.000243	0.0270	0.0000950	0.0269
Chromium	0.080	0.0136	0.0936	0.0053	0.085
Cobalt	0.0240	0.00501	0.0290	0.00195	0.0260
Copper	1.16	0.0163	1.18	0.00637	1.17
Lead	0.00300	0.00222	0.00522	0.000868	0.00387
Manganese	97.3	0.346	97.7	0.135	97.4
Mercury	0.0135 [a]	0.00000168	0.0135	0.000000654	0.0135
Molybdenum	0.0461	0.000377	0.0464	0.000147	0.0462
Nickel	0.560	0.0133	0.573	0.00519	0.565
Silver	0.00207 [a]	0.0000473	0.00212	0.0000185	0.00209
Strontium	3.72	0.0159	3.74	0.00622	3.73
Vanadium	0.0289 [a]	0.0146	0.0434	0.00569	0.0346
Zinc	4.16	0.0468	4.21	0.0183	4.18

Notes:
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

Table 5-4 Baseline and Predicted Future Leafy Vegetation Concentrations (mg/kg WW)

Metal/COPC	*Baseline Leaf Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (193.5 g/m2/year) over 4 years of operations*		*Incremental Contribution of Dust Deposition Outside of PDA (75.5 g/m2/year) over 4 years of operations*	
		Project	*Project + Baseline*	*Project*	*Project + Baseline*
Aluminum	70.6	12.2	82.8	4.8	75.4
Antimony	0.00320 [a]	0.000763	0.00396	0.000298	0.00350
Arsenic	0.00780	0.0148	0.0226	0.0058	0.0136
Barium	37.4	0.260	37.7	0.101	37.5
Beryllium	0.00128 [a]	0.000219	0.00150	0.0000856	0.00137
Boron	19.0	0.0885	19.1	0.0346	19.0
Cadmium	0.0592	0.000499	0.0597	0.000195	0.0594
Chromium	0.0800	0.0235	0.103	0.0092	0.089
Cobalt	0.0531	0.00879	0.0619	0.0034	0.057
Copper	2.35	0.0307	2.38	0.0120	2.36
Lead	0.0450	0.00393	0.0489	0.00153	0.0465
Manganese	1430	2.81	1433	1.10	1431
Mercury	0.0288 [a]	0.00000327	0.0288	0.00000127	0.0288
Molybdenum	0.0870	0.000682	0.0877	0.000266	0.0873

Nickel	0.880	0.0227	0.903	0.00884	0.889
Silver	0.0128 [a]	0.000112	0.0129	0.0000439	0.0128
Strontium	30.6	0.107	30.7	0.0418	30.6
Vanadium	0.040	0.025	0.065	0.0099	0.050
Zinc	11.0	0.102	11.1	0.040	11.0

Notes:
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

6 ASSESSMENT OF PREDICTED CHANGE IN TRACE METALS DUE TO DUST DEPOSITION ON SOILS AND VEGETATION

6.1 Assessment Approach

A screening level assessment of predicted changes to area soils, berries and vegetation is presented in Section 6.2. The approach presents comparisons of predicted future soil concentrations to health-based soil quality guidelines (Section 6.2.1); an evaluation of potential future berry and leafy vegetation concentrations, relative to baseline berry and leafy vegetation concentrations (as there are no berry and leafy vegetation guidelines for the protection of humans via consumption) (Section 6.2.2). Conclusions are presented in Section 6.3.

6.2 Screening Level Assessment

6.2.1 Comparison of Predicted Soil Concentrations to Health-Based Soil Quality Guidelines

Total future soil concentrations (predicted increment for the operational time period of 4 years + 90^{th} percentile baseline) for the 2 sites [MPOI on Haul Road, plus the maximum annual average deposition for areas 30 – 70 m along the Haul Road] were compared to CCME soil quality guidelines (*e.g.*, CCME, 2018). In addition, predicted future soil concentrations were also compared to Nova Scotia contaminated sites pathway specific soil quality guidelines (NSE, 2014) and the maximum measured baseline soil concentrations. These comparisons were undertaken to gather perspective on whether the incremental soil concentrations, once added to baseline, will exceed soil quality guidelines or indicate a noticeable increase over maximum baseline soil concentrations.

The soil quality guidelines used in these comparisons are derived by Canadian regulatory agencies, and are widely used across Canada for determining whether or not chemicals present in soils merit further study. The soil quality guidelines used in the screening level assessment are for an agricultural land use classification (agricultural land use guidelines are the most conservative, relative to guidelines derived for all other land uses). These guidelines are suitable for rural areas. CCME soil quality guidelines were used preferentially and represent the lower of the human and ecologically-based guidelines. In addition, guidelines from Nova Scotia were also used, which are a compilation of guidelines from several jurisdictions, including the CCME. Guidelines presented from Nova Scotia were based on the soil contact/ingestion pathway protective of human health.

In addition to soil quality guideline comparisons, it is also important to consider the naturally occurring metals levels in the existing environment (*i.e.*, baseline conditions). The available baseline dataset for metals levels in soils is small (N = 11 for most elements), but this baseline data provides an indication of existing natural metals soil concentration ranges within the area of the Haul Road (see Table 2-2). The baseline soil chemistry data provides an additional benchmark of comparison to identify which metals could become noticeably elevated in local soils as a result of ore dust deposition.

Where predicted future metals soil concentrations (baseline + project increment, accumulated over the 4 year operational period considered in the assessment) are below the applicable agricultural land use soil quality guidelines, and within the range of measured baseline soil concentrations (which is the same as being less than the maximum baseline soil concentrations), there is a reasonably high degree of confidence that human health will not be adversely affected. If predicted future metals soil concentrations (baseline + project increment) are greater than both the applicable soil quality guideline and the maximum baseline soil concentration, humans are not necessarily at risk, but, further evaluation would be appropriate. Manganese lacked a soil quality guideline, and therefore comparisons could only be made to maximum baseline soil concentrations. Exceedances of future soil concentrations above the baseline maxima were considered to require further discussion/evaluation.

Table 6-1 presents a comparison of the maximum baseline and predicted future concentrations to soil quality guidelines for the 193.5 g/m^2/year dust deposition scenario along the Haul Road (based on the MPOI) and Table 6-2 presents the comparison for the 75.5 g/m^2/year dust deposition scenario for areas from 30 to 70 m from the Haul Road (based on the maximum annual average).

Table 6-1 Comparison of Baseline and Predicted Future Soil Concentrations (based on the MPOI annual deposition rate) to Provincial and Federal Soil Quality Guidelines

Metal/COPC	***Baseline Surface Soil Concentration (90th %ile) (mg/kg)***	***Incremental Contribution of Dust Deposition Outside of PDA (193.5 g/m2/year) over 4 years of operations***				***Soil Quality Guidelines***	
		5 cm Soil Depth		***20 cm Soil Depth***			
		Project	***Project + Baseline***	***Project***	***Project + Baseline***	***NSE***	***CCME***
Aluminum	**22400**	221	**22600**	55.1	**22500**	15400	n/a
Antimony	0.05	0.0108	0.0608	0.00270	0.0527	7.5	20
Arsenic	10	0.345	10.3	0.0863	10.1	31	12
Barium	35	0.807	35.8	0.202	35.2	10000	750
Beryllium	0.4	0.00396	0.404	0.000990	0.401	38	4
Boron	**3**	0.0540	**3.05**	0.0135	**3.01**	4300	2
Cadmium	0.11	0.00264	0.113	0.000660	0.111	1.4	1.4
Chromium	21	0.422	21.4	0.106	21.1	220	64
Cobalt	10.2	0.157	10.4	0.0393	10.2	22	40
Copper	10	0.271	10.3	0.0677	10.1	1100	63
Lead	16.4	0.0710	16.5	0.0178	16.4	140	70
Manganese	801	5.61	807	1.40	802	n/a	n/a
Mercury	0.1	0.0000258	0.100	0.00000645	0.100	6.6	6.6
Molybdenum	0.5	0.00695	0.507	0.00174	0.502	110	5
Nickel	14	0.322	14.3	0.0806	14.1	330	45
Silver	0.1	0.0013	0.101	0.000325	0.100	77	20
Strontium	9	0.118	9.12	0.0296	9.03	9400	n/a
Vanadium	35	0.463	35.5	0.116	35.1	39	130

Zinc	36	0.779	36.8	0.195	36.2	5600	250

Notes:
Bolded values highlighted in greyscale indicate an exceedance of soil quality guidelines
[a] Nova Scotia Environmental Quality Standards (EQS) are the soil contact/ingestion values for coarse/fine-textured soil in an agricultural land use from Nova Scotia Environment (2014)
[b] CCME Soil Quality Guidelines (SQG) are the SQG for the Protection of Environmental and Human Health for the agricultural land use from CCME (2018)

Table 6-2 Comparison of Baseline and Predicted Future Soil Concentrations (based on the maximum annual average deposition rate for areas 30 – 70 m from the Haul Road) to Provincial and Federal Soil Quality Guidelines

Metal/COPC	*Baseline Surface Soil Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (75.5 g/m2/year) over 4 years of operations*				*Soil Quality Guidelines*	
		5 cm Soil Depth		*20 cm Soil Depth*			
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	*NSE*	*CCME*
Aluminum	**22400**	86.0	**22500**	21.5	**22400**	15400	n/a
Antimony	0.05	0.00422	0.0542	0.00105	0.0511	7.5	20
Arsenic	10	0.135	10.1	0.0337	10.0	31	12
Barium	35	0.315	35.3	0.0787	35.1	10000	750
Beryllium	0.4	0.00155	0.402	0.000386	0.400	38	4
Boron	**3**	0.0211	**3.02**	0.00527	**3.01**	4300	2
Cadmium	0.11	0.00103	0.111	0.000258	0.110	1.4	1.4
Chromium	21	0.165	21.2	0.0412	21.0	220	64
Cobalt	10.2	0.0614	10.3	0.0153	10.2	22	40
Copper	10	0.106	10.1	0.0264	10.0	1100	63
Lead	16.4	0.0277	16.4	0.00693	16.4	140	70
Manganese	801	2.19	803	0.547	802	n/a	n/a
Mercury	0.1	0.0000101	0.100	0.00000252	0.100	6.6	6.6
Molybdenum	0.5	0.00271	0.503	0.000678	0.501	110	5
Nickel	14	0.126	14.1	0.0314	14.0	330	45
Silver	0.1	0.0005	0.101	0.000127	0.100	77	20
Strontium	9	0.0462	9.05	0.0115	9.01	9400	n/a
Vanadium	35	0.181	35.2	0.0452	35.0	39	130
Zinc	36	0.304	36.3	0.0759	36.1	5600	250

Notes:
Bolded values highlighted in greyscale indicate an exceedance of soil quality guidelines
[a] Nova Scotia Environmental Quality Standards (EQS) are the soil contact/ingestion values for coarse/fine-textured soil in an agricultural land use from Nova Scotia Environment (2014)
[b] CCME Soil Quality Guidelines (SQG) are the SQG for the Protection of Environmental and Human Health for the agricultural land use from CCME (2018)

Based on the comparisons presented in Table 6-1 (MPOI annual deposition rate) and 6-2 (maximum annual average deposition rate in areas 30 – 70 m from the Haul Road), none of the COPC predicted project + baseline concentrations exceed relevant soil quality guidelines, with the exception of aluminum and boron, which exceed either NSE (2014) soil quality guidelines (in the case of aluminium) or CCME soil quality guidelines (in the case of boron) in the two dust deposition scenarios. In both cases, baseline concentrations exceed the guideline, and contribute to the majority of the project + baseline soil concentrations, with the project adding very little to the total. Note that for boron, the baseline 90th percentile concentrations and predicted future Project + Baseline do not exceed the NSE (2014) guideline. The CCME boron guideline was developed in 1991, and no fact sheet describing the technical basis for this guideline is available. The NSE (2014) boron guideline is based on OMOE (2011) and is likely more recent and appropriate. Furthermore, boron was only detected in 2 of 30 waste rock samples used to predict dustfall concentrations, and only detected in 6 of 11 soil samples. Based on the predicted soil concentrations, dust deposition along the Haul Road at the MPOI and on average in areas 30 – 70 m from the Haul Road is not estimated to have a substantial effect on soil quality relative to the existing baseline aluminum and boron concentration in soil. In both cases, the predicted future soil concentrations are within the maximum baseline measured concentrations (see Table 2-2). Similarly, while manganese has no soil quality guideline, the predicted future concentrations are less than the baseline maximum concentration (see Table 2-2), and hence, no concerns are identified.

6.2.2 Comparison of Predicted Berry and Leafy Vegetation Concentrations to Maximum Baseline Concentrations

In order to evaluate the potential for accumulation of metals in berries and leafy vegetation, predictions of possible future berry and leafy vegetation concentrations were undertaken, relative to dustfall outside the PDA along the Haul Road at the MPOI (193.5 g/m^2/year) and 30 to 70 m from the Haul Road (75.5 g/m^2/year, maximum annual average over 5 years). These predictions involved the use of site-specific soil to berry and leafy vegetation uptake factors from the existing baseline data, as well as atmospheric deposition onto the plants. Since there are no regulatory benchmarks available related to berry or vegetation metals uptake, the predicted incremental concentrations are added to the 90th percentile of baseline concentrations, and compared to maximum baseline concentrations, for perspective.

Table 6-3 Comparison of Baseline and Predicted Future Berry Concentrations (mg/kg WW)

Metal/COPC	*Baseline Berry Concentration (90th %ile)*	*Incremental Contribution of Dust Deposition Outside of PDA (193.5 g/m2/year) over 4 years of operations*		*Incremental Contribution of Dust Deposition Outside of PDA (75.5 g/m2/year) over 4 years of operations*		*Max Baseline Berry Concentration*
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	
Aluminum	3.1	**6.9**	**10**	2.7	**5.8**	3.3
Antimony	0.000239 [a]	0.000351	0.000590	0.000137	0.000376	<0.005
Arsenic	0.00579 [a]	0.00663	0.0124	0.00259	0.00838	<0.02
Barium	2.55	0.0399	2.59	0.0156	2.57	2.93

Beryllium	0.000155 [a]	0.000124	0.000279	0.0000485	0.000203	<0.005
Boron	3.05	0.0154	3.06	0.00601	3.05	3.24
Cadmium	0.0268	0.000243	0.0270	0.0000950	0.0269	0.0271
Chromium	0.080	0.0136	0.0936	0.0053	0.085	0.11
Cobalt	0.0240	0.00501	0.0290	0.00195	0.0260	0.052
Copper	1.16	0.0163	1.18	0.00637	1.17	1.72
Lead	0.00300	0.00222	0.00522	0.000868	0.00387	0.013
Manganese	97.3	0.346	97.7	0.135	97.4	112
Mercury	**0.0135 [a]**	0.00000168	**0.0135**	0.000000654	**0.0135**	<0.01
Molybdenum	0.0461	0.000377	0.0464	0.000147	0.0462	0.052
Nickel	0.560	0.0133	0.573	0.00519	0.565	0.82
Silver	0.00207 [a]	0.0000473	0.00212	0.0000185	0.00209	<0.005
Strontium	3.72	0.0159	3.74	0.00622	3.73	8.68
Vanadium	**0.0289 [a]**	0.0146	**0.0434**	0.00569	**0.0346**	<0.02
Zinc	4.16	0.0468	4.21	0.0183	4.18	5.51

Notes:
Bolded values highlighted in greyscale indicate an exceedance of the maximum measured berry concentration
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

Table 6-4 Comparison of Baseline and Predicted Future Leafy Vegetation Concentrations (mg/kg WW)

Metal/COPC	*Baseline Leaf Concentration (90th %ile) (mg/kg)*	*Incremental Contribution of Dust Deposition Outside of PDA (193.5 g/m2/year) over 4 years of operations*		*Incremental Contribution of Dust Deposition Outside of PDA (75.5 g/m2/year) over 4 years of operations*		*Max Baseline Leaf Concentration*
		Project	*Project + Baseline*	*Project*	*Project + Baseline*	
Aluminum	70.6	12.2	82.8	4.8	75.4	208
Antimony	0.00320 [a]	0.000763	0.00396	0.000298	0.00350	<0.005
Arsenic	0.00780	0.0148	0.0226	0.0058	0.0136	0.04
Barium	37.4	0.260	37.7	0.101	37.5	46.5
Beryllium	0.00128 [a]	0.000219	0.00150	0.0000856	0.00137	<0.005
Boron	19.0	0.0885	19.1	0.0346	19.0	25.1
Cadmium	0.0592	0.000499	0.0597	0.000195	0.0594	0.0765
Chromium	0.0800	0.0235	0.103	0.0092	0.089	0.14
Cobalt	0.0531	0.00879	0.0619	0.0034	0.057	0.069
Copper	2.35	0.0307	2.38	0.0120	2.36	3.39
Lead	0.0450	0.00393	0.0489	0.00153	0.0465	0.327
Manganese	1430	2.81	1433	1.10	1431	1440

Mercury	**0.0288** [a]	0.00000327	**0.0288**	0.00000127	**0.0288**	<0.01
Molybdenum	0.0870	0.000682	0.0877	0.000266	0.0873	0.119
Nickel	0.880	0.0227	0.903	0.00884	0.889	0.94
Silver	**0.0128** [a]	0.000112	**0.0129**	0.0000439	**0.0128**	<0.005
Strontium	30.6	0.107	30.7	0.0418	30.6	68.1
Vanadium	0.040	0.025	**0.065**	0.0099	0.050	0.05
Zinc	11.0	0.102	11.1	0.040	11.0	13.3

Notes:
Bolded values highlighted in greyscale indicate an exceedance of the maximum measured leaf concentration
[a] Chemical was not detected in any results. Therefore, baseline concentration was predicted using a literature-based bioconcentration factor.

Based on the predicted berry concentrations (Table 6-3), all project + baseline berry concentrations were within the range of baseline with the exception of aluminum, mercury, and vanadium, which were estimated to increase in concentration above maximum baseline concentrations at the MPOI along the Haul Road (Table 6-3; 193.5 g/m^2/year deposition rate) and in areas 30 to 70 m from the Haul Road (Table 6-3; 75.5 g/m^2/year deposition rate). For mercury and vanadium, the increase in concentration is attributed to the use of the literature-based BCF to calculate a predicted baseline concentration, as mercury and vanadium were not detected in any berry samples.

Based on the predicted leafy vegetation concentrations (Table 6-4), mercury and silver were estimated to increase in concentration above maximum baseline concentrations at the MPOI along the Haul Road (Table 6-4; 193.5 g/m^2/year deposition rate) and in areas 30 to 70 m from the Haul Road (Table 6-4; 75.5 g/m^2/year deposition rate). In addition, vanadium is estimated to exceed the maximum baseline concentration at the MPOI along the Haul Road in the Project + Baseline scenario. For mercury and silver, the increase in concentration above the maximum baseline concentrations is likely an artifact of the use of literature-based BCFs to predict baseline concentrations as mercury and silver were not detected in any leaf samples. Furthermore, mercury and silver contributions from the Project are predicted to be minimal when compared to the contributions from predicted baseline concentrations. In general, the use of MPOI and maximum annual average dust deposition rates are considered to be conservative assumptions when predicting chemical concentrations in environmental media.

6.3 Summary/Conclusions for Soil, Berries and Leafy Vegetation

Based on the assessment conducted herein, the following can be concluded:

- Metals will be released from dust deposition along the proposed Haul Road and have the potential to accumulate in soils, and hence, in vegetation.
- The spatial extent of dust deposition and impact to soil is predicted to rapidly decline with increasing distance from the Haul Road.
- Future predicted soil concentrations of all metals considered in the assessment with the exception of aluminum and boron (at the MPOI along the Haul Road and in areas 30 to 70 m from the Haul Road), were below provincial and federal soil quality guidelines. For

aluminum and boron, baseline concentrations contribute to the majority of the project + baseline soil concentrations, with the project contributing minimally to the total. Based on the predicted soil concentrations, dust deposition along the Haul Road at the MPOI and on average in areas 30 to 70 m from the Haul Road are not estimated to have a substantial effect on soil quality relative to the existing baseline aluminum and boron concentration in soil. Furthermore, in either cases, the predicted future soil concentrations are within the maximum baseline measured concentrations.

- Based on the estimated future soil concentrations of all metals considered, some accumulation within vegetation is anticipated to occur, but would likely be localized to areas most affected by dust loadings which are generally limited in their spatial extent (see Figure 4-1).
- Based on the predicted berry concentrations, some chemical concentrations are estimated to exceed maximum baseline concentrations at the MPOI along the Haul Road and in areas 30 to 70 m from the Haul Road. However, with the exception of aluminum, these exceedances are largely due to baseline metal concentrations (which were predicted using literature-based BCFs) and are unrelated to dustfall from the use of the Haul Road.
- Similarly, a limited number of predicted leafy vegetation concentrations are estimated to exceed maximum baseline concentrations at the MPOI along the Haul Road and in areas 30 to 70 m from the Haul Road. However, with the exception of vanadium, these exceedances are largely due to baseline metal concentrations (which were predicted using literature-based BCFs) and are unrelated to dustfall from the use of the Haul Road.

7 ASSESSMENT OF HUMAN EXPOSURES TO TRACE METALS IN DUSTS FROM CONSUMPTION OF BERRIES AND LEAFY VEGETATION

7.1 Methods

The approach to predicting human exposure from consumption of berries and leafy vegetation was based on Health Canada (2012) guidance as detailed in the sections below. Consumption rates for berries are based on the First Nations Food, Nutrition and Environment Study (FNFNES) for Atlantic Canada by Chan et al. (2017). The daily intake rate of berries/plants by adult (>18 years) heavy consumers (95th percentile) from First Nations in Atlantic Canada was used as a starting point to estimate the consumption rate for berries. This consumption rate was adjusted for the other lifestages using consumption ratios from Health Canada (1994). For leafy vegetation, an adult consumption rate for mint and Labrador tea of 3 g/day was obtained from Wein (1989) and Alberta Health and Wellness (AHW) (2007). This value was corroborated in a recent study examining the consumption of traditional plants, such as mint and Labrador tea, in two First Nations communities in northern Alberta (McAuley *et al*. 2016). The study estimated that 1-2 sprigs of mint and 3-4 dried leaves of Labrador tea were consumed by community elders on a daily basis. According to the study authors, these estimates are "within the same range as past studies completed in the Regional Municipality of Wood Buffalo, which estimated the consumption of traditional tea vegetation by adults at approximately 3 g/day" (McAuley *et al*. 2016). In the absence of site specific data, it was assumed that First Nations near the Beaver Dam Mine Site would consume comparable amounts of dried vegetation in the form of tea; therefore, these consumption rates were used to estimate exposure via the consumption of leafy vegetation, on a daily basis (as tea). The consumption rates were also adjusted based on the assumption that not all of a person's berry and leafy vegetation would come from the MPOI area. It is highly probable that harvesting from this area would be occasional and therefore, a factor of 0.5 was applied to the consumption rates to account for this site use pattern, indicating that half of all berry and leafy vegetation would be harvested from this specific area. In addition, to provide a more realistic scenario, metal concentrations in berry and leafy vegetation over an area ranging from 30 m to 70 m from the Haul Road were predicted and it was assumed that all of a person's berry and leafy vegetation would come from this area. Table 7-1 presents the consumption rates for berries and leafy vegetation for each lifestage.

Table 7-1 Consumption rates for Berries and Leafy Vegetation

Dust Deposition Scenario	*Environmental Media*	*Consumption Rate [a] (g/day)*				
		Infant	*Toddler*	*Child*	*Adolescent*	*Adult*
MPOI	Berries	0	3.4	8.0	6.4	9.1
	Leafy vegetation	0	0.5	0.5	1.5	1.5
30 to 70 m from the Haul Road	Berries	0	6.9	16	12.9	18.2
	Leafy vegetation	0	1.0	1.0	3.0	3.0

Notes:

a Consumption rates for berries are based on the daily intake rate of berries/plants by adult heavy consumers (95th percentile) from First Nations in the Atlantic Region of Canada. Consumption rates for other lifestages were adjusted based on consumption ratios in Health Canada (1994) for berries. Consumption rates for leafy vegetation were based on Wein (1989) and AHW (2007). Infants were not assumed to be consuming berries and leafy vegetation. For the MPOI scenario, it was assumed that half of all harvested media would be collected from this area and therefore, a factor of 0.5 was applied to the consumption rates.

Berries

The following equation was used to estimate human exposure via consumption of wild berries (Health Canada, 2012). Consumption rates used to predict berry exposures were obtained from Chan et al. (2017) and adjusted as explained previously.

$$EDI_{berry} = P_b \times IR_{berry}$$

Where:

EDI_{berry} = estimated daily intake of chemical via consumption of berries (µg/d)
Pb = chemical concentration in berries from root uptake (mg/kg WW)
IR_{berry} = berry ingestion rate (g/d)

Note, bio-accessibility of chemical in plant was assumed to be 100%.

Leafy Vegetation

The following equation was used to estimate human exposure via consumption of leafy vegetation (Health Canada, 2012). Consumption rates and equations used to predict exposures were obtained from Chan et al. (2017) and adjusted as explained previously.

$$EDI_{leaves} = C_{leaves} \times IR_{leaves}$$

Where:

EDI_{leaves} = estimated daily intake of chemical via consumption of leafy vegetation (µg/d)
C_{leaves} = total chemical concentration in leafy vegetation (mg/kg WW)
IR_{leaves} = leafy vegetation ingestion rate (g/d)

Total Human Exposure

Total exposure was calculated by summing the individual exposures from each medium (*i.e.*, berry and leafy vegetable intake) for all relevant exposure pathways on a per chemical and per life stage basis (Health Canada, 2012):

$$EDI_{total} = EDI_{berries} + EDI_{leaves}$$

Where:

EDI_{total} = total estimated daily intake of chemical via all routes (µg/d)
$EDI_{berries}$ = estimated daily intake of chemical from consumption of berries (µg/d)
EDI_{leaves} = estimated daily intake of chemical from consumption of leaves (µg/d)

Toxicity Reference Values

In the selection of exposure limits, preference was generally given to Health Canada. Where exposure limits were not available from Health Canada, they were obtained from a number of other leading scientific and regulatory authorities, including the following:

- United States Environmental Protection Agency (US EPA);
- World Health Organization (WHO);
- Health Institute of the Netherlands (RIVM); and
- JECFA (Joint FAO/WHO Expert Committee on Food Additives).

To ensure that the most defensible and appropriate exposure limit was selected for each chemical, consideration was given only to exposure limits meeting the following criteria:

- Established or recommended by leading scientific and regulatory authorities.
- Protective of the health of the general public based on the current scientific understanding of the health effects known to be associated with exposures to the COPC.
- Protective of sensitive individuals, typically through the use of appropriate uncertainty factors.
- Supported by adequate and available documentation.

All supporting documents were critically evaluated to identify the most appropriate and defensible limits for use in the assessment. In the case that the above criteria were supported by more than one standard, guideline or objective, the most scientifically defensible limit was selected. Table 7-2 presents the toxicity reference values (TRVs) selected for use in the assessment of risks from exposure to the COPC.

Table 7-2 Toxicity Reference Values used in the Assessment

Chemical of Potential Concern	*Chronic Oral Exposure Limits*				
	Averaging Time	*Type*	*Value (µg/kg bw/day)*	*Critical Effect*	*Agency*
Aluminum (Al)	Annual	RfD	143	Developmental, kidney, liver, nervous system and reproductive effects	WHO 2010a,b
Antimony (Sb)	Annual	RfD	0.2	Liver effects	Health Canada 2010
Arsenic (As)	Annual	RfD	0.3	Hyperpigmentation and keratosis	US EPA 1993

Arsenic (As)_cancer	Annual	RsD	0.006	Bladder, liver and lung cancer	Health Canada 2010
Barium (Ba)	Annual	RfD	200	Renal effects	Health Canada 2010
Beryllium (Be)	Annual	RfD	2	Gastrointestinal effects	US EPA 1998
Boron (B)	Annual	RfD	200	Developmental effects	US EPA 2004
Cadmium (Cd)	Annual	RfD	1	Renal effects	Health Canada 2010
Chromium (Cr)	Annual	RfD	1	Hepatotoxicity	Health Canada 2010
Cobalt (Co)	Annual	RfD	1.4	Cardiovascular effects	RIVM 2001
Copper (Cu) (Adult)	Annual	RfD	141	Hepatotoxicity and gastrointestinal effects	Health Canada 2010
Copper (Cu) (Toddler)	Annual	RfD	91	Hepatotoxicity and gastrointestinal effects	Health Canada 2010
Lead (Pb) (Adult)	Annual	RfD	1.3	Increased blood pressure	JECFA 2011
Lead (Pb) (Toddler)	Annual	RfD	0.6	Neurodevelopmental effects	JECFA 2011
Manganese (Mn) (Adult)	Annual	RfD	156	Neurotoxicity	Health Canada 2010
Manganese (Mn) (Toddler)	Annual	RfD	136	Neurotoxicity	Health Canada 2010
Mercury (Hg)	Annual	RfD	0.57	Renal effects	WHO 2010c
Molybdenum (Mo) (Adult)	Annual	RfD	28	Reproductive effects	Health Canada 2010
Molybdenum (Mo) (Toddler)	Annual	RfD	23	Reproductive effects	Health Canada 2010
Nickel (Ni)	Annual	RfD	11	Perinatal lethality	Health Canada 2010
Silver (Ag)	Annual	RfD	5	Argyria	US EPA 1996a
Strontium (Sr)	Annual	RfD	600	Developmental effects, skeletal changes	US EPA 1996b
Vanadium (V)	Annual	RfD	2.1	Developmental effects	RIVM 2009
Zinc (Zn) (Adult)	Annual	RfD	570	Reduced iron and copper status	Health Canada 2010
Zinc (Zn) (Toddler)	Annual	RfD	480	Developmental effects	Health Canada 2010

Human Risk Calculations

Risk quotient (RQ) values for non-carcinogens and incremental lifetime cancer risks (ILCRs) for carcinogens (per 100,000) were estimated using the following equations and the calculated exposure estimates.

Non-Carcinogens

The following equation was used to calculate the risk quotients for non–carcinogens (Health Canada, 2012):

$$RQ_i = \frac{EDI_{total\_BW}}{RfD}$$

Where:

RQ$_i$ = risk quotient of chemical for the 'i' life stage of the Indigenous peoples (unitless)
EDI$_{total_BW}$ = total estimated daily intake of chemical via all routes adjusted to body weight for the 'i' life stage (µg/kg bw/d)
RfD = chemical-specific reference dose (µg/kg bw/d)

The maximum RQ of all the life stages (i.e., infant, toddler, child, adolescent, and adult) was presented in the report for non-carcinogens. The toddler life stage had the highest RQ of all the life stages.

As only the oral exposure pathway was considered in the HHRA, an HQ of 0.2 was used as a benchmark to assess the risk level for non-carcinogenic exposures. This allows for exposure to the COPC through other routes (air, water, dermal contact and commercially available foods). An HQ of 0.2 assumes an exposure of 20% of the allowable level to come from the traditional foods and 80% to come from other sources. If the calculated HQ is greater than the benchmark of 0.2, then there may be potential for adverse health effects and further assessment may be required. An HQ less than the benchmark of 0.2 indicates that the intake of the COPC through the consumption of traditional foods does not exceed the TRV and no adverse health effects are expected. It is noted that the assessment does not include all traditional foods that could be consumed from the area; this is discussed further in the uncertainties section.

Carcinogens

The following equation was used to calculate the ILCRs (per 100,000) for carcinogens (Health Canada, 2012):

$$\begin{aligned} ILCR = {} & \frac{EDI_{total\_BW-inf}}{RsD} \times LAF_{-inf} + \frac{EDI_{total\_BW-tod}}{RsD} \times LAF_{-tod} \\ & + \frac{EDI_{total\_BW-child}}{RsD} \times LAF_{-child} + \frac{EDI_{total\_BW-adol}}{RsD} \times LAF_{-adol} \\ & + \frac{EDI_{total\_BW-adult}}{RsD} \times LAF_{-adult} \end{aligned}$$

Where:

ILCR = ILCR of chemical for the sum of the life stages of the Indigenous peoples (unitless)
EDI$_{total_BW-i}$ = total estimated daily intake of chemical via all routes adjusted to body weight for the 'i' life stage (µg/kg bw/d)
RsD = chemical-specific risk-specific dose (µg/kg bw/d)
LAF$_{-i}$ = Lifetime adjustment factor for the 'i' life stage for general population (yr-life stage/yr-total)

The sum of the ILCR values of all the life stages (*i.e.*, infant, toddler, child, adolescent, and adult) was presented in the report for carcinogens. For the purposes of assessing carcinogenic substances, a benchmark cancer risk level of 1 in 100,000 (i.e., 1×10^{-5}) is used; cancer risks are deemed negligible when the estimated ILCR is ≤ 1 in 100,000. An ILCR greater than 1 in 100,000 does not necessarily imply that an actual risk exists; rather, an exceedance is an indication that there may be the potential for adverse health effects and further assessment may be required.

7.2 Screening Level Assessment

7.2.1 Predicted Exposure and Risk associated with Berry and/or Leafy Vegetation Consumption

The predicted RQ values for the non-carcinogenic COPC are presented in Table 7-3. With the exception of manganese, the predicted RQ values for all COPC based on the MPOI annual deposition rate and the maximum annual average deposition rate for areas 30 to 70 m from the Haul Road are below the benchmark RQ value of 0.2. This indicates that with the exception of manganese, adverse health effects from the consumption of berries and leafy vegetation collected from the vicinity of the Haul Road are not anticipated. For manganese, the majority of the risks are due to existing baseline concentrations rather than from contributions from the Project. Manganese contributions from the Project are two to three orders of magnitude less than from the Baseline case and are considered to be minimal when compared to contributions from existing baseline conditions.

Table 7-3 Chronic Non-Carcinogenic Risk Quotients for the Indigenous Group

Metal/COPC	Risk Quotients					
	MPOI annual deposition rate			Maximum annual average deposition rate for areas 30 – 70 m from Haul Road		
	Baseline	Project	Project + Baseline	Baseline	Project	Project + Baseline
Aluminum	1.9E-02	1.3E-02	3.3E-02	3.9E-02	1.0E-02	4.9E-02
Antimony	7.3E-04	4.8E-04	1.2E-03	1.5E-03	3.8E-04	1.8E-03
Arsenic	5.1E-03	6.1E-03	1.1E-02	1.0E-02	4.8E-03	1.5E-02
Barium	8.3E-03	8.1E-05	8.4E-03	1.7E-02	6.3E-05	1.7E-02
Beryllium	3.6E-05	1.7E-05	5.2E-05	7.1E-05	1.3E-05	8.4E-05
Boron	6.1E-03	2.9E-05	6.1E-03	1.2E-02	2.3E-05	1.2E-02
Cadmium	7.4E-03	6.7E-05	7.5E-03	1.5E-02	5.2E-05	1.5E-02
Chromium	2.1E-02	3.7E-03	2.4E-02	4.1E-02	2.9E-03	4.4E-02
Cobalt	4.7E-03	9.7E-04	5.7E-03	9.5E-03	7.5E-04	1.0E-02
Copper	3.5E-03	4.9E-05	3.5E-03	7.0E-03	3.8E-05	7.0E-03
Lead	3.3E-03	1.0E-03	4.3E-03	6.6E-03	7.8E-04	7.4E-03
Manganese	**4.7E-01**	1.2E-03	**4.7E-01**	**9.4E-01**	9.0E-04	**9.4E-01**
Mercury	6.5E-03	8.0E-07	6.5E-03	1.3E-02	6.3E-07	1.3E-02
Molybdenum	5.4E-04	4.4E-06	5.5E-04	1.1E-03	3.5E-06	1.1E-03

Nickel	1.4E-02	3.3E-04	1.4E-02	2.7E-02	2.5E-04	2.7E-02
Silver	1.6E-04	2.7E-06	1.7E-04	3.3E-04	2.1E-06	3.3E-04
Strontium	2.8E-03	1.1E-05	2.8E-03	5.7E-03	8.5E-06	5.7E-03
Vanadium	3.6E-03	1.9E-03	5.5E-03	7.3E-03	1.5E-03	8.7E-03
Zinc	2.5E-03	2.7E-05	2.5E-03	5.0E-03	2.1E-05	5.0E-03

Notes:
Bolded values highlighted in greyscale indicate an exceedance of the RQ benchmark of 0.2

The predicted ILCRs for the carcinogenic COPC (*i.e.*, arsenic) are presented in Table 7-4. The predicted ILCRs based on the MPOI annual deposition rate and the maximum annual average deposition rate for areas 30 to 70 m from the Haul Road are all below the benchmark value of 1 in 100,000. Therefore, the cancer risk from the consumption of berries and leaves collected from the vicinity of the Haul Road is considered to be negligible and adverse health effects are not expected.

Table 7-4 Chronic Incremental Lifetime Cancer Risks for the Indigenous Group Associated with Consumption of Berries and Leaves in Areas Adjacent to Haul Road

Metal/COPC	***Incremental Lifetime Cancer Risks (per 100,000)***	
	MPOI annual deposition rate	***Maximum annual average deposition rate for areas 30 – 70 m from Haul Road***
	Project	***Project***
Arsenic	2.1E-01	1.6E-01

7.3 Summary

With the exception of manganese, non-carcinogenic risks from the consumption of berries and leafy vegetation collected in the vicinity of the Haul Road are not anticipated to result in adverse health effects. Furthermore, potential risks from manganese (in both the MPOI and areas 30 to 70 m from the Haul Road) are largely due to existing manganese concentrations in the Baseline case and impacts related to the deposition of ore dust from use of the Haul Road are considered to be minimal. Manganese is an essential element and is involved in the formation of bone and in various aspects of metabolism (IOM 2001). In general, dietary sources are the primary route of human exposure to manganese, with people who consume a high amount of plant-based foods, and legumes having potentially higher intake than other individuals (IOM 2001, ATSDR 2012, WHO 2004). The highest intake levels predicted in this assessment (2,100 µg/day) is below the recognized NOAEL of 10,000 µg/day (10 mg/day) (WHO 2004). As a result, it is unlikely that adverse effects associated with chronic manganese exposure would result from the consumption of local foods. To date, the manganese exposure levels at which adverse effects are expected in humans have not been clearly defined; although, the weight of evidence indicates that exposure below 10 mg/day is unlikely to be associated with adverse effects (IOM 2001; Santamaria and Sulsky 2010; Andersen et al. 2010). Furthermore, the World Health Organization (WHO 2004) noted in its toxicological review that manganese is not considered very toxic to humans given the existence of homeostatic mechanisms, and that the incidence of adverse health effects at the upper range of dietary intake is negligible. For arsenic, predicted ILCRs were below the benchmark ILCR of 1 in 100,000 in all scenarios and assessment cases. Therefore, the potential for carcinogenic adverse health effects from arsenic exposure are considered negligible.

8 CONCLUSIONS

Based on the assessment conducted, the following can be concluded:

- Metals are naturally occurring in the environment and are present within existing soils and vegetation in the region. The use of the Haul Roads to transport crushed ore from the Beaver Dam Mine Site to the Touquoy Mine Site will result in increased deposition of dust in the vicinity of the Haul Road;
- Dustfall predictions indicate that the areas outside the PDA that will potentially receive higher dustfall rates are small in size (see Figure 4-1), which limits the exposure potential for people in the area;
- The bioavailability of ore dust is unknown at this time, but is likely low in that the mineral types and forms of metals present in the ore may serve to limit the potential for uptake into terrestrial vegetation;
- Based on the estimated future soil concentrations of all metals considered, some accumulation within vegetation is anticipated to occur, but would likely be localized to areas most affected by dust loadings which are generally limited in size.
- Based on the assessment conducted, it is considered unlikely that ore dust deposition from the Haul Road at the rates considered in this assessment would result in levels of metals in berries and leafy vegetation that would be harmful to human health, if consumed, based on the risk assessment conducted.

<u>Uncertainties, Conservative Assumptions and Limitations</u>:

As inherent in any risk assessment study, there are limitations, uncertainties and conservative assumptions applicable to this screening level risk assessment, as follows:

- Geochemistry from waste rock obtained from the Beaver Dam Mine Site was used in the assessment to predict the composition of dust fall and the potential exposures related to berries and vegetation harvested from the vicinity of the Haul Road. The use of waste rock in the estimation of potential Haul Road dust levels is considered to represent a conservative assumption since much of the road will likely be characterized by local quarry rock as opposed to waste rock.
- The use of literature-based BCFs to predict baseline berry and leafy vegetation concentrations is considered standard practice where site-specific BCFs cannot be calculated. Although this represents a source of uncertainty, predictions in the assessment using the literature-based BCF tended to result in conservative estimations, given that concentrations for those chemicals were not detected in any of the samples.

- For the purposes of calculating summary statistics to represent baseline soil, berry, and leafy vegetation concentrations (*e.g.*, 90^{th} percentile), where a chemical concentration was not detected in a sample, ½ of the detection limit was used for the sample in the calculations. This is a standard approach, however, it represents an area of uncertainty due to the absence of an actual detected concentration.
- Indigenous peoples were assumed to harvest and consume 50% of all berries and leafy vegetation from within 30 m of the Haul Road for their entire lifespan in the MPOI deposition rate scenario and all of their berry and leafy vegetation harvest from areas 30 to 70 m from the Haul Road for their entire lifespan in the maximum annual average deposition rate scenario. In the absence of site specific consumption information, these assumptions are considered to represent highly conservative assumptions as it is unlikely that people would continually harvest and consume berries and leafy vegetation at such rates in the vicinity of the Haul Road for their entire lifetimes. In addition, dusting events associated with the use of the Haul Road related to Beaver Dam Mine Site are estimated to only occur over a 4 year period, and hence, lifetime exposure to these levels is not plausible.
- The assessment is limited to the evaluation of the consumption of berries and leafy vegetation among the traditional foods consumed by Indigenous peoples. It is likely that the Indigenous peoples in the area will consume other traditional food items that may have the potential to be impacted by dust deposition from the use of the Haul Road. This represents an area of uncertainty, but due to the lack of change predicted in soils and food sources, and the short duration of time the Haul Road will experience dusting, and the size of the spatial area potentially affected by dusting events, significant change in chemistry of other traditional foods is not anticipated.
- Bio-accessibility of metals in consumed vegetation was assumed to be 100%.
- Vegetation was assumed to be unwashed prior to consumption.
- TRV incorporate several layers of uncertainty factors often ranging from 100 to 1000 and points of departure typically based on NOAELs.

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Appendix A – Baseline Analytical Results

Report ID:	288107-IAS
Report Date:	24-Sep-18
Date Received:	06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard

Project #: 17-175

Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-11	288107-12	288107-13
Client Sample ID:			Berry 1	Berry 2	Berry 3
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	86.0	91.9	86.4

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

RL = Reporting Limit

<Original signed by>

<Original signed by>

Ross Kean
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 288107-IAS
Report Date: 24-Sep-18
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Fax: 506.452.0594
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-14	288107-15	288107-16
Client Sample ID:			Berry 4	Berry 5	Berry 6
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	88.4	82.4	85.1

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Report Date: 24-Sep-18
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-17	288107-18	288107-19
Client Sample ID:			Berry 7	Berry 8	Berry 9
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	83.2	81.3	84.3

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-20
Client Sample ID:			Berry 10
Date Sampled:			31-Aug-18
Analytes	**Units**	**RL**	
Moisture	%	0.1	82.2

Report ID: 288107-IAS
Report Date: 24-Sep-18
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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-11	288107-12	288107-13
Client Sample ID:			Berry 1	Berry 2	Berry 3
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	2.2	0.4	3.1
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	2.55	1.88	1.14
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	1.28	2.52	0.67
Cadmium	mg/kg	0.0005	0.0005	0.0161	< 0.0005
Calcium	mg/kg	2	240	305	197
Chromium	mg/kg	0.02	0.08	0.05	0.05
Cobalt	mg/kg	0.002	< 0.002	0.024	0.003
Copper	mg/kg	0.02	0.79	0.78	0.25
Iron	mg/kg	1	4	5	2
Lead	mg/kg	0.002	0.002	0.003	0.003
Lithium	mg/kg	0.002	0.002	0.004	< 0.002
Magnesium	mg/kg	0.5	91.6	225.	74.7
Manganese	mg/kg	0.02	52.5	75.3	97.3
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.021	0.030	0.009
Nickel	mg/kg	0.02	0.12	0.56	0.13
Potassium	mg/kg	1	975	1530	861
Rubidium	mg/kg	0.002	9.63	10.3	3.62
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	15	27	12
Strontium	mg/kg	0.02	1.55	2.32	2.03
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.481	3.63	0.122
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	0.94	3.10	0.68

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-14	288107-14 Dup	288107-15
Client Sample ID:			Berry 4	Lab Duplicate	Berry 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	0.2	0.3	0.3
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	1.63	1.70	1.23
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	0.64	0.64	3.05
Cadmium	mg/kg	0.0005	0.0096	0.0094	0.0231
Calcium	mg/kg	2	138	128	359
Chromium	mg/kg	0.02	< 0.02	< 0.02	0.11
Cobalt	mg/kg	0.002	< 0.002	< 0.002	0.010
Copper	mg/kg	0.02	0.49	0.41	1.03
Iron	mg/kg	1	1	2	8
Lead	mg/kg	0.002	< 0.002	< 0.002	0.003
Lithium	mg/kg	0.002	0.012	0.020	< 0.002
Magnesium	mg/kg	0.5	70.8	66.5	350.
Manganese	mg/kg	0.02	6.02	3.21	88.9
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.010	0.011	0.046
Nickel	mg/kg	0.02	0.04	0.06	0.50
Potassium	mg/kg	1	752	640	2230
Rubidium	mg/kg	0.002	2.64	2.13	6.35
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	5	6	15
Strontium	mg/kg	0.02	0.99	1.42	1.85
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.017	0.013	2.15
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	0.79	0.96	5.51

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Report Date: 24-Sep-18
Date Received: 06-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-16	288107-17	288107-18
Client Sample ID:			Berry 6	Berry 7	Berry 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	0.3	2.7	2.6
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	0.52	1.61	0.96
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	1.86	1.32	0.65
Cadmium	mg/kg	0.0005	0.0203	0.0012	< 0.0005
Calcium	mg/kg	2	136	648	154
Chromium	mg/kg	0.02	0.05	0.03	0.08
Cobalt	mg/kg	0.002	0.010	< 0.002	< 0.002
Copper	mg/kg	0.02	0.83	0.30	0.72
Iron	mg/kg	1	3	2	3
Lead	mg/kg	0.002	< 0.002	0.013	< 0.002
Lithium	mg/kg	0.002	< 0.002	0.002	< 0.002
Magnesium	mg/kg	0.5	287.	268.	77.5
Manganese	mg/kg	0.02	112.	1.76	2.21
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.042	0.025	0.013
Nickel	mg/kg	0.02	0.20	0.19	0.12
Potassium	mg/kg	1	1520	1900	1210
Rubidium	mg/kg	0.002	12.5	20.1	5.22
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	9	19	22
Strontium	mg/kg	0.02	0.90	8.68	1.11
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.622	0.392	0.153
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	1.36	0.85	0.76

Report ID: 288107-IAS
Report Date: 24-Sep-18
Date Received: 06-Sep-18

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Middle Musqudoboit, NS B0X 1X0

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Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			288107-19	288107-20
Client Sample ID:			Berry 9	Berry 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	1.2	0.4
Antimony	mg/kg	0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	1.53	2.93
Beryllium	mg/kg	0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	3.24	2.64
Cadmium	mg/kg	0.0005	0.0271	0.0268
Calcium	mg/kg	2	424	353
Chromium	mg/kg	0.02	0.04	0.03
Cobalt	mg/kg	0.002	0.005	0.052
Copper	mg/kg	0.02	0.95	1.72
Iron	mg/kg	1	6	6
Lead	mg/kg	0.002	0.002	< 0.002
Lithium	mg/kg	0.002	0.003	0.002
Magnesium	mg/kg	0.5	250.	412.
Manganese	mg/kg	0.02	82.3	18.8
Mercury	mg/kg	0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.035	0.052
Nickel	mg/kg	0.02	0.45	0.82
Potassium	mg/kg	1	1900	1680
Rubidium	mg/kg	0.002	6.03	13.7
Selenium	mg/kg	0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005
Sodium	mg/kg	2	15	13
Strontium	mg/kg	0.02	1.63	3.72
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	1.96	0.231
Uranium	mg/kg	0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	4.16	4.16

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-01	288107-01 Dup	288107-02
Client Sample ID:			Soil 1	Lab Duplicate	Soil 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Carbon - Organic	mg/kg	0.01	2.19	2.21	5.34

Report ID: 288107-IAS
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Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-03	288107-04	288107-05
Client Sample ID:			Soil 3	Soil 4	Soil 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Carbon - Organic	mg/kg	0.01	0.83	7.11	5.46

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-06	288107-07	288107-08
Client Sample ID:			Soil 6	Soil 7	Soil 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Carbon - Organic	mg/kg	0.01	1.18	9.58	1.17

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			288107-09	288107-10
Client Sample ID:			Soil 9	Soil 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Carbon - Organic	mg/kg	0.01	2.79	5.78

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-01	288107-01 Dup	288107-02
Client Sample ID:			Soil 1	Lab Duplicate	Soil 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	1	6870	7150	12800
Antimony	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	1	1	14
Barium	mg/kg	1	12	13	14
Beryllium	mg/kg	0.1	< 0.1	< 0.1	0.2
Bismuth	mg/kg	1	< 1	< 1	< 1
Boron	mg/kg	1	3	3	2
Cadmium	mg/kg	0.01	0.04	0.04	0.09
Calcium	mg/kg	50	260	240	150
Chromium	mg/kg	1	10	10	15
Cobalt	mg/kg	0.1	1.4	1.4	2.7
Copper	mg/kg	1	4	4	6
Iron	mg/kg	20	17500	18000	44700
Lead	mg/kg	0.1	6.8	6.9	13.8
Lithium	mg/kg	0.1	3.2	3.5	9.1
Magnesium	mg/kg	10	1060	1130	1690
Manganese	mg/kg	1	67	73	254
Mercury	mg/kg	0.01	0.03	0.03	0.10
Molybdenum	mg/kg	0.1	< 0.1	< 0.1	0.5
Nickel	mg/kg	1	4	4	7
Potassium	mg/kg	20	350	410	250
Rubidium	mg/kg	0.1	7.0	7.2	5.0
Selenium	mg/kg	1	< 1	< 1	2
Silver	mg/kg	0.1	< 0.1	< 0.1	0.3
Sodium	mg/kg	50	< 50	< 50	< 50
Strontium	mg/kg	1	9	8	4
Tellurium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1	< 1
Uranium	mg/kg	0.1	0.3	0.3	0.5
Vanadium	mg/kg	1	40	40	28
Zinc	mg/kg	1	10	11	18

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-03	288107-04	288107-05
Client Sample ID:			Soil 3	Soil 4	Soil 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	1	5070	2260	22400
Antimony	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	2	< 1	10
Barium	mg/kg	1	12	23	35
Beryllium	mg/kg	0.1	< 0.1	< 0.1	0.4
Bismuth	mg/kg	1	< 1	1	< 1
Boron	mg/kg	1	< 1	2	3
Cadmium	mg/kg	0.01	0.01	0.11	0.08
Calcium	mg/kg	50	90	450	260
Chromium	mg/kg	1	4	3	21
Cobalt	mg/kg	0.1	1.3	0.9	10.2
Copper	mg/kg	1	2	3	11
Iron	mg/kg	20	4780	3200	32400
Lead	mg/kg	0.1	4.2	9.5	16.4
Lithium	mg/kg	0.1	8.3	1.8	29.6
Magnesium	mg/kg	10	680	470	2850
Manganese	mg/kg	1	160	72	801
Mercury	mg/kg	0.01	0.02	0.07	0.16
Molybdenum	mg/kg	0.1	< 0.1	< 0.1	0.8
Nickel	mg/kg	1	3	2	14
Potassium	mg/kg	20	280	210	870
Rubidium	mg/kg	0.1	8.1	2.1	15.0
Selenium	mg/kg	1	< 1	< 1	2
Silver	mg/kg	0.1	< 0.1	0.1	< 0.1
Sodium	mg/kg	50	< 50	< 50	< 50
Strontium	mg/kg	1	3	8	7
Tellurium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1	< 1
Uranium	mg/kg	0.1	0.3	0.2	0.9
Vanadium	mg/kg	1	6	7	26
Zinc	mg/kg	1	7	7	36

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-06	288107-07	288107-08
Client Sample ID:			Soil 6	Soil 7	Soil 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	1	7700	5760	2060
Antimony	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	5	< 1	< 1
Barium	mg/kg	1	12	24	6
Beryllium	mg/kg	0.1	0.1	< 0.1	< 0.1
Bismuth	mg/kg	1	< 1	< 1	< 1
Boron	mg/kg	1	< 1	2	< 1
Cadmium	mg/kg	0.01	0.02	0.16	0.02
Calcium	mg/kg	50	140	300	100
Chromium	mg/kg	1	11	4	2
Cobalt	mg/kg	0.1	2.7	0.9	0.3
Copper	mg/kg	1	3	3	< 1
Iron	mg/kg	20	14300	3570	1340
Lead	mg/kg	0.1	5.4	11.0	2.9
Lithium	mg/kg	0.1	11.1	1.7	1.2
Magnesium	mg/kg	10	2240	500	210
Manganese	mg/kg	1	200	54	27
Mercury	mg/kg	0.01	0.02	0.07	0.01
Molybdenum	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Nickel	mg/kg	1	7	2	< 1
Potassium	mg/kg	20	400	360	120
Rubidium	mg/kg	0.1	6.3	6.0	1.5
Selenium	mg/kg	1	< 1	< 1	< 1
Silver	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Sodium	mg/kg	50	< 50	< 50	< 50
Strontium	mg/kg	1	3	7	2
Tellurium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1	< 1
Uranium	mg/kg	0.1	0.4	0.7	0.4
Vanadium	mg/kg	1	17	12	3
Zinc	mg/kg	1	16	11	2

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Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			288107-09	288107-10
Client Sample ID:			Soil 9	Soil 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	1	3130	7970
Antimony	mg/kg	0.1	< 0.1	< 0.1
Arsenic	mg/kg	1	< 1	2
Barium	mg/kg	1	26	27
Beryllium	mg/kg	0.1	< 0.1	0.1
Bismuth	mg/kg	1	< 1	< 1
Boron	mg/kg	1	< 1	1
Cadmium	mg/kg	0.01	0.06	0.08
Calcium	mg/kg	50	610	830
Chromium	mg/kg	1	4	12
Cobalt	mg/kg	0.1	4.9	2.7
Copper	mg/kg	1	1	3
Iron	mg/kg	20	4190	16100
Lead	mg/kg	0.1	6.4	9.3
Lithium	mg/kg	0.1	2.0	6.0
Magnesium	mg/kg	10	500	2150
Manganese	mg/kg	1	792	95
Mercury	mg/kg	0.01	0.04	0.07
Molybdenum	mg/kg	0.1	< 0.1	0.3
Nickel	mg/kg	1	4	8
Potassium	mg/kg	20	380	550
Rubidium	mg/kg	0.1	5.3	5.0
Selenium	mg/kg	1	< 1	< 1
Silver	mg/kg	0.1	< 0.1	< 0.1
Sodium	mg/kg	50	< 50	50
Strontium	mg/kg	1	6	10
Tellurium	mg/kg	0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1	< 0.1
Tin	mg/kg	1	< 1	< 1
Uranium	mg/kg	0.1	0.3	0.4
Vanadium	mg/kg	1	7	35
Zinc	mg/kg	1	7	18

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General Report Comments

288107-1 to 288107-10
Samples were air dried and sieved at 2 mm. A portion of each was digested according to EPA Method 3050B.
The resulting solutions were analyzed for trace elements by ICP-MS.
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
A portion of each sample was dried and sieved at 2 mm. Total and Inorganic Carbon were determined using combustion/acid evolution infrared methods. Total Organic Carbon is calculated as the difference.

288107-11 to 288107-20
The samples were homogenized and portions were prepared by Microwave Assisted Digestion in nitric acid (SOP 4.M26).
The resulting solutions were analyzed for trace elements by ICP-MS (SOP 4.M01).
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
Results are reported on an "as received" (wet weight) basis.
† Arsenic could not be reported due to a matrix based interference.

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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			CRM088027	RB052177
Type:			CRM NIST1573a	Blank
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	494.	< 0.1
Antimony	mg/kg	0.005	0.026	< 0.005
Arsenic	mg/kg	0.02	†	< 0.02
Barium	mg/kg	0.05	63.9	< 0.05
Beryllium	mg/kg	0.005	0.019	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	32.5	< 0.05
Cadmium	mg/kg	0.0005	1.53	< 0.0005
Calcium	mg/kg	2	57300	< 2
Chromium	mg/kg	0.02	1.91	< 0.02
Cobalt	mg/kg	0.002	0.551	< 0.002
Copper	mg/kg	0.02	4.36	< 0.02
Iron	mg/kg	1	362	< 1
Lead	mg/kg	0.002	0.585	< 0.002
Lithium	mg/kg	0.002	0.622	< 0.002
Magnesium	mg/kg	0.5	11400	< 0.5
Manganese	mg/kg	0.02	260.	< 0.02
Mercury	mg/kg	0.01	0.03	< 0.01
Molybdenum	mg/kg	0.002	0.559	< 0.002
Nickel	mg/kg	0.02	1.54	< 0.02
Potassium	mg/kg	1	29700	< 1
Rubidium	mg/kg	0.002	16.5	< 0.002
Selenium	mg/kg	0.05	0.10	< 0.05
Silver	mg/kg	0.005	0.012	< 0.005
Sodium	mg/kg	2	136	< 2
Strontium	mg/kg	0.02	102.	< 0.02
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	0.042	< 0.002
Tin	mg/kg	0.002	0.034	0.011
Uranium	mg/kg	0.002	0.025	< 0.002
Vanadium	mg/kg	0.02	0.80	< 0.02
Zinc	mg/kg	0.02	30.5	< 0.02

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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			CRM087844	RB052079
Type:			CRM NIST2709a	Blank
Analytes	**Units**	**RL**		
Aluminum	mg/kg	1	26900	2
Antimony	mg/kg	0.1	0.1	< 0.1
Arsenic	mg/kg	1	8	< 1
Barium	mg/kg	1	437	< 1
Beryllium	mg/kg	0.1	0.8	< 0.1
Bismuth	mg/kg	1	< 1	< 1
Boron	mg/kg	1	37	< 1
Cadmium	mg/kg	0.01	0.35	< 0.01
Calcium	mg/kg	50	14800	< 50
Chromium	mg/kg	1	77	< 1
Cobalt	mg/kg	0.1	12.1	< 0.1
Copper	mg/kg	1	31	< 1
Iron	mg/kg	20	31900	< 20
Lead	mg/kg	0.1	11.6	< 0.1
Lithium	mg/kg	0.1	37.0	< 0.1
Magnesium	mg/kg	10	12400	< 10
Manganese	mg/kg	1	475	< 1
Mercury	mg/kg	0.01	0.89	< 0.01
Molybdenum	mg/kg	0.1	0.9	0.1
Nickel	mg/kg	1	77	< 1
Potassium	mg/kg	20	3740	< 20
Rubidium	mg/kg	0.1	33.7	< 0.1
Selenium	mg/kg	1	1	< 1
Silver	mg/kg	0.1	0.1	< 0.1
Sodium	mg/kg	50	560	< 50
Strontium	mg/kg	1	109	< 1
Tellurium	mg/kg	0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	0.2	0.2
Tin	mg/kg	1	< 1	5
Uranium	mg/kg	0.1	1.8	< 0.1
Vanadium	mg/kg	1	71	< 1
Zinc	mg/kg	1	97	< 1

CERTIFICATE OF ANALYSIS
for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Methods

Analyte	RPC SOP #	Method Reference	Method Principle
EPA 3050B Digestion	4.M19	EPA 3050B	Nitric Acid/Hydrogen Peroxide Digestion
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES
Mercury	4.M53	EPA 245.5	Cold Vapor AAS

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
Halifax, NS B3J 1K1

921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-01	290705-01 Dup	290705-02
Client Sample ID:			Veg 1	Lab Duplicate	Veg 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	56.8	57.9	62.2

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

RL = Reporting Limit

<Original signed by>

<Original signed by>

Ross Kean
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental
Sciences Inc
5121 Sackville Street, Suite 506
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rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-03	290705-04	290705-05
Client Sample ID:			Veg 3	Veg 4	Veg 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	77.3	55.8	71.5

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-06	290705-07	290705-08
Client Sample ID:			Veg 6	Veg 7	Veg 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Moisture	%	0.1	†	72.5	61.8

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-09	290705-10
Client Sample ID:			Veg 9	Veg 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Moisture	%	0.1	76.9	78.2

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
Halifax, NS B3J 1K1

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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-01	290705-01 Dup	290705-02
Client Sample ID:			Veg 1	Lab Duplicate	Veg 2
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	47.8	51.0	12.6
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	46.5	49.2	22.1
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	19.0	19.6	15.7
Cadmium	mg/kg	0.0005	0.0019	0.0018	0.0423
Calcium	mg/kg	2	3610	3680	2580
Chromium	mg/kg	0.02	0.08	0.08	0.04
Cobalt	mg/kg	0.002	0.017	0.012	0.037
Copper	mg/kg	0.02	2.28	2.14	2.35
Iron	mg/kg	1	34	32	25
Lead	mg/kg	0.002	0.027	0.028	0.023
Lithium	mg/kg	0.002	0.036	0.030	0.008
Magnesium	mg/kg	0.5	1250	1270	1210
Manganese	mg/kg	0.02	803.	692.	1110
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.026	0.025	0.055
Nickel	mg/kg	0.02	0.62	0.62	0.94
Potassium	mg/kg	1	2150	2150	3230
Rubidium	mg/kg	0.002	14.6	14.7	25.8
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	20	21	7
Strontium	mg/kg	0.02	27.4	27.3	19.8
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	0.002
Tin	mg/kg	0.002	0.055	0.020	0.015
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	0.04	0.03	< 0.02
Zinc	mg/kg	0.02	5.53	5.41	4.72

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
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921 College Hill Rd
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-03	290705-04	290705-05
Client Sample ID:			Veg 3	Veg 4	Veg 5
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	49.6	7.6	10.0
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	17.2	18.4	10.3
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	8.36	9.09	10.7
Cadmium	mg/kg	0.0005	0.0009	0.0012	0.0422
Calcium	mg/kg	2	1870	2730	2030
Chromium	mg/kg	0.02	0.03	0.05	0.04
Cobalt	mg/kg	0.002	0.028	0.069	0.005
Copper	mg/kg	0.02	0.67	1.82	1.40
Iron	mg/kg	1	19	43	21
Lead	mg/kg	0.002	0.011	0.031	0.011
Lithium	mg/kg	0.002	0.018	0.149	0.006
Magnesium	mg/kg	0.5	570.	1110	1110
Manganese	mg/kg	0.02	1440	554.	921.
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.013	0.119	0.045
Nickel	mg/kg	0.02	0.77	0.88	0.23
Potassium	mg/kg	1	980	1900	1740
Rubidium	mg/kg	0.002	3.28	5.96	5.13
Selenium	mg/kg	0.05	0.11	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	23	365	11
Strontium	mg/kg	0.02	19.0	19.2	10.7
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	0.002	< 0.002
Tin	mg/kg	0.002	0.020	0.007	0.015
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	2.51	11.0	5.23

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
Halifax, NS B3J 1K1

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-06	290705-07	290705-08
Client Sample ID:			Veg 6	Veg 7	Veg 8
Date Sampled:			31-Aug-18	31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**			
Aluminum	mg/kg	0.1	24.6	208.	34.9
Antimony	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	8.51	23.7	37.4
Beryllium	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	8.73	12.8	9.36
Cadmium	mg/kg	0.0005	0.0254	0.0043	0.0019
Calcium	mg/kg	2	1150	8910	4120
Chromium	mg/kg	0.02	0.07	0.05	0.06
Cobalt	mg/kg	0.002	0.017	0.005	0.011
Copper	mg/kg	0.02	1.56	0.62	1.29
Iron	mg/kg	1	24	23	17
Lead	mg/kg	0.002	0.009	0.327	0.015
Lithium	mg/kg	0.002	0.012	0.020	0.011
Magnesium	mg/kg	0.5	709.	2610	1130
Manganese	mg/kg	0.02	751.	30.5	140.
Mercury	mg/kg	0.01	< 0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.023	0.032	0.010
Nickel	mg/kg	0.02	0.20	0.14	0.71
Potassium	mg/kg	1	1040	3270	2250
Rubidium	mg/kg	0.002	5.26	12.5	6.45
Selenium	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005	< 0.005
Sodium	mg/kg	2	13	6	14
Strontium	mg/kg	0.02	7.97	68.1	28.7
Tellurium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.036	0.017	0.013
Uranium	mg/kg	0.002	< 0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	0.05	< 0.02
Zinc	mg/kg	0.02	3.47	5.18	3.23

Report ID: 290705-IAS
Report Date: 10-Oct-18
Date Received: 26-Sep-18

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
Halifax, NS B3J 1K1

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Christine Moore
Project #: Not Available
Location: Atlantic Mining

Analysis of Samples

RPC Sample ID:			290705-09	290705-10
Client Sample ID:			Veg 9	Veg 10
Date Sampled:			31-Aug-18	31-Aug-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	12.2	30.5
Antimony	mg/kg	0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	0.04	< 0.02
Barium	mg/kg	0.05	15.4	32.5
Beryllium	mg/kg	0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	11.9	15.3
Cadmium	mg/kg	0.0005	0.0765	0.0593
Calcium	mg/kg	2	2640	2260
Chromium	mg/kg	0.02	0.04	0.05
Cobalt	mg/kg	0.002	0.009	0.053
Copper	mg/kg	0.02	1.14	1.79
Iron	mg/kg	1	22	21
Lead	mg/kg	0.002	0.011	0.045
Lithium	mg/kg	0.002	0.015	0.013
Magnesium	mg/kg	0.5	804.	1840
Manganese	mg/kg	0.02	968.	113.
Mercury	mg/kg	0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.073	0.087
Nickel	mg/kg	0.02	0.54	0.53
Potassium	mg/kg	1	3250	1540
Rubidium	mg/kg	0.002	6.44	8.31
Selenium	mg/kg	0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005
Sodium	mg/kg	2	14	9
Strontium	mg/kg	0.02	12.5	30.6
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	0.022	0.004
Tin	mg/kg	0.002	0.008	0.062
Uranium	mg/kg	0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	0.04
Zinc	mg/kg	0.02	7.73	10.4

CERTIFICATE OF ANALYSIS

for
Intrinsik Environmental Sciences Inc
5121 Sackville Street, Suite 506
Halifax, NS B3J 1K1

rpc
921 College Hill Rd
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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

General Report Comments

The samples were homogenized and portions were prepared by Microwave Assisted Digestion in nitric acid (SOP 4.M26).
The resulting solutions were analyzed for trace elements by ICP-MS (SOP 4.M01).
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
Results are reported on an "as received" (wet weight) basis.
† The sample was mis-placed prior to sub-sampling for Moisture analysis.

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

*** Revised Report ***

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard
Project #: 17-175
Location: Beaver Dam Haul Road

Analysis of Samples

RPC Sample ID:			289142-2	289142-3
Client Sample ID:			Berry II	Vegetation II
Date Sampled:			5-Sep-18	5-Sep-18
Analytes	**Units**	**RL**		
Aluminum	mg/kg	0.1	3.3	70.6
Antimony	mg/kg	0.005	< 0.005	< 0.005
Arsenic	mg/kg	0.02	< 0.02	< 0.02
Barium	mg/kg	0.05	0.57	35.4
Beryllium	mg/kg	0.005	< 0.005	< 0.005
Bismuth	mg/kg	0.05	< 0.05	< 0.05
Boron	mg/kg	0.05	2.47	25.1
Cadmium	mg/kg	0.0005	0.0109	0.0455
Calcium	mg/kg	2	140	3260
Chromium	mg/kg	0.02	0.03	0.14
Cobalt	mg/kg	0.002	0.014	0.023
Copper	mg/kg	0.02	1.16	3.39
Iron	mg/kg	1	6	29
Lead	mg/kg	0.002	< 0.002	0.016
Lithium	mg/kg	0.002	0.006	0.013
Magnesium	mg/kg	0.5	310.	1040
Manganese	mg/kg	0.02	65.7	1430
Mercury	mg/kg	0.01	< 0.01	< 0.01
Molybdenum	mg/kg	0.002	0.033	0.046
Nickel	mg/kg	0.02	0.19	0.66
Potassium	mg/kg	1	2310	3200
Rubidium	mg/kg	0.002	5.14	5.24
Selenium	mg/kg	0.05	< 0.05	< 0.05
Silver	mg/kg	0.005	< 0.005	< 0.005
Sodium	mg/kg	2	19	6
Strontium	mg/kg	0.02	0.87	20.9
Tellurium	mg/kg	0.002	< 0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002	< 0.002
Tin	mg/kg	0.002	0.710	0.006
Uranium	mg/kg	0.002	< 0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02	< 0.02
Zinc	mg/kg	0.02	1.78	13.3

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

RL = Reporting Limit

<Original signed by>

<Original signed by>

Ross Kean
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

*** Revised Report ***

Attention: James Millard

Project #: 17-175

Location: Beaver Dam Haul Road

Analysis of Soil

RPC Sample ID:			289142-1	289142-1 Dup
Client Sample ID:			Soil II	Lab Duplicate
Date Sampled:			5-Sep-18	5-Sep-18
Analytes	**Units**	**RL**		
Carbon - Organic	mg/kg	0.01	3.35	3.54

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

*** Revised Report ***

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: James Millard

Project #: 17-175

Location: Beaver Dam Haul Road

Analysis of Metals in Soil

RPC Sample ID:			289142-1
Client Sample ID:			Soil II
Date Sampled:			5-Sep-18
Analytes	**Units**	**RL**	
Aluminum	mg/kg	1	27400
Antimony	mg/kg	0.1	< 0.1
Arsenic	mg/kg	1	8
Barium	mg/kg	1	49
Beryllium	mg/kg	0.1	0.5
Bismuth	mg/kg	1	< 1
Boron	mg/kg	1	< 1
Cadmium	mg/kg	0.01	0.07
Calcium	mg/kg	50	180
Chromium	mg/kg	1	26
Cobalt	mg/kg	0.1	20.0
Copper	mg/kg	1	10
Iron	mg/kg	20	29200
Lead	mg/kg	0.1	16.6
Lithium	mg/kg	0.1	53.9
Magnesium	mg/kg	10	4500
Manganese	mg/kg	1	3450
Mercury	mg/kg	0.01	0.10
Molybdenum	mg/kg	0.1	0.5
Nickel	mg/kg	1	18
Potassium	mg/kg	20	1020
Rubidium	mg/kg	0.1	26.3
Selenium	mg/kg	1	2
Silver	mg/kg	0.1	< 0.1
Sodium	mg/kg	50	60
Strontium	mg/kg	1	7
Tellurium	mg/kg	0.1	< 0.1
Thallium	mg/kg	0.1	0.2
Tin	mg/kg	1	< 1
Uranium	mg/kg	0.1	1.2
Vanadium	mg/kg	1	24
Zinc	mg/kg	1	57

CERTIFICATE OF ANALYSIS
for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
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Canada E3B 6Z9
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www.rpc.ca

General Report Comments

289142-1
Sample was air dried and sieved at 2 mm. A portion was digested according to EPA Method 3050B.
The resulting solution was analyzed for trace elements by ICP-MS.
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
A portion of the sample was dried and sieved at 2 mm. Total and Inorganic Carbon were determined using combustion/acid evolution infrared methods. Total Organic Carbon is calculated as the difference.

289142-2 & 289142-3
The samples were homogenized and portions were prepared by Microwave Assisted Digestion in nitric acid (SOP 4.M26).
The resulting solutions were analyzed for trace elements by ICP-MS (SOP 4.M01).
Mercury was analyzed by Cold Vapour AAS (SOP 4.M52 & SOP 4.M53).
Results are reported on an "as received" (wet weight) basis.

Revision Comments

Incorrect results were reported due to a calculation error.
Results have been revised.

Report ID: 289142-IAS Rev01
Report Date: 01-Oct-18
Date Received: 14-Sep-18

CERTIFICATE OF ANALYSIS

for
Atlantic Mining NS Group
Atlantic Gold
6749 Moose River Road, RR#2
Middle Musqudoboit, NS B0X 1X0

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			RB052179
Type:			Blank
Analytes	**Units**	**RL**	
Aluminum	mg/kg	0.1	< 0.1
Antimony	mg/kg	0.005	0.005
Arsenic	mg/kg	0.02	< 0.02
Barium	mg/kg	0.05	< 0.05
Beryllium	mg/kg	0.005	< 0.005
Bismuth	mg/kg	0.05	0.10
Boron	mg/kg	0.05	< 0.05
Cadmium	mg/kg	0.0005	< 0.0005
Calcium	mg/kg	2	< 2
Chromium	mg/kg	0.02	< 0.02
Cobalt	mg/kg	0.002	< 0.002
Copper	mg/kg	0.02	< 0.02
Iron	mg/kg	1	< 1
Lead	mg/kg	0.002	< 0.002
Lithium	mg/kg	0.002	< 0.002
Magnesium	mg/kg	0.5	< 0.5
Manganese	mg/kg	0.02	< 0.02
Mercury	mg/kg	0.01	< 0.01
Molybdenum	mg/kg	0.002	0.004
Nickel	mg/kg	0.02	< 0.02
Potassium	mg/kg	1	< 1
Rubidium	mg/kg	0.002	< 0.002
Selenium	mg/kg	0.05	< 0.05
Silver	mg/kg	0.005	< 0.005
Sodium	mg/kg	2	< 2
Strontium	mg/kg	0.02	< 0.02
Tellurium	mg/kg	0.002	< 0.002
Thallium	mg/kg	0.002	< 0.002
Tin	mg/kg	0.002	0.003
Uranium	mg/kg	0.002	< 0.002
Vanadium	mg/kg	0.02	< 0.02
Zinc	mg/kg	0.02	0.02

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Project #: 17-175
Location: Beaver Dam Haul Road
QA/QC Report

RPC Sample ID:			CRM088117	RB052223
Type:			CRM NIST2709a	Blank
Analytes	**Units**	**RL**		
Aluminum	mg/kg	1	26400	< 1
Antimony	mg/kg	0.1	0.1	< 0.1
Arsenic	mg/kg	1	8	< 1
Barium	mg/kg	1	429	< 1
Beryllium	mg/kg	0.1	0.8	< 0.1
Bismuth	mg/kg	1	< 1	< 1
Boron	mg/kg	1	35	11
Cadmium	mg/kg	0.01	0.36	< 0.01
Calcium	mg/kg	50	13200	< 50
Chromium	mg/kg	1	72	< 1
Cobalt	mg/kg	0.1	11.7	< 0.1
Copper	mg/kg	1	30	< 1
Iron	mg/kg	20	30900	< 20
Lead	mg/kg	0.1	11.4	< 0.1
Lithium	mg/kg	0.1	35.6	< 0.1
Magnesium	mg/kg	10	12500	< 10
Manganese	mg/kg	1	465	< 1
Mercury	mg/kg	0.01	0.81	< 0.01
Molybdenum	mg/kg	0.1	0.4	0.7
Nickel	mg/kg	1	75	< 1
Potassium	mg/kg	20	3710	70
Rubidium	mg/kg	0.1	32.5	< 0.1
Selenium	mg/kg	1	< 1	< 1
Silver	mg/kg	0.1	0.2	< 0.1
Sodium	mg/kg	50	560	< 50
Strontium	mg/kg	1	107	< 1
Tellurium	mg/kg	0.1	< 0.1	< 0.1
Thallium	mg/kg	0.1	0.2	< 0.1
Tin	mg/kg	1	< 1	5
Uranium	mg/kg	0.1	1.8	< 0.1
Vanadium	mg/kg	1	65	< 1
Zinc	mg/kg	1	96	< 1

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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
EPA 3050B Digestion	4.M19	EPA 3050B	Nitric Acid/Hydrogen Peroxide Digestion
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES
Mercury	4.M53	EPA 245.5	Cold Vapor AAS

Appendix B – Geochemistry Data for Waste Rock and Calculations of Metals Ratios for Dust Characterization

Geochemistry Data for Waste Rock and Calculations of Metals Ratios for Dust Characterization

The chemical composition of dust deposition used in the evaluation of potential exposures related to soil, berries and vegetation harvested from the vicinity of the haul road was based on the geochemistry of waste rock from the Beaver Dam Mine. The use of waste rock in the estimation of potential haul road dust levels is considered to represent a conservative assumption since much of the road will likely be characterized by local quarry rock as opposed to waste rock. A total of 30 waste rock samples were obtained from Atlantic Gold and analyzed for a suite of metals. The laboratory results were examined and statistical calculations were conducted. Where a chemical concentration was not detected in a sample, half of the detection limit was substituted in place of the non-detect value for statistical calculations. The geometric mean was selected to represent the metal concentrations of the waste rock dust. These geometric means were converted to percent values and applied to the dust deposition rates in the assessment to characterize dust composition.

Sample ID	Hole ID	Sampler	Interval		Lithology	Paste pH	Total S	Sulphate S (CO3)	Sulphate S (HCl)	Sulphide S (calc)	C	CO2	CO3	CaNP	Modified NF	CaNPR	NPR
			From	To			%	%	%	%	%	%	%	kg CaCO3/t	kg CaCO3/t		
LX17-01	BD15-GT02	Lorax (2017)	10	11	GA	7.9	0.36	0.03	0.01	0.33	0.06	0.2	0.3	4.548	9	0.441018182	0.8727273
LX17-02	BD15-GT02	Lorax (2017)	15	16	AG	8.2	0.32	0.03	0.02	0.29	0.05	0.2	0.2	4.548	7	0.501848276	0.7724138
LX17-03	BD15-GT02	Lorax (2017)	26	27	AG	8.5	0.4	0.02	0.01	0.38	0.05	0.2	0.2	4.548	8	0.382989474	0.6736842
LX17-04	BD15-GT02	Lorax (2017)	31	32	AG	7.9	1.14	0.01	0.02	1.13	0.05	0.2	0.2	4.548	8	0.12879292	0.2265487
LX17-05	BD15-GT02	Lorax (2017)	46	47	GA	8.4	0.39	0.01	0.02	0.38	0.19	0.7	0.9	15.918	25	1.340463158	2.1052632
LX17-06	BD15-GT08	Lorax (2017)	91	10	GW	9	0.01	0.01	0.02	0.01	0.1	0.4	0.5	9.096	14	29.1072	44.8
LX17-07	BD15-GT08	Lorax (2017)	14	15	GA	8.5	0.03	0.01	0.03	0.02	0.05	0.2	0.2	4.548	7	7.2768	11.2
LX17-08	BD15-GT08	Lorax (2017)	23	24	GW	8.9	0.01	0.01	0.02	0.01	0.12	0.4	0.6	9.096	16	29.1072	51.2
LX17-09	BD15-GT08	Lorax (2017)	37	38	AG	9.1	0.01	0.02	0.02	0.01	0.05	0.2	0.2	4.548	8	14.5536	25.6
LX17-10	BD14-172	Lorax (2017)	140	141	AG	9.1	0.07	0.01	0.02	0.07	0.17	0.6	0.8	13.644	23	6.237257143	10.514286
LX17-11	BD14-172	Lorax (2017)	170	171	AG	9.1	0.03	0.02	0.03	0.01	0.05	0.2	0.2	4.548	9	14.5536	28.8
LX17-12	BD14-178	Lorax (2017)	7	7.9	AR	8.9	0.02	0.01	0.02	0.02	0.05	0.2	0.2	4.548	6	7.2768	9.6
LX17-13	BD14-178	Lorax (2017)	15	16	AG	9	0.01	0.01	0.01	0.01	0.05	0.2	0.2	4.548	8	14.5536	25.6
LX17-14	BD14-178	Lorax (2017)	30	31	GA	9.1	0.01	0.01	0.01	0.01	0.05	0.2	0.2	4.548	9	14.5536	28.8
LX17-15	BD14-178	Lorax (2017)	58	59	GA	8.7	0.04	0.01	0.02	0.04	0.57	2.1	2.8	47.754	58	38.2032	46.4
LX17-16	BD14-178	Lorax (2017)	49	50	GW	9.1	0.03	0.01	0.01	0.03	0.2	0.7	1	15.918	23	16.9792	24.533333
LX17-17	BD14-178	Lorax (2017)	161	162	GA	8.1	0.48	0.01	0.01	0.48	0.05	0.2	0.2	4.548	6	0.3032	0.4
LX17-18	BD14-178	Lorax (2017)	147	148	GA	8.5	0.14	0.01	0.01	0.14	0.16	0.6	0.8	13.644	18	3.118628571	4.1142857
LX17-19	BD15-GT05	Lorax (2017)	15	16	GA	9	0.3	0.01	0.02	0.3	0.05	0.2	0.2	4.548	5	0.48512	0.5333333
LX17-20	BD15-GT05	Lorax (2017)	25	26	GW	9	0.29	0.01	0.03	0.28	0.05	0.2	0.2	4.548	7	0.519771429	0.8
LX17-21	BD15-GT05	Lorax (2017)	41	42	GW	9.5	0.42	0.01	0.03	0.42	0.05	0.2	0.2	4.548	9	0.346514286	0.6857143
LX17-22	BD15-GT05	Lorax (2017)	57	58	AR	9	0.32	0.01	0.01	0.32	0.05	0.2	0.2	4.548	6	0.4548	0.6
LX17-23	BD14-188	Lorax (2017)	10	11	GA	9	0.05	0.01	0.02	0.05	0.3	1.1	1.5	25.014	34	16.00896	21.76
LX17-24	BD14-188	Lorax (2017)	22	23	AR	8.4	0.18	0.01	0.02	0.18	0.05	0.2	0.2	4.548	9	0.808533333	1.6
LX17-25	BD14-188	Lorax (2017)	38	39	GWKE	9.2	0.01	0.01	0.02	0.01	0.39	1.4	1.9	31.836	41	101.8752	131.2
LX17-26	BD14-188	Lorax (2017)	51	52	GWKE	9.1	0.03	0.01	0.05	0.03	0.05	0.2	0.2	4.548	9	4.8512	9.6
LX17-27	BD14-173	Lorax (2017)	12	13	GWKE	8.9	0.02	0.01	0.02	0.02	0.09	0.3	0.4	6.822	12	10.9152	19.2
LX17-28	BD14-173	Lorax (2017)	22	23	AG	8.7	0.04	0.01	0.04	0.04	0.05	0.2	0.2	4.548	10	3.6384	8
LX17-29	BD14-173	Lorax (2017)	37	38	GA	8.9	0.03	0.01	0.02	0.03	0.16	0.6	0.8	13.644	19	14.5536	20.266667
LX17-30	BD14-173	Lorax (2017)	53	54	GWKE	8.9	0.01	0.01	0.02	0.01	0.6	2.2	3	50.028	58	160.0896	185.6

Sample ID	Hole ID	Sampler	Interval From	To	Hg ppm	Ag ppm	Al %	As ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %	La ppm
LX17-01	BD15-GT02	Lorax (2017)	10	11	0.0025	0.5	1.5	10	5	60	0.5	1	0.4	0.25	13	38	47	3.06	10	0.5	0.43	30
LX17-02	BD15-GT02	Lorax (2017)	15	16	0.0025	0.1	3.22	17	5	80	0.5	1	0.2	0.25	24	37	42	6.22	10	0.5	0.83	40
LX17-03	BD15-GT02	Lorax (2017)	26	27	0.0025	0.1	2.72	157	5	110	0.25	1	0.26	0.25	19	44	55	5.3	10	0.5	0.98	30
LX17-04	BD15-GT02	Lorax (2017)	31	32	0.0025	6.6	2.72	11	5	110	0.6	26	0.25	0.5	29	43	155	6.16	10	0.5	1.11	30
LX17-05	BD15-GT02	Lorax (2017)	46	47	0.0025	0.1	3.3	13	5	150	0.6	1	1.54	0.25	17	52	67	4.54	10	0.5	0.98	30
LX17-06	BD15-GT08	Lorax (2017)	91	10	0.0025	0.1	2.32	11	5	130	0.25	1	0.57	0.25	18	50	25	4.05	10	0.5	0.74	30
LX17-07	BD15-GT08	Lorax (2017)	14	15	0.0025	0.1	3.12	9	5	90	0.25	1	0.2	0.25	23	50	57	5.65	10	0.5	0.76	20
LX17-08	BD15-GT08	Lorax (2017)	23	24	0.0025	0.1	2.2	8	10	40	0.25	1	0.67	0.25	15	48	29	3.85	10	0.5	0.22	20
LX17-09	BD15-GT08	Lorax (2017)	37	38	0.0025	0.1	3.02	15	5	130	0.25	1	0.21	0.25	21	62	67	5.09	10	1	0.9	20
LX17-10	BD14-172	Lorax (2017)	140	141	0.0025	0.1	2.64	15	5	120	0.25	1	0.85	0.25	19	48	4	4.45	10	1	0.85	20
LX17-11	BD14-172	Lorax (2017)	170	171	0.0025	0.1	3.21	28	10	100	0.25	1	0.24	0.25	25	48	13	5.4	10	0.5	0.84	30
LX17-12	BD14-178	Lorax (2017)	7	7.9	0.0025	0.1	2.74	17	5	90	0.5	1	0.2	0.25	20	41	28	4.57	10	0.5	1.08	30
LX17-13	BD14-178	Lorax (2017)	15	16	0.0025	0.1	2.97	8	5	140	0.5	1	0.24	0.25	21	51	26	4.84	10	0.5	1.12	30
LX17-14	BD14-178	Lorax (2017)	30	31	0.0025	0.1	2.42	14	5	190	0.25	1	0.33	0.25	16	54	17	3.81	10	0.5	1.24	20
LX17-15	BD14-178	Lorax (2017)	58	59	0.0025	0.1	2.07	17	5	90	0.5	1	2.3	0.25	14	60	6	3.85	10	0.5	0.46	30
LX17-16	BD14-178	Lorax (2017)	49	50	0.0025	0.1	1.13	10	5	40	0.7	1	0.93	0.25	7	31	18	2.12	10	0.5	0.21	30
LX17-17	BD14-178	Lorax (2017)	161	162	0.0025	0.1	1.97	1915	5	120	0.6	1	0.26	0.25	14	38	51	3.63	10	0.5	0.78	20
LX17-18	BD14-178	Lorax (2017)	147	148	0.0025	0.1	0.69	2800	5	20	0.25	1	0.68	0.25	4	21	13	1.5	5	0.5	0.16	20
LX17-19	BD15-GT05	Lorax (2017)	15	16	0.0025	0.1	2.71	1750	5	90	0.25	1	0.12	0.25	25	39	21	5.12	10	0.5	0.86	30
LX17-20	BD15-GT05	Lorax (2017)	25	26	0.0025	0.1	2.68	231	5	80	0.25	1	0.16	0.25	25	37	35	5.23	10	0.5	0.85	20
LX17-21	BD15-GT05	Lorax (2017)	41	42	0.0025	0.3	1.61	1205	5	130	0.25	1	0.28	0.25	16	39	24	3.24	10	0.5	0.92	20
LX17-22	BD15-GT05	Lorax (2017)	57	58	0.0025	0.1	1.24	116	5	90	0.25	1	0.15	0.25	9	36	18	2.48	10	0.5	0.64	10
LX17-23	BD14-188	Lorax (2017)	10	11	0.0025	0.1	1.99	25	5	130	0.6	1	1.33	0.25	13	41	25	3.28	10	0.5	0.98	30
LX17-24	BD14-188	Lorax (2017)	22	23	0.0025	0.1	2.94	22	5	110	0.7	1	0.36	0.25	19	41	44	4.85	10	0.5	0.99	30
LX17-25	BD14-188	Lorax (2017)	38	39	0.0025	0.1	1.33	8	5	90	0.25	1	1.53	0.25	9	31	28	2.29	10	0.5	0.65	20
LX17-26	BD14-188	Lorax (2017)	51	52	0.0025	0.1	1.24	7	5	30	0.25	1	0.34	0.25	7	24	9	2.37	10	0.5	0.21	20
LX17-27	BD14-173	Lorax (2017)	12	13	0.0025	0.1	1.32	19	5	30	0.5	1	0.51	0.25	7	31	24	2.53	10	0.5	0.15	20
LX17-28	BD14-173	Lorax (2017)	22	23	0.0025	0.1	2.9	29	5	80	0.8	1	0.34	0.25	21	45	39	4.85	10	0.5	0.63	20
LX17-29	BD14-173	Lorax (2017)	37	38	0.0025	0.1	2.12	14	5	30	0.9	1	0.73	0.25	14	40	21	3.91	10	0.5	0.16	30
LX17-30	BD14-173	Lorax (2017)	53	54	0.0025	0.1	2.29	12	5	20	0.5	1	2.2	0.25	16	41	15	4.05	10	0.5	0.18	30

red font is non-detect sample, at half of the detection limit

	Hg	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La
average	0.0025	0.33667	2.2776667	283.767	5.33333	90.6667	0.425	1.83333	0.61267	0.25833	16.6667	42.0333	34.1	4.0763333	9.83333	0.53333	0.697	25.3333
geomean	0.0025	0.12585	2.1368851	33.4357	5.23647	78.161	0.38377	1.11472	0.42801	0.25584	15.2386	40.9337	26.2464	3.8647976	9.7716	0.52365	0.58115	24.4949
75th percentile	0.0025	0.1	2.86	28.75	5	120	0.575	1	0.7175	0.25	21	48	43.5	5.03	10	0.5	0.965	30
95th	0.0025	0.41	3.2155	1840.75	7.75	145.5	0.755	1	1.903	0.25	25	57.3	67	5.9305	10	0.775	1.1155	30
geomean percent	2.50E-07	1.26E-05	2.14E+00	3.34E-03	5.24E-04	7.82E-03	3.84E-05	1.11E-04	4.28E-01	2.56E-05	1.52E-03	4.09E-03	2.62E-03	3.86E+00	9.77E-04	5.24E-05	5.81E-01	2.45E-03

Sample ID	Hole ID	Sampler	Interval From	To	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	S %	Sb ppm	Sc ppm	Sr ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
LX17-01	BD15-GT02	Lorax (2017)	10	11	0.8	447	15	0.06	27	560	54	0.41	1	6	8	10	0.09	5	5	40	5	63
LX17-02	BD15-GT02	Lorax (2017)	15	16	1.65	634	1	0.02	43	520	10	0.33	1	4	4	10	0.13	5	5	42	5	123
LX17-03	BD15-GT02	Lorax (2017)	26	27	1.33	601	0.5	0.04	37	490	11	0.43	1	7	9	10	0.15	5	5	54	5	102
LX17-04	BD15-GT02	Lorax (2017)	31	32	1.51	675	1	0.03	59	360	179	1.26	1	7	7	10	0.15	5	5	50	5	143
LX17-05	BD15-GT02	Lorax (2017)	46	47	1.06	732	0.5	0.11	45	500	8	0.42	1	8	62	10	0.16	5	5	56	5	80
LX17-06	BD15-GT08	Lorax (2017)	91	10	1.18	624	0.5	0.05	36	540	5	0.005	1	8	13	10	0.16	5	5	54	5	79
LX17-07	BD15-GT08	Lorax (2017)	14	15	1.6	640	0.5	0.03	48	640	4	0.04	1	7	9	10	0.14	5	5	51	5	111
LX17-08	BD15-GT08	Lorax (2017)	23	24	1.35	512	0.5	0.05	36	630	5	0.005	1	6	10	10	0.09	5	5	57	5	78
LX17-09	BD15-GT08	Lorax (2017)	37	38	1.75	680	0.5	0.04	44	660	1	0.01	1	10	7	10	0.15	5	5	72	5	102
LX17-10	BD14-172	Lorax (2017)	140	141	1.52	774	0.5	0.05	43	640	7	0.06	1	7	20	10	0.16	5	5	54	5	103
LX17-11	BD14-172	Lorax (2017)	170	171	1.85	677	0.5	0.03	51	670	5	0.03	1	6	8	10	0.14	5	5	50	5	116
LX17-12	BD14-178	Lorax (2017)	7	7.9	1.43	534	0.5	0.03	44	610	11	0.02	1	6	10	10	0.17	5	5	44	5	89
LX17-13	BD14-178	Lorax (2017)	15	16	1.67	726	0.5	0.04	45	710	3	0.01	1	7	12	10	0.18	5	5	62	5	89
LX17-14	BD14-178	Lorax (2017)	30	31	1.33	578	1	0.06	36	710	3	0.005	1	9	24	10	0.2	5	5	66	5	69
LX17-15	BD14-178	Lorax (2017)	58	59	1.19	800	0.5	0.04	30	750	33	0.04	1	8	35	20	0.15	5	5	76	5	65
LX17-16	BD14-178	Lorax (2017)	49	50	0.58	372	1	0.04	15	520	2	0.03	1	3	15	10	0.09	5	5	29	5	34
LX17-17	BD14-178	Lorax (2017)	161	162	1.04	511	0.5	0.07	27	310	8	0.54	1	6	10	10	0.13	5	5	46	5	67
LX17-18	BD14-178	Lorax (2017)	147	148	0.4	274	1	0.04	6	180	17	0.15	2	2	6	10	0.03	5	5	20	5	43
LX17-19	BD15-GT05	Lorax (2017)	15	16	1.38	463	1	0.02	46	400	4	0.31	1	4	5	10	0.11	5	5	37	5	110
LX17-20	BD15-GT05	Lorax (2017)	25	26	1.43	518	0.5	0.02	38	340	3	0.33	1	4	4	10	0.14	5	5	36	5	105
LX17-21	BD15-GT05	Lorax (2017)	41	42	0.89	359	1	0.05	25	260	33	0.45	1	6	7	10	0.15	5	5	47	5	66
LX17-22	BD15-GT05	Lorax (2017)	57	58	0.75	312	0.5	0.05	15	210	20	0.35	1	6	5	10	0.13	5	5	40	5	57
LX17-23	BD14-188	Lorax (2017)	10	11	1.05	512	0.5	0.05	30	650	7	0.05	1	7	20	10	0.17	5	5	51	5	76
LX17-24	BD14-188	Lorax (2017)	22	23	1.63	621	0.5	0.03	42	650	6	0.19	1	5	16	10	0.15	5	5	45	5	120
LX17-25	BD14-188	Lorax (2017)	38	39	0.69	461	0.5	0.05	18	510	8	0.005	1	5	19	10	0.13	5	5	35	5	50
LX17-26	BD14-188	Lorax (2017)	51	52	0.7	310	1	0.04	15	450	2	0.02	1	3	10	10	0.07	5	5	23	5	38
LX17-27	BD14-173	Lorax (2017)	12	13	0.71	388	0.5	0.04	16	530	3	0.02	2	3	14	10	0.06	5	5	32	5	25
LX17-28	BD14-173	Lorax (2017)	22	23	1.74	687	0.5	0.03	43	690	4	0.04	1	6	24	10	0.09	5	5	49	5	90
LX17-29	BD14-173	Lorax (2017)	37	38	1.24	594	0.5	0.03	33	680	2	0.03	1	3	13	10	0.03	5	5	42	5	64
LX17-30	BD14-173	Lorax (2017)	53	54	1.4	1045	0.5	0.03	38	770	4	0.005	1	4	22	10	0.02	5	5	42	5	75

red font is non-detect sample, at half of the detection limit

	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th	Ti	Tl	U	V	W	Zn
average	1.228333	568.7	1.11667	0.04233	34.3667	538	15.4	0.1865	1.06667	5.76667	14.2667	10.3333	0.124	5	5	46.7333	5	81.0667
geomean	1.154819	543.795	0.67372	0.03942	31.2256	507.551	6.8817	0.05841	1.04729	5.40132	11.4672	10.2337	0.11064	5	5	44.8706	5	75.4452
75th percentile	1.5175	676.5	1	0.05	43.75	657.5	10.75	0.33	1	7	18.25	10	0.15	5	5	54	5	102.75
95th	1.7455	788.3	1	0.0655	49.65	732	44.55	0.4995	1.55	8.55	30.05	10	0.1755	5	5	69.3	5	121.65
geomean percent	1.15E+00	5.44E-02	6.74E-05	3.94E-02	3.12E-03	5.08E-02	6.88E-04	5.84E-02	1.05E-04	5.40E-04	1.15E-03	1.02E-03	1.11E-01	5.00E-04	5.00E-04	4.49E-03	5.00E-04	7.54E-03

Appendix C.3

Dust Control Plan

Fugitive Dust Control Plan

Atlantic Gold
Beaver Dam Gold Project

February 2019

PRESENTED TO THE CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY

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Table of Contents

1. INTRODUCTION

Atlantic Gold Corporation (AGC) provides a Fugitive Dust Control Plan (the Plan), herein, that has been developed to address an Information Request (IR) received from the Canadian Environmental Assessment Agency (CEAA) in August 2017. Specifically, the IR in question was identified as NSE 1-42 and originated from Nova Scotia Environment's (NSE) review of the Beaver Dam Mine Project Environmental Impact Statement (EIS) which was submitted to CEAA in June 2017.

Specifically, IR NSE 1-42 requested that AGC:

> *"Provide a dust suppression plan for the Beaver Dam Mine site, haul road and addition mitigation measures for the Touquoy site."*

The Project Description for the Beaver Dam Mine Project was originally submitted in the June 2017 EIS. A Revised EIS with Project Description is currently in preparation and is scheduled for re-submission to CEAA in February 2019. The revised EIS will incorporate responses to IRs including NSE 1-42 (i.e., this report).

This Plan has been developed based on experience gained from the Touquoy Mine which as been in operational phase since October 2017 and in construction phase 2016 to 2017. Industry best practice has also been used to develop this plan. An excellent guidance document that has been adopted is the *Ontario Ministry of Environment and Climate Change* (MOECC) *Technical Bulletin - Management Approaches for Industrial Fugitive Dust Sources (February 2017)*. The MOECC document is very useful because it is an overview that incorporates best management practices for industrial sources of fugitive dust emissions from a broad list of references collected from jurisdictions worldwide.

This Plan is considered preliminary in nature and will updated and revised to include approved project scope and will incorporate project specific conditions as issued by CEAA. The revised Plan will be submitted as part of the NSE Industrial Approval application process.

2. PLAN OBJECTIVES

The Fugitive Dust Control Plan describes the control measures and practices to be employed to minimize and control fugitive dust. The plan is based on five principles:

- Problem identification
- Design mitigation (plan)
- Operating mitigation (do)
- Monitoring and reporting (check)
- Corrective action (act)

The overall goal of the Plan is to provide a framework for the control of fugitive dust which will enable AGC to protect the health and safety of its workers and the public, as well as to mitigate potential adverse effects to the adjacent natural environment (e.g., impacts to plants and fauna). To meet this goal, the Fugitive Dust Control Plan has the following objectives:

- Identify fugitive dust emission sources
- Describe primary and contingent control measures and practices
- Explain inspection and observation procedures
- Establish reporting requirements
- Detail corrective action
- Define training issues

Identification of fugitive dust emission sources will be accomplished by a thorough review of the proposed operating plan. Primary and contingent control measures from industry best practices (i.e., MOECC Technical Bulletin, 2017) will be applied to each source of fugitive dust emissions. Inspection and observation procedures will provide feedback as to the effectiveness of mitigation measures and the need for corrective action. Reporting will provide the basis for corrective action and, if necessary, amending and improving the control measures. Training will be focused on hazard recognition, taking corrective action, and implementing proper procedures.

3. FUGITIVE EMISSIONS SOURCES

Fugitive dust can be generated throughout project phases and from specific components of the project site. These include construction phase activities initially and during operational phase, the open pit, waste rock stockpile, quarries, process plant, crushing operations and the service complex. Closure phase will be similar to construction phase in regard to dust generation. A description of the general sources of fugitive dust are as follows.

3.1 Construction and Closure Phase Activities

During construction activities dust can be generated from several sources including vehicular traffic on gravel road surfaces, loading and dumping of soil and aggregate materials, tracking and re-entraining aggregate materials along asphalt roads, quarrying and borrowing activities, road grading, and dozing/levelling activities. Similar activities will occur during closure phase with the addition of building demolition and leveling/recontouring of the ground surface.

3.2 Open Pit – Beaver Dam Mine Site and Quarries / Borrow Pits – Beaver Dam Haul Road

Dust is generated by the various unit operations involved in mining. Drilling can generate dust from the ground up rock that forms the cuttings. Blasting creates dust during detonation. Dust can be generated during excavation of dry muck and subsequent loading into trucks. Dozing and grading material on bench floors and roads will generate dust in dry conditions. Ditches and sumps may become a source of dust if they fill with fines and dry out.

3.3 Haul Roads – Beaver Dam and Touquoy Mine Sites, Beaver Dam Haul Road

Dust can be generated from mine haul truck tires interacting with gravel surfaced Mine Haul Roads and Beaver Dam Haul Roads. Dust is also generated during the truck loading and dumping activities. There is the potential for dust to be blown from haul trucks that are uncovered. Dust can also be tracked across asphalt roads and re-entrained by traffic or by the wind.

3.4 Waste Rock Stockpile – Beaver Dam Mine Site

Dust can be generated on the waste rock stockpile by the unloading of trucks and the pushing of waste material to create each working lift. The haul road to the waste dump from the open pit is also a potential source of dust from haul trucks and other mobile equipment moving along its length.

3.5 Process Plant – Touquoy, Crushing Plants Beaver Dam Mine Site and Beaver Dam Haul Road

Dust can be generated at the process plant and crushing plants in three distinctly different areas. When ore or aggregate is hauled to the crusher pads, dumping in the ore / aggregate stockpiles or crusher dump pockets can generate dust in a similar manner to that which occurs on the waste rock stockpile. The loader on the ROM pad and crusher pads can generate dust while tramming ore/aggregate to the crushers, loading trucks, or cleaning off grizzlies. Dust emissions from storage piles of granular material can result from dust pick-up under certain wind speeds and directions. Dust emissions can also occur as material is dropped from a conveyor, loader or other equipment where there is an associated drop height onto the storage pile.

The crushing circuits generate dust as the blasted rock or ore is reduced in size. Dust occurs at conveyor transfer points, the sizing screens, and during discharge onto the crushed stockpiles. Dust can also occur when feeders draw ore from under the crushed ore stockpile to the reclaim conveyor which feeds the ball mill.

3.6 Service Complex

Dust may be generated on the service complex access roads, in the site parking lots, and maintenance yards.

4. OPERATING PRACTICES AND CONTROL MEASURES

The following sections describe the primary and contingent control measures to be employed to manage fugitive dust generated by the Project for the identified processes. Primary control measures generally focus on prevention through design of physical or operating systems, for example, a dust collection system. Contingent control measures are directed towards mitigation of fugitive dust and rely more on operating procedures. It should be recognized that the prevailing wet climate will be effective in suppressing dust in all outdoor areas for substantial spans of time throughout the year. The reader is also directed to the *MOECC Technical Bulletin - Management Approaches (2017) for Industrial Fugitive Dust Sources* which provides current best practices for dust control under a variety of conditions.

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4.1 Process Sources

- Minimize fugitive dust emissions considering alternative processes/equipment to eliminate or minimize primary dust generation.
- Relocating an outdoor activity indoors for better fugitive dust control where feasible.
- Wetting material prior to processing or loading where possible.
- Installing and maintaining process containment and redirecting dust emissions to the dust collection system.
- Implementing a preventative maintenance program for processes and control equipment.

4.2 Aggregate, Ore, Waste Rock and Soil Stockpiles

- Dust control options for storage piles can include enclosures, barriers, shelters, proper layout, covers, water application, or other dust suppressant.
- Enclosures covered storage of very fine materials with a high dust emitting potential should be considered (e.g., fine ore stockpile).
- Use silos, bunkers or hoppers where feasible. Doors should be kept closed. Properly designed ventilation and filtering systems should be used as appropriate.
- Locate storage piles, especially of fine materials, in sheltered or protected areas where feasible.
- Storage piles should be located away from the prevailing downwind site boundaries where practical, or in designated areas with windbreaks and restricted traffic, and as far away from residents and other human receptors as possible.
- The number of piles should be kept to a minimum for the same material to minimize surface area.
- Open storage piles may be covered with durable materials such as tarpaulins or plastic. Alternatively, soil or latex binders may be applied on the top of the pile to reduce wind erosion of the material. For piles that are inactive, a vegetative cover may also be used.
- Use a water or dust chemical dust suppressant that is compatible with the stored material can be applied to the surface of the storage pile to reduce wind erosion

4.3 Transport of Materials on Haul Roads

Paved Roads

- Dust emissions from paved surfaces where there are entrained fines can be minimized by movement control and handling of fine materials to prevent spillages onto paved surfaces.
- Regular cleaning of paved surfaces, using a mobile sweeper in conjunction with a water truck.
- Mud and dust track-out from unpaved roads can be minimized by the use of simple wheel shakers (but these can sometimes impractical and cause unacceptable wear and tear on the equipment).

Unpaved Surfaces/Gravel Roads

- Wet suppressant (water) should be applied during dry periods using a water truck and/or fixed sprinklers; water requirements may vary based on temperature, humidity, solar insolation, or soil moisture content.
- Use of chemical dust suppressants where use of water is deemed ineffective. This involves the use of chemical additives in the water (in warmer weather), or application of a dry product (in cold weather) which help to form a crust on the surface and bind the dust particles together. Chemical stabilization reduces the watering requirements, but any savings can be offset by the cost of the additives. Typical chemical dust suppressants that are effective include flake and liquid magnesium chloride which has been used successfully at the Touquoy Mine. In addition, there are other types of chemical dust suppressants that can be used including: non-petroleum products and petrochemicals; synthetic polymers; and synthetic fluids.
- Adopt and enforce appropriate speed limit controls.

Other Measures

- Crushed or broken ore or aggregate materials should be transported in trucks with adequate freeboard to avoid spillage.
- Cover truck loads whenever feasible with durable materials such as tarpaulins or screening material that are extended over the truck bed and secured to the truck.

4.4 Material Handling/Transfer Activities

- Where feasible, activities that take place at an existing storage pile (i.e., loading and unloading) should be confined to the downwind side of the storage pile.
- Continuous transport such as conveyors should be used where feasible.
- Conveyors should be designed to minimize material overflow or spillage and where feasible should be enclosed or housed especially for fine material.
- Optimize the conveyor speed with the use of an adjustable speed conveyor.
- Use water sprays or sprinklers at conveyor transfer points.
- Minimize drop heights at transfer points, including use of conveyors that can be raised and lowered.
- Perform regular clean-up of spillages around transfer points.
- When handling/loading/dumping material using a front-end loader, excavator, or dump truck consider dumping material in a sheltered location when feasible, minimize the speed of descent; and minimize the material free fall (drop height).
- Where feasible, use sprinklers or water sprays around hoppers and other transfer points.
- Design hopper load systems to ensure a good match with truck size.
- Where feasible, the loading and unloading activities should be conducted when the wind speed is low to minimize fugitive dust emissions. In very high wind conditions, these activities should be suspended where practical.

4.5 Mine Site Infrastructure Pads

- Use of windbreak measures where feasible including use of natural land features, or artificial features such as barriers, to provide a degree of wind protection.
- Berms, tree lines or vegetation should be used in the surrounding areas of the mine infrastructure pad.
- All accumulated material on the windward side of the windbreak should be periodically removed to prevent failure of the windbreak.
- Application of water and chemical dust suppressants as required.

4.6 Exposed Erodible Soil Surfaces

- Implement a progressive re-vegetation plan to reduce wind and rain erosion of berms or disturbed areas Techniques such as hydroseeding and the use of geotextiles should be used on sloping ground and other difficult surfaces.

4.7 Open Pit and Quarries Activities

- Drilling should employ a water spray suppression system to control dust on each drill rig as feasible. The annulus of each blast hole will be shrouded by a rubber dust curtain which hangs down from the drill deck and prevents cuttings from blowing away.
- Loading of trucks will ensure that payload is centred with adequate freeboard to avoid spillage. Excavators and loaders will place material in truck boxes to avoid excessive fall when filling trucks.
- Haul roads in and out of the pit should be watered as required to prevent dust generation.
- Establish and adhere to speed limits.
- Bench floors and haul roads should be constructed of material containing minimum fines. Capping should be competent granular material which doesn't easily break down into fines.
- Sumps and ditches should be cleaned out regularly so that they too do not create a source of fines that can result in dust generation.

4.8 Waste Rock Stockpile

- The haul road and working platforms on the waste rock stockpile should be watered and maintained in the same way as the roads and benches in the pit.
- Mud and material containing organics will be stockpiled separately and will not be used to construct travel surfaces as they have poor bearing strength and will generate dust when they dry.
- Consideration should be given to progressive reclamation of the waste rock pile as it is developed, especially in regards to re-sloping, covering with topsoil, and re-vegetated. .

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5. INSPECTION, MONITORING, AND REPORTING

Formal inspections of working areas will be conducted periodically by management and employee representatives of the Occupational Health and Safety Committee (OHSC). Monthly or more frequent inspections will also be conducted by each shift supervisor in each respective area. Lastly, observations are to be made each shift regarding dust conditions.

The inspections will use the principles and objectives of the Fugitive Dust Control Plan as a guide. The course of inspections should adhere to the following pattern:

- Review dust management practices for the area
- Conduct physical inspection
- Identify any sources of fugitive dust not being effectively managed
- Recommend existing corrective action
- Suggest alternatives to the management group if existing practice is deemed ineffective
- Determine if additional resources are required and inform management group
- Establish accountability for the corrective action (s)
- Document inspection finding in report form
- Submit report for review and to enable follow up

OHSC inspection reports will be circulated at the general management level. Shift supervisor reports will be circulated at the department management level. Observations made each shift will be recorded in the shift log book along with corrective action taken and any other pertinent information. Shift supervisors and department managers will be responsible for addressing recognized fugitive dust issues in cooperation with the Health, Safety and Environment Department which will serve as a technical resource to operating groups. The early identification of fugitive dust is first and foremost a visual assessment.

Science-based fugitive air quality dust sampling/monitoring programs will also be implemented on a periodic basis (e.g., monthly, quarterly, annual) as specified in the EA project conditions and as outlined in the NSE Industrial Approval. The monitoring results from these programs will be compared to applicable guidelines and limits and used as a basis to objectively determine the overall effectiveness of dust mitigation and may trigger corrective actions in the form of additional mitigation. Qualified professionals will be used to develop, implement, and to interpret the results of these programs.

6. TRAINING

An integral part of the implementation of the Fugitive Dust Control Plan is appropriate training for the personnel involved. Training regarding fugitive dust control will be integrated into the overall new employee orientation and health and safety plans for the site. Specifically, the health and safety plan involves field level risk assessments, analyses and adoption of adequate controls to mitigate risk, and job or procedure specific task training.

Supervisors will be trained to recognize and identify the hazards related to fugitive dust and will understand specific tasks related to dust control. Job specific task training would teach personnel how to manage fugitive dust issues that may affect them when performing their specific job functions. For example, a water truck driver would learn the frequency to water roads, and correct mixing (for chemical suppressants) and application procedure to maximize the effectiveness dust suppression without creating other hazards. A grader operator would be taught the importance of proper drainage and the need to use select material in construction to avoid the excessive generation of fines by traffic. Basic knowledge of fugitive dust issues and the responsibility of each employee to report occurrences will be imparted during initial employment orientation. Periodic safety meetings can be used as a forum to discuss how crews can employ best practice to manage fugitive dust in the workplace.